

Disaster Risk Reduction  
Methods, Approaches and Practices

Riyanti Djalante  
Matthias Garschagen  
Frank Thomalla  
Rajib Shaw *Editors*

# Disaster Risk Reduction in Indonesia

Progress, Challenges, and Issues

 Springer

# **Disaster Risk Reduction**

Methods, Approaches and Practices

**Series editor**

Rajib Shaw, Keio University, Fujisawa, Japan

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Disaster risk reduction is a process, which leads to the safety of community and nations. After the 2005 World Conference on Disaster Reduction, held in Kobe, Japan, the Hyogo Framework for Action [HFA] was adopted as a framework of risk reduction. The academic research and higher education in disaster risk reduction has made/is making a gradual shift from pure basic research to applied, implementation-oriented research. More emphasis is given on the multi-stakeholder collaboration and multidisciplinary research. Emerging university networks in Asia, Europe, Africa and the Americas have urged for the process-oriented research in disaster risk reduction field. Keeping this in mind, this new series will promote the outputs of action research on disaster risk reduction, which will be useful for a wider range of stakeholders including academicians, professionals, practitioners and students and researchers in the related field. The series will focus on some of the emerging needs in the risk reduction field, starting from climate change adaptation, urban ecosystem, coastal risk reduction, education for sustainable development, community-based practices, risk communication, human security, etc. Through academic review, this series will encourage young researchers and practitioners to analyse field practices and link it to theory and policies with logic, data and evidences. Thus, the series emphasizes evidence-based risk reduction methods, approaches and practices.

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Riyanti Djalante • Matthias Garschagen  
Frank Thomalla • Rajib Shaw  
Editors

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# Foreword

Reducing disaster risks and building resilience amongst communities and nations are key goals in the so-called Post-2015 Development Agenda and its policy frameworks, including the Sendai Framework for Disaster Risk Reduction, the Paris Agreement on climate change, the Sustainable Development Goals of the 2030 Agenda and the New Urban Agenda.

According to the WorldRiskReport published by UNU-EHS and the Alliance Development Works, Indonesia is amongst the countries with the highest risk from environmental hazards and climate change impacts. The risk effects from local environmental degradation, global climate change, rapid urbanization, coastal development as well as socio-economic disparity are increasingly felt, not only in big cities like Jakarta but increasingly in smaller cities and rural areas of Indonesia. The Indian Ocean Tsunami in 2004 has shown the high potential for disaster in Indonesia, but has also lead to concerted academic, practical and political action for the reduction of such risks. Indonesia can therefore draw on a number of positive lessons in resilience building. However, many questions and challenges still persist.

The Indonesian Institute of Sciences (LIPI) is an important partner of UNU-EHS. Both institutions have collaborated in research and capacity building of government officials and students, starting after the 2004 Indian Ocean Tsunami within the German-Indonesian Tsunami Early Warning System (GITEWS) project and since 2014 within the TWIN-SEA expert network on coastal adaptation towards climatic and societal changes in Southeast Asia.

I welcome the publication of this edited book *Disaster Risk Reduction in Indonesia: Progress, Challenges and Issues*. The book gathers important analyses by 80 authors from all over the world on key topics concerned with disaster risk reduction in Indonesia. A multitude of factors affecting the governance for DRR is being discussed. In addition to discussion on roles of different actors and organizations and mainstreaming to important sectors such as education, urban planning and infrastructure, there are also analyses of factors affecting community resilience, discussed from various angles including those of psychology and the studies of culture and religion.

With Indonesia's strong commitment to the implementation of the Sendai Framework for Disaster Risk Reduction over the coming years, the book offers a timely and highly relevant entry point into the study of achievements and positive lessons as well as remaining challenges and emerging new problems with regard to the country's efforts on resilience building. I appreciate the great added value that this book will bring not only for academic circles but also for risk practitioners and policymakers.

I wish to thank the editors and contributing authors for their efforts in producing such an important and timely contribution for research and practice on DRR in Indonesia.

Vice Rector in Europe of UNU and Director of the  
Institute for Environment and Human Security (UNU-EHS)  
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Jakob Rhyner

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We would like to express our gratitude to all the authors from different parts of the world who are working on DRR topics on Indonesia. It is great to see such enormous development in the degree of collaboration amongst Indonesian and international authors, as well as between early career researchers and PhD students and the more senior colleagues with extensive expertise and experiences in DRR. The topics discussed have ranged widely from the DRR governance and roles of different actors from the international to local level to discussions on legal, technical, psychological, religion and cultural aspects of DRR in Indonesia.

Our appreciation is also extended to the colleagues at UNU-EHS and external reviewers who have been involved in the review processes and discussions which also help shape the book. We would also like to thank Harry James, who has worked hard to proofread and edit all of the chapters.

Finally, Dr. Riyanti Djalante would specifically like to thank the Alexander von Humboldt Foundation for the Fellowship for Experienced Researchers, which enabled her to conduct her research at the UNU-EHS, Germany. She would like to express her gratitude to the mayor of Kendari City, Dr. Asrun, and the rector of Haluoleo University, Prof. Usman Rianse, of the organizations that she affiliated with in Indonesia. She would also like to thank her family and friends who have



been the source of continuous support and for making the time in Bonn truly enjoyable. It has been a great pleasure to work with everyone in this endeavour.

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Matthias Garschagen  
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# List of Abbreviations and Non-English Words

## Abbreviations

AAAA	Addis Ababa Action Agenda
AADMER	ASEAN Agreement on Disaster Management and Emergency Response
ACCCRN	Asian Cities Climate Change Resilience Network
ACTIVED	Actions Changing the Incidence of Vector-Borne Endemic Diseases
ADB	Asian Development Bank
ADRAS	Australian Development Research Awards Scheme
AHA Centre	Coordinating Centre for Humanitarian Assistance on Disaster Management
AMAN	<i>Aliansi Masyarakat Adat Nusantara</i> (Indonesian Indigenous Peoples' Alliance)
AMCDRR	Asian Ministerial Conference on Disaster Risk Reduction
API	<i>Adaptasi Perubahan Iklim</i> (Climate Change Adaptation)
APN	Asia-Pacific Network for Global Change Research
ARF	Aceh Recovery Framework
ASB	<i>Arbeiter-Samariter-Bund Deutschland</i> eV Indonesia and Philippines Office (Workers' Samaritan Federation)
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute
ASEAN	Association of Southeast Asian Nations
ASTAAG	Asia Science Technology and Academic Advisory Group
AusAid	Australian Aid
BAKORNAS	<i>Badan Koordinasi Nasional</i> (National Coordinating Board)
BAKORNAS PB	<i>Badan Koordinasi Nasional Penanggulangan Bencana</i> (National Coordination Board for Disaster Management)
BAKORNAS PBA	<i>Badan Koordinasi Nasional Penanggulangan Bencana Alam</i> (National Coordination Board for Natural Disaster Management)

BAKORNAS PBP	<i>Badan Koordinasi Nasional Penanggulangan Bencana dan penanganan pengungsi</i> (National Coordination Board for Disaster and Displaced People Management)
BAPPEDA	<i>Badan Perencanaan Pembangunan Daerah</i> (District or Provincial Development Planning Agency)
BAPPENAS	<i>Badan Perencanaan Pembangunan Nasional</i> (National Development Planning Agency)
BIG	<i>Badan Informasi Geospasial</i> (Geospatial Information Agency)
BKSDA	<i>Badan Konservasi Sumber Daya Alam</i> (Nature Conservation Agency Indonesia)
BKSDA	<i>Balai Konservasi Sumber Daya Alam</i> (Natural Resources Conservation Unit)
BMKG	<i>Badan Meteorologi, Klimatologi dan Geofisika</i> (Indonesian Agency for Meteorology, Climatology and Geophysics)
BNPB	<i>Badan Nasional Penanggulangan Bencana</i> (National Disaster Management Agency)
BP2BAP	<i>Badan Pertimbangan Penanggulangan Bencana Alam Pusat</i> (National Board for Natural Disaster Management)
BPBA	<i>Badan Penanggulangan Bencana Aceh</i> (Aceh Disaster Management Agency)
BPS	National Bureau of Statistics ( <i>Badan Pusat Statistik</i> ).
BRR	<i>Badan Rehabilitasi dan Rekonstruksi</i> (Rehabilitation and Reconstruction Agency)
CBFiM	Community-Based Fire Management
CBO	Community-based organizations
CBSO	Community-based society organization
CCA	Climate change adaptation
CDRP	Centre for Disability Research and Policy
CFAN	Coordination Forum for Aceh and Nias
CMA	Composite Mapping Analysis
CONSRN	Consortium to Restore Shattered Livelihoods in Tsunami-Devastated Nations
COP	Conference of the Parties
COP21	The twenty-first session of the Conference of the Parties, Paris, France – 2015 Paris Climate Conference
COREMAP	Coral Reef Rehabilitation and Management Program
CRAA	Climate Risk and Adaptation Assessment
CRED	Centre for Research on the Epidemiology of Disasters
CSO	Civil Society Organization
DAK	<i>Dana Alokasi Khusus</i> (Special Allocation Fund)
DAU	<i>Dana Alokasi Umum</i> (General Allocation Fund)
DBH	<i>Dana Bagi Hasil</i> (Revenue Sharing Fund)
DEM	Digital elevation model
DEPDAGRI	<i>Departemen Dalam Negeri</i> (Department of Foreign Affairs)
DFAT	Department of Foreign Affairs and Trade

DFID	Department of International Development
DIBI	<i>Data dan Informasi Bencana Indonesia</i> (Indonesia Disaster Database)
DiDRR	Disability-Inclusive Disaster Risk Reduction
DiDRRN	Disability-Inclusive Disaster Risk Reduction Network
DKM	<i>Dewan Keluarga Masjid</i> (Mosque Family Council)
DNPI	<i>Dewan Nasional Perubahan Iklim</i> (National Climate Change Council)
DPD	<i>Local Representative Council</i> (Dewan Perwakilan Daerah)
DPOs	Disabled People's Organizations
DRF	Disability Rights Fund
DRR	Disaster Risk Reduction
DRRM	Disaster Risk Reduction and Management
DSP	<i>Dana Siap Pakai</i> (Ready-to-Use Fund)
Eco-DRR	Ecosystem-Based Disaster Risk Reduction
EM-DAT	Emergency Events Database
EMDAT-CRED	Emergency Events Database of the Centre for Research on the Epidemiology of Disasters
ENSO	El Niño-Southern Oscillation
FAO	Food and Agriculture Organization of the United Nations
FBO	Faith-based organization
FEMA	Federal Emergency Management Agency
FGD	Focus group discussions
FIRMS	Fire Information for Resource Management System
GDP	Gross domestic product
GERHAN	<i>Gerakan Reklamasi Hutan dan Lahan</i> (Movement for Forest and Land Reclamation)
GIS	Geographic information system
GITEWS	German-Indonesian Tsunami Early Warning System
GIZ	<i>Deutsche Gesellschaft für Internationale Zusammenarbeit</i> (German Society for International Cooperation)
GoI	Government of Indonesia
GR	Government Regulation
HFA	Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters
HPH	<i>Hak Pengusahaan Hutan</i> (forest concession permit)
HTI	<i>Hutan Tanaman Industri</i> (industrial plantation forest)
IABI	<i>Ikatan Ahli Kebencanaan Indonesia</i> (Indonesia Disaster Experts Association)
ICCSR	Indonesia Climate Change Sectoral Roadmap
ICSF	International Collective in Support of Fishworkers
ICSU	International Council for Science
IDDR	International Day for Disaster Reduction
IFRC	International Federation of Red Cross and Red Crescent Societies
IGES	Institute for Global Environmental Strategies

INATEWS	Indonesia Tsunami Early Warning System
INGO	International non-governmental organization
IPCC	Intergovernmental Panel on Climate Change
IRBI	<i>Indeks Risiko Bencana Indonesia</i> (Indonesian Index for Disaster Risk)
IRDR	Integrated Research on Disaster Risk
IRI	Islamic Relief Indonesia
ISSC	International Social Science Council
ITB	<i>Institut Teknologi Bandung</i> (Bandung Institute of Technology)
JICA	Japan International Cooperation Agency
KFCP	Kalimantan Forests and Climate Partnership
KII	Key informant interviews
KKRI	<i>Kementerian Kehutanan Republik Indonesia</i> (Ministry of Forestry of the Republic of Indonesia)
KLH	<i>Kementerian Lingkungan Hidup</i> (Ministry of Environment)
KLHK	<i>Kementrian Lingkungan Hidup dan Kehutanan</i> (Ministry of Environment and Forestry Republic of Indonesia)
KLHS	<i>Kajian Lingkungan Hidup Strategis</i> (Strategic Environmental Assessment)
KPK	<i>Komisi Pemberantasan Korupsi</i> (Corruption Eradication Commission)
KSN	<i>Kawasan Strategis Nasional</i> (National Strategic Area)
LAPAN	<i>Lembaga Penerbangan dan Antariksa Nasional</i> (National Institute of Aeronautics and Space)
LAPI	<i>Lembaga Afiliasi Penelitian dan Industri</i> (Institute of Research and Industrial Affiliation)
LIPI	<i>Lembaga Ilmu Pengetahuan Indonesia</i> (Indonesian Institute of Sciences)
LCM	Land Cover Map
LFFRM	Land and Forest Fires Reduction Management
LSE	London School of Economics
MEA	Millennium Ecosystem Assessment
MoBEC	Ministry of Basic Education and Culture
MoCI	Ministry of Communication and Information Technology
MoCSME	Ministry of Cooperatives and Small and Medium Enterprises
MODIS	Moderate Resolution Imaging Spectroradiometer
MoE	Ministry of Environment
MoEF	Ministry of Environment and Forestry
MoEMR	Ministry of Energy and Mineral Resources
MoF	Ministry of Forestry
MoFA	Ministry of Foreign Affairs
MoHa	Ministry of Home Affairs
MoLHR	Ministry of Law and Human Rights
MoLSP	Ministry of Land and Spatial Planning
MoMF	Ministry of Marine and Fisheries
MoPW	Ministry of Public Works and Housing

MoRT	Ministry of Research and Technology
MoSA	Ministry of Social Affairs
MoVDT	Ministry of Village, Disadvantaged Areas and Transmigration
MPBI	<i>Masyarakat Penanggulangan Bencana Indonesia</i> (Indonesian Society for Disaster Management)
MPW	Ministry of Public Works
MRP	Mega Rice Project
MUI	<i>Majelis Ulama Indonesia</i> (Indonesian Muslim Council)
NAD	<i>Nanggroe Aceh Darussalam</i>
NASA	National Aeronautics and Space Administration
NDRI	Natural Disaster Risk Index
NGO	Non-governmental organization
OCHA	Office for the Coordination of Humanitarian Affairs
OISCA	Organization for Industrial, Spiritual and Cultural Advancement
OR	Odds ratio
PACC	Paris Agreement on Climate Change
PAD	<i>Pendapatan Asli Daerah</i> (Original Regional Revenue Fund)
Perda	<i>Peraturan Daerah</i> (local regulation)
Perkada	<i>Peraturan Kepala Daerah</i> (governor/mayor regulation)
Planas PRB	<i>Platform Nasional untuk Pengurangan Risiko Bencana</i> (National Platform for DRR)
PLANAS	<i>Platform Nasional</i> (National Platform)
PLG	<i>Pengembangan Lahan Gambut</i> (Peatland Development Projects)
Polri	<i>Polisi Republik Indonesia</i> (Indonesian Police)
PPOCK	<i>Paguyuban Penyandang Cacat Klaten</i> (Organization of the People with Disability in Klaten)
PPNS	<i>Penyidik Pegawai Negeri Sipil</i> (civil service investigators)
PT	<i>Perseroan Terbatas</i> (limited liability company)
PU	<i>Pekerjaan Umum</i> (public works)
RAN API	<i>Rencana Aksi Nasional Adaptasi Perubahan Iklim</i> (National Action Plan for Climate Change Adaptation)
RAN MAPI	<i>Rencana Aksi Nasional Mitigasi dan Adaptasi Perubahan Iklim</i> (National Action Plan for Climate Change Mitigation and Adaptation)
RAN PRB	<i>Rencana Aksi Nasional Pengurangan Risiko Bencana</i> (National Action Plan for DRR)
RDTR	<i>Rencana Detail Tata Ruang</i> (detailed spatial plan)
REDD	Reducing Emissions from Deforestation and Forest Degradation
Renas PB	<i>Rencana Nasional Penanggulangan Bencana</i> (National Plan of Disaster Management)
RePPRot	Regional Physical Planning Programme for Transmigration
RI	Republic of Indonesia
Rp	Indonesian rupiah (currency)



RPJM	<i>Rencana Pembangunan Jangka Menengah</i> (Medium-Term Development Plan)
RPJMD	<i>Rencana Pembangunan Jangka Menengah Daerah</i> (Regional Development Policy)
RPJMN	<i>Rencana Pembangunan Jangka Menengah Nasional</i> (National Medium-Term Development Plan)
RPPLH	<i>Rencana Perlindungan dan Pengelolaan Lingkungan Hidup</i> (Environment Protection and Management Plan)
RTR	<i>Rencana Tata Ruang</i> (Spatial Plan)
RTRW	<i>Rencana Tata Ruang Wilayah</i> (Area Spatial Plan)
RZWP3K	<i>Rencana Zonasi Wilayah Pesisir dan Pulau-Pulau Kecil</i> (Zoning Plan for Coastal and Small Islands)
Satkorlak PBA	<i>Satuan Koordinasi Pelaksanaan Penanggulangan Bencana Alam</i> (Provincial Coordinating Agency for Disaster Management)
SDGs	Sustainable Development Goals
SEI	Stockholm Environment Institute
SFDRR	Sendai Framework for Disaster Risk Reduction 2015–2030
SIERA	Social Institutional Economic Resilience Activities
SKL	<i>Satuan Kemampuan Lahan</i> (Land Capability Unit)
SNI	<i>Standar Nasional Indonesia</i> (National Standard of Indonesia)
SP	Spatial planning
SRM-NSES	Social Resilience Module-National Socio-Economic Survey
STIS	<i>Sekolah Tinggi Ilmu Statistik</i> (Institute of Statistics)
Tahura	<i>Taman Hutan Raya</i> (Forest Park Conservation Area)
TDMRC	Tsunami and Disaster Mitigation Research Center, Syiah Kuala University
TEWS	Tsunami Early Warning System
TKP2BA	<i>Tim Koordinasi Nasional Penanggulangan Bencana Alam</i> (National Coordination Team for Natural Disaster Management)
TNI	<i>Tentara Nasional Indonesia</i> (Indonesian Armed Forces)
UK	United Kingdom
UN	United Nations
UNCRPD	United Nations Convention on the Rights of Persons with Disabilities
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children’s Fund
UNISDR	United Nations International Strategy for Disaster Reduction
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNU-EHS	United Nations University Institute for Environment and Human Security
URDI	Urban and Regional Development Institute

USAID	United States Agency for International Development
USD	United States dollar
VARMAP	Vulnerability Assessment, Risk Management and Adaptive Planning
VRA	Vulnerability and Risk Assessments
WAVES	Wealth Accounting and the Valuation of Ecosystem Services
WCDR	World Conference on Disaster Reduction
WHO	World Health Organization
WIIP	Wetlands International Indonesia Program
WRI	World Risk Index
WWA	Women's Welfare Association
YU	Youth Union

## Definitions of Key Terms

Climate change adaptation	<p>(a) The Intergovernmental Panel on Climate Change (IPCC) defines climate change as “a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use”.</p> <p>(b) The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (UN/ISDR 2016).</p>
Disaster risk governance	The way in which the authorities, public servants, media, private sector and civil society coordinate in communities and on regional and national levels in order to manage and reduce disaster and climate-related risks (UNDP 2012).
Disaster risk management	The systematic process of using administrative directives, organizations and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster (UN/ISDR 2016).

Disaster risk reduction	The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment and improved preparedness for adverse events (UN/ISDR 2016).
Disasters	A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources (UN/ISDR 2016).
Hydrometeorological hazard	Process or phenomenon of atmospheric, hydrological or oceanographic nature that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption or environmental damage (UN/ISDR 2016).
Natural hazard	Natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption or environmental damage (UN/ISDR 2016).
Resilience	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions (UN/ISDR 2016).
Risks	The combination of the probability of an event and its negative consequences (UN/ISDR 2016).
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (UN/ISDR 2016).
Vulnerability	The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard (UN/ISDR 2016).

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## Non-English Words

<i>Adat</i>	Custom
<i>Adat Laot</i>	Customary marine laws
<i>Al Qur'an</i>	Holy book of Islam
<i>Al-A'dah Muhakkamah</i>	Traditional, Local Wisdom
<i>Al-Balad</i>	The City, name of one chapter in the Quran
<i>Al-Hadid</i>	The Iron, name of one chapter in the Quran
<i>Ali-Imran</i>	The Family of Imran, name of one chapter in the Quran Allah (alone) is Sufficient for us, and He is the Best Disposer of affairs (for us)
<i>An-Nisa</i>	The Women, name of one chapter in the Quran
<i>Ar-Ra'd</i>	The Thunder, name of one chapter in the Quran
<i>At-Taubah</i>	The Repentance, name of one chapter in the Quran
<i>Bid'ah</i>	Forbidden
<i>Blang</i>	Agricultural land
<i>Camat</i>	District head
<i>Desa</i>	Death is a Favour: A little view of Philosophers, Theologians, Scientists and the Quran
<i>Ghafir/Al-Mu'min</i>	Village
<i>Gotong Royong</i>	The Forgiver or the Believer, name of one chapter in the Quran
<i>Hadith</i>	Mutual cooperation
<i>Hadits</i>	Collection of traditions containing sayings of the prophet Muhammad that constitute the major source of guidance for Muslims apart from the Quran
<i>Kabupaten</i>	Guidance from Prophet Muhammad SAW
<i>Karhutla</i>	Regency
<i>Kecamatan</i>	Land and forest fires
<i>Kopassus</i>	Sub-district
<i>Kota</i>	Special Forces
	City

<i>kraton makhluk alus</i>	The palace of the spirits
<i>La Tahzan</i>	Don't be sad
<i>Laot</i>	Sea
<i>Lembaga adat</i>	Customary institution
<i>Lhok</i>	Bay
<i>Luqman</i>	Luqman, name of one chapter in the Quran
<i>Madrasah</i>	Place of education for Islamic religion
<i>Mahdhah</i>	Worshipping
<i>Majelis Ulama Indonesia (MUI)</i>	Indonesian Muslim Council
<i>Masjid</i>	Mosque
<i>mbah</i>	Grandfather
<i>Muamallah</i>	Set of rules in Islam
<i>Muhammadiyah</i>	One of the largest Islamic organizations in Indonesia
<i>Mushalla</i>	Small Islamic prayer house
<i>Nahdlatul Ulama</i>	One of the largest Islamic organizations in Indonesia
<i>Panglima Laot</i>	Sea commander
<i>Pengadilan adat</i>	Customary judicial court system
<i>Pesantren</i>	Islamic boarding school
<i>Pikiran Rakyat</i>	Local newspaper in West Java province
<i>Provinsi</i>	Province
<i>Qanun</i>	Law
<i>Quran</i>	The Islamic sacred book
<i>Reformasi</i>	Reformation
<i>Regeling op de Staat van Oorlog en van Beleg</i>	(SOB) (Regulation on the State of War and of Siege)
<i>SAR</i>	Search and rescue
<i>Surah Al A'raf</i>	Chapter "The Heights" in the holy book of Islam
<i>Surah Al Maidah</i>	Chapter "The Table" in the holy book of Islam
<i>Surah Al Qasas</i>	Chapter "The Stories" in the holy book of Islam
<i>Surah Al Yusuf</i>	Chapter "Joseph" in the holy book of Islam
<i>Surah Ar-ra'd</i>	Chapter "The Thunder" in the holy book of Islam
<i>Tengku</i>	Recognized and respected as religious leaders in Aceh. The Psychology of Death: Changing Fear into Optimism
<i>Uteun</i>	Forest
<i>wa Hasbunallah ni'mal wakil: wedhus gembel</i>	Literally means sheep, refers to hot clouds out from the crater of Mt. Merapi wherein its shape looks like a sheep
<i>Yasin</i>	One chapter in the Quran that talks about death

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# Chapter 1

## Introduction: Disaster Risk Reduction in Indonesia: Progress, Challenges, and Issues

Riyanti Djalante, Matthias Garschagen, Frank Thomalla, and Rajib Shaw

**Abstract** Indonesia is amongst the countries with the highest disaster risk globally. This risk is driven by the country's high exposure to a range of geophysical and hydro-meteorological hazards, combined with grave vulnerabilities resulting from population growth, unequal economic development, urbanization, a lack of social and environmental considerations within development processes, and other drivers. Disasters caused by environmental hazards are becoming increasingly costly and severe in Indonesia. While efforts to manage disaster impacts and reduce disaster risk have long been considered, the 2004 Indian Ocean tsunami transformed the way disasters are viewed and how the risks are managed and reduced. Internationally, the Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters was adopted in 2005 and succeeded by the Sendai Framework for Disaster Risk Reduction 2015–2030. In order to document the transformations that have taken place in disaster risk reduction (DRR) in Indonesia, this book presents the progress, challenges and issues concerned with DRR governance and practices. It aims to answer the following questions: *Which advances in DRR have been made? Which roles do different actors have? Which remaining challenges and emerging new issues need to be addressed in order to enable more sustainable DRR in Indonesia?* This introduction presents the rationale, objective and structure of the book.

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## 1.1 Overview and Rationale of Study

Indonesia is the world's largest archipelago and straddles the equator, between the continents of Asia and Australia. Its major islands include Sumatra, Java, Kalimantan, Sulawesi, Maluku and Papua (Fig. 1.1). The country is considered one of the most disaster-prone countries, given its high exposure to a range of natural and climatic hazards as well as considerable social vulnerabilities (UNU-EHS and ADW 2014). The interaction between an increasing population, largely uncontrolled urbanization and economic development in high-risk areas without proper consideration of the social and environmental impacts, has led to high disaster and climate-related vulnerability and risk in Indonesia (Djalante 2013; Firman 2016).

It is the fourth most populous country in the world at more than 255 million people (BPS 2016b). More than 145 million of these people live on Java, the most populous island, and its capital city, Jakarta, is home to more than 10 million people (BPS 2016b). Indonesia has more than 300 ethnic groups, 700 dialects and is also the largest Islamic country in the world (World Bank 2016b). Politically, it is the second largest democratic nation in the world, and largely decentralized with 34 provincial and 514 local governments (BPS 2016b). Economically, it is the largest country in South East Asia and part of the G-20, and is classified as a lower middle income country by the World Bank with a Gross Domestic Product (GDP) of 862 billion US Dollars (World Bank 2016a). Despite these political and economic advances, inequality within the country is still high, with a Gini ratio of 0.40 (1 being total inequality) in urban areas and 0.33 in rural areas (BPS 2016a). There are

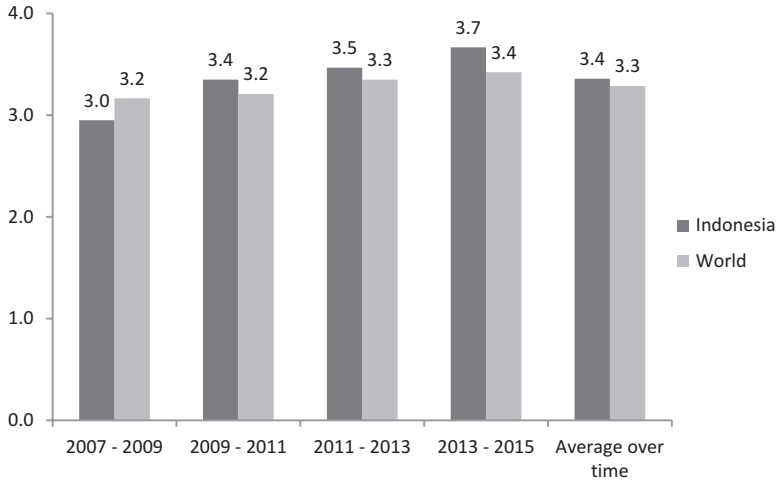


Fig. 1.1 Map of Indonesia (UNU-EHS 2016)

still 28 million (12%) people who live below the poverty line, and 40% of the population are still vulnerable to falling into poverty (World Bank 2016b). The country houses some of the largest tropical forests in the world, as well as large deposits of minerals, oil and natural gas. However, poor enforcement of environmental law has led to rampant deforestation, illegal logging, forest and land conversion as well as forest and peatland fires (Korhonen-Kurki et al. 2013; Obidzinski and Kusters 2015). The livelihood sources of the majority of people are small-scale farming, fishing and work and trade (World Bank 2016b). These sectors are climate dependent and the future negative impacts of climate change could threaten the livelihood sources of those who work in them (Cinner et al. 2012; Kirilenko and Sedjo 2007).

Disasters caused by environmental hazards are becoming increasingly costly and severe in Indonesia. Hydro-meteorological hazards (floods, typhoons, droughts, etc.) are the most frequent examples and affect the greatest number of people, whilst geophysical hazards have caused the most deaths in Indonesia (EM-DAT 2016). Located between the tectonic plates of Asia and Australia, the country lies in a zone of high tectonic activity which frequently results in earthquakes and tsunamis (Hsu et al. 2006). Furthermore, rows of mountains and active volcanoes spread across the islands, which form part of the Pacific Ring of Fire (Suppasri et al. 2012). Taken together, volcanic eruptions, tsunamis and earthquakes are the deadliest hazards in Indonesia (EM-DAT 2016). The 8.9 magnitude earthquake, which caused the Indian Ocean Tsunami in 2004, was one of the deadliest disasters to strike Indonesia and other countries in the region (EM-DAT 2016). In addition, floods are increasingly becoming more frequent, and affect the most number of people, especially those living in urban areas (EM-DAT 2016). As an archipelago, Indonesia has many low elevation coastal zones and the majority of people live within 100 km of the coast and under 100 m above sea level (Kusuma-Atmadja and Purwaka 1996). Future sea level rise due to climate change therefore poses a great risk to the country (Nicholls 1995; McGranahan et al. 2007). It is therefore extremely important for Indonesia to reduce disaster risks and build disaster resilience amongst the nation and its communities (Djalante et al. 2013; UNISDR 2016; BNPB 2015).

In the face of such risks, there have been transformational changes in the way disaster risks and disaster impacts have been dealt with in Indonesia. The 2004 Indian Ocean Tsunami was a definitive turning point in risk reduction and management internationally and also in Indonesia. The adoption of the Hyogo Framework for Action (HFA) in 2005 has influenced a fundamental change towards disaster risk reduction and management (UNISDR 2005a). The HFA contains five Priorities for Action, namely: (1) DRR governance, (2) risk assessment and early warning, (3) knowledge and education, (4) reducing the underlying risk factors, and (5) disaster preparedness and response (UNISDR 2005a). The HFA provides a monitoring and review mechanism by which national governments can measure their level of progress towards the HFA Priorities for Action, from 1 (minor), 2 (relatively small), 3 (not substantial), 4 (substantial) and 5 (comprehensive achievements) for DRR (UNISDR 2005a). Indonesia has transformed from a focus on emergency response after disasters to a more comprehensive and preventive approach to DRR (BNPB 2015). As a result, the country moved gradually from a score of 3.0 in implementing the HFA Priorities for Action, to 3.7 (out of five) during the period of 2013–2015



**Fig. 1.2** Indonesia's level of progress in HFA priority areas (out of five) compared to the rest of the world (Modified from BNPB 2011a, 2013, 2015, PreventionWeb 2016)

(BNPB 2011a, b, 2013, 2015) (Fig. 1.2). Over the years, Indonesia's level of progress has been slightly higher than the rest of the world.

This progress was in part due to the establishment of regulatory and institutional frameworks for DRR, marked noticeably by the adoption of Law 24/2007 on Disaster Management, as well as the formation of National and Local Disaster Management Agencies (BNPB and BPBDs) (BNPB 2015). These newly formed agencies have more power and mandates along with the financial and technical capacity to plan and implement DRR strategies. Many policies, strategies and plans were developed to guide DRR (BNPB 2015). For instance, hazard early warning systems, along with national and community preparedness, have been progressively developed and maintained (BNPB 2015). In line with the decentralization in the development and planning approach, the responsibility for DRR and DRM is shared across different levels of government, from heavy reliance on national governments to greater responsibility of local governments (Lassa 2013). Non-government organizations (NGOs) and local governments have important roles especially to increase preparedness and resilience to disasters at the local and community level (Djalante 2012; Kusumasari et al. 2010).

While many of these changes have been transformative and bring enormous change to the way DRR is governed, after 12 years since the tsunami, it is apt to examine how these institutions and regulations have evolved. In particular, how plans and strategies at the policy level are being implemented in practice (at the local and community level), how local level organizations have increased their capacity and capability, what challenges in terms of institutional configurations encourage or hinder progress, which actors and organizations have been involved, how future climate risks are perceived, and finally, what emerging issues need attention and will influence the future pathway for DRR in Indonesia.

## 1.2 Objective of the Book

This book aims at answering the following questions: *Which advances in DRR have been made? Which roles do different actors have? Which remaining challenges and emerging new issues need to be addressed in order to enable more sustainable DRR in Indonesia?*

It provides an overview of the ways in which DRR is conceived, planned and implemented by a variety of governmental organizations at various governance levels, and by other actors from civil society, the business sector and academia. It also examines the multiplicity of regulatory frameworks and financial mechanisms that orchestrate DRR in Indonesia and how they have been mainstreamed within important sectors such as infrastructure, spatial planning, education and the environment. Apart from the larger frameworks, particular interest is paid to exploring the multitude of resilience building initiatives at the community level, both formal and informal. The book also examines how hazards, risk and resilience can be quantified.

Whilst there is a wealth of knowledge available on DRR in Indonesia, it mainly exists in the form of organizational reports, government documents, journal articles and news items. This book adds to this breadth of knowledge, through collating, reviewing and discussing trends in hazards and disasters, as well as plans, strategies and activities in DRR, and the latest research from key research institutions and DRR practitioners at the science-policy interface. The process of developing the book is meant to be a transdisciplinary co-production of knowledge between academic and non-academic communities, which is a prerequisite for research aiming at more sustainable development paths (Pohl et al. 2010; Jasanoff 2004). Sustainability challenges such as addressing and dealing with the multitude of factors which cause vulnerability to natural hazards and disasters, call for new ways for knowledge production and decision making. Perspectives from different organizations are presented from government, non-government, scientific and community-based organizations, as well as woman's collectives. Academic scholars collaborate with government officials to review policy and practice of DRR, while others utilize authors' direct experiences of implementing DRR activities. Involvement of multitudes of actors is crucial to help integrate available knowledge, reconcile values and preferences, and also create ownerships for problems and solutions (Lang et al. 2012).

The book addresses key questions of institutions and governance. Topics discussed range from the linkage between DRR with education, spatial planning, infrastructure, law and regulation. The resultant discussions encompass different spatial levels from the national, to the sub-national and local level, and include novel topics such as the role of culture, religion, psychology and the media in DRR. The hazards and disasters discussed include forest fires, floods, tsunamis, earthquakes and windstorms. While half of the chapters look at Indonesia as whole, specific localities are also explored on Aceh, Padang, Jambi, Bandung, Jakarta and Kalimantan.

The studies were developed using a variety of methods from desk-study data collection and modeling and utilization of statistical data to case studies, field research and interviews with private sector firms and authorities, as well as focus group

discussions and surveys at the community and household levels. These multitudes of research methods are strategically chosen to help understand and consider multiple approaches to advance DRR understanding for its current and future states. As Lang et al. (2012) suggest, transdisciplinary, community-based, interactive, or participatory research approaches could be considered an appropriate way to help understand real-world problems and also meet the goals of sustainability science.

This book is timely and innovative since there have been many transformational changes that have occurred in the governance of DRR in Indonesia, especially on how DRR has been implemented from the national to local level, the progress in mainstreaming DRR at different important sectors, and the impacts of future climate change risks in Indonesia. This book is innovative since it presents perspectives across the scale, from different organizations and identifies emerging issues from psychology, religion and culture, and their implications for future DRR, and finally, on how future DRR can be aligned with other related international agendas.

### **1.3 Target Readers**

The book targets both readers from academics and policy realms. It is specifically intended for researchers and students in disaster, environmental and governance studies, who want to gain a comprehensive understanding of the nature and variety of environmental hazards and risk patterns affecting Indonesia, the vulnerability and resilience to these risks, and how these disaster risks have been managed and governed over time. This book is also beneficial for policy makers, especially in government, that are related to various aspects of DRR. Part A and B in the book focuses on the analysis of progress and challenges for DRR and the roles of different organisations in DRR. Policy makers from government organisations such as BAPPENAS and BAPPEDA (national and local planning agencies) and also BNPB and BPBDs (the national and local disaster management agencies) will benefit from reading the analysis on how the agencies have been progressing over time. This book can also inform practitioners in DRM on what have been the latest activities to strengthen community resilience to natural hazards and disasters.

### **1.4 About the Contributors**

Contributions in terms of authorship of the book were made by four editors, with a total of 80 authors and other additional contributors. The authors are affiliated with combinations of international research organizations and government, academic and non-government organizations from Indonesia. The majority of the authors have research expertise in the field of human geography, environmental

management, governance and hazard and risk assessment, while others have worked in the field of media and religious studies. While most of the authors represent universities and research institutions, there are also collaborations from members of national governments, local governments and non-government organisations. The authorships are comprised of one third female authors, half Indonesians and half early career researchers. This is a significant development to strengthen capacity for academic writing and international publishing for researchers from Indonesia. Several studies have shown that female researchers and writers are in general less visible (Lewison 2001; Lewison and Markusova 2011; Aksnes et al. 2011). A study by Djalante (2016), who did a systematic literature review on research related to hazards, disasters, risk reduction and climate change in Indonesia, finds that non-Indonesian authors strongly dominate the number of researchers, female authorship is very low, and international collaborations took place only by limited Indonesian scientific organisations and authors.

## 1.5 Structure of the Book

The book is organised into four thematic parts, comprising a total of 25 chapters. We structure the book so that Part A starts with more general reviews of disaster risk reduction governance at different levels and progress and challenges for integrating DRR into other development sectors. In part B the chapters contribute to a novel discussion on the roles of organizations that are not largely discussed in the literature such as those of the media, manufacturing firms and traditional institutions. In part C, the chapters discuss innovative and emerging issues in DRR research and practice. Identifying these emerging issues is important since they need to be dealt with and can influence the future course and pathways of DRR in Indonesia. Finally, in Part D, the last part of the main discussion in the book, looks at various methods for measuring and quantifying hazards, risk and resilience. In this part, some chapters focus on approaches to measuring institutional and community resilience while others present analyses of risks and vulnerability assessments of different hazards at different spatial scales.

### 1.5.1 *Part A: Disaster Risk Governance from National to Local Level and Its Integration into Development Sectors*

This part has eight chapters and discusses changes in the regulatory and institutional framework for DRR and further outlines how changes at the national and local levels have evolved. It further examines the progress of integration with key development sectors, with examples of regulatory analysis, education and spatial planning. Finally, it outlines important future issues to be considered to enhance DRR planning and implementation.

Chapter 2 is written by Djalante and Garschagen who review the trends in disaster occurrences and impacts, as well as the history of institutional responses to these disasters in Indonesia from 1900 to 2015. The author reviews disaster events and impacts and assesses the effectiveness of governance and institutions in responding to disasters in the past and for reducing future risk. The study finds that most disasters are caused by hydro-meteorological and geophysical hazards and that six distinct periods for DRR can be defined, marked by changes in presidential leadership and in the socio-economic situation in Indonesia, from ad-hoc response to victims of wars and disasters by natural hazards, to a more comprehensive approach to DRR and increased recognition of climate change and environmental risks in urban areas.

Chapter 3 is by Mardiah et al. who present and discuss the regulatory framework and institutional network for DRR in Indonesia. The authors find that the Law 24/2007 on Disaster Management has some contradictory contents in terms of determining the level of disasters which has strong implications for budget allocation and the cooperation between local regions, as well as identification of vulnerable groups. They argue that the law needs to be revisited to focus more on the mainstreaming of DRR into development policies and programs, and identify the two agencies for disaster management (BNPB and BPBDs) and development planning (BAPPENAS and BAPPEDA) are at the frontline for development mainstreaming. They recommend that strategies for more inclusive, locally based and community focused DRR strategies should include better consideration of climate risks, strengthen the capacity of local institutions and make comprehensive efforts to reduce vulnerability and build community resilience.

Chapter 4, by Das and Luthfi, discusses the implications for DRR at the sub-national and local level in Indonesia. The authors review the complementarity and incongruence between institutional structures and frameworks for decentralization and DRR, and how this will likely impact DRR implementation. The most important findings include that disaster management agencies at the national and local level (BNPB and BPBDs respectively) have greater authority and financial capacity than similar agencies in the past, and that the new disaster management regulation is about sharing responsibility and authority between national and local governments. Recommendations proposed include giving greater responsibility and authority to provincial governments which have better financial and technical resources (rather than the current decentralized situation in which local governments tend to have more implementing power), increasing the capacity of local government through trainings, equipping technical persons from outside the local government, and finally, increasing the role of non-state actors in disaster management that have the capability to help local governments.

Having discussed the governance of DRR at different levels in the previous parts, Chap. 5, by Anantasari et al., discusses the DRR capacity and capability of six local governments in Indonesia, through adopting the Local Government Self-Assessment Tool for DRR and developing a subsequent scoring system. There are nine categories with 34 indicators used to measure the capacity and capability of local governments for planning and implementing DRR strategies. They find that while community development, funding and networking generally scored higher, there is

a need for improvements in understanding hazards and risks, risk reduction activities, regulations, strategic planning, building development and controls, and education and training.

The remaining four chapters discuss the integration of DRR into key sectors of the legal framework, spatial planning and education.

In Chap. 6, Nurhidayah and Djalante discuss the adequacy of Forest Fire Risk Governance at the national and local level, utilizing a disaster risk management approach to assess progress and challenges in managing land and forest fires during the prevention and mitigation, emergency response and post-fire rehabilitation and recovery phases. They find that the institutional and regulatory framework for managing land/peatland fires (LFFRM) is not integrated with that of forest fires. Moreover, progress for fire management is still focused on the emergency response phase and there is slower progress at the lower governance level for different stages of LFFRM, whilst community livelihood has failed to be integrated into the process.

Thereafter follow two chapters that discuss the interlinkages between DRR and education. In Chap. 7, Bisri and Sakurai assess Disaster Education and School Safety Governance following the 2004 Indian Ocean Tsunami. They find that disaster education and school safety is not the exclusive domain of disaster management policy. Necessary policy instruments that are needed to ensure city-wide implementation of disaster education and school safety include ministerial-level regulation in the education sector, combined with a local regulation (Perda) or mayor regulation, which can ensure the use of public budget for disaster education.

In Chap. 8, Nurmalahayati et al. look at the progress, challenges and opportunities for integrating DRR and CCA into school curricula, comparing those from national policy to local implementation. They first identify topics related to DRR and CCA in the Indonesian curriculum, progress at the policy level, opportunities and challenges at school level, and then propose policy and practical recommendations. Whilst there has been major progress nationally, the adoption is hindered by a lack of teacher capacity, practical guidance and financial/policy supports. Recommendations to improve the integration include supporting teachers, providing handbooks for teaching about DRR and CCA and providing financial and policy support.

Finally in Chap. 9, Nurrohman et al. discuss the current and potential integration of DRR and CCA into spatial planning in Indonesia. They state that effective spatial planning can help to minimize vulnerability to disasters and climate change since it serves as a guideline to ensure the allocation of zones and areas that are suitable for development in the short, medium and long term by examining the potential and limitations in physical, ecological and socioeconomic aspects. The authors propose an integrative approach through a combined vulnerability and risk assessment that can serve the need of DRR and CCA analysis within the spatial planning process.



### ***1.5.2 Part B: Roles of Different Actors for DRR***

Part B examines one important part of governance: the interface of formal and informal organisations and institutions involved in DRR. Specifically, it analyses the roles of organisations that are not largely discussed in the literature such as those of media, manufacturing firms and also traditional institutions. It draws from different case studies in different parts of Indonesia that were affected by different types of disasters. There are eight chapters in this part.

In Chap. 10, Hayat and Amaratunga assess the roles and capacity of local government in maintaining post-disaster road reconstruction assets following the 2004 Indian Ocean Tsunami in Aceh. It finds that the reconstructed road assets, although of high quality, are generally poorly maintained by the local governments. Their capacities for maintenance are affected by social, political, institutional and technical factors, since maintenance is not prioritized in the government budget and there is a lack of technical capacities for carrying it out.

Chapter 11 is by Neise et al. who discuss the role of manufacturing firms as stakeholders within collective adaptation to floods in Jakarta. They propose a concept of integrative adaptive regional development (IARD), defined as outcomes of individual and collective adaptation to reconfigure prevailing risk-prone situations and hence affect future pathways for adaptation, which range from resistance to resilience, transformation or collapse. They find that manufacturing firms' production processes are heavily disrupted by floods and their adaptation strategies, individually and collectively, do not contribute towards IARD. Recommended strategies for achieving IARD include improving cooperation amongst firms and with government authorities, as well as strengthening law enforcement.

Chapter 12 is by Musaruddin who reviews the role of media representation of disasters using visual discourse analysis, in particular following the Mount Merapi eruption in Yogyakarta in 2010. The author argues that media representation is rooted in a modern scientific discursive formation of Mt. Merapi and its eruptions, which is mainly sponsored by the state, and promotes opposing claims. In particular, the author finds that Mt. Merapi is depicted as a powerful, sacred subject, while people affected by the eruption are seen as helpless. The evacuation process is also depicted as a scene of despair, in contrast to the positive representation of capable government relief efforts. In this representation, the role of community volunteers is largely ignored by the media. Consequently, the author underlines the importance of ethics in disaster journalism and makes recommendations that coverage should be aligned to public interest, accurate, and gives a voice to the voiceless.

Villeneuve et al. in Chap. 13 review the role and capacity of disabled people's organizations (DPOs) as advocates for disability-inclusive DRR in Indonesia, with case studies from Yogyakarta, Central and West Java. They suggest that, as the Sendai Framework for DRR (SFDRR) now recognizes persons with disabilities as key stakeholders, there is a need to broaden knowledge on the role of DPOs in DRR. Through capacity building initiatives, they have been able to increase collaboration

between disability and DRR actors and provide a practical model for supporting DPOs as policy advocates in other regions and countries.

In Chap. 14, Boyland et al. discuss the role of *Panglima Laot* (sea commander) in Aceh in the 2004 Indian Ocean Tsunami. *Panglima Laot* is a customary fisheries institution in Aceh which consists of 200 coastal community leaders and coordinating bodies at district and provincial levels. The authors find that *Panglima Laot* leaders and the institution had important roles in the recovery of Aceh's coastal fishing communities. The *Panglima Laot* institutions are trusted by communities, act as mediators between communities and others and were involved in planning, implementing, monitoring and evaluating livelihood recovery programmes.

Chapter 15 is by Mulyasari and Shaw on the role of faith-based organizations (FBOs) in Bandung, West Java, as risk communicators for strengthening community resilience. Mulyasari and Shaw propose a social, economic and institutional resilience activities (SIERA) framework with a scope of 45 activities covering three different disaster periods (before, during and post disaster). They find that the roles of FBOs involve dissemination of information about disaster risks during prayer sessions, utilization of community networks and resources when sending out emergency warnings to reach wider neighborhoods and the establishment of disaster early warning mechanisms with local government.

Chapter 16 by McNamara et al. assesses the performance of a Caritas-funded disaster recovery project in Salam village after the May 2006 earthquake. Through focus group discussions, they find that although the social, economic and environmental outcomes indicated that the project was perceived by beneficiaries as 'high benefit and low risk', a number of weaknesses also emerged that complicated the potential growth and long-term sustainability of the project.

The last chapter in this part, Chap. 17, is by Raffiana who discusses the role of scientific organizations in Indonesia, in particular the Indonesian Institute of Science (LIPI), in helping to translate science into practice. The author draws on her own experience as the coordinator of the Community Preparedness (COMPRESS) programmes from 2005 to 2014. The chapter shares key highlights of communicating science, as well as instrumental challenges in sustaining science communication in Indonesia, due to a number of social factors.

### ***1.5.3 Part C: Emerging Issues in DRR Research and Practice***

Part C discusses emerging issues in DRR research and practice. There are three chapters in this part and the discussion ranges from ecosystems, culture, to psychology and religion, and the interlinkages with disaster mitigation, recovery, and resilience. Identification of these emerging issues is important since they need to be addressed and can influence the future course and pathways of DRR in Indonesia.

In Chap. 18, Triyanti et al. discuss the opportunities and challenges for ecosystem-based DRR (Eco-DRR) in Indonesia. The eco-DRR approach is promoted as a compatible approach to endorse community inclusiveness and participation, and is

shown to be cost efficient, socially friendly and sustainable. The potential for its adoption in Indonesia is extremely high and preferable considering the geographical conditions of the low-lying coastal country and the high percentage of people dependent on natural resources provided by coastal areas. Taking the case study of Demak and Kuwaru in Java, they identify challenges to the adoption of Eco-DRR including the differing natural and physical magnitude of hazards, the issue of exclusion and inequality within the community and also the lack of coordinated strategies with other approaches.

In Chap. 19, taking the case of urban coastal communities in Jakarta, Surtiari et al. propose that unpacking and knowing particular elements of culture and its influence on the progression of resilience can lead to better understanding of how vulnerable communities build their own resilience. They find that reciprocal support is culturally preconditioned and makes for one of the central components of a community's capacity to cope with a disaster. Communities self-organize through rearranging social structures, dividing tasks amongst family members and assigning local leaders to manage relief programs. Furthermore, to assist with the long term recovery process, the communities utilise their networks within similar ethnic groups for socio-economic support. Finally, the ability to learn to adapt from the impacts of past floods is found to be mainly influenced by people's strongly held belief that, because they have survived past floods, they can do so again in the future. However, their findings suggest that such beliefs could also represent a barrier to preparation for future disasters.

In Chap. 20, Rahim et al. provide an account on narratives of how the Acehese interpret and heal trauma following the 2004 Indian Ocean tsunami. They argue that little is known about how Islam, as the prominent religion in Indonesia, perceives disasters, death and loss due to disasters and the role of faith in recovery. They recommend that future post-disaster mental health programs need to respect the religious perspectives of the victims in counseling and discussions; future programs needed to be supported by religious figures, incorporate the use of prayers as a means of coping and healing and integrate mental health programs with livelihood programs to help victims rebuild their lives.

#### ***1.5.4 Part D: Measuring Hazards, Risks and Community Resilience***

Part D is the last part of the book. There are five chapters in this part, which discuss different approaches, entities and methods to measure and quantify hazards, risks and resilience. The first two chapters analyse flood and forest/land fires while the last three chapters focus on approaches to measuring institutional and community resilience.

In Chap. 21, Budiyo et al. discuss flood risk in polder systems in present day Jakarta and in the future. The authors assess the benefits and costs of the polder

system in Jakarta under current conditions and under future scenarios of climate change, land use change and subsidence. The results show that cost-benefit ratios greater than 1 exist at one third of the polders which reduce a quarter of risk under current conditions. In the future, half of all polders will reduce more than half the risks and polders with very high net benefits are located away from the coastline.

Chapter 22 is by Thoha et al. who present a study on measuring the hazard level of forest and land fires in Kapuas District, Central Kalimantan Province. The authors analyze variables that affect the level of risk of land and forest fires, develop a spatial hazard model, and determine the distribution of forest and land fires. Highly hazardous areas were mostly distributed in deep peat areas, found under a land cover class of secondary swamp forest and shrub swamp and in close proximity to the road. They recommend that to develop time-series forest and land fires hazard maps in the future should include socio-economic variables in the model.

In Chap. 23, Adiyoso and Kanegae review methods to integrate religious factors into risk information, in order to help strengthen tsunami preparedness. They utilize tsunami preparedness indicators comprising a tsunami early warning system, ‘emergency plan’ and ‘capacity’ and measure preparedness at the individual, family, community and societal levels. They find that information containing Islamic messages increases preparedness at the group level, while religious leaders can help preparedness even at the individual level.

Chapter 24, is by Dokhi et al. who review the Social Resilience Module of the 2014 National Socio Economic Survey to determine the role of social capital in strengthening disaster preparedness. They find that social capital positively influences knowledge of disaster preparedness. Persons with a high level of trust, tolerance, social networks and collective action tend to have a higher knowledge of disaster preparedness. Tolerance and social-networking are the most influencing factors, while the effect of trust and collective action tend to be moderate but still statistically significant.

Chapter 25, the last in this book, is by Anwar et al. who propose a framework for community resilience which incorporates factors including community capitals (social, cultural and economic), disaster risk governance and spatial planning. Taking a case study of Yogyakarta, they conducted household interviews, focus group discussions and in-depth interviews to determine the level of resilience of the community. They find that experiences of large scale disaster which lead to large scale reconstruction following the Mt. Merapi eruption, greatly improved the awareness and capacity of local governments. Local communities, through their existing networks that have long been established, and also the role of *Gotong Royong* (working together), created supporting tools that are utilized during normal and emergency situations.

## 1.6 Conclusion

Strengthening DRR governance has shown great advances in Indonesia, especially in the development and adoption of laws, regulations and institutions. Integrating DRR into development agendas is the key prerequisite in addressing the underlying causes of national and community vulnerabilities to natural hazards. The paradigm for dealing with disasters and their impacts has started to move from emergency response and prediction to addressing the root cause of disasters and efforts for more comprehensive DRR.

The first part of the book has shown that greatest progress for DRR governance tends to happen at the national level. Local governments are still lacking in their capacity to reduce disaster risks, respond to disasters and recover from the impacts. We call for strengthening the role of local governments in various stages of disaster management. Strengthening risk governance at the local and community level should be done through strengthening institutions and equipping them with the necessary economic and technical skills to plan and implement DRR.

It has also been shown that Law 24/2007 on Disaster Management (GoI 2007b) and Law 23/2014 on Decentralization (GoI 2007a) are the foremost legal basis for addressing disaster management and clarifying the roles of national and most importantly, local governments, in DRR. In line with these regulations, the roles of BAPPEDA and BAPPENAS as the two key agencies for development planning, and BNPB and BPBDs, as the two key agencies for disaster management, are the foremost organizations at the national and local level respectively, which hold the greater responsibility, mandate and also roles for mainstreaming DRR into development agendas.

There is increasing calls for engagement of more diverse stakeholders at different levels of governance. This means that Indonesia needs to identify, work with, and maintain relationships with more diverse stakeholders. While some groups of stakeholders such as governments and international NGOs have long been involved in DRR, others have been overlooked and underutilized, especially for increasing preparedness at the local and community level. The roles of new actors in DRR, beyond those normally identified, are heavily discussed in this book. The roles of media, civil society organisations, private companies, faith-based organisations, women's groups, community leaders, religious leaders, and even scientific organisations, are those who act as connectors, creating shadow networks and informal forums by which communities can express their needs and also potential roles, identify priorities and help develop intervention actions from outside. Identifying, working with and nurturing these already existing networks in the community and society at large is important if we want to strengthen community resilience in Indonesia.

There is also an increasing call for action on disaster preparedness and emergencies. Increasing populations, environmental destruction, urbanization and climate change all contribute to an increase in disaster risk. Indonesia needs to strengthen preparedness to earthquakes and tsunami as these two hazard types cause the high-

est deaths in Indonesia (EM-DAT 2016). Moreover, there is a heightened emergency and humanitarian crisis felt around the world and Indonesia needs to also be prepared for cross-border disaster emergencies. Cross-border humanitarian emergencies, either triggered by natural hazards or other causes could be expected to increase. Strengthening implementation of these legal frameworks, through collaborative strategies and sharing of resources, is the key to such cooperation.

In this book, the rehabilitation and reconstruction approach has been critically analysed to see whether long term sustainability could be addressed through the 'Build back better' approach, which has been strongly advocated following the 2004 Indian Ocean Tsunami. Indonesia needs to use and be prepared to use disasters as opportunities to implement strategies which substantially reduce future vulnerabilities to disasters.

Furthermore, this book has presented different methods in not only assessing hazards and risks, but also the resilience of communities. While there have been plenty of assessments focusing on geophysical hazards such as earthquakes, volcanic eruptions and tsunamis (Djalante 2016), more research and assessments are needed on those caused by hydro-meteorological hazards, biological hazards and those caused by man-made and technological hazards.

Finally, the year 2015 and 2016 mark significant timelines on global human and environmental changes. Several international agreements were adopted, the SFDRR (UN/ISDR 2015) superseding the HFA, the sustainable Development Goals (SDGs) (United Nations 2015b) and the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) (UNFCCC 2015), and in 2016, the New Urban Agenda (UN Habitat 2016). The discussion in this book has shown that increased complexities in DRR need to be faced with expanded tools, approaches and actors in Indonesia. In doing so, it is hoped that within the 15 year period of implementing the SFDRR, Indonesia will be able to substantially reduce disaster risk and losses and achieve the specific aim of sustainable development goal number eleven, to make cities and human settlements inclusive, safe, resilient and sustainable.

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**Part I**  
**Disaster Risk Governance from National to**  
**Local Level and Its Integration into**  
**Development Sectors**

# Chapter 2

## A Review of Disaster Trend and Disaster Risk Governance in Indonesia: 1900–2015

Riyanti Djalante and Matthias Garschagen

**Abstract** Indonesia is one of the most disaster-prone countries on the planet, given its high exposure to natural hazards coupled with its high socio-economic vulnerability. The aim of this chapter is to review disaster events and impacts, and assess effectiveness of risk governance in responding to disasters and reducing risk. It discusses institutional and social-economic changes that have happened in response to particular disasters, and how different social political changes influence disaster risk governance. There are extensive studies that have examined the progress in building resilience in Indonesia, but studies that link disaster events and key historical institutional responses over the period between 1900 and 2015 have not yet been done systematically. Learning from these can help to achieve more effective disaster risk reduction (DRR) governance in the future. This study is done through review of the Emergency Events Database of the Centre for Research on the Epidemiology of Disasters (EM-DAT-CRED) combined with desktop review of disasters, DRR, and socio-economic-political changes in Indonesia.

The findings show that there have been 429 recorded disasters caused by natural hazards since 1900, with floods and earthquakes being the most frequent. More than 238,000 people have been killed and more than 29 million people have been affected. Total economic damages are in excess of 44 million USD (UNISDR 2016). Most disasters are caused by hydrometeorological and geophysical hazards. Hydrometeorological disasters occur the most, affect the highest number of people and cause the greatest economic losses while geophysical disasters lead to the greatest number of deaths. The next finding shows that presidential leadership and changes in the social and economic situation played significant roles for the institutional changes for DRR. Six distinct time periods from 1900 to 2015 are marked. It

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starts with Dutch colonial government response to disasters before 1945, to management of people affected by war and disasters after 1945. It continues to multi-agency coordination after 1960. From 2004, the policy is transformed through the formation of legal and institutional frameworks for more systematic and holistic DRR. The period since 2014 marks increasing consideration for climate risks, urban risks, strengthening capability of local governments and organizations and the focus on community.

**Keywords** History • Natural hazard • Governance • Disaster risk reduction • Indonesia

## 2.1 Introduction

Indonesia is one of the countries with the highest risk of disasters related to natural hazards (EM-DAT 2016; UNU-EHS and ADW 2014). It houses some of the most active volcanoes, has experienced some of the world largest earthquakes ever recorded and has been increasingly affected by floods and forest fires (EM-DAT 2016; UNISDR 2016). With its population of 250 million, high poverty and inequality rates and rapid urbanization, the country is very vulnerable to the impacts of disasters and climate change (Djalante et al. 2012; Firman 2016; Harwell 2000).

The authors review the trend and occurrences of disasters caused by natural hazards, hereafter stated as *disaster* in this chapter, and impacts on Indonesia and assesses the effectiveness of changes in the political and institutional responses that happen after those disasters. This review is important since it outlines the institutional and social-economical changes that have happened in response to, but also cause the vulnerability to, those disasters. Moreover, it sheds lights on how different social political changes which are associated with particular presidential terms influence disaster management and risk reduction.

There have been extensive studies that examine natural hazards and disasters in Indonesia, such as those on tsunamis (Horspool et al. 2014; Hsu et al. 2006; Lavigne et al. 2009; Paris et al. 2010), earthquakes (Ashadi et al. 2015; Aydan 2008; Bellier et al. 1997; Briggs et al. 2006; Darpito et al. 2011; Ghosal et al. 2012; Nalbant et al. 2005; Singh et al. 2010), volcanic eruptions (Jenkins et al. 2013; Lavigne 1999; Lavigne and Gunnell 2006; Lavigne et al. 2000; Mei and Lavigne 2012; Picquout et al. 2013; Suroño Jousset et al. 2012) and flood (Akmalah and Grigg 2011; Liu et al. 2015; Sarminingsih et al. 2014). However, these studies are done either in isolation of each other or focus on specific disaster events and impacts only.

There are also an increasing number of studies on the progress of disaster risk reduction (DRR) and examinations of political and institutional changes for managing disasters in Indonesia (e.g. Djalante 2013a; Djalante and Thomalla 2012; Djalante et al. 2012; Lassa 2010b). Lassa (2010a, 2013) examines the changes in disaster management and governance since the Dutch colonial era and proposes six phases of disaster risk management policy and regulations, from the colonial emergency policy to the postcolonial and development period and adoption of disaster

management Law, but the review spans from 1930 to 2010 only. Djalante et al. (2013, 2012) finds that the 2004 Indian Ocean tsunami had created a window of opportunity for transformational changes from emergency management to risk reduction and from pure response to disaster, to a comprehensive management from mitigation, response, recovery and reconstruction. They further suggest that to strengthen resilience building in Indonesia, there needs to be linkage between DRR and climate change adaptation (CCA), reducing urban risks, strengthening of local governments and more involvement of non government organizations (NGOs). This study builds on these existing studies to examine major disaster events in the past, in combination with social, economic and political changes, which have influenced the way disaster risk is perceived and governed in Indonesia.

This study aims to fill the gap by examining disasters and institutional changes in disaster management across different presidencies and major social and economic developments. It recommends future strategies that need to be taken based on the trends of the impacts observed. This study is important for several reasons. First, it reviews the EM-DAT publications based on available data and examines the yearly trends. Second, it examines the political and social changes that lead to increased vulnerability to disasters. Third, it examines how different Indonesian presidencies deal with disasters and disaster management. By examining the inter-linkages between disaster trends and major disaster events with social political changes and leaderships, and with consequent changes in disaster management paradigm, this study hopes to identify factors that hinders or foster changes in risk reduction paradigm, and hence determine recommendations for more effective disaster risk management and governance in the future.

The study is done through reviewing data available from the International Disaster Database of the Centre for Research on the Epidemiology of Disasters (CRED) (EM-DAT 2016b). EM-DAT was initially developed in 1988 by the WHO and the Belgian government and has been maintained by the CRED (EM-DAT 2016b). It contains core data on the occurrence and effects of more than 18,000 mass disasters that have occurred worldwide from 1900 to the present day. The database comprises data from sources such as UN agencies, governments and NGOs, research institutes or even press agencies (EM-DAT 2016b). Data are selected from the natural disaster group available from EM-DAT, namely from 1900 to 2016. Data examined include event, timeline, number of deaths, disaster groups and sub-groups, number of people affected and the economic impacts expressed in current value of US dollar (EM-DAT 2016b).

The chapter is structured as follows. Section 2.2 describes the EMDAT-CRED database and its disaster classification. Section 2.3 examines the occurrence of different types of disasters caused by environmental hazards in Indonesia between 1900 and 2015, their trends over time and their socio-economic impacts. Section 2.4 reviews selected major disaster events and the corresponding policies and strategies addressing those disasters during different presidencies and periods of major social, economic and political change. The last section is the conclusion which outlines future strategies for disaster data collection, research needs and lessons for Indonesian DRR policy including climate risk management.

## 2.2 The EM-DAT Database

The EM-DAT database provides data of different categories of Country profile, Disaster profile, Disaster list, Disaster trends, and pre-made maps (EMDAT-CRED 2016). The database includes a disaster identification number, place, date and impacts in terms of total number of deaths and affected (injured, displaced, missing) (EM-DAT 2016b). Some of the key publications which were developed using this database include the Annual Disaster Review (CRED 2015; Guha-Sapir et al. 2014) and the CredCruch series which periodically summarizes disaster events and impacts (e.g. CRED 2016). For a disaster to be entered into the database at least one of the following criteria must be fulfilled:

- Ten (10) or more people reported killed,
- A hundred (100) or more people reported affected,
- Declaration of a state of emergency and or a call for international assistance (EM-DAT 2016b)

This chapter utilize disaster within the natural disaster group and within this group, the sub group of Geophysical, Meteorological, Hydrological, and Climatological (See [Appendix](#) on categorization by EMDAT-CRED).

## 2.3 Events and Trends of in Indonesia Since 1900

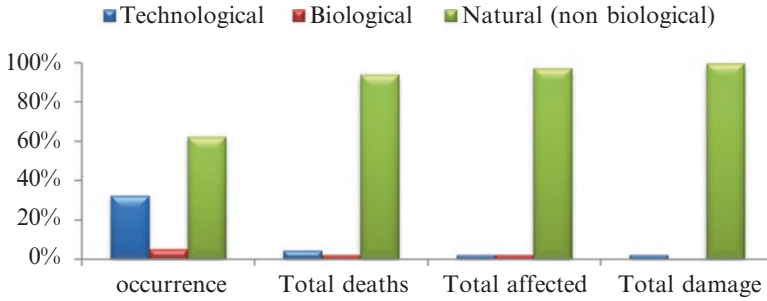
This section gives an outline of frequency and trends in disasters caused by natural hazards in Indonesia. A natural hazard is defined as a ‘natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage’ (EM-DAT 2016a). Natural hazard events can be characterized by their magnitude or intensity, speed of onset, duration and area of extent (EM-DAT 2016a). A disaster is defined by EM-DAT as a:

Situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance (definition considered in EM-DAT); An unforeseen and often sudden event that causes great damage, destruction and human suffering (EM-DAT 2016a).

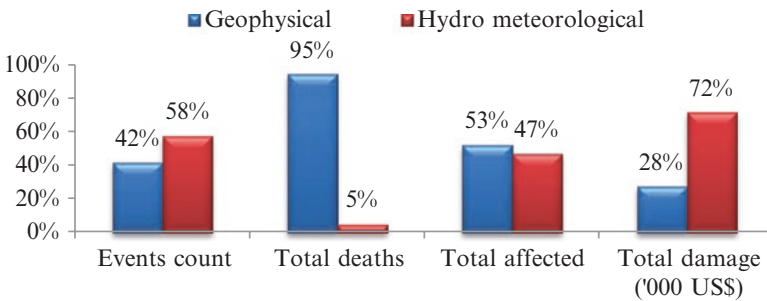
In this study, the authors focus the analysis on disasters caused by geophysical and hydro-meteorological hazards since it is shown in the following accounts that they dominate the profile of disasters in Indonesia.

Figure 2.1 compares the number of and impacts of disasters in Indonesia caused by different types of hazards: Natural (hydro-meteorological and geophysical), biological and technological (EM-DAT 2016).

Figure 2.1 show that disasters caused by hydro-meteorological and geophysical hazards, which belong to natural disaster group according to EMDAT-CRED classification ([Appendix](#)), dominate in occurrence and impacts in Indonesia. Hence, the



**Fig. 2.1** Comparison of number and impacts of technological, biological, hydro-meteorological and geophysical disasters in Indonesia (EM-DAT 2016)



**Fig. 2.2** Number and impacts of disasters caused by geophysical and hydro-meteorological hazards in Indonesia (Modified from EM-DAT 2016)

authors focus the analysis on the geophysical and hydro-meteorological hazards as they constitute the most frequent, deadly and damaging disasters in Indonesia. Moreover, past and current disaster management strategies in Indonesia focus mostly on the occurrences of hydro-meteorological disasters (DIBI 2016). It is only after the Sendai Framework for DRR was adopted in 2015, that a multi-hazard approach has been taken (UNISDR 2015).

When comparing the event count and impacts between geophysical and climate-related disasters, geophysical disasters have been extremely deadly, while climate-related disasters occurred more often and caused more damage (Fig. 2.2).

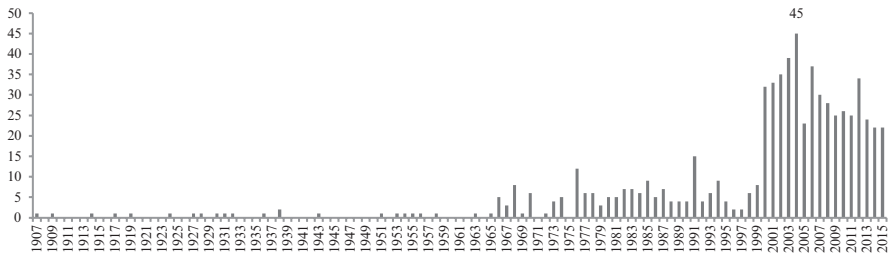
Since 1900 there have been 429 disasters caused by the impacts of geophysical and climate-related hazards in terms of total deaths, total affected and total damage (Table 2.1).

In the following sub-section, the authors review:

- The impacts of disasters and relative position of Indonesia within the global scale.
- The disaster types which contribute the most in terms of number of events, deaths, number of people affected and amount of damages and losses.
- The frequency and impacts over time of the most impactful disaster types.

**Table 2.1** Number and impacts of natural (geophysical and hydro-meteorological) disasters from 1900 to 2015 (EM-DAT 2016)

Group	Type	Occurrences	Deaths	Total affected	Total damage ('000 US\$)
Geophysical	Drought	10	9340	4,804,220	160,200
	Earthquake (ground movement)	106	30,115	8,548,649	7,189,326
	Earthquake (tsunami)	9	168,372	580,520	4,506,600
	Volcanic activity (ash fall)	56	18,310	1,321,528	530,390
	Landslide (rockfall)	1	12	55	–
	Sub total	182	226,149	15,254,972	12,386,516
Hydro-meteorological	Flood	179	7409	9,906,074	6,422,047
	Landslide	53	2542	397,897	121,745
	Storm	9	1978	18,248	–
	Wildfire	10	319	3,444,142	25,429,000
	Sub total	251	12,248	13,766,361	31,972,792
<b>Total</b>		<b>429</b>	<b>237,578</b>	<b>29,011,349</b>	<b>29,260,308</b>



**Fig. 2.3** Number of disasters in Indonesia from 1907 to 2015 (EM-DAT 2016)

### 2.3.1 Number of Disaster Events

The first measure on the impact of disasters is the frequency of occurrences. Indonesia is the 4th most affected country in the world, after the United States, India and China, in terms of the number of disasters and these account for 3 % of all disaster occurrences across the globe (EM-DAT 2016). A detailed yearly assessment shows these disasters have occurred steadily over the years, with the last 30 years showing a sharp increase (Fig. 2.3). Floods and earthquakes are the two most frequent disasters in Indonesia (Fig. 2.4).

Looking deeper into the figure, the frequency of occurrence of reported flood and also earthquake disasters increases substantially within the period from the 1950s to

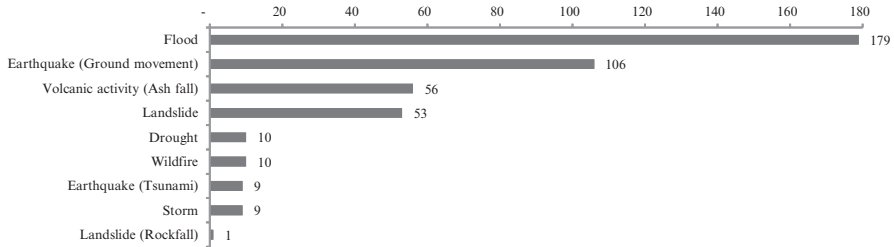


Fig. 2.4 Number of different types of disasters in Indonesia from 1900 to 2015 (EM-DAT 2016)

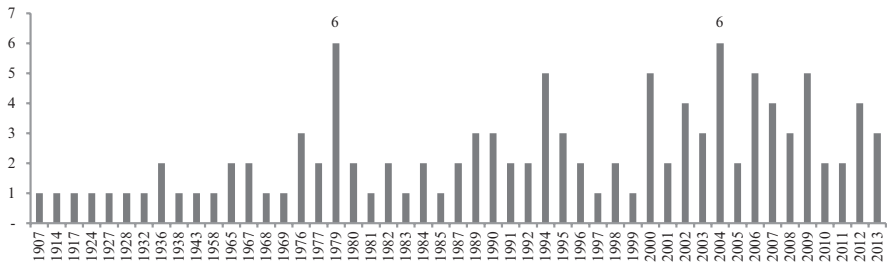


Fig. 2.5 Number of flood disasters in Indonesia from 1907 to 2015 (EM-DAT 2016)

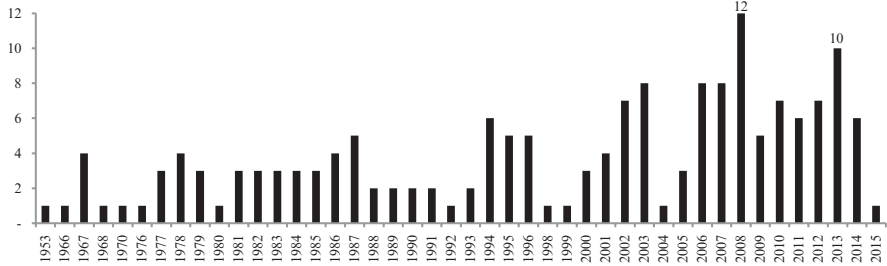


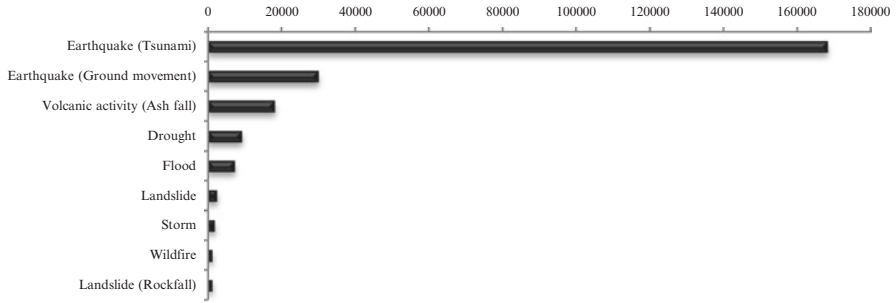
Fig. 2.6 Number of earthquake disasters in Indonesia from 1953 to 2015 (EM-DAT 2016)

now (Figs. 2.5 and 2.6). Floods have been included in EM-DAT since 1907 and earthquakes since 1953 (EM-DAT 2016).

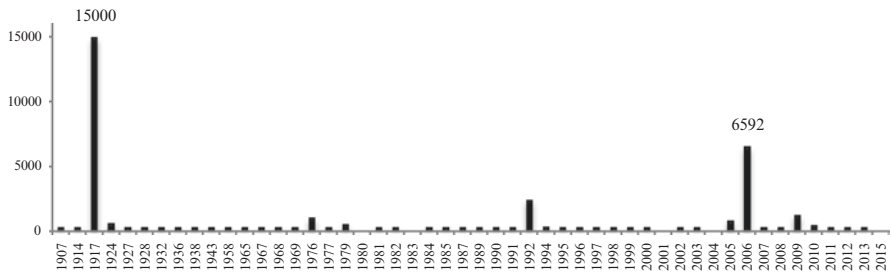
### 2.3.2 Number of People Killed by Disasters

The second measure on the impact of disasters is the number of casualties. More than 237,578 people have been killed by geophysical and hydro-meteorological disasters in Indonesia (EM-DAT 2016), comprising 1 % of the total number of deaths due to disasters worldwide (EM-DAT 2016). Indonesia has the 8th highest number of deaths caused by disasters in the world (EM-DAT 2016). Figure 2.7

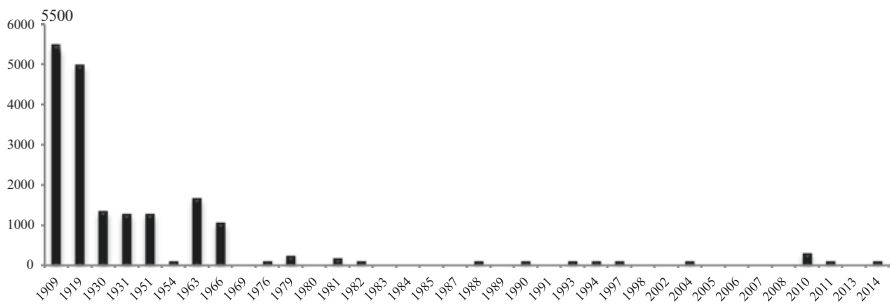




**Fig. 2.7** Number of total deaths caused by disasters disaggregated by types between 1900 and 2015 (EM-DAT 2016)



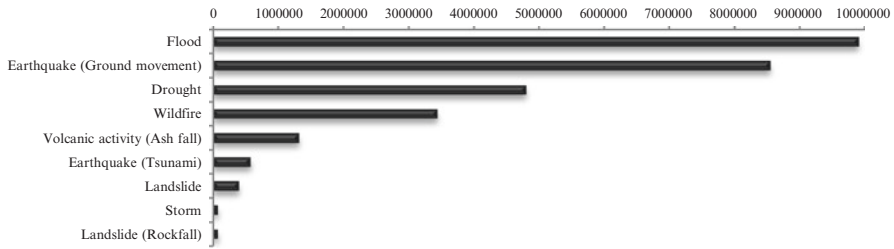
**Fig. 2.8** Number of people killed by disasters in Indonesia per year, without the 2004 tsunami (EM-DAT 2016)



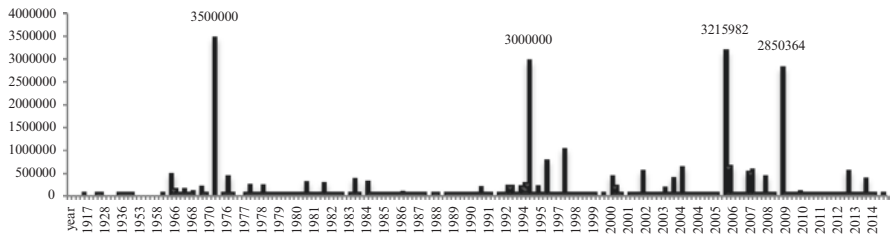
**Fig. 2.9** Number of people killed by volcanic activity in Indonesia per year from 1900 to 2015 (EM-DAT 2016)

shows that earthquakes are the deadliest disasters, comprising 70 % of total deaths (EM-DAT 2016).

The deadliest earthquake was the 2004 Indian Ocean earthquake and tsunami which killed 165,816 people, followed by the Bali earthquake in 1917 and the Yogyakarta earthquake in 2006 which were the second and third most deadly earthquakes in Indonesia respectively (EM-DAT 2016) (Fig. 2.8). On the other hand, deaths due to volcanic activity has declined rapidly over the years (Fig. 2.9).



**Fig. 2.10** Total number of people affected by different types of disasters in Indonesia from 1900 to 2015 (EM-DAT 2016)



**Fig. 2.11** Number of people affected due to disasters per year in Indonesia from 1900 to 2015 (EM-DAT 2016)

### 2.3.3 Number of People Affected by Disasters

The third measure of the impact of disasters is the number of people affected. As shown in Table 2.1, the total number of people affected by disasters includes the number of people injured, left homeless or otherwise affected by the event (EM-DAT 2016b). Almost 29 million people in Indonesia have been affected by disasters since 1900. Whilst high, this number is low compared to some other countries. With more than three billion people affected by disasters during the same time period, China has the highest number of people affected (EM-DAT 2016). Floods and earthquakes, followed by droughts and wildfires have caused the highest total number of people affected (Fig. 2.10).

The average total number of people affected by disasters per year has been increasing since 1900 (Fig. 2.11). Four events that occurred in 1972, 1994, 2006 and 2009 affected around three million people each. The events in 1972 and 1994 were prolonged droughts (Salafsky 1994) and forest fires (Jim 1999; Wooster and Strub 2002) and those in 2006 and 2009 were floods that occurred all over Indonesia.

Figure 2.12 shows the number of people affected by floods per year. Since 1953 there has been an increasing trend in the number of people affected. This might be explained largely by the strong population growth during the 1950s and following decades.

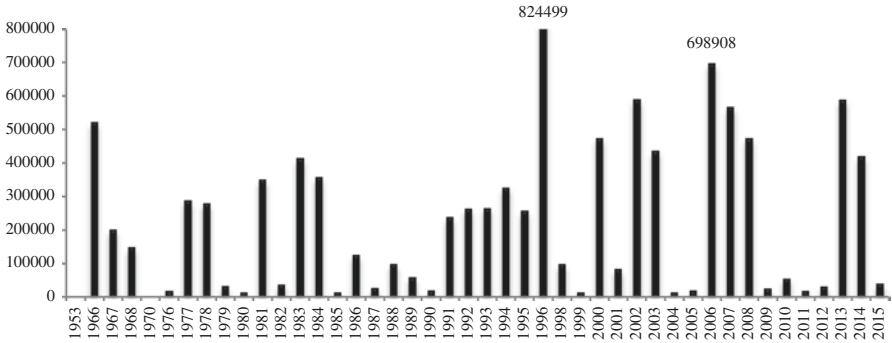


Fig. 2.12 Number of people affected by floods per year from 1953 to 2015 (EM-DAT 2016)

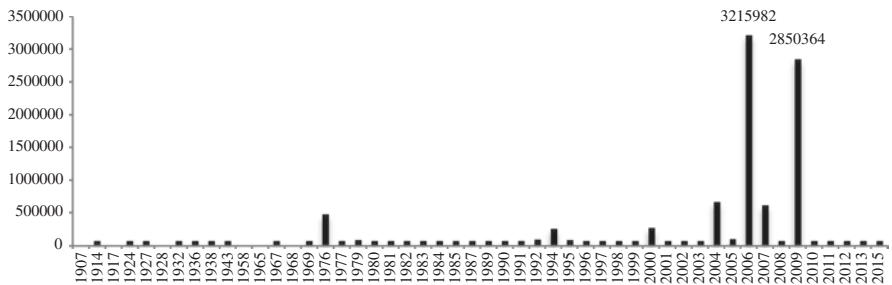
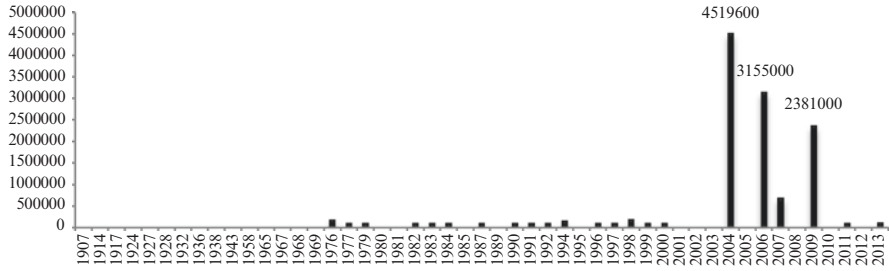


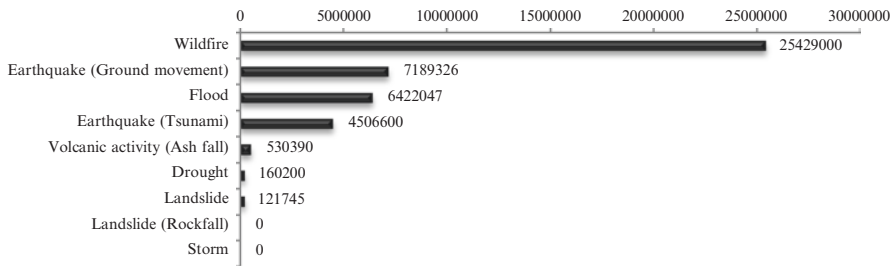
Fig. 2.13 Number of people affected by earthquakes per year from 1900 to 2015 (EM-DAT 2016)

It is only in the 1980s that the growth started to decline gradually (World Bank 2016c). This increase in population is hence expected to have increased people’s exposure (i.e., the number of people in harm’s way) to hazards. The time period between the 1990s and 2010s contains the two decades with the most frequent and devastating flood events in Indonesia. Two events in particular, one in 1996 and the other in 2006 affected the highest number of people, almost 1.5 million people combined (EM-DAT 2016). Moreover, these flood events have impacted the urban poor dwellings disproportionately’. These events happened in Jakarta, when a large concentration of the urban poor live. This is consistent with data from the World Bank which shows that the 1990s marked the time when 10 % of the Indonesian population lived within cities of more than one million people (World Bank 2016d).

Figure 2.13 shows the number of people affected by earthquakes. The two events with the highest number of people affected are the Yogyakarta earthquake in 2006 and the Padang earthquake in 2009 (EM-DAT 2016).



**Fig. 2.14** Amount of damage caused by disasters per year in Indonesia from 1900 to 2015 (EM-DAT 2016)



**Fig. 2.15** Total damage caused by different types of disasters from 1900 to 2015 in Indonesia, in USD (EM-DAT 2016)

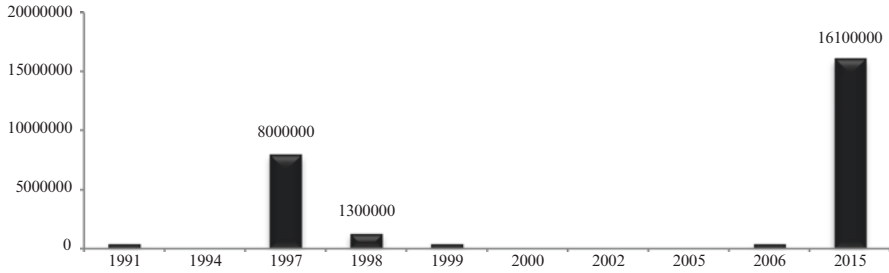
### 2.3.4 Damages and Losses Caused by Disasters

The last measure of the impact of disasters is related to the economic impacts of disasters, which are the losses and damages caused by an event. Disasters have caused more than USD 28 billion in losses and damages worldwide (EM-DAT 2016), with Indonesia ranking 13th in the world. Damages and losses have been significant since 1907 and have continued to increase overtime. The three costliest disasters happened in the period between 2004 and 2009 (Fig. 2.14), namely the 2004 Indian Ocean tsunami, the 2006 Padang earthquake and the 2009 Yogyakarta earthquake.

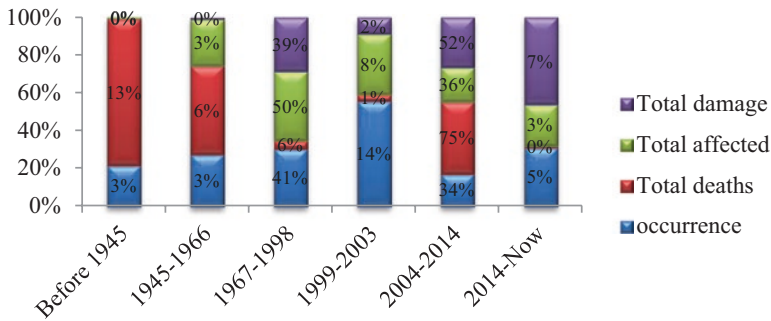
The greatest damages are caused by wildfires, earthquakes, floods and earthquake tsunamis (Fig. 2.15) (EM-DAT 2016).

Figure 2.16 shows the damages caused by five forest and wildfire events in Indonesia, four of which happened between 1997 and 1999 and one in 2015 which cost more than 16 million USD (EM-DAT 2016).

To summarize this section, the authors have reviewed disasters (caused by geophysical and hydro-meteorological hazards) in Indonesia from the EM-DAT data of number of events, deaths, people affected and damages and losses caused. It has been discussed that flooding is the most frequent disaster that also affected most people, whilst earthquake and tsunami are the deadliest ones. Forest and wildfires caused the most damages.



**Fig. 2.16** Total annual damage caused by forest and wildfires in Indonesia from 1990 to 2015 (EM-DAT 2016)



**Fig. 2.17** Percentage of occurrences and impacts of disasters in six different periods in Indonesia from 1990 to 2015 (EM-DAT 2016) (The values are to be added horizontally within the same color/category)

## 2.4 Evolution of Institutional Responses to Major Disasters Caused by Natural Hazards

After providing a historical overview of the occurrences and impacts of disasters in Indonesia, this part links those major disaster events and trends with policies for disaster risk management. Through linking the events with the current political and institutional situations at these periods, it can be seen that the roles of presidential leaderships as well as social and political changes have significantly contributed to the way disasters were managed, marked noticeably by the formation of institutions mandated for disaster management.

The authors find that there are six distinct periods in which major disaster events correspond to major changes in the institutional and governance responses for disaster management and risk reduction in Indonesia.

Figure 2.17 shows the occurrences and impacts of disasters during these periods. The highest deaths happened within the Dutch colonial period before 1945, while between 1945 and 1966, there was an increase in the number of people affected. In the period of 1967–1998, despite a sharp reduction in deaths, there were large jumps

in total losses and damages. The period between 1999 and 2003 saw large numbers of people affected. The period between 2004 and 2014 saw large-scale, high impact disasters with a high number of deaths. Finally, in the period 2014 to now, total damage has increased substantially (EM-DAT 2016).

Table 2.2 summarizes the six periods, large scale disaster events and the impacts, and major policy responses in Indonesia and globally.

In the following six sub-sections, the authors review:

- The types and cumulative impacts of disasters.
- Major disaster events that have occurred.
- Key institutional changes that were established as responses to those events, major changes within DRR governance and institutions in Indonesia.

#### ***2.4.1 Time Period Before 1945: Indonesia Under Dutch Colonialism***

The first time period is before 1945 which marks the Dutch colonial period in Indonesia. EM-DAT includes 15 disasters that occurred between 1900 and 1945 that affected more than 35,000 people, of which the majority were earthquakes and volcanic eruptions (EM-DAT 2016). There is no EM-DAT data prior to 1900 (EM-DAT 2016), and the losses and damages were unfortunately not documented since economic damage did not receive much attention at that time. The two major events prior to the 1900s that received most attention were the great Tambora eruption in 1815 (Self et al. 2004; Stothers 1984) and the Krakatau eruption in 1883 (Carey et al. 2001). Scientific discussions on these events focused on how these major disasters occurred and impacted the environment and people (e.g. Self et al. 2004; Stothers 1984). Oppenheimer (2003) estimated that the Tambora explosion caused 71,000 deaths in Sumbawa and Lombok and even influenced the global climate system (Chenoweth 2001; Kandlerbauer et al. 2013; Oppenheimer 2003; Rampino and Self 1982; Schurer et al. 2015).

In general, due to difficulty in finding relevant literature, it is difficult to make links between the disasters that occurred in this time period and the changes in governance as a response to these events. A rare and recent study on disaster management and Colonialism from 1840 to 1920 in the Indonesian archipelago by Schrikker (2016), proposes that Colonial government response to disasters were mostly ad-hoc and with minimal action.

Schrikker (2016) states that mid-nineteenth century disaster response was characterized by religious, cross-cultural interaction and cooperation amongst the indigenous and island communities with Dutch colonial rule. In the late nineteenth century, relief works formed an important form of government aid, and in the early twentieth century, refugee camps emerged in disaster sites such as that after the Merapi Eruption in 1930 (Schrikker 2016). In 1883 after the Krakatoa eruption, members of the European community in Batavia (now Jakarta) set up a separate

**Table 2.2** Ten most important disasters and their links with key policies for disaster risk management during six defined time periods (Author, with reference from BNPB 2016; Djalante 2012a; EM-DAT 2016; Lassa 2010b, 2013; Schrikker 2016)

Period	Date	Major disaster Event	Impacts	Key policy responses in Indonesia and internationally
Before 1945: Indonesia under colonialisms	1815	Mount Tambora eruption	Changes in global climate Deaths 71,000	Mid-nineteenth century: religious, cross-cultural interaction and cooperation amongst the indigenous and island communities and with the Dutch colonial (Schrikker 2016)
	1883	Mount Krakatau eruption		In 1883 after the Krakatoa eruption, members of the European community in Batavia (now Jakarta) set up separate fund of European victims (Schrikker 2016)
	1909	Mount Semeru eruption	Deaths 5500	Late nineteenth century, relief works formed an important form of government aid (Schrikker 2016)
	1917	Bali earthquake	Deaths 15,000	
	00-05-1919	Kelud eruption	Deaths 5000	Volcano-monitoring services (Schrikker 2016) First establishment of disaster prevention project to flood tunnel from Mount Kelud (Schrikker 2016) First scientific inquiry on geophysical hazards in Indonesia (Schrikker 2016)
	1930	Merapi eruption	Deaths 1369	Early twentieth century, refugee camps (Schrikker 2016)
	1939			<i>Regeling op de Staat van Oorlog en van Beleg</i> (SOB) (regulation on the state of war and of siege)
1945–1966: President Soekarno, management of dangerous situations (war, conflicts, separatisms, disaster by natural hazards)	1945			Indonesian independence (17 August 1945) The national board for war victims (BPKKP / <i>Badan Keluarga Korban Perang</i> )
	1946			Law 16/1946 on emergency situation ( <i>Keadaan Bahaya</i> )
	1957			Law 74/1957 on emergency situation ( <i>Keadaan Bahaya</i> )
	1959			Perppu 23/1959 on emergency situation / <i>Keadaan Bahaya</i>

	03-01-1963	Mount Agung eruption (Bali)	Deaths 1584	The national board for natural disaster management (BP2BAP/Badan Pertimbangan Penanggulangan Bencana Alam Pusat)
	1966	Java and Lombok drought	Deaths 8000	
	14.03.1966	Bengawan Solo river flood	Total affected 524,100	
1967-1998: President Suharto, coordination for managing natural disaster	1967			National coordination team for natural disaster management (TKP2BA/ Tim Koordinasi Nasional Penanggulangan Bencana Alam)
	1972	ENSO java/ famine	Total affected 3,500,000	
	18th of June, 1979			National coordination board for natural disaster management (BAKORNAS PBA/Badan Koordinasi Nasional Penanggulangan Bencana Alam). At the provincial level, coordinating agency for disaster management (Satkorlak PBA/Satuan Koordinasi Pelaksanaan Penanggulangan Bencana Alam).
	1990			National coordination board for disaster management (BAKORNAS PB /Badan Koordinasi Nasional Penanggulangan Bencana)
	1982/1983, 1986, 1990, 1991, 1994, 1997	Wildfire (Islands of Borneo and Sumatra)	Affected 328,771 Total fire damage of almost ten billion USD in 1997-8	Haze on neighboring countries in Malaysia, Singapore, Hong Kong Large scale, multi-agencies, multi-level fire-fighting and management Community-based approach for fire risk reduction

(continued)



Table 2.2 (continued)

Period	Date	Major disaster Event	Impacts	Key policy responses in Indonesia and internationally
1999–2003: The reform era, three presidents, Coordination for managing natural and social disasters	1998	Highest number of disasters, 41 % of total		President BJ Habibie (1998–1999)
	1999			President Abdurrahman Wahid (1999–2001) National coordination board for disaster management (BAKORNAS PB/ <i>Badan Koordinasi Nasional Penanggulangan Bencana</i> ) There is an escalation of separatism and religion-ethnic-based conflict at multiple places across Indonesia (Aceh, Maluku, North Maluku, East Timor) East Timor referendum and become a country of Timor Leste
	2001			President Megawati Sukarnoputri (2001–2004) National Coordination board for disaster and displaced people management (BAKORNAS PBB/ <i>Badan Koordinasi Nasional Penanggulangan Bencana and penanganan pengungsi</i> )
2004–2014: President SB Yudhoyono, an era for DRR	2004	Highest number of disaster in 1 year (45)	Deaths 165,708 Total affected 532,898 Damage USD 4,451,600 Affected multiple countries in Asia and Africa	President Susilo Bambang Yudhoyono (2004–2014)
	26–12-2004	Indian Ocean tsunami (Aceh)		The national coordination board for disaster management (BAKORNAS PB/ <i>Badan Koordinasi Nasional Penanggulangan Bencana</i> ) Indonesia tsunami rehabilitation and reconstruction board (BRR/ <i>Badan Rehabilitasi dan Rekonstruksi</i> ) World conference on disaster reduction (WCDR) Hyogo framework for action 2005–2015 (HFA)
	2005			Global and regional tsunami early warning systems (EWS, GITEWS, INATEWS)

27-05-2006	Yogyakarta Earthquake	Deaths 5778 Total affected 3,177,923 Damage 3,100,000	A series of transformational actions in legislative, institutional and financial strategies for DRR were taken: National action plan for DRR (RAN PRB) 2006-2009 Disaster management law 24/2007 Presidential regulation 3/2007 related to catastrophic events National disaster management Agency (BNPb) BPBD at the provinces and local governments formed INATEWS (Indonesia tsunami early warning system) Indonesia disaster database (DIBI) Various presidential regulations related to: Roles of international agency and INGOs in DM Budgeting and management of disaster aid Implementations of DM nationally and locally
22-12-2006	Flood all over Indonesia	Total affected 618,486	
2007	Highest number of people affected by disaster in 1 year (mostly due to flood)	More than 4.7 million people affected	
31-01-2007	Jakarta flood	Damages USD 971,000	
12-09-2007	Bengkulu earthquake	Damages USD 500,000	
30-09-2009	Padang earthquake	Total people affected 2,501,798 Damages USD 2,200,000	First and second global platform for DRR National platform for DRR (PLANAS) Padang reconstruction The ASEAN agreement on disaster management and emergency response (AADMER)
2010			National guidelines for DM ( <i>Renas PB</i> ) 2010-2014
2011			Indonesian President, Susilo Bambang Yudhoyono named Global Champion for DRR Third global platform for DRR ASEAN coordinating center for humanitarian assistance on disaster management (AHA Center)

(continued)

Table 2.2 (continued)

Period	Date	Major disaster Event	Impacts	Key policy responses in Indonesia and internationally
2014–2016: managing urban risks, climate change and achieving sustainable development	2012			AMCRR in Yogyakarta
	17-01-2013	Jakarta flood	Damages USD 3,000,000	Jakarta Governor Joko Widodo (2012–2014)
	08-01-2014	Jakarta flood	Damages USD 600,000	President Joko Widodo (2014–Now) Jakarta Governor Basuki T Purnama (2014–Now) Indonesia ratified ASEAN agreement of trans-boundary haze pollution
2015	00-01-2015	Forest fire in Sumatra and Kalimantan Southeast Asian haze	Damages USD 16,100,000	BNPB was involved in wildlife and forest firefighting ( <i>Karhutala Kebarakaran Hutan dan Lahan</i> ) 6 Provinces in Kalimantan and Sumatra were declared at state of haze emergency
				4 Global agendas: Sendai framework for DRR Sustainable development goals Paris Agreement on Climate Change Addis Ababa action agenda

fund for European victims (Schrikker 2016). After subsequent Kelud eruptions in 1848, 1875, 1901 and 1919, the colonial government set up a project for volcano-monitoring services and the first establishment of a disaster prevention project in forms of flood tunnel, which also marked the application of science to geophysical hazards in Indonesia (Schrikker 2016).

Only one particular disaster-related law was issued shortly before 1945. Lassa (2010a) stated that a *Regeling op de Staat van Oorlog en van Beleg* (SOB) (Regulation on the State of War and of Siege) was issued in 1939 by the Dutch to regulate war emergencies and extraordinary emergencies. This however, as suggested by Arifin (1957), developed strategies toward military and defense law, rather than strategies to manage risks towards disasters. There are no mentions of disasters or refugee management in this regulation.

#### **2.4.2 Time Period After Indonesian Independence 1945–1966 Under President Sukarno**

1945 was a significant year in Indonesia since the country gained independence from the Dutch on August 17th with Sukarno as the first Indonesian president (Vickers 2005). During this time there were 14 disaster events recorded, with more than 13,000 deaths, 850,000 people affected and a cost of 33 million USD (EM-DAT 2016). The years between 1945 and 1960 were dominated by the management of dangerous situations including war, war victims, displaced people and natural disasters. The agency for welfare of war victims and their families (BPKKP/*Badan Penolong Keluarga Korban Perang*) was formed on the 20th of August 1945 (BNPB 2016). Between 1946 and 1959 three laws were developed that focused on the management of dangerous situations which included war, conflict, separatism and natural disasters (Lassa 2010a). These were: Law 6/1946 on Emergency Situation (*Bahaya*), the amendment of Emergency Situation Law 1/1948 and Law 30/1948 on the transfer of full sovereignty to the president during dangerous situations including regulating emergency situations due to war and natural disasters. The fourth law, law 6/1946 acknowledged civil society actors as an alternative power to deal with emergencies through Law 74/1957 (Lassa 2010a).

There were three major disasters at the time, including: the eruption of Mount Agung in Bali in 1963, the Java and Lombok drought in 1966, which caused widespread famine and the deaths of 8000 people and also the Bengawan Solo river flood which affected more than 500,000 people (EM-DAT 2016). The el Niño southern Oscillation (ENSO) season in the 1960s and 1970s caused extremely low rainfall (Juneng and Tangang 2005) and prolonged droughts in Java and Lombok (Harger 1995b) which impacted crop production in Indonesia (Amien et al. 1996, 1999; Kirono and Tapper 1999). It was only after these subsequent disasters that Indonesia started to recognize the increasing impacts of disasters, mainly from the large-scale and nation-wide impacts of droughts, coupled with volcanic eruptions and floods. In

1966 the first agency with a specific name and mandate related to disasters caused by natural hazards was formed. This was the National Consultative Board for Natural Disaster Management (*Badan Pertimbangan Penanggulangan Bencana Alam* /BP2BAP) headed by the Ministry of Social Affairs (Lassa 2010a). However, its mandate was limited to managing emergency situations and coordinating the distribution of humanitarian aid to people affected by disasters.

### ***2.4.3 Time Period Between 1967 and 1998 Under President Suharto***

The third time period is between the 1960s and the 1990s and marked the first significant period in which the government moved away from the Dutch colonization and Indonesia started to experience increased economic development (Berger 1997; Pritchett 2011). Within this 31 year period, there were 177 disasters that caused almost 14,000 deaths, affected almost 15 million people and caused more than 11 billion USD in damages (EM-DAT 2016). This period was the worst in terms of impacts of disasters. Forty percent of total disasters occurred over this period, accounting for almost 50 % of the total number of people affected in Indonesia and representing 34 % of the overall damage (EM-DAT 2016). The most notable event in this period was the ENSO period in 1972, which caused large-scale famine and affected 3.5 million people across Indonesia (Juneng and Tangang 2005; Kirono and Tapper 1999; Naylor et al. 2001).

In 1967 Suharto took power as president until 1998 (Vickers 2005). Due to economic development, unequal distribution of wealth, an increasing population and the intensification of urbanization, Indonesia experienced a dramatic shift in its disaster profile. The population also grew from 88.69 to 178.6 million (World Bank 2016e). A rapidly growing population forces people to inhabit hazard-prone areas such as unstable slopes, river banks and coastal areas. Despite strong economic growth in this period, there were still 11.2 % of people living below the poverty line (World Bank 2016e). All of these situations made people more vulnerable to shocks such as disasters. Hence addressing development deficits, such as reducing the poverty rate, improving infrastructure and bettering social and economic conditions, could subsequently reduce risks from disasters (Pelling 2003; Schipper et al. 2016; Schipper and Pelling 2006).

Under Suharto's new leadership, the National Coordination Team for Disaster Management (TKP2BA) was formed in 1967 (BNPB 2016). The agency was initiated to manage the impacts of the large-scale droughts and Begawan Solo floods, coincidentally the birthplace of Suharto, which occurred in 1967. Since the frequency and impact of disasters caused by natural hazards was increasingly felt, there was a realization that disaster management should not be focused entirely on the emergency phase but should also consider preparedness, rehabilitation and reconstruction, in other words, from reactive to more proactive and comprehensive policies for

disaster management (Lassa 2010b). A larger and stronger mandate for better coordination of disaster risk management led to the creation of the National coordination board for natural disaster management (BAKORNAS PBA/*Badan Koordinasi Nasional Penanggulangan Bencana Alam*) in 1979. The Coordinating Ministry of Welfare, which has coordinating power over technical ministries, was then leading the coordinating board. This is also an important step in the recognition of multi-stakeholders and multi-agencies coordination for dealing with the increasing impacts of disasters.

Subsequently, the ministry of Internal Affairs, who coordinated provincial governments, issued instruction 27/1979 to form the Coordinating Agency for Disaster Management (Satkorlak PBA/*Satuan Koordinasi Pelaksanaan Penanggulangan Bencana Alam*). BAKORNAS PBA and Satkorlak PBA continued the mandate for 11 years. The formation of Satkorlak PBA at the provincial level is another major transformation of devolution of responsibility for disaster management not only at the national level but also down to the provincial level. A call for a multi-governance level has been advocated to enable more coordination and faster and more effective risk management (Betsill and Bulkeley 2006; Corfee-Morlot et al. 2009; Djalante 2012b; Djalante et al. 2013).

The world on a whole is experiencing an increased number and impacts of disasters due to natural hazards (UN/ISDR 2016a). This is also the case in Indonesia (EM-DAT 2016). Hence in 1990, the period of 1990–1999 was designated as the International Decade for Natural Disaster Reduction (UN/ISDR 2016a). The previous BAKORNAS PBA, which focused on natural disasters only, was changed to the National Coordination board for disaster management (*BAKORNAS PB /Badan Koordinasi Nasional Penanggulangan Bencana*) in 1990 and continued to remain the same until 2001. This new agency was created with an expanded mandate, not only to deal with the impacts of disasters by natural hazards but also other disasters which caused humanitarian crises, such as dealing with people affected by conflicts in various places in Indonesia (BNPB 2016; Lassa 2010b).

In this period, Suharto allowed for massive land conversion to industrial palm oil production, financed by businesses within Indonesia and also from Malaysia and Singapore (Aditjondro 2001; Barber and Schweithelm 2000; Gellert 1998). Land conversion for these oil productions requires massive forest trees to be cleared through cutting and burning. Hence Large-scale forest and wildfire events occurred in the tropical forests in Borneo/Kalimantan and Sumatra, which contributed to the costliest event in this period. It started to cause great problems not only in Indonesia but also in neighboring countries such as Malaysia, Singapore and even Hong Kong (Chan et al. 2001). The fire events in 1982–1997, which occurred almost annually, were associated with human actions of large scale forest conversion and land clearing for pulp wood, rubber tree and oil palm plantations (Schindler 1998). Moreover, as Jim (1999) wrote, the forest fires of 1997–1998 represent an unprecedented ecological disaster, by which ineffective land use and land management couple with prolonged drought caused by the El Niño event (Stolle and Tomich 1999; Wooster et al. 2012; Wooster and Strub 2002). BAKORNAS PB which was formed in 1990 and headed by the Vice President, along with the *Satkorlak* at the provincial level

and *Satlak* at the regency level, were the leading agencies responsible for fire fighting and management efforts (Hoffmann 2004). A notable institutional change as a result of the firefighting efforts was the increasing collaboration amongst different agencies, such as the BAKORNAS PB, Ministry of Forestry, the Army and the Police, as well as provincial and local governments (Hoffmann 2004). Increasingly, efforts for community involvement and also community-based solutions were being advocated as a means to reduce fire risk in the first place (Hoffmann 2004).

#### ***2.4.4 Time Period Between 1998 and 2004: The Reform Era of Three Presidents of Habibie, Wahid and Soekarnoputri***

During this fourth time period, 63 disasters occurred which killed more than 2000 people, affected more than 23 million people, and caused almost 21 million USD in damages – a comparatively calm period for disaster emergencies in Indonesia.

Over the next 14 years, the Indonesian government continued to become more stable and prosper. It was one of the Asian economic tigers (Berger 1997) and underwent rapid economic and social development. However, the rapid economic development that occurred for 30 years was not followed by an even distribution of wealth across different places in Indonesia. The late period of the 1990s marked the most unstable state of Indonesia policies and leaderships. After more than 30 years reigning, Suharto and his government were slowly becoming corrupted and accused with favoritism and nepotism, and were hence overthrown in 1998 following mass unrest across the nation (Robertson-Snape 1999).

It was a new era of reform (*Reformasi*) in the country. The president was changed from BJ Habibie, to Abdurrahman Wahid, to Megawati Sukarnoputri (Kim et al. 2006). Many claimed that wealth was mainly concentrated in Java and there was a Java – non Java sentiment at that time (Berger 1997). Separatism and religious-ethnic conflicts erupted in different islands spreading from the Western to the Eastern part of Indonesia, Aceh in Sumatera, Maluku, North Maluku and Poso in Sulawesi (Bertrand 2008). The East Timor referendum in 1999 resulted in the separation from Indonesia and formation of the new country of Timor-Leste (Molnar 2009). The people of Aceh through the Free Aceh Movement (*Gerakan Aceh Merdeka*) intensified their struggle (Sulistiyanto 2001). Religion-based conflict in Maluku and Poso (Sulawesi), between Muslims and non-Muslims, erupted between 1999 and 2002 (Bertrand 2008).

To respond to the escalated impacts these conflicts, the mandate of BAKORNAS-PB, which was formed in 1990, was enlarged to include the management of displaced people due to conflicts. Consequently, the name changed to National Coordination board for disaster and Displaced People management BAKORNAS PBP (BNPB 2016). BAKORNAS PBP was established from 2001 to 2004, until the end of Abdurrahman Wahid's presidency (GoI 2001). While BAKORNAS-PBP was not responsible for managing the conflict itself, it was

responsible for managing refugees and displaced people due to those conflicts (GoI 2001).

### **2.4.5 Time Period Between 2004 and 2014 Under President Yudhoyono**

Following the political turmoil and social unrest of the previous time period, Indonesia held its first direct presidential election in 2004, in which Susilo Bambang Yudhoyono was elected (Honna 2007). This period was the most challenging period for disaster management in Indonesia. In particular, this short 10 years represented 34 % of all recorded disasters, in which 75 % of all deaths occurred, affected 36 % of all people and caused more than 50 % of the total damage.

On 26th December 2004, a magnitude 8.9 earthquake occurred in the Indian Ocean off the coast of Sumatra and caused a tsunami that was so powerful it caused enormous damages not only in Indonesia, but 15 other countries in the Indian Ocean (Telford and Cosgrave 2007). For Indonesia alone, it claimed 165,708 lives, affected 532,898 people and caused damages of almost 4.5 million USD (EM-DAT 2016).

The unprecedented scale of the 2004 Indian Ocean Tsunami paved the way for very strong momentum for disaster risk reduction not only in Indonesia but globally. It brought transformational changes in the way disasters were viewed and how disaster risks were managed worldwide. In January 2005 the Hyogo Framework for Action (HFA) was adopted as the first international framework for DRR (UNISDR 2005). Immediately following the launch of the HFA, Presidential Decree 80/2005 gave the National Coordination board for disaster management (BAKORNAS PB) the mandate to coordinate disaster management (BNPB 2016). To coordinate the tsunami emergency management, Indonesia also formed the Tsunami Rehabilitation and Reconstruction Board (BRR/*Badan Rehabilitasi dan Rekonstruksi*) to manage the rehabilitation and reconstruction processes utilizing financial and technical support from various international agencies (Nazara and Resosudarmo 2007). The progresses of the tsunami rehabilitation and reconstruction have been reported by various agencies (e.g. Page 2009; Telford and Cosgrave 2007). The tsunami brought a window of opportunity for peace and reconciliation in Aceh, massive scale housing and infrastructure projects were constructed and vast community and gender driven economic development and empowerment strategies were established (Chang et al. 2011; Jayasuriya and McCawley 2010; e.g. Kennedy et al. 2008; Mulligan and Shaw 2011). The year 2014 also marked a decade after the 2004 Indian Ocean tsunami and discussion on the progress and challenges of rehabilitation and reconstruction processes, current health and wellbeing of the people, displacement, land and house ownerships as well as impacts of economic development and community-based strategies (Shaw 2015)

Indonesia has been progressing well in implementing the HFA. The National Disaster management agency was established along with its provincial and local



counterparts, a new law on disaster management was adopted and various activities to strengthen community resilience were implemented by government, international organizations and NGOs (BNPB 2011a, b, 2013, 2015; Djalante et al. 2012). This was a new era for DRR in Indonesia, which called for involvement of multiple stakeholders, accountability in disasters and also for strengthening and building community resilience (Djalante et al. 2012). A new law on Disaster management 24/2007 was created. The national disaster management agency (Badan Nasional Penanggulangan Bencana/BNPB) and BPBD at the provincial and local government levels were established (BNPB 2016). These organizations have the mandate and accountability of coordinating, planning and implementing any aspects on DRM and DRR in Indonesia. Strategic documents on DRR such as the National DRM guidelines, and the National Action Plan for DRR were produced (BNPB 2011a, b, 2013, 2015; Djalante et al. 2012). Regulations were issued related to the formation of BNPB and BPBD, the roles of NGOs, finance for DRR and the roles of vulnerable communities (BNPB 2011a, b, 2013, 2015; Djalante et al. 2012). The Indonesian tsunami early warning system was also established (Birkmann et al. 2015; Schlurmann and Siebert 2011) and President Yudhoyono was appointed the UN secretary general as the global champion for DRR (UNISDR 2011).

Indonesia experienced a second wave of rehabilitation and reconstruction after a further series of major disasters in this period, this time not only geophysical but also climate-related disasters. For example, the Yogyakarta earthquake in 2006, the Bengkulu earthquake in 2007 and the Padang earthquake in 2009 (BNPB 2015). As a result the country received a lot of support from various international organizations such as the World Bank and UNDP as well as bilateral support and international development funding (BNPB 2015).

Indonesia has progressed not only nationally, but has also helped to strengthen DRR regionally in south East Asia through ASEAN, through which AADMER was agreed and the AHA centre was established and headquartered in Jakarta (ASEAN 2005). The AMCDRR was held in Yogyakarta, where the earthquake occurred in 2006. The Indonesian Tsunami Early warning system, which can also detect disturbances in the regiona, was established in 2008 (BMKG 2016).

All of the above activities have helped to strengthen Indonesia's capacity to respond to emergencies caused by disasters and also to establish a system that helps to reduce vulnerability, in turn reducing risks to disasters in the first place.

#### ***2.4.6 Time Period from 2014 to Now Under President Joko Widodo***

This sixth period is currently the era of urban risks and hydro-meteorological disasters. Statistically, however, it is the period with the lowest disaster occurrences and impacts overall.

Urban risk governance is complex since it needs strategies which address disaster risks and the underlying vulnerability drivers such as poverty, inefficient land use and planning, lack of infrastructure, competing power relations and agendas as

well as the need to focus on the urban poor (Padawangi and Douglass 2015; van Voorst 2014, 2015, 2016). The impacts of the floods that affected Jakarta on a massive scale in 2007, and later in 2013 and 2014, were enormous in terms of loss of productivity, business value, damage to roads, buildings and infrastructure (Marfai et al. 2014; Padawangi and Douglass 2015; Vollmer et al. 2015; Ward et al. 2013).

The election of Joko Widodo as President in 2014 and Basuki Tjahaja Purnama as the Governor of Jakarta, with their immediate focus on reducing flood risk, has shown great improvement in urban flood risk management in Indonesia's capital city. The strategies include reservoir construction and normalization, river dredging and normalization of retention basins and rivers financed (World Bank 2016a). The Widodo government has also focused on strengthening flood risk governance through fighting corruption on infrastructure projects, focusing on public services in terms of better information on flood warning and providing various social insurance and safety nets to the people of Jakarta, including relocation to fully furnished social houses for the urban poor and financial supports (Padawangi and Douglass 2015; van Voorst 2016). Political leadership and governance, committed to transparency and working with the poor and informal communities, has been shown by Governor Purnama to be very influential in assuring the effectiveness of DRR (Padawangi and Douglass 2015; van Voorst 2016).

Particular climate-related disasters that have affected Indonesia during this time period are the forest fires in Sumatera and Kalimantan in 2015 (BNPB 2014). The important implication for this is that while forest and wildfire events are among the rarest disaster type, the damage and losses have been extremely costly. In particular, the events in 1997 and 2015 were the two costliest events recorded. These types of hazards are strongly linked with the El Niño Southern Oscillation (ENSO) phenomenon (D'Arrigo and Wilson 2008; Gutman et al. 2000; Harger 1995a; Siegert et al. 2001), an anomalous climatic pattern, which can cause increased temperatures and is often attributed to an enhanced greenhouse effect or volcanic dust causing a major change in the earth's climate system (Allan and D'Arrigo 1999). Moreover, wild and forest fires have contributed a significant amount of economical as well as health and wellbeing damage not only on Indonesia, but also in neighboring countries due to the resulting trans-boundary haze. Experts have repeatedly called for an integrated process from regional, national and community levels since the root causes of the fires sometimes lies in the long tradition of slash and burning methods of farming by local communities in Kalimantan and Sumatera. The involvements of businesses are also importance since some of the cleared lands are mostly used for palm plantation. Rampant deforestation in Indonesia has also been claimed to cause the fires (Agung et al. 2014). Solving the fire and haze will allow opportunities for not only for reducing fire risks but also for adapting to and mitigating climate change, since it is estimated that the emissions from the fires have significantly contributed to the CO<sub>2</sub> in the atmosphere (Van Der Werf et al. 2008). The impact of the fires was not only felt in Indonesia but also in the neighboring South East Asian countries and this has created new political tensions. The increasing economic impacts of the fires within the country, the haze affecting other countries in the region, and pressure from the global community to enhance climate change mitiga-

tion, have forced the Government of Indonesia to strengthen its efforts to reduce the risk of forest fires. For the first time, BNPB was mandated by President Joko Widodo to be responsible for extinguish fires (BNPB 2014). The task, which was originally the mandate of the Ministry of Forestry, had been considered unsuccessful as the BNPB do not have the necessary equipment and personnel for firefighting (BNPB 2014). There have been calls for an integrated management of fire risk, from national to local community level (Forsyth 2014; Lee et al. 2016; Nurhidayah 2013; Tacconi et al. 2008; Varkkey 2013; Whitehead 2013). As the impacts of ENSO are increasingly being felt, with more warming expected, climate-related hazards will need to be integrated into DRR strategies and planning.

## 2.5 Conclusion

In conclusion, the chapter has outlined that occurrences of disasters triggered by natural hazards, coupled with the social and economic vulnerability context, has influenced the creation and establishment of particular forms of institutions and organizations for managing disasters in Indonesia. Through a systematic review of the Indonesian disaster profile using data from EM-DAT, we can see that disasters are mainly caused by geophysical and hydro-climatological hazards. While the numbers of deaths are expected to decline, the overall frequency and impacts of disasters are expected to increase substantially. Cutter and Gall (2015) called for better utilization of disaster loss databases, metrics, classifications and time horizons. Gall (2015) further stated that current loss and damages databases have not been able to measure loss either from slow onset disasters or non-direct losses as there is not yet a robust enough means for measuring or estimating these. There is no complete picture on the accounts of disasters and their impacts in Indonesia that are not included in the current EM-DAT database. There is also no account on the loss of ecosystems services associated with the ENSO period in 1990s and 2015.

The author has presented the links between disaster events and their impacts and the political and institutional changes that have taken place in Indonesia over six distinct time periods from Indonesian independence until today. The analysis shows that occurrence of disasters, political and leadership changes and social and economical situations at particular periods are the most influential factors affecting the development of institutional and paradigm changes for managing disasters in Indonesia. The study categorizes the events and impacts through several periods of prior 1945 (before Indonesian independence), from 1945 to 1960s, and from 1960s to 1990s, from 2004 to 2014, and from 2015 onwards. These periods marked major changes in the social, economical and political situations in Indonesia.

The documentation of the frequency and impacts of disasters has been useful in determining how certain policies and institutional changes might or might not help to reduce the impacts of disasters in the future. The reduction of deaths could be attributed to increased awareness and adoption of strategies and actions for risk

reduction and preparedness. The author stresses the importance of community and national preparedness to geophysical disasters, namely earthquakes and tsunamis, because when they happen, the loss of life is unpredictable. However, the high number of deaths from earthquakes and tsunamis called for better early warning and community preparedness since this can save lives. Some researchers still questioned whether Indonesia is better prepared 11 years after the 2004 Indian Ocean Tsunami (Løvholt et al. 2014). The author proposes that Indonesia has improved its institutional and technological capacity, in terms of putting in place the necessary organizations and systems that are responsible and capable to provide early hazard warnings and to set up the technologies for early warning. But the country still needs to build a culture of safety, preparedness and resilience though enhanced risk knowledge, training and preparedness drills at the community level, particularly involving those who are most vulnerable to hazards.

An increased population, greater exposure to risks, increased urbanization and hence concentration of risks in urban areas, increasing risks of climate change, as well as high levels of poverty and inequality as the underlying cause of vulnerability, are all the factors that contribute to the expected rise of disaster impacts in Indonesia, socially, environmentally and economically. It is expected that the rate of urbanization in the world and also Indonesia will require a more comprehensive approach in reducing urban disaster risks. Governing urban risk in Indonesia needs to consider poverty reduction, better infrastructure, effective law enforcement and working inclusively with informal networks and communities. Indonesia has successfully moved from a low-income to a lower middle income country through addressing poverty progressively (World Bank 2016b).

The country still needs to address the increasingly vulnerable urban poor communities in large cities like Jakarta, Surabaya and Makassar and in other medium size cities on the islands of Kalimantan, Sulawesi or Papua. Infrastructure provision has been the development priority of the countries through the provision of roads, electricity, clean water and sanitations (World Bank 2016b). It is now time to address those services in urban areas where those informal settlements are located and also in under-served rural areas in disadvantaged parts such as those in rural areas and eastern part of Indonesia (Firman 2016). The roles of NGOs and local organizations have been instrumental in helping those communities at risk and informal communities in reducing risks and strengthening their ability to cope and recover from environmental and disaster shocks and risks (Djalante et al. 2012).

We have seen that over the years, the institutions have moved away from a focus of only managing the effects of natural hazards to including the impacts of social conflicts and displaced people. Indonesian independence in 1945 marked the key year by which the government started to act on and recognize the impacts of disasters. We have also seen that the 2004 Indian Ocean Tsunami created a transformational momentum for the importance of community preparedness and disaster risk reduction, not only within Indonesia but also in the South East Asian region and globally. 2004 marked a great opportunity for disaster risk reduction and there have been strong shifts from managing disasters only after emergencies towards the

overall aim of reducing disaster risks within the whole cycle of project management, from preparedness all the way to rehabilitation and reconstruction.

This transformational shift did not only happen in Indonesia, but also globally with the adoption of the Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters (UN/ISDR 2016b). Ever since this period, while there has been great progress nationally and also at the community level, the study calls for focusing DRR efforts by strengthening the capacity of local governments and local stakeholders, and on those communities who are greatly at risk and to start taking into account other man-made disasters such as technological and biological disasters, as outlined in the newly adopted Sendai Framework for Disaster Risk Reduction (SFDRR) in 2015 (UN/ISDR 2016c).

Finally, the study reiterates the adoption of various international frameworks in 2015. Four major frameworks were adopted, the Sendai Framework for Disaster Risk Reduction (SFDRR), the Sustainable Development Goals (SDGs), the Paris Agreement on Change and the Addis Ababa Action Agenda on Financing for Development (AAAA) and the New Urban Agenda in 2016. The SFDRR has an increased scope compared to its predecessor, the HFA, which includes disasters resulting from all types of hazards including health, biological and man-made hazards. Within the SDGs, disaster risks are incorporated as part of the indicators for achievements in goal 1 on poverty alleviation, goal 2 on ending hunger and food security, goal 11 on cities and human settlements and in goal 13 on climate change. In the AAAA, disasters are considered as a source of shocks and on the importance to provide finance to achieve climate and disaster resilient development. The Paris Agreement on Climate Change, DRR is specifically acknowledged as efforts to build resilience in cities and at community level in target 11 (UNFCCC 2015). Indonesia has taken some major measures to implement these international agendas in an integrated way including institutional integration for DRR and CCA and the activities to address and reduce vulnerability climate risks at the local and community level (Djalante et al. 2013, 2012). It remains to be seen how the current leadership and DRR governance will achieve the implementation of all of these strategies in an integrated and sustained way Strengthening future governance for DRR through learning experiences from the past and anticipate complexities in the future, which calls for more integrated assessment and management of past and future risks and disasters along with the recognitions of past and future impacts might be a way to help integrating these global agendas together.

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## Appendix

### Categorization of disaster (according to EM-DAT)

Disaster Group	Disasterv sub-group	Disaster type	Disaster sub-type	Disaster sub-sub type	
Natural	Geophysical	Earthquake	Ground shaking		
			Tsunami		
		Volcanic activity	Ash fall		
			Lahar		
			Pyroclastic flow		
			Lava flow		
		Mass movement			
	Meteorological	Storm	Tropical storm		
			Extra-tropical storm		
			Convective storm	Derecho	
				Hail	
				Lightning/thunderstorm	
				Rain	
				Tornado	
				Sand/dust storm	
				Winter storm/blizzard	
				Storm/surge	
		Wind			
		Extreme Temperature	Cold wave		
Heat wave					
	Severe winter conditions	Snow/ice			
		Frost/freeze			
	Fog				

(continued)

Disaster Group	Disasterv sub-group	Disaster type	Disaster sub-type	Disaster sub-sub type
	Hydrological	Flood	Coastal flood	
			Riverine flood	
			Flash flood	
			Ice jam flood	
		Landslide	Avalanche (snow, debris, mudflow, rock fall)	
		Wave action	Rogue wave	
	Seiche			
	Climatological	Drought	Drought	
		Glacial lake outburst		
		Wildfire	Forest fires	
	Land fire: brush, bush, pasture			
	Biological	Epidemic	Viral diseases	
			Bacterial diseases	
			Parasitic diseases	
			Fungal diseases	
			Prion diseases	
		Insect infestation	Locust	
	Grasshopper			
	Animal accident			
	Extra-terrestrial	Impact	Airburst	
Space weather		Energic particles		
		Geomagnetic storm		
Shockwave				
Techno logical	Technological	Industrial accident	Chemical spill	
			Collapse	
			Explosion	
			Fire	
			Gas leak	
			Poisoning	
			Radiation	
			Other	
		Miscellaneous acciden	Collapse	
			Explosion	
			Fire	
			Other	
		Transport accident	Air	
	Rail			
	Road			
	Water			

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# Chapter 3

## Toward Integrated and Inclusive Disaster Risk Reduction in Indonesia: Review of Regulatory Frameworks and Institutional Networks

Andri N.R. Mardiah, Jon C. Lovett, and Nukila Evanty

**Abstract** Policies and strategies for disaster risk reduction (DRR) in Indonesia have been transformed politically and institutionally. Studies have shown that current progress for DRR in Indonesia has been largely focused at the national level. More efforts are needed to strengthen local institutions, increase focus on the community, and adopt a more integrated approach with development. This chapter highlights the need to assess regulatory and institutional frameworks from the standpoint of collaborative governance theories, which emphasize the inter-organizational arrangements to pursue the common goals of strengthening community resilience. The aim of this chapter is to examine current progress, identify challenges and propose strategies for more integrated, locally-based and community-focused DRR strategies. The objectives are threefold. First, to examine, review and identify legal gaps within current DRR regulations, using the Regulatory Mapping (RegMAP) method. Second, to investigate the institutional arrangements through Discourse Network Analysis (DNA). Third, to conduct a need-gap analysis as prelude to recommendations for a more comprehensive DRR policy.

The first key finding from the RegMAP analysis shows that Law 24/2007 on Disaster Management contains some contradictory elements in terms of adoption of disaster status, budget allocation and cooperation between regions, as well as vulnerable groups. The law needs revisiting and focus shifting to the mainstreaming of DRR into development policies and programs. Second, the DNA identifies that agencies for disaster management and development planning are at the frontline for

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internalizing the DRR agenda into development policy. Finally, learning from the past and current experiences and challenges for DRR, we propose several recommendations for more inclusive, locally-based and community-focused DRR strategies, namely: (a) to develop climate inclusive DRR; (b) to strengthen capacity of local key institutions; and (c) to make comprehensive efforts to reduce vulnerability and build community resilience.

**Keywords** Collaborative governance • Regulatory framework • Institutional network • Climate inclusive DRR

### 3.1 Introduction

Disasters and their impacts are unexpected, hazardous and cause complex problems. Increase in human population and the effects of climate change means that they are becoming increasingly more complex, frequent and uncertain. We argue that, in order to deal with disasters, there should be a paradigm shift from government to governance, with more emphasis on inter-organizational arrangements (Peters 2013). The governance regime has been chosen to anticipate various problems in the public sector that cannot be handled solely by one organization (Huxham et al. 2000). Hitherto, the terminology of ‘coordination’, ‘cooperation’, ‘partnership’, ‘joint-working’, ‘alliance’, ‘collaboration’, and ‘network’ have all been part of the governance domain and are continuously discussed by many governance proponents. Nevertheless, case study investigations of collaborative governance practices, especially in an unexpected and uncertain situation such as a disaster, remain the least explored.

To investigate successful governance collaboration within a disaster context, we consider Indonesia as a case study for several reasons. Firstly, Indonesia is the fourth most populous country in the world and growing. According to The National Bureau for Statistics (BPS) the population of Indonesia was only 60.7 million in 1930s but is projected to reach 305.6 million by 2035, a fivefold increase in a century (BPS 2013, p. 57). An increasing population also means an increasing people’s exposure to disaster (Kusumasari 2014), especially considering 67% of the population are concentrated in coastal urban areas (BPS 2013) where there is a risk of storm and tsunami damage. The Indonesian Index for Disaster Risk (i.e. *Indeks Risiko Bencana Indonesia/IRBI*) shows that around 65% of a total of 496 districts/cities within 34 provinces are categorized as high risk and the remaining 35% as medium risk (BNPB 2013). Secondly, The Government of Indonesia (GoI) suffered 167,741.8 billion Rupiah of loss and damage due to disasters between 2000 and 2014 (BAPPENAS 2014a, p. 3). Disruption and economic loss means that disaster impact will hinder development of disaster prone regions in Indonesia. Thirdly, there has been much progress in DRR in Indonesia, as a result of which the President Yudhoyono was awarded the first Global Champion for DRR in 2011 (UNISDR 2011).

This research aims to investigate the regulations and institutional network at a national level and from that identify the most essential policy recommendations for fostering Indonesian DRR implementation in the future. The following research questions are explored: (1) what are the gaps and issues in the current DRR's governance and policy in Indonesia?; and (2) how will any gaps and issues impact on the future improvement of the DRR policy and implementation?. Thus, this chapter will focus on: (1) the most influential policies/legal aspects in DRR governance in Indonesia in order to identify policy/legal gaps (i.e. what should be regulated and/or improved) and (2) the institutional arrangements (i.e. network and framework) in order to improve the process of dealing with future challenges. Research into DRR governance in Indonesia has been conducted by both local and international scholars (Lassa 2011; Djalante et al. 2011; Djalante 2012; Seng 2013; Kusumasari 2014; Grady et al. 2015), and the number of publications in this field are increasing, especially after the 2004 tsunami disaster. However, most of them only focus on specific locations and/or occurrences instead of discussing DRR from a macro policy and/or governance perspective.

The chapter consists of six sections. The first three parts comprise the introduction, methods and collaborative governance theories. The fourth part will present the analysis and findings based on: (1) the regulatory framework of DRR in Indonesia from 2005 to 2014; (2) the institutional arrangements mainly in accordance with the Law 24/2007 and some of its derivative regulations. The fifth part proposes directives of DRR policy based on the findings, gaps and challenges. Finally, the last section is the conclusion.

## 3.2 Methods

The chapter adopts a mixed methods approach including Regulatory Mapping (RegMAP) and Discourse Network Analysis (DNA) based on a series of focus group discussions (n = 5), interviews (n = 20), government documents and regulations (n > 30) as well as official reports. Focus groups and semi-structured interviews were targeted at policy makers and professionals in the DRR field, in order to collect information from relevant stakeholders, especially those of experts, practitioners (Local/International NGO), and government officers. Official reports are in the form of policies, regulations, manuals/guidelines and statistics.

RegMAP is a method to map and assess the various regulations and legal documents in order to gain in depth understanding on impact and/or potential problems (USAID 2009). RegMAP also helps in defining responsibilities of institutions and stakeholders, and precluding duplication of responsibilities (OECD 2008). DNA is a method to map the network of actors within particular policies or strategies. It was derived from policy networks and advocacy coalition framework theories, and was initially aimed at investigating the influence of political actors in the legislative and its policymaking process (Leifeld 2013). Thus, both methods aim to



assess the collaborative process among stakeholders and their influence towards outcomes.

We then conduct intermediary analyses using the matrix of a need-gap analysis. A gap analysis is a method of assessing the differences in performance of a program or policy to determine whether it had been able to meet ‘expectations’ or not, and if not, what steps should be taken to ensure expectations are met successfully. A need-gap analysis may also be referred to as a gap analysis, a needs analysis, or a needs assessment. It is used to determine how to allocate resources and/or propose recommendations in order to bridge the gap.

### 3.3 Theory of Collaborative Governance and Network

In general, governance can be defined as ‘the attempts of the state, and its allies in the private sectors, to steer the economy and society’ (Peters 2013, p. 78). Governance may involve activities that utilize resources and create more consistent and coordinated policies (Peters 2013) through interaction among actors despite their conflicting objectives (Duit et al. 2010).

Concepts of collaborative governance are mainly influenced by policy network theory (Enroth 2013), institutional theory (Ostrom 1990, 2005; Peters 2013), organizational theory (Williamson 1995; Christensen 2013), and the economics of transaction costs as well as rational choice theory (Williamson and Masten 1999; Dowding 2013). From institutional perspectives, the new governance approach is based on the assumption that ‘the conventional institutions of government are no longer capable of providing effective steering on their own and must be supplemented, or supplanted, by social actors’ (Peters 2013, p. 78). In short, collaborative governance emphasizes the inter-organizational arrangements across the boundaries (such as public agencies, level of government, and/or public/private/NGOs/CSOs) that are ‘involved in working relationships with each other in the pursuance of common purpose’ (Huxham et al. 2000, p. 341). Huxham et al. (2000) argued that this new concept of governance emerged in anticipation of the challenges of ‘complexity and diversity’. Meanwhile, Frederickson and Smith pointed to the fact that ‘... governments have become less hierarchical’ (2003, as cited in Silvia 2011, p. 66). There is a tendency to form collaborative networks to govern since the boundaries of responsibility, authority and activity across levels of governments have become blurred (Silvia 2011). By definition, a (social) network refers to ‘...ties and networks (that) constrain resource flow by keeping it within ties and networks’ (Jiang and Carroll 2009, p. 52). Resources in this case could be in the form of information, economic, intellectual or emotional resources (Moody and Paxton 2009). The collaborative network environment can be complicated due to the differing objectives each network’s member has for the outcome of their combined effort. Therefore, it is essential in collaborative governance to ensure agreement regarding the network’s target and strategy. Another critical foundation is to establish a clear playing field in the form of roles, norms, regulations and legitimacy among the network members

(Silvia 2011). At the following part, our analysis will focus on regulatory framework and institutional network, as referred in the handbook of governance, ‘at the most general level, governance refers to theories and issues of social coordination and the nature of all patterns of rule’ (Bevir 2013).

### 3.4 Analysis and Findings

This part comprises the regulatory and institutional analysis. The regulatory analysis consists of analysis of DRR and other supporting regulations, meanwhile the institutional analysis will be divided into national (national policy based-network) and sub national level (local institutional framework).

#### 3.4.1 DRR Regulatory Framework

A rapid change in the DRR regulatory framework took place between 2004 and 2006, with the international framework for the Hyogo Framework for Action as one of the driving forces behind this national reform. Three years after the Hyogo Declaration, and following a series of debates within the legislative forum and public consultation (i.e. professional, academia and communities), GoI finally ratified the Disaster Management Law (i.e. Law 24/2007). Since then, all disaster management implementation in Indonesia should refer to this law (BNPB 2008). The law is expected to govern disaster management on legal basis, as well as to encourage clearer coordination among stakeholders in order to assist the government as the primary actor in the field of disaster management (The House of Representatives of Indonesia 2007).

Accordingly, the paradigms within disaster management practice changed as follows: (1) from responsive to preventive; (2) from sectoral to multi sectoral; (3) from government initiative to shared responsibility among stakeholders; (4) from centralized to decentralized; and finally (5) from merely mitigation to comprehensive disaster risk reduction. Beside the law and its derivative regulations, GoI has also endorsed the formulation and implementation of the National Plan on Disaster Management (i.e. *Rencana Nasional Penanggulangan Bencana/Renas PB*) and the National Action Plan on DRR (i.e. *Rencana Aksi Nasional Pengurangan Risiko Bencana/RAN PRB*) (BNPB 2006, 2010a, b). In line with the aforementioned regulations, there are other relevant laws that should be in compliance with one another.

Table 3.1 shows the milestones of disaster management policy over the period of two National Medium-Term Development Plans (i.e. *Rencana Pembangunan Jangka Menengah Nasional/RPJMN*) from 2004–2009 to 2010–2014 and the DRR-related law (BAPPENAS 2014b).

The next sections will analyse these regulations in detail, particularly DRR regulations and other supporting regulations. The key findings are that Law 24/2007 has

**Table 3.1** Milestones of DRR regulatory framework 2004–2014

Year	Key regulations
2004	DRR-related law: Law 25/2004 on National Development Planning System
2007	DRR regulation: Law 24/2007 on Disaster Management (DM) DRR-related law: Law 26/2007 on Spatial Planning; Law 27/2007 on the Management of Coastal Areas and Small Islands
2008	Government Regulations (i.e. Peraturan Pemerintah/PP) 21/2008 on Disaster Management (DM); PP 22/2008 on DM financing and aid assistance; and PP 23/2008 on DM external supports (International agency and non- governmental agency) Presidential Regulation (i.e. Perpres) 8/2008 on the establishment of National Disaster Management Agency (known as BNPB) Regulation of Minister of Home Affairs 46/2008, (i.e. Permendagri) on Organizational and Management of Local Disaster Management Agency (i.e. BPBD) Regulation of the Head of BNPB 3/2008, (i.e. Perka BNPB) on the establishment of Local Disaster Management Agency (i.e. BPBD) And many other regulations of the Head of BNPB/Minister
2009	DRR-related law: Law 31/2009 on Meteorology, Climatology and Geophysics; Law 32/2009 on the Protection and Environmental Management
2014	DRR-related law: Law 23/2014 on the Regional Government; Law 6/2014 on Village

Sources: Authors (2016)

some confusing components, especially in terms of disaster status, budget allocation and cooperation between regions, as well as vulnerable groups. In addition to this, the analysis highlights the importance of integrated spatial data and regulations, as well as harmonious cooperation between various ministries, especially with the Geospatial Information Agency (i.e. *Badan Informasi Geospasial/BIG*) and National Bureau for Statistics (i.e. *Badan Pusat Statistik/BPS*).

### 3.4.1.1 Analysis of DRR Regulations

The Law 24/2007 has some unclear, ambiguous and confusing contents (BAPPENAS 2008; UNDP Indonesia 2008). It is unclear how an ‘occurrence’ can be interpreted as a disaster and then categorized as national, provincial or local disaster. Therefore, there should be clarity in regard of: (1) the size of occurrence that can be categorized as a disaster; (2) the region’s ability to deal with the impact of the disaster; (3) the number of people affected; and (4) the extent to which a fair and objective decision will avoid hidden interests.

The ‘status’ is also directly related to the resources available to address disaster impact, especially whether or not to use the funds from the state budget, local budget and/or from any additional resources. As a consequence, if the status has not been well defined in the Law, the government could spend money arbitrarily or may not issue the budget at all. In addition, although according to article 60 of the Law 24/2007 the GoI and local governments should allocate disaster management fund adequately, and according to Article 4 of the Government Regulation 22/2008 there

should be budget sharing between GoI and the local governments (Government of Indonesia 2008b), the Law does not oblige them to execute the budget. As a result, many local governments do not consider it necessary to allocate a budget for disaster management.

Budgets should also be in line with development plans, however, the Law does not necessitate that the disaster plan should be associated with the national and local development plans. Furthermore, there is no specific responsibility of GoI and local governments in the joint management plan to other related parties. Although Government Regulation 21/2008 has identified the possibility of the involvement of various stakeholders (Government of Indonesia 2008a), for instances in preparing the national action plan, the GoI does not specify a mechanism to engage stakeholders and ensure community participation. In addition, there are no special regulations on vulnerable groups such as: people with special physical or psychological needs, women, children, the elderly, the indigenous population, refugees and migrants, persons with disabilities, minorities and people with language barriers.

In addition to this, collaborative governance of DRR through cooperation between regions has not been clear enough. The Government Regulation does not give further information on how they work, coordinate, and cooperate with nearby regions during an emergency response, especially in the case of unavailable and inadequate human resources, equipment, logistics in the specific province/district/city and how local governments of the affected regions may request assistance to other local regions nearby.

#### **3.4.1.2 Analysis of Other Supporting Regulations**

Law 27/2007 on the Management of Coastal Areas and Small Islands explains disaster mitigation in its legal consideration (Government of Indonesia 2007b). However, the role of GoI and local governments in implementing programs of disaster mitigation in coastal areas and small islands has not yet been detailed. Similarly, Law 32/2009 on Protection and Environmental Management does not encourage the integration of environmental protection plans into a disaster management plan (Government of Indonesia 2009). Although there has been an initiative to synchronize coastal and environmental risk management with disaster management, the fact remains that, up until now, Climate Change Adaptation (CCA) and DRR have been used as separate tools in managing risk. The integration is designed to avoid budget inefficiency due to duplication of activities and to make an effective use of human resources and technology. In addition, it is expected to drive the interconnected actions at the local and community level in order to achieve the sustainable development goal targets (SDGs) (BAPPENAS 2015a; KLHK 2015; Widjaja 2015).

Unavailability of appropriate large-scale maps has been claimed as the underlying factor for local governments not being able to obtain specific hazard maps and/or a Zoning Plan for Coastal Areas and Small Islands. Law 25/2004 on the National Development Planning System has mandated that planning should be based on data and information that is accurate and reliable, including geospatial data and informa-

tion (Government of Indonesia 2004a). In addition, Law 26/2007 on Spatial Planning has mandated the need for geospatial data and information in formulating a spatial plan whether national, provincial or for districts/cities (Government of Indonesia 2007a). Accordingly, the spatial plan (i.e. *Rencana Tata Ruang/RTR*) should be aligned with the rules of other sectors and vice versa. Hitherto, RTR has not been consistently used as a guideline for the development of sectoral and regional development plans. As a result, land use arrangements and their control may not be carried out effectively.

The aforementioned issues indicate the importance of harmonious cooperation between various ministries with the Geospatial Information Agency (BIG). Although Law 4/2011 on Geospatial Information describes the essential role of geospatial information in managing natural resources as well as disaster management in the territory of the Republic of Indonesia, there must be strict command from GoI to refer to the same source maps and an appropriate scale for development (Government of Indonesia 2011a). The same principle should also be applied to statistical data from the National Bureau for Statistics (BPS).

### 3.4.2 *DRR Institutional Arrangements*

DRR policy change in Indonesia was driven by a hybrid process of local and international interaction (Lassa 2013). Furthermore, the political atmosphere after the enactment of Law 22/1999 (especially in terms of decentralization and local autonomy) also influenced the decision of GoI to give more responsibility to regions in managing various issues (including disasters) within their jurisdiction (Kusumasari and Alam 2012). In fact, the governance trends in Indonesia have moved towards a more fluid cooperation with non-government actors, so government is no longer recognized as the hegemonic power in the process of DRR policy making.

Historically, the institutional arrangements for disasters prior to 2008 were less focused on DRR issues due to ad-hoc organizational character, which was suited more to 'reactive' than 'preventive' functions (Lassa 2013). An example for this was the Rehabilitation and Reconstruction process for the Aceh Tsunami (i.e. through the establishment of BRR Aceh-Nias). At that time, GoI had a responsibility to determine whether it was necessary (or not) to establish a special agency addressing the post-disaster recovery process (Kusumasari and Alam 2012).

In the following section, the institutional aspects are analyzed further at the national level, through national policy-based institutional network analysis and at the sub national level through an analysis of the local institutional framework. The key findings are that at the national level, BNPB remains the core actor among other key players due to its functions to coordinate the implementation of disaster management policy in Indonesia. The main actors at local level for disseminating and implementing the DRR agenda are BPBDs and BAPPEDAs. Both these actors are in the frontline for internalizing the DRR agenda into regional development policy. Nevertheless, the non-governmental actors such as Universities, NGOs and a few

international agencies are also playing an important role in translating government policy into practice at community level.

### 3.4.2.1 Analysis of the National Policy-Based Institutional Network

In accordance with the National Medium-Term Development Plan (RPJMN) 2015–2019 (Government of Indonesia 2015), the Disaster Management Program is no longer classified as a development priority, but instead it plays a role as the supporting policy for the seventh priority of the Joko Widodo President in ‘Nawa Cita’, i.e. to create economic independence through environment and disaster management investment that aims to protect the sustainability of strategic sectors of the domestic economy (Soetiarso et al. 2014).

With the target to reduce disaster risk in growth centers at high and medium risk, as per the Indonesian Disaster Risk Index (IRBI) (BNPB 2013), GoI set up strategies for disaster management policy as follows: (1) Internalization of DRR within the sustainable development framework at national and local level (five sub strategies); (2) Reducing the vulnerability to disasters (eight sub strategies); and (3) Strengthening the capacity of central government, local government and communities (eight sub strategies). The focus of RPJMN 2015–2019 is on the 136 districts/cities which are located in an economic growth area, consisting of 120 districts/cities with a high index of risk and 16 districts/cities with moderate risk level. The spatial distribution of those 136 districts/cities, as follows: Papua (10 districts/cities), Jawa-Bali (36), Kalimantan (18), Maluku (12), Nusa Tenggara (15), Sulawesi (24), and Sumatra (21).

Figure 3.1 shows the network map of the key actors based on sub strategies at the national level. More than 20 ministries/agencies as well as local governments, universities, NGOs and the donor community are connected in support of the disaster management agenda, which represents 90% of actors with a DRR-related agenda.

After classifying sub strategies into main strategies, Fig. 3.2 clearly shows the seven key players in the DRR agenda: BNPB, the Ministry of Home Affairs/MoHA (i.e. *Kementerian Dalam Negeri/Kemendagri*), the Ministry of Public Work and Housing/MoPW (i.e. *Kementerian Pekerjaan Umum dan Perumahan Rakyat/KemenPUPera*), BPBDs, BAPPEDAs (i.e. Local Development Planning Agency), NGOs and Universities.

BNPB remains the core actor among other key players due to its function of coordinating the implementation of disaster management policy in Indonesia. Nevertheless, collaborative governance is compulsory for the DRR agenda (BNPB 2016a), as illustrated by the following: the BNPB budget capacity in 2013 was 1045 billion Rupiah, but after collaborating with more than 30 line ministries and agencies, the budget for disaster management reached 9500 billion Rupiah (Widjaja 2014, p. 11). In addition to this, the DRR strategy should also reflect the perspective of regional development that there is cooperation between regions in managing common risk and maintaining local and national development goals (Soetiarso et al. 2014; BAPPENAS 2015b).



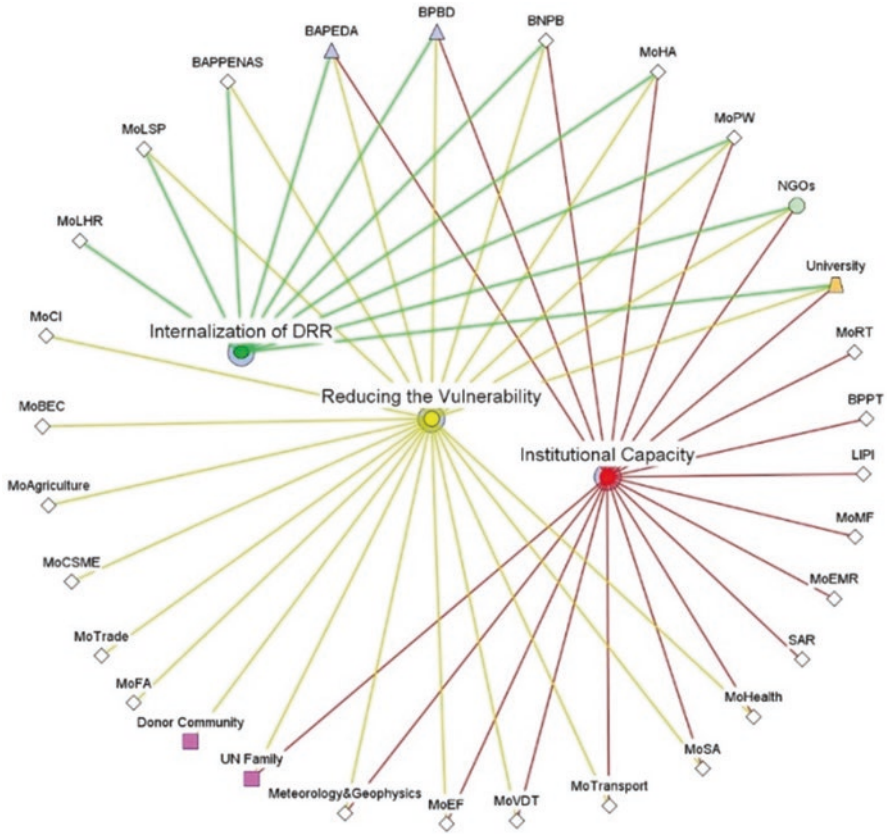


Fig. 3.2 The national policy-based network for implementing DRR (Sources: Authors 2016)

In addition to this, the recognition of the formal data sourced from Geospatial Information Agency (CNNIndonesia 2015) and National Bureau for Statistics (Antaranews 2008; Gatranews 2016) should be encouraged, though there has been collaboration network concerning data with the Agency for Meteorology and Geophysics. This is in line with the Presidential directives in many cabinet sessions to all line ministries and other government offices. Unless there is an issue of insufficient or unavailable data, this rule is also applied to Indonesian Institute of Sciences (i.e. *Lembaga Ilmu Pengetahuan Indonesia/LIPI*), Agency for the assessment and application of Technology (i.e. *Badan Pengkajian dan Penerapan Teknologi/BPPT*) and university research activities.

At the meso level, the actors that could bridge and work directly at the grass roots are Universities, NGOs and a few international agencies (Djalante 2013; BAPPENAS 2015b). They are more flexible on budget and type of activities (Dompot Dhuafa 2015; Mercy Corps 2016), meaning they can better adapt to the inherent uncertainties associated with disaster management (Djalante 2013) and benefit the commu-



nity as their primary partner. However, these actors may or may not have a similar agenda to the national agenda. In fact, some of them have been working beyond the GoI development framework (BAPPENAS 2015b; BNPB 2016a). Nevertheless, the international agencies and NGOs (both local and international) have played an important role in initiating new global concepts (i.e. Climate Change Adaptation (CCA) and DRR integration and community based DRR), then internalizing and implementing them at local level within projects (Djalante 2013; Mercy Corps 2016).

Beside the aforementioned non-government actors, the national platform for DRR (i.e. *Platform Nasional untuk Pengurangan Risiko Bencana/Planas PRB*) has also been useful as a forum to integrate insights, aspirations and interests as well as bridging the various stakeholders of DRR in Indonesia (BNPB 2016a). In addition to this, government officers, professionals, NGOs and academia have also been connected within the Indonesia Disaster Experts Association (i.e. *Ikatan Ahli Kebencanaan Indonesia/IABI*) to exchange ideas and build understanding in order to translate GoI policies into practice or propose new knowledge-based policy. Moreover, both have contributed significantly to facilitating the annual gathering of DRR stakeholders at two national events - 'the Commemoration of DRR' and the 'Indonesian Disaster Expert Conference' - where DRR issues are discussed in depth.

### 3.4.2.2 Analysis of Local Institutional Framework

The main actors at local level for disseminating and implementing the DRR agenda are BPBDs and BAPPEDAs. These two actors are in the frontline for internalizing the DRR agenda into regional development policy (i.e. *Rencana Pembangunan Jangka Menengah Daerah/RPJMD*). Nevertheless, implementation still requires the coordination and supporting programs from other agencies acting within their jurisdiction. The next section will explain in more detail the BPBD's role as core actor at sub national level.

In 2015, the majority of BPBDs (90%) at district/city level were established and operationalized (BAPPENAS 2015c). The next challenge is to strengthen the BPBDs with regards to their duty and responsibility in reference to two regulations, namely the Regulation of Minister of Home Affairs 46/2008 and The Regulation of Head of BNPB 3/2008 (Government of Indonesia 2008c, d). The BPBDs have three functions: coordination, command and control. Coordination is based on Head of BNPB Decree 3/2008, which is meant as a tool for cooperation with other line ministries or other government offices, as well as cooperation with other countries both in emergency response and post disaster. Meanwhile, the command function relates to the status of disaster emergency. Lastly, the control function is related to the use of technology that poses a risk or potentially becomes a hazard, and/or for controlling the exploitation of natural resources that gradually represent a high risk to living things and the environment (Government of Indonesia 2012b).

All provincial BPBDs have produced a provincial Disaster Management Plan in 2012, but only about 15% of BPBDs at district/city level have prepared a Disaster Management Plan for their respective district/city (BAPPENAS 2015c). The role of a Disaster Management Plan is important not only as a sign of commitment of local governments to carry out systematic and comprehensive disaster management, but also to prepare for whenever a disaster might occur. Lack of a budget for disaster management practice is also an essential problem (Kusumasari and Alam 2012; BPBD Bantul Regency 2015). The low budget allocation may lead to chronic and systemic problems, especially for regions exposed to hazards on regular basis, such as Jakarta's floods. In Jakarta's case, although the Disaster Management Plan has been integrated into the RPJMD and an annual development program (i.e. RKA-T), it was noted that the BPBD of Jakarta had only set a minimum target for budget allocation, representing about 1% of the total provincial budget plan for every fiscal year (Intarti et al. 2013, p. 18).

Apart from budgeting issues, the enabling mechanism for grass roots participation is worth exploring further. There needs to be a greater focus on policy to reduce vulnerability and risk at the community level through active participation (Hadi 2014; Local People 2015; The Ministry of Village Disadvantaged Regions and Transmigration 2015). This could be through education and training within a school system as an effective tool in preparing communities to be able to deal with disasters.

### **3.5 Results: Need-Gap Analysis and Future Directives for Integrated and Inclusive Disaster Risk Reduction**

The findings were derived from two components of collaborative governance theory, the regulatory framework and institutional arrangement as the 'vehicle' of governance. From these two components, we had gathered information and found essential findings in Indonesian DRR context. This included: Climate Change Adaptation/CCA-DRR concept and policy integration issue; institutional arrangements problems; budgeting issues; problems of joint-management and implementation; data and information issues; and affirmative policy. The summary of the regulatory framework and institutional network analysis from the previous section is presented in Table 3.2.

Based on the findings and gaps summarized in Table 3.2, as well as by using the keywords of 'social change' (Perry 2005), 'capacity' and 'cope' (Anderson 1985), we identified three essential issues for mainstreaming DRR into the Indonesia development agenda. The results are grouped into three main challenges: Climate inclusive DRR, local government capacity and community resilience. Within these groups there is a detailed explanation of recommendations for the relevant policies.

**Table 3.2** Matrix of need-gap analysis

No	Findings (i.e. the present state)		Gaps <sup>a</sup>	Group of challenges (i.e. target state)	Relevant policies	Directives for integrated and inclusive DRR (i.e. bridging the gaps)
	Regulatory framework	Institutional arrangements				
1.	Problems of policy integration, especially in term of CCA and DRR	Problems of institutional arrangements for the convergence of CCA and DRR Benefits of the convergence of CCA and DRR	1. There needs to be integration between CCA and DRR within development policy and implementation at all levels and across sectors	Climate change inclusive DRR	Climate change inclusive DRR	1.a Integrating the programs of line ministries along with interconnected indicators and shared locus, a cost-benefit analysis for activities, budgeting support, as well as a systematic monitoring and evaluation system 1.b Proposing concept of integrating CCA and DRR
2.	Problems of institutional network, especially in terms of data and information integration of CAA and DRR	Problems of institutional network, especially in terms of data and information integration of CAA and DRR	2. There need to be agreement and commitment of Ministry of Environment and Forestry and BNPB, especially in terms data	Climate change inclusive DRR	Climate change inclusive DRR	2. Continue focusing integration on the five key aspects: policies and regulations, institutional framework, budgeting, process (i.e. planning- implementing- monitoring and evaluation), as well as research, data and information systems

3.	Problems of budgeting policy for financing DRR because of the unclear definition of 'disaster'		3. There needs to be a clear definition of 'disaster' due to its impact on the level of decision for DRR budgeting (i.e. national, provincial, local) as well as local planning and resources allocation	National and local government capacity	National and local government capacity on budget planning and resource allocation	3. Reviewing Law 24/27 and the Government Regulation 21/2008
4.	Problems of low budgeting policy for financing DRR at local level because of low commitment from local government		4. There need to be strong political will and commitment from head of districts/mayors to allocate sufficient budget for DRR programs	Local Government Capacity	Local government capacity on budget planning and resource allocation	4. Legislative agency, NGOs, CSOs and Media monitor and evaluate DRR budgeting formulation and implementation
5.	Problems of coordination and joint management plan with other related parties, especially with the nearby regions in terms of inadequate resources	Benefit from cross sector budget allocation Benefit from DRR forums Benefit from steering committee composition in the local level	5. There need to be guidelines on how relevant parties relate and work together in DRR at level of implementation	National and local government capacity	National and local government capacity in terms of coordination, collaborating and enhancing community participation	5.a Reviewing Government Regulation 22/2008 5.b Collaborating in order to formulate the minimum service standard of Disaster Management

(continued)

Table 3.2 (continued)

No	Findings (i.e. the present state)		Gaps <sup>a</sup>	Group of challenges (i.e. target state)	Relevant policies	Directives for integrated and inclusive DRR (i.e. bridging the gaps)
	Regulatory framework	Institutional arrangements				
6.		Problems of institutional network, in terms of data and information integration in DRR, especially maps and statistics	6. There needs to be commitment and collaboration between line ministries in terms of data sharing and provision	National and local government capacity	National and local government capacity in terms of data collaboration for development	<p>6.a Encouraging the one map policy and one source (statistical) data for development</p> <p>6.b The provision of appropriate scale maps for district level that is 1: 50.0000 and municipal levels with a map scale of 1 : 25.000</p> <p>6.c Building network and forum for the needs of shared data</p>
7.		Problems of institutional network, especially in terms of planning and implementing disaster management plans and spatial plans	7. There needs to be commitment, coordination and cooperation among units at the local level to use spatial plans and disaster management plans as a reference for sectoral development	Local government capacity	Local government capacity in terms of planning and internalizing DRR and spatial plans into development	<p>7.a Local government to review and evaluate the existing spatial plan to be synchronized with the plan and program on reducing Disaster Risk Index</p> <p>7.b BAPPEDAs have strategic position as the spearhead to ensure that DRR becomes a tool to protect the high risk growth centre areas, as has been mandated in RPJMN 2015–2019</p>

8.	Problems of policy implementation at local level		8. There needs to a greater focus on policy to reduce vulnerability and risk at community level through active participation	Community resilience	Disaster resilient villages	<p>8.a Reviewing the Law 24/27 (article 60). The concept should be supported by Law 6/2014 and Law 23/2014</p> <p>8.b Using mechanism of Musrenbang at village level to identify the priorities.</p> <p>8.c Integrating DRR knowledge into school system at district and city levels</p> <p>8.d Developing an effective and integrated model that is also creative and enjoyable</p>
9.	Problems of affirmative policy for the most vulnerable groups		9. There needs to a greater focus on the most vulnerable groups		Disaster resilient villages	<p>9. Special attention should be given to vulnerable groups, such as women, the disabled and poor people</p>

Sources: Authors (2016)

<sup>a</sup>*Gap* refers to the space between the present state, 'where we are' and the target state, 'where we want to be'. A gap analysis may also be referred to as a needs analysis. needs assessment or need-gap analysis

### 3.5.1 *Climate Inclusive DRR (Convergence)*

Climate change has been associated with increasing frequency and intensity of climate-related hazards such as droughts, floods, forest fires, landslides, storms and tornadoes, extreme waves and erosion (UNISDR 2015). According to BNPB, 98% of disaster occurrences in Indonesia stemmed from hydro-meteorological hazards between 2002 and 2014 (KLHK 2015; Widjaja 2015). Long droughts have affected various regions in Indonesia since August 2015 including: South Sumatra, Lampung, Java, Bali, West Nusa Tenggara, East Nusa Tenggara and South Sulawesi (BAPPENAS 2015c). In addition, the forest fires that have occurred since September 2015 are claimed to be more severe than the those in 1997, with an estimated loss of 2.61 million hectares of forest and 221 trillion Rupiah (BNPB 2016b). Meanwhile, the total loss from flooding in Jakarta in 2007 and 2013 reached more than 13 trillion Rupiah (BAPPENAS 2014a, p. 3). As Yusuf and Francisco (2015) found, Jakarta is one of the most vulnerable cities in Southeast Asia.

This relationship between climate change and disaster occurrence has compelled GoI to integrate the concept of climate change adaptation (CCA) into DRR. This is not only because resilience is a common goal for both, but also due to the promise of a more sustainable process of effective, efficient and integrated activities (Djalante et al. 2013; Widjaja 2015). Unfortunately, CCA has not been optimally integrated into Indonesia's DRR governance system. Table 3.3 shows that although CCA and DRR have been internalized into the national development plan, they remain two separate strategies.

In spite of the separation between DRR and CCA, the GoI already has an established system (i.e. institutional and regulatory) that can provide opportunities for integration. CCA can adopt methods and approaches that have been widely used in the Indonesian DRR system, as well as lessons learnt on how to utilize local wisdom. Thus, it is not efficient nor effective for CCA to construct its own 'vehicle' for achieving the same goal of resilience (Mercer 2010, as cited in Djalante 2013). In addition, adaptation (i.e. CCA) can also offer a broad, long term perspective that links supporting activities into the core activities of DRR in order to build a resilient recovery towards sustainable development (Mardiah and Lovett 2015). Accordingly, Fig. 3.3 shows the conceptual framework of convergence, modified from the concept of the Ministry of National Development Planning.

To date, there has been a task force (i.e. *Kelompok Kerja/Pokja Adaptasi*) at the national and local level for integrating DRR and CCA that focuses on five key aspects: policies and regulations, institutional framework, budgeting, process (i.e. planning-implementing-monitoring and evaluation), as well as research, data and information systems (KLHK 2015; Widjaja 2015). Meanwhile, in order to formulate an integrated and comprehensive policy for CCA and DRR, there should be integrated programs of line ministries along with: (1) interconnected indicators; (2) a shared locus; (3) a cost-benefit analysis for activities; and (4) budgeting support; as well as (5) a systematic monitoring and evaluation system.

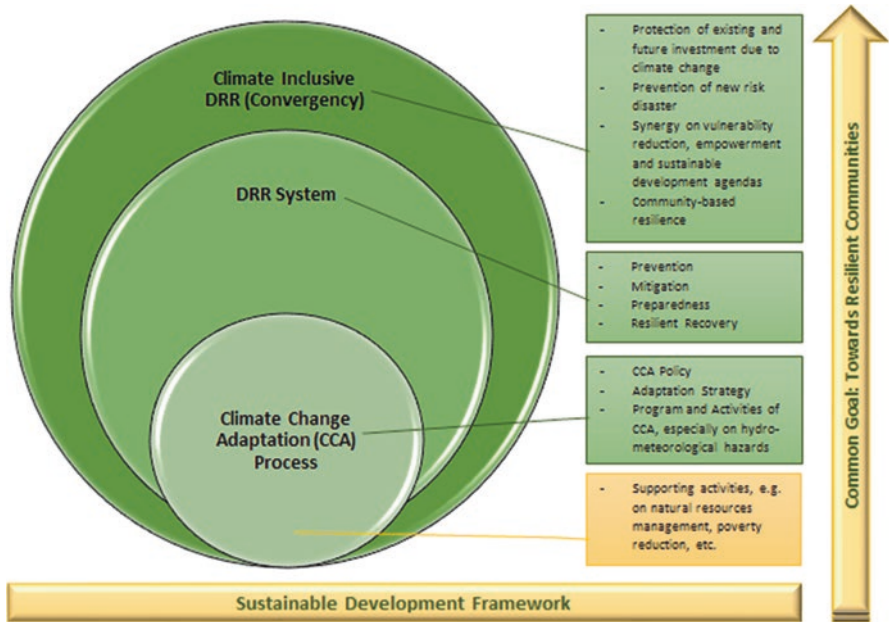
**Table 3.3** The profile of CAA and DRR Governance in Indonesia

Comparison	CCA	DRR
<b>A. National management:</b>		
A.1. Regulation	Law 32/2009	Law 24/2007
A.2. Key actors/ agencies	BAPPENAS, Ministry of Environment and Forestry, National Council for Climate Change (DNPI)	BAPPENAS, BNPB, BPBDs
A.3. Planning	National Action Plan of Climate Change Adaptation (RAN-API)	National Action Plan on Disaster Management (Renas PB)
<b>B. Supporting system:</b>		
B.1. Forum	Task force of adaptation	National Platform on DRR
B.2. Research methodology	Various methods of climate risk and adaptation assessment	<i>Perka</i> BNPB 02/2012 of General Guideline for Risk Assessment
B.3. Data and information	Monev of RAN API and SIDIK	DIBI and Disaster Risk Index
<b>C. International network:</b>		
C.1. Key actor/ agency	United Nations Framework Convention on Climate Change (UNFCCC)	United Nations International Strategy for Disaster Reduction (UNISDR)
		GFDRR
		ASIA DRR
		ASEAN DRR
C.2. Forum	Intergovernmental Panel on Climate Change (IPCC)	Global Platform for DRR
	Asian Adaptation Platform	

Sources: Authors (2016), compiled from many sources

To endorse the policy convergence of CCA and DRR, we identified key players, such as: the National Disaster Management Agency (BNPB), the Ministry of Environment and Forestry, the Ministry of National Development Planning and the BAPEDAs and BPBDs. At the local level, BAPEDAs and BPBDs are expected to empower communities to internalize DRR and CCA in their daily lives and strengthen social capital for adapting to climate change. However, based on the interviews, the very first integration must be focused on integrated data and information (BAPPENAS 2015b; BNPB 2016a). GoI has initiated an integration of adaptation data (i.e. *Sistem Informasi Data Indeks Kerentanan/SIDIK*) and the disaster risk index (i.e. *Data dan Informasi Bencana Indonesia/DIBI*). In this case, the Ministry of Environment and Forestry (i.e. KLHK) and BNPB have been collaborating with the Geospatial Information Agency (BIG), the Agency for Meteorology and Geophysics (i.e. *Badan Meteorologi dan Geofisika/BMKG*) and the National Bureau for Statistics (BPS), as well as relevant line ministries.





**Fig. 3.3** The concept of climate-inclusive DRR (Sources: Authors 2016, with modification from BAPPENAS (2015a))

### 3.5.2 Local Government Capacity

From a series of discussions with local government officers, one important issue that arose is the commitment and capacity of local governments to internalize the DRR agenda into development plans. For this purpose, local government plays an important role in implementing effective and successful DRR programs. This is in line with the priority two of the Sendai Framework for DRR: ‘Strengthening disaster risk governance to manage disaster risk’ (UNISDR 2015).

With reference to *Perka* BNPB 3/2012 on assessment aspects of disaster management capacity (Government of Indonesia 2012b), one of basic challenges in Indonesia is the capacity of the local governments (i.e. at District/City level) to conduct an assessment, formulate and review a plan (i.e. pre-disaster, emergency response and post disaster), and then internalize it into the local development plan. Two essential problems have been identified, namely to review spatial plans and to prepare a minimum service standard. This would involve the following key actors: the Ministry of Home Affairs, BNPB, the Ministry of National Development Planning (i.e. *Badan Perencanaan Pembangunan Nasional/BAPPENAS*), Geospatial Information Agency (BIG), the Ministry of Land and Spatial Planning (i.e. *Kementerian Agraria dan Tata Ruang*), BPBDs, BAPPEDAs and the Governors/Head of Districts/Mayors.

First, spatial planning aims to produce an effective use of space but its secondary outcome is disaster risk reduction through mitigation and prevention. For that reason, it is suggested that local government should begin to review and evaluate the existing spatial plans in order to be synchronized with plans and programs for reducing the Disaster Risk Index. In this case, BAPPEDAs have a strategic position as the spearhead to ensure that DRR becomes a tool to protect the high risk growth center areas, as has been mandated in RPJMN 2015–2019. DRR internalization process in RPJMD should also be supported by the provision of appropriate scale maps for the city and district level. There needs to be district-level risk mapping studies using a scale of 1: 50.000 and municipal levels using a scale of 1: 25.000. To achieve this, local governments (including the line ministries) must have better cooperation with the Geospatial Information Agency (BIG). Solway (1994, as cited in Intarti et al. 2013) argues that the capacity of local government in terms of building resilience would also be greatly influenced by having a good relationship and network with central government.

Second, in accordance with article 12 verse 1.e within Law 23/2014 on Local Government (Government of Indonesia 2014b), disaster management is categorized under the theme of mandatory government affairs relating to basic services, including disaster management issues. As a consequences of this, BNPB, the ministry of Home Affairs and the Ministry of National Development Planning, need to coordinate in order to formulate the minimum service standard of Disaster Management (i.e. *Standar Pelayanan Minimum/SPM*). The SPM is required not only because of the characteristics of the basic services, but also to provide a secure guarantee as promised in the preamble of Constitution 1945. Although most line ministries/agencies have developed methods and tools for assessment, the basic challenge is to establish a commonly agreed assessment that will be used by the local governments, especially BPBDs. In addition, the other consequence beside SPM is that disaster management has to become a priority affair for local governance that can be seen in its planning (i.e. *Rencana Kerja Pemerintah Daerah/RKPD*) and budgeting (i.e. *Anggaran Pendapatan Belanja Daerah/APBD*).

Since disaster management has become mandatory for government affairs relating to basic services, there should be further regulation that obliges and encourages the local governments to allocate an adequate budget to implement the minimum service standards in DRR, especially for disaster prone areas. This requires the revision of Government Regulation (PP) 22/2008, article 6 verse 3, which states that local governments can provide ‘on-call-budget’ for the disaster management budget that comes from the official budgetary process that was placed in the regional budget (i.e. APBD). The statement of “can” is not firm and less obliging. In addition, local regulation (i.e. Perda) should also firmly state the obligation to provide ‘on-call-budget’ on regular basis besides the regular disaster management budget allocation (BAPPENAS 2008 p. 40). Nevertheless, regions with budgetary constraint (i.e. disadvantaged regions) that must implement the budget efficiently and effectively are strongly suggested to shift their perspective from responsive actions to preventive and risk management activities.

### 3.5.3 Community Resilience

Based on interviews with respondents, most of them agreed that education and training is an asset for building community resilience (BPBD Bantul Regency 2015; Dompot Dhuafa 2015; Local People 2015; Mercy Corps 2016). Education and training contribute to the development of awareness and embed it in local wisdom and culture (Arendt and Alesch 2015). Special attention should also be given to vulnerable groups, such as women, the disabled and the poor. The policy to build the resilience of these groups complies with SDG Target 1.5 (UN-DESA 2015). In relation to this, we have identified the following challenges that need to be followed up:

- The concept of a Disaster Resilient Village (named as *Desa Tangguh Bencana/ Destana*, Government of Indonesia 2012a), needs to be strengthened. With the concept's historical background originating in ad hoc projects of local/international NGOs or International Agencies, many practitioners are beginning to questioning the sustainability and integration of this concept, as many other line ministries have also similar concepts called *Desa Siaga*, *Kampung Siaga Bencana*, *Mukim Daulat Bencana*, *Desa Pesisir*, etc.
- The concept of a Disaster Preparedness School (i.e. *Sekolah Siaga Bencana/ SSB*) and an environmentally friendly school needs to be institutionalized within the education system. It is claimed that disaster education has not been well organized or a part of the curriculum at school (Dwiningrum and Sudaryono 2010).

Disaster Resilient Villages are important as vulnerability characteristics are often grounded in a local context (The Ministry of Village Disadvantaged Regions and Transmigration 2015). There are three stages (i.e. *pratama*, *madya* and *utama*) and six indicators that must be met to become a Disaster Resilient Village (Government of Indonesia 2012a). The concept of a *Disaster Resilient Village* is regulated under *Perka* BNPB 1/2012, however there should be concerted action at the village level supported by higher level regulation. In order to strengthen implementation, the concept should be embedded in the community empowerment scheme within Law 6/2014 on the Village.

National Development Planning Law 25/2004 suggests that *Musrenbang* at village level is used as a development planning mechanism and dialogical process that can help identify and agree common priorities at the village level, and then be used as the basis of a Rural Development Plan. The sustainability of this is also increased if disaster management has been integrated and synchronized in the village development planning process, in which case it will not only be supported by Law 6/2014 (Government of Indonesia 2014a) but also by Law 23/2014 (Government of Indonesia 2014b). The following stakeholders are essential in order to operationalize the idea at a practical level: the Ministry of Home Affairs, BNPB, the Ministry of National Development Planning, Governors/Head of Districts/Mayors, BPBDs and the Chief of the village. In addition, a Disaster Resilient Village also needs to be supported by the Ministry of Village, Disadvantaged Regions and Transmigration

(i.e. *Kementerian Desa, Daerah Tertinggal dan Transmigrasi/KemendesDTT*), especially concerning livelihood resilience (Hadi 2014; The Ministry of Village Disadvantaged Regions and Transmigration 2015), as well as other line ministries that have similar programs at village level.

In terms of institutionalizing the concept of a Disaster Preparedness School (SSB), GoI needs to integrate DRR knowledge into the school system, in particular for district/city governments as they are the actual service provider. The main idea is to make education an effective tool in preparing the community to be able to deal with a disaster. Within the community, the student's participation could be started from the very basic form and then developed and embedded in their community (Jahangiri et al. 2011). The responsibility for this can be shared between teachers and students at school through the learning process. The options for implementing this can be varied depending on the respective district/city, culture and school character. It is suggested that schools with the support of local governments should develop not only an effective and integrated model but also a creative and enjoyable one so as to minimize the study load at school (Dwiningrum and Sudaryono 2010). The technical support and budget from BPBD, BNPB and the Ministry of Basic Education and Culture (i.e. *Kementerian Pendidikan Dasar dan Kebudayaan*) would be very helpful to initiate this process.

According to *Perka BNPB 4/2012* on the implementation of school safety from disaster, the sustainability of the Disaster Preparedness School can be encouraged by creating new extra-curricular activities or integrating it into the national curriculum (Government of Indonesia 2012c). However, in order to build awareness from school, the process should also be interesting and attractive activities for students so that the knowledge can be easily internalized, such as outdoor activities, field trips, role play as well as activation of local wisdom through fairy tales and folk songs. The research identified involvement of the following stakeholders as important: the Ministry of Basic Education and Culture, BNPB, Governors/Head of Districts/Mayors, BPBDs, Local education offices (i.e. *Dinas Pendidikan*) and Schools.

### **3.6 Conclusion and Practical Recommendations for More Integrated, Locally-Based, Community-Focused DRR**

Based on the regulatory framework analysis, it can be concluded that there is still ambiguous and ineffective content in some regulations. There should be synchronization and harmonization of laws and their derivative regulations in order to achieve the same level of understanding of the disaster management framework among relevant ministries or agencies. There should not be conflicting regulations as this will have an impact on the optimization of the functions of institutions and cooperation networks; or in short, good coordination between agencies must be supported by a synergetic regulatory framework. From an institutional perspective, the National

Disaster Management Agency (BNPB) remains as the key player to optimize the coordination and collaborative governance among stakeholders.

Collaborative governance emphasizes the inter-organizational arrangements across the boundaries of organizations in order to pursue common goals, despite their conflicting interests. To improve collaborative governance of DRR in Indonesia, this chapter has provided a set of recommendations as an attempt to offer meaningful advice to the authorities or other relevant stakeholders. In terms of the effectiveness and sustainability of moving the DRR agenda forward, there needs to be a revision of Law 24/2007 and its derivative regulations. In particular, more focus on DRR integration and internalization into development policies, planning and programs at all levels is required. This should include – but not be limited to – the following: (1) the development of climate inclusive DRR; (2) capacity development and strengthening of institutions, especially on procedures/mechanisms and the minimum service standard at district/city level; (3) building community resilience through systematic efforts to reduce vulnerability and risk.

This chapter proposes that practical strategies for more integrated and locally-based and community-focused DRR strategies include:

- To develop an integrated and comprehensive policy between CCA and DRR. This can be initiated by integrating programs of line ministries along with: interconnected indicators; a shared locus; a cost-benefit analysis for activities; and budgeting support; as well as a systematic monitoring and evaluation system. However, the very first integration must be focused on integrated data and information
- To synchronize plans and programs for reducing the Disaster Risk Index (IRBI), local government should begin to review and evaluate the existing spatial plans. DRR internalization process in RPJMD should also be supported by the provision of appropriate scale maps for the city and district level
- To devise local regulation (i.e. *Peraturan Daerah/Perda*) which firmly state the obligation to provide ‘on-call-budget’ in addition to the disaster management budget allocation on a regular basis
- To support Disaster Resilient Villages through the Law 6/2014 and Law 23/2014, as well as by line ministries policies that have similar programs at village level
- To develop policy that aims to integrate DRR knowledge into the school system, in particular at district/city level. It can be in the form of new extra-curricular activities or integrating it into the national curriculum with a variety of fun and creative activities, as well as activation of local wisdom

This chapter has contributed to analysis and recommendations for strengthening DRR institutions and regulations in Indonesia and is also relevant for other countries worldwide, especially for those which have a similar socio-political arrangement to Indonesia. For understanding the DRR in Indonesia and the engagement of multi-stakeholders, there needs to be further investigation of the influence of private sector actors in disaster governance, thus future research is expected to explore appropriate mechanisms for them to collaborate with other DRR stakeholders and how they can contribute to achieving the National DRR policy agenda.

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# Chapter 4

## Disaster Risk Reduction in Post-Decentralisation Indonesia: Institutional Arrangements and Changes

Ashok Das and Asrizal Luthfi

**Abstract** Decentralisation has fundamentally changed governance in Indonesia by transferring authority and responsibility from the national to local levels. More recently, disaster management (DM) and disaster risk reduction (DRR) responsibilities have also increasingly moved down to local and provincial levels. Decentralisation seeks more efficient, accountable, and equitable planning and development through democratization and greater participation of communities and non-state actors. This chapter investigates complementarity and incongruence between Indonesia's institutional structures and arrangements for decentralisation and DM; and how that likely impacts the practice of DRR on the ground. After almost 20 years, decentralisation continues to face predicted and unforeseen challenges. Pertinent lessons from its implementation are potentially instructive for improving the country's new DM framework. Therefore, this chapter: (1) clarifies and summarizes how decentralisation has impacted local governance in Indonesia; (2) explores and describes how the new DM framework is expected to alter local government roles, responsibilities, and capacities; and (3) discusses how well the extant decentralised governance structure and the DM framework facilitate local DRR and resilience. Mainly by reviewing the literature and analyzing documents, it infers that although decentralisation and DM frameworks are structurally quite similar, the former's shortcomings in building local institutional capacity and attaining regional coordination constrain the latter. Also, local DM efforts seem less transparent and accountable than decentralised local governance today. With its larger focus on building resilience, materializing DRR's objectives on the ground remains less resolved. Decentralisation has increased the participation of non-state actors in local governance and planning, but their contribution to DRR is limited, sporadic, and/or uncoordinated. The concluding emphasis of this chapter is on increasing clarity, capacity, and civil society collaboration for strengthening local DRR capacity.

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**Keywords** Disaster management • Disaster risk reduction • Decentralisation • Institutional arrangements • Indonesia

## 4.1 Introduction

In 1998 Indonesia launched ambitious and extensive decentralisation reforms that transformed its governance and planning systems with far-reaching political and economic impacts. Decentralisation gave local governments unprecedented power to control and manage their own affairs. Indonesia is a disaster-prone country; since 1900 over 500 disasters (natural and other) have caused more than 250,000 deaths, affected more than 30 million people, and cost over USD 29 billion ([http://www.emdat.be/country\\_profile/index.html](http://www.emdat.be/country_profile/index.html)). The last decade has seen Indonesia suffer from unusually frequent and large disasters. The 2004 Indian Ocean Tsunami made apparent the urgent need for Indonesia to have a robust disaster management system. So the Government of Indonesia (GoI) embarked on developing a new national disaster management framework. In 2007 the GoI-issued Law 24 on Disaster Management stressed the need for comprehensive risk reduction, shared responsibilities between national and local governments, as well as the importance of engaging non-government actors and communities. Similar to the objective of decentralisation, this law too significantly shifted responsibilities to the local level (Djalante et al. 2012).

A glut of terminology today exists pertaining to efforts that try to reduce and respond to disasters; notably, disaster risk reduction (DRR) and disaster management (DM). DRR focuses on reducing disaster risks through systematic efforts to analyze and manage their causal factors, such as by reducing exposure to hazards, lessening vulnerability of people and property, prudent management of land and the environment, and improving preparedness for adverse events (UNISDR 2009). It reflects the increasing awareness that dealing with disasters goes much beyond responding to an exigency, and that preemptive measures embedded into everyday planning and governance are critical (Miller and Douglass 2016). Traditionally, DM implied some preventative physical actions, like evacuation, but mostly involved reactive responses during and after disasters<sup>1</sup>, such as emergency relief, humanitarian assistance, and reconstruction. Lately, a much expanded DM concept emphasizes the notions of resilience and recovery—returning the lives of victims and places back to a normal state following a disaster (Coppola 2015). DM is believed to be a cyclical process comprising of four phases: mitigation, preparedness, response, and recovery. Today, with the growing popularity of the concept of resilience, recovery also implies bouncing back better. Although broadly similar, different international institutions use different terms—for instance, the United Nations prefers DRR, whereas the World Bank now uses an amalgamated form called Disaster Risk Management (DRM).

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<sup>1</sup>In many countries disaster management was/is also known as emergency management; for instance, the lead agency for dealing with disasters in the United States is the Federal Emergency Management Agency.

In this chapter we will use both the terms, DM and DRR—mostly in accordance with the appropriateness of the objective, regulation, or institution’s role being discussed, but also interchangeably at times when the distinction is less obvious. According to the latest national law (No. 24/2007, p.2), DM involves a series of activities, including setting development policy that highlights prevention, emergency response, and rehabilitation. The notion of DRR is frequently invoked in regard to the responsibilities of different levels of the state; yet, “risk reduction” is much less clearly defined, except that disaster prevention includes the *reduction* or elimination of hazards and vulnerabilities that raise the threat of disasters (p.4). Core capacity issues affect urban and rural governance in similar and distinct ways, but in this chapter the term local generally alludes to the urban context.

The new DM and decentralisation frameworks both increase the authority, roles, and responsibilities of the local government in development and disaster response. But these two frameworks are not always congruent, which can be challenging. For example, DM’s effectiveness is premised on local governments having some optimal level of capacities (notably, at least adequate human and financial resources); but such capacity depends on preexisting local political economy and socio-cultural factors, and how they have been altered by decentralisation’s impacts, which vary considerably (Antlöv et al. 2016; Bebbington et al. 2006; Silver 2003). Local governments’ increased authority and responsibilities may not yet be matched by sufficient or requisite capacity to execute. Thus, it is essential to explore how in heavily decentralised Indonesia its new DM framework is likely to fare.

What have been the key impacts of decentralisation on local governance and planning in Indonesia? How is the new institutional framework for DM in Indonesia likely to affect local government roles, responsibilities, and capacities? These are the leading questions that guide this chapter. Its objectives therefore are to: (1) clarify how decentralisation has impacted local governance in Indonesia; (2) explore and describe how the new DRR framework will affect local government roles, responsibilities, and capacities; and (3) discuss how well the extant decentralised governance structure complements the DRR framework. The research utilizes a mix of qualitative research methods: reviewing pertinent published literature (scholarly articles and books); document analysis; content analysis (of information gleaned from document analysis); and interviews. Scanning news and mass media sources provided supplemental information about the implementation of DM and DRR initiatives.

Analyzing documents helps to establish the appropriate background and context for analysis, exposes gaps between assumptions and outcomes, suggests the need for additional data and information, and is often the most effective source of data when events are hard to observe or research on the ground (Bowen 2009, pp. 30–31). The primary documents analyzed include recent national laws and decrees, and other legal and policy reports pertaining to Indonesia’s decentralisation and DM. All the policy documents we accessed are freely available online—directly from institutional websites, or from Google or Google Scholar. The secondary literature reviewed focuses on various aspects of decentralisation and DM, ranging from macro to micro levels of analysis. Most of the decentralisation literature pertains to

administrative and fiscal decentralisation in Indonesia and elsewhere. It highlights the theoretical assumptions and the practical experiences of executing decentralisation, especially focusing on the institutional dimensions of ushering in such structural changes. Also, primary qualitative data from interviews with representatives of local government, DM agencies, and CSOs conducted in 2009, 2013, and 2016 allow some nuanced inferences. The analysis leads us to infer that even though decentralisation and DM frameworks are structurally quite similar, the former's shortcomings in regard to building local institutional capacity and attaining regional coordination constrain the latter. Lacking clarity, capacity, and civil society collaboration hampers DRR.

The chapter is organized into five sections. Following this brief introduction, the second section describes the research's theoretical framework, which straddles literatures on disasters, resilience, decentralisation, planning, governance, and civil society. The third section then reflects on the institutional changes that have come about with decentralisation reforms and the new DM framework to evaluate their synergies and incongruences. The fourth section critically discusses what we posit as potentially the main shortcomings of the new decentralised DM framework—the lack of clarity, capacity, and civil society collaboration in DRR. We recommend some ways to overcome these shortcomings. The fifth section reiterates the chapter's objectives and main discussion to underscore the conclusions.

## **4.2 Theoretical Framework**

### ***4.2.1 Disasters and Resilience***

Disasters are defined as traumatic events that have an acute onset, are collectively experienced, and may be attributed to natural, technological or human causes (Norris et al. 2008; McFarlane and Norris 2006). Large disasters affect millions of people each year and can cause heavy losses of life and property (Kamanga et al. 2003). The acute impact of disasters, and their growing frequency and intensity have engendered DRR as a conceptual platform to respond to disasters. The DRR concept builds upon two paradigmatic influences on disaster studies. The hazard paradigm had long dominated the scientific study of disasters, centering on nature's threats or hazards, and ways to minimize or eliminate them (Gaillard 2010). Then came the vulnerability paradigm, emphasizing more the vulnerabilities to natural hazards (McEntire et al. 2002). Vulnerability is the susceptibility to suffer damage from a potentially dangerous event (natural, economic, political, etc.), arising from conditions that turn a hazard into a disaster (Gaillard 2010). Instead of eliminating hazards, the vulnerability paradigm is about addressing factors—physical, social, economic and political—that contribute to increasing vulnerability (Gaillard 2010; Pearce 2003; McEntire 2004).

The vulnerability paradigm has germinated various related DRR concepts such as Community Based DRR (Gaillard 2010), Disaster Resilient Communities,

Sustainable Hazard Mitigation, and Comprehensive Vulnerability Management (McEntire et al. 2002; Pearce 2003). This is because the concepts of capacity and resilience have also bolstered the vulnerability paradigm (Gaillard 2010) by drawing attention to coping strategies and mechanisms. Coping strategies refer to how people and organizations leverage resources to achieve various beneficial ends during a disaster's unusual, abnormal or adverse conditions (Gaillard 2010). Thus, DRR has evolved from being focused purely on physical interventions to a comprehensive multi-disciplinary endeavor (Gaillard 2010; McEntire et al. 2002); and from a technocratic approach to a participatory process involving communities (Gaillard 2010; Norris et al. 2008; Pearce 2003). It has also expanded the focus from response and recovery onto mitigation, risk management (Pearce 2003), and adaptation (Jabareen 2013; Norris et al. 2008).

Resilience, which characterizes *inter alia* individuals, communities, and cities, is conceptualized as a process rather than an outcome, as the capacity for adaptability rather than stability (Norris et al. 2008) in the face of disturbance, stress or adversity (Vale and Campanella 2005). Inspired by how ecosystems cope with stresses and external disturbances (Jabareen 2013), DRR emphasizes a network of adaptive capacities required after a disaster (Norris et al. 2008), which depends on individual as well as collective abilities (Norris et al. 2008). To embed this concept of resilience in routine development policy toward building the adaptive capacity for DRR is challenging (Gaillard 2010). National and international policy guidelines that have adopted resilience as a guiding concept, such as the United Nations International Decade for Natural Disaster Reduction (1994) and United Nations International Strategy for Disaster Reduction (2005 and 2009), have not really trickled down yet to transform local communities (Gaillard 2010).

Steadily accumulating evidence and refining critiques also point to weaknesses in how DRR perceives resilience. Some have argued that it is interpreted more as 'resistance' rather than 'adaptation' (McEntire et al. 2002). Others have argued how 'bounce back' suggests a mere return to pre-disaster conditions, instead of reducing vulnerability by adaptation to future threats (McEntire et al. 2002)—the need to bounce forward or bounce back better (Alexander 2013; Manyena et al. 2011). Importantly, conventional DM usually does not include all the actors and expertise that contribute to resilience (McEntire et al. 2002); its use in DM lacks the richness of its diverse theorizing and ignores the multidisciplinary and complex nature of resilience (Jabareen 2013). Vulnerability, urban governance, prevention, an uncertainty oriented disposition, and the simultaneity of social, economic, and environmental concerns are all challenges for planning. Nonetheless, the planning profession and its institutions are uniquely positioned to pursue resilience with the necessary comprehensiveness and multidimensionality (Jabareen 2013).

Development and planning have become increasingly more participatory, and community-based and community-driven (Beard et al. 2008; Hickey and Mohan 2004; Mansuri and Rao 2004). Planning institutions should encourage more community involvement and broader participation even in DM because communities are usually the best assessors of local conditions, needs, and potentials. In regard to DRR and DM, policies stemming from community perspectives are likely to prove more

adaptive and sustainable (Gaillard 2010; Norris et al. 2008; Pearce 2003). Moreover, capable planning institutions can meld scientific knowledge and international policy wisdom with local practice to develop contextually appropriate resilience frameworks and ends. Of course, all this requires strong political will (Gaillard 2010).

## 4.2.2 *Decentralisation and Planning*

Decentralisation seeks more effective governance and development by transferring political authority, governing capacity, and resources from the national government to sub-national levels (Eaton 2004; Litvack et al. 1998). It enhances community participation in planning, implementation and resource allocation towards democratizing development (Langran 2011; Dasgupta and Beard 2007; Hutchcroft 2001).

Since the early 1980s scholars and multilateral development institutions have prescribed decentralisation in developing countries for various ends: good governance; targeting local development needs and potentials better; improving public services; reducing uneven regional development, and boosting civil society and private sector roles in development (see, for instance, Bardhan and Mookherjee 2006; Beard et al. 2008; Bird and Vaillancourt 2008; Cheema and Rondinelli 1983; Grindle 1997, 2004, 2012; Litvack et al. 1998; Rondinelli 1989). A primary motivator of decentralisation is to attain two kinds of efficiencies (Kahkonen and Lanyi 2001): (a) *allocative*—through better matching of public services to local preferences; and (b) *productive*—through increased accountability of local governments to citizens, less bureaucracy, and better knowledge of local costs. Their comprehensive attainment requires several kinds of decentralisation—spatial, administrative, fiscal, political, and market (Rondinelli 1989). It is relatively easier for countries to implement spatial and administrative decentralisation.

Administrative decentralisation, the most common form, transfers, in different measures, authority, responsibility, resources, and accountability from central to intermediate and local levels of government, as well as non-governmental, private, or voluntary organizations (Cohen and Peterson 1997; Schneider 2003; World Bank 2005). Countries have often neglected essential details related to human resources and other capacities when implementing administrative decentralisation (World Bank 2005, pp. 17–18), which can be of four types (Rondinelli 1983): (1) deconcentration (transfer of functions within the central government hierarchy by shifting workload from central ministries to field officers); (2) delegation (transfer of functions to regional or functional development authorities, parastatal organizations or special project implementation units); (3) devolution (transfer of functions and decision-making authority to sub-national governments); and (4) transfer of activities from the public to the private sector and other non-state actors.

Complexity causes decentralisation outcomes to vary considerably across places and time (Bardhan and Mookherjee 2006; Beard et al. 2008; Gadenne and Singhal 2013; Martinez-Vasquez and Valliancourt 2011). Decentralisation does not necessarily achieve positive objectives (Holzhacker et al. 2016; Prud'homme 1995;

Seymour and Turner 2002); in countries like Mexico, Ghana, Colombia and the Philippines, decentralisation barely improved the performance of local planning institutions (Devas and Korboe 2001; Escobar 2002; Boone 2003). Others have noted how it can lead to inequities in revenue distribution (Silver 2003) or local public services, the entrenchment of local elites and downward spread of corruption (Kohl 2003), and the strengthening of clientelism (García-Guadilla and Pérez 2002; Kohl 2003; Lane 2003).

Decentralisation's impacts can reasonably be expected to affect disaster preparedness and management at local and provincial levels. Vaillancourt (2013) found that more fiscal decentralisation correlates positively with a reduction in the number of people affected by disasters. Likewise, Ahmed and Iqbal (2009) found that implementing political and fiscal decentralisation jointly significantly reduces fatalities at the lowest administrative tiers. The poor quality of the state's human resources—a common decentralisation woe—is a key challenge toward better understanding the mechanisms of DM and preparedness (Sserwadda 2011; Scott and Tarazona 2011). Likewise, low levels of citizen awareness due to poverty and/or authoritarian legacies impede participatory DRR (Scott and Tarazona 2011).

Sudden decentralisation, often after long periods of centralized top-down development, is burdensome for local governments. With their already expanded roles and responsibilities, handling new DM and DRR responsibilities can be especially difficult. Everything—inter alia managing human resources, financial and fiscal tools and resources, inter-sectoral and inter-governmental coordination, to efficient resources allocation (Kim 2008; Bolton and Farrel 1990)—becomes more complicated. However, decentralisation has the potential to transform local planning institutions and attain better governance through better law enforcement, coordination, and conflict resolution (Huther and Shah 1998). Local governments with strong and effective leadership are more likely to succeed (Bunnell et al. 2013), so boosting local leadership capacity is vital for positive institutional transformation (Firman 2009).

### ***4.2.3 Disaster Governance and Non-state Actors***

Decentralisation also encourages the state to partner with non-state actors for planning and development (Devas 2001). Entrusting local governments with planning and development responsibilities, and promoting public private partnerships (PPPs), community participation, and state-civil society collaboration has caused new institutional arrangements to emerge at multiple scales, especially for local services delivery (Mansuri and Rao 2013; Woetzel et al. 2014). The spread of democracy and the concomitant rise of civil society worldwide have boosted institutional partnerships with non-governmental organizations (NGOs) and community-based organizations (CBOs) toward greater participation and citizen empowerment (Fung and Wright 2003). Likewise, the rapid surge in research on social capital has helped mainstream the notion of participatory development using multi-stakeholder



partnerships (Isham et al. 2002; Krishna 2003; Woolcock and Narayan 2000). Planning theory's debunking of rational planning thought and exhorting more radical, progressive, and inclusive forms (for instance, see Beard 2003; Miraftab 2009; Sandercock 1998) also emphasize democratizing and pluralizing planning practice. However, the debilitating effects of civil society's historical suppression during the New Order in Indonesia are still manifest in CSOs' limited participation (which we discuss later). That hampers participatory urban development efforts (Das 2015a) or can cause adverse outcomes because of the complicity of CSOs in distancing the poor (Ito 2011).

The partnerships with non-state actors for decentralised planning and governance, overall, can and should as well be sought specifically for DM and DRR. Non-state actors include prominent individuals, international CSOs, private corporations, NGOs, CBOs, and other associations (Wagner 2013). Their inclusion will facilitate effective disaster governance, which Miller and Douglass (2016) see as moving away from technocratic environmental determinism, strictly within the policy domain, toward embracing historical, social, cultural, and political dimensions that make most disasters uniquely contextual. Non-state entities already play some or can play more vital roles in enabling multi-stakeholder partnerships for DRR and DM in Indonesia (Djalante et al. 2013; Djalante and Thomalla 2012). To build local government capacity and participatory approaches in decentralised institutional frameworks, a critical component is the role of NGOs (Davidson and Peltenburg 1993; Krishna 2003). The lack of local institutional capacity can be compensated by involving NGOs to leverage their experience and knowledge, and link communities to city-level institutions so that policymaking can better reflect local needs, negotiate societal challenges and leverage community assets (Das 2015a). Academic institutions are also underutilized actors that can improve policy research and program innovation. International donor organizations too should continue to support appropriate endeavors for enhancing local capacity. These concerns and considerations are even more pertinent for smaller Asian cities, with weaker institutional capacities, that tend to be urbanizing faster and more haphazardly (Rumbach 2016).

### **4.3 Decentralisation and Disaster Management in Indonesia**

We begin this section by discussing key characteristics of decentralisation in Indonesia, its implementation and impacts. Next, we present a brief overview of the evolution of DM in Indonesia. Then we explore the potential transformation of disaster governance in Indonesia by discussing the new DM framework in Indonesia and its impacts, especially focusing on the aspects of shared responsibilities and authority, financing, role of non-state actors, and spatial planning.

### 4.3.1 Decentralisation

#### 4.3.1.1 Decentralisation Characteristics and Implementation

Indonesian decentralisation has political, administrative and economic objectives (Kemitraan 2011). It seeks a democratic political infrastructure, based on popular sovereignty, manifested in local elections, in which people directly elect their legislators at sub-national levels (provincial, city, and district). The administrative objective seeks to maximize effectiveness, efficiency, equity, and economic objectives of development by encouraging elected local and regional heads to perform their functions more closely with the respective legislative authority (DPRD). The economic objectives target larger socio-economic goals—utilizing and expanding social capital, intellectual capital and financial capital—to enable broad societal welfare.

Indonesia's current form of decentralisation came about during the *Reformasi* (reformation/reforms) period of 1998–1999 with the issuance of Law 22/1999 on Regional Government, and Law 25/1999 on Fiscal Balance between the Central Government and the Regions. These were later amended by, respectively, Laws 32/2004 and 33/2004 (Miller 2013). The Government of Indonesia (GoI) instituted two other laws related to political decentralisation: Law 22/2014 on the Election of Regional Heads; and Law 6/2014 on Villages [political and administrative structures]. Law 32/2004 authorized local governments to regulate autonomous regions and manage their own affairs and the interests of local communities. Most recently, in 2014 Law 23/2014 further made overall amendments to the general decentralisation provisions of Law 32/2004.

The four main decentralisation laws mentioned above have reconfigured inter-governmental relations and eliminated the hierarchical relationship between Indonesia's provincial and sub-provincial governments. Now city and district administrations have much greater authority and responsibility over the political, administrative and economic affairs of their own jurisdictions. Previously, during the New Order—the period of President Suharto's authoritarian rule from 1966 to 1998—provincial administrations carried out policy directives from Jakarta through a centrally appointed governor. After decentralisation provincial governors gained no new powers.<sup>2</sup> It was the local level that gained markedly more responsibilities and powers. Other than foreign affairs, defense and security, the judiciary, monetary and fiscal affairs, and religious matters, all other areas of policymaking were decentralised (Law 32/2004, article 10). Law 22/1999, with later amendments from Law 32/2004, granted sub-provincial administrations control over local investment, trade and industry, public works, education, health, labor, agriculture, and the environment sectors.

Political decentralisation in Indonesia has been an ongoing and vacillating project. Law 22/1999 established indirect local elections for mayors (*walikota*) and regents (*bupati*, heads of regencies/districts), who prior to decentralisation were

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<sup>2</sup>Except in Aceh, Papua, Yogyakarta and Jakarta, where separate special autonomy arrangements devolve most state authority to the second-tier of provincial level administration (Miller 2009).

central government appointees. Law 32/2004 further amended this to allow citizens to directly elect regional heads (Miller 2013), opening the floodgates for citizen participation (Darmawan 2008). However, other than spelling out the citizen's role in local elections, the said law does not articulate any other mechanism for promoting citizen participation (Yappika 2006). A Constitutional Court ruling further revised the law to allow independent candidates and party cadres to directly contest local elections (Miller 2009). Law 22/2014 on Regional Head Elections added more provisions to regulate local elections. Some observers have also expressed serious concern over a proposed revision to Law 32/2004 that may rescind the provision for directly electing regional heads.

Another piece of national legislation, Law 23/2014 altered some articles of Law 32/2004 to more comprehensively explain regional governance dynamics. It now categorizes three types of tasks/affairs for different levels of the government to legislate—absolute, concurrent, and general. Only the national government legislates on absolute affairs; general affairs pertain to rare discretionary legislation by the President, as the head of state. The concurrent affairs exemplify the foundation of Indonesia's decentralised governance today. National as well as sub-national governments enjoy shared authority to legislate on and regulate these affairs. As Table 4.1 illustrates, concurrent affairs are further classified as basic, non-basic, and optional. As discussed later, there is mention of disaster related activities under both the basic and non-basic categories. The national government sets the overall norms, standards, procedures, and criteria as guidelines to ensure cohesiveness in local governments' actions, and assists and supervises their implementation roles. To execute specific national policies at the local level it also delegates power to governors, mayors, regents, as well as national line agencies.

A close reading of decentralisation related laws and regulations provides valuable insights into how and how much the continual interventions have altered the landscape of local and regional planning and governance. Table 4.2 presents some significant transformations that have accompanied successive pieces of decentralisation legislation. One is the proliferation of sub-national administrative units, which has generated new challenges (Toha and McPherson 2014). Today there are 34 provinces, 93 urban local governments (*Kota*) and 415 rural local governments (*kabupaten*).

Under the new decentralisation framework, sub-national governments (provincial and urban/rural districts) create their own policies and regulations at the local (*Perda*) and regional levels (*Perkada*). Provincial governments also delegate their policies to the rural/urban district governments and village administrations for implementation. Additionally, urban/rural districts are able to delegate policies to neighborhood/village level administrations. Such delegation is now likely to be more meaningful. The national government is resetting multi-level governance relationships, by strengthening the hitherto weakened role of the provincial government, with a clear delineation of decentralised roles to each level of government level (national, provincial and urban/rural district) and eliminating much of the prevalent ambiguity. As the governmental structure's regional tier, the provincial government now duly has more power to control and coordinate local (urban/rural

**Table 4.1** Concurrent affairs of decentralised governance

Basic services	Non-basic services	Optional
Education	Labour	Marine and fisheries
Health	Women empowerment and children protection	Tourism
Public works and spatial planning	Food	Agriculture
Housing and residential areas	Land	Forestry
Peace, public order, and community protection	Environment	Energy and mineral resources
Social	Citizens administration and civil registration	Trading
	Community empowerment and village	Industry
	Population control and family planning	Transmigration
	Transportation	
	Communication and informatics	
	Cooperatives, small and medium businesses	
	Capital investment	
	Youth and sport	
	Statistics	
	Cryptography	
	Culture	
Library; and archival		

**Table 4.2** Key features of decentralisation laws

Law	Key reform/intervention	Decentralisation type
Law 23/2014 on regional development (replaced Law 32/2004, which previously replaced Law 22/1999)	Shared responsibilities and authorities between national, provincial and local (urban/rural district) government for: basic services; non-basic services; optional	Administrative
Law 33/2004 on fiscal balance between national and regional (replaced Law 25/1999)	General Allocation Fund ( <i>Dana Alokasi Umum</i> —DAU), Special Allocation Fund ( <i>Dana Alokasi Khusus</i> —DAK), and Revenue Sharing Fund ( <i>Dana Bagi Hasil</i> —DBH)	Fiscal
	Original local (city/district) revenue ( <i>Pendapatan Asli Daerah</i> —PAD)	Fiscal
Law 22/2014 about electing regional heads	Direct local election	Political
Law 6/2014 on villages	Village funds (from national government budget and urban/rural district budget)	Fiscal
	Original village revenue	
	Direct village election	Political

district) governments. Law 23/2014 has notably restored to the *Kecamatan* (a sub-district of a city or regency) the status of sub-local government—it previously was just a governmental working unit (*Satuan kerja perangkat daerah*). The law has also accordingly added, reduced, and better regulated some roles of regional governments—there now exist mechanisms for sanctioning provincial governors and city mayors who do not implement national policies or permit services.

The expansion of sub-national administrative units and upgrading of their administrative responsibilities necessitated changes to Indonesia's fiscal arrangements too. Initiated by law 25/1999 and later amended by law 33/2004, fiscal decentralisation today entitles cities and districts to funding from four main revenue streams. First, reflecting their leading role in public service delivery, cities and districts receive from the national government the General Allocation Fund or *Dana Alokasi Umum* (DAU)—an equalization block grant for routine expenditure. DAU's objective is to reduce economic disparities among resource-rich and resource-poor regions. Because many cities/districts produce/have limited natural resources (an important consideration in revenue redistribution) and other sources of income, usually the DAU supports around 70% of local government spending (Miller 2013).

The second revenue stream that provinces, cities, and districts receive on a needs basis is called the Special Allocation Fund or *Dana Alokasi Khusus* (DAK). These matching funds are transferred for special purposes, typically sectoral projects. Sub-national units receive this funding, for pursuing projects proposed by the national government, if they too provide some from their own budget. Since 2001, DAK projects have emphasized health, education, infrastructure, potable water provision, agriculture, fisheries and the environment (World Bank 2008). A third type of funding is revenue sharing funds called *Dana Bagi Hasil* (DBH). The national government originally raises DBH from taxes and natural resources, and then distributes it to local governments. Proportionately, urban/rural districts get more DBH than provinces, but this revenue stream too sends more funds to districts in resource rich provinces. The fourth stream is what provincial, city, and district governments generate themselves within their own jurisdictions. Local taxes, local levies, and other local government collected and managed sources constitute this Original Regional Revenue fund or *Pendapatan Asli Daerah* (PAD). For cities and districts with large populations and limited revenue sources, PAD usually amounts to less than 10% of public expenditure (Comola and de Mello 2010).

The latest effort to make decentralisation reforms penetrate deeper down into the Indonesian polity is the Village Law 6/2014. It wants to improve village level administration, which affects nearly half the population, by shifting more control over resource management and planning to village governments. Now, with funds from the national and urban/rural district government, villages can manage their own affairs more autonomously; generate their own revenues; and elect leaders through direct election. Albeit a step in the right direction, significant challenges remain that can only be overcome with greater upward accountability and involvement of non-state actors (Antlöv et al. 2016).

The various decentralisation laws have progressively acknowledged, yet not with sufficient clarity, various essential inputs for decentralised DM. In a recent instance of tinkering, Law 23/2014 identified DM objectives under two areas related to basic services: peace, public order and community protection; and the social realm. Table 4.3 illustrates how Law 23/2014 articulates the sharing of authority and responsibility pertaining to disasters among the national, provincial and urban/rural district governments. The ‘peace, public order and community protection’ category just mentions that each level of government will be responsible for managing disasters deemed to be of an apposite level of significance. Sans sufficient explanation, the same category also mentions ‘fires’ (likely because it is a major threat in rural and urban areas alike) as a distinct disaster category. In regard to fires, the national government will create rules and criteria for standardizing *inter alia* firefighters’ infrastructure, certification, informational systems; the provinces are required to map major fire prone areas; and local governments are responsible for actually preventing and fighting fires on the ground. Under the ‘social realm’ category, all levels of government have ‘disaster management’ as a main objective. The main emphasis for all government levels now appears to be relief and recovery from trauma; but the national and local governments are also expected to create community preparedness models for enhanced disaster preparedness. However, the law explicates little beyond stating these idealized objectives—what they mean precisely or how they are to be attained remains fuzzy.

#### 4.3.1.2 Decentralisation Impacts

Eighteen years of Indonesian decentralisation have yielded an unexpectedly mixed bag of outcomes, in which persistent, evolving, and novel challenges seem to outnumber a few solid gains. Entrenched democracy with political stability (“Beyond the crossroads,” 2009; Kimura 2011), allayed fears of territorial fragmentation, good local urban governance exemplars (Bunnell et al. 2013), and extensive regional autonomy in a pluralistic polity (Shah and Chaudhry 2004) are some of decentralisation’s notable achievements. It has effectively reduced conflict and separatist demands provinces like Aceh and Papua (Tadjoeddin 2014). Among the myriad reasons bedeviling Indonesian decentralisation is the New Order’s lasting deleterious influences on the state’s institutions as well as non-state institutions (Datta et al. 2011)—such as the lack of bottom-up accountability (Shah and Chaudhry 2004) that is still pervasive.

The specific impacts on Indonesian local governance and planning are equally confounding. Some provinces, districts, and municipalities display highly positive impacts, while they are hardly positive or mostly negative in others (Firman 2009; Miller 2013). The progress of decentralisation in every province, district and municipality depends on the quality and ability of the leadership of local government and its agencies to respond to its changes and challenges (Firman 2009). Here we highlight certain challenges that could possibly also affect, directly or obliquely, the implementation of the country’s new DM framework.

**Table 4.3** Disaster management under the new decentralisation law (23/2014)

Mandates	Issues	National	Provincial	City/rural districts
<i>Peace, public order, and community protection</i>	<i>Disasters</i>	Managing disasters of national level (significance)	Managing disasters of provincial level (significance)	Managing disasters of national level (significance)
		May allocate additional emergency funds to sub-national levels if regular funding (from <i>Dana Siap Pakai</i> ) is insufficient for any exigency	Provincial legislative councils/heads (governors) can draft special regulations in the case of extraordinary situations, conflicts, or natural disasters	Local legislative councils/heads (mayors, <i>bupati</i> ) can draft special regulations in the case of extraordinary situations, conflicts, or natural disasters
	<i>Fires</i>	Standardizing firefighters' infrastructure	Mapping fire-prone areas	Prevention, control, firefighting, rescue and handling hazardous materials and toxic fires
		Standardizing firefighters' competency and certification		Inspecting fire protection equipment
		Operationalization of fire information system		Investigating fire events
				Empowering communities in fire prevention
<i>Social</i>	<i>Disaster management</i>	Provision of basic needs and trauma recovery for the victims of local level disasters	Provision of basic needs and trauma recovery for victims of national disasters	Provision of basic needs and trauma recovery for victims of provincial level disasters
		Creating a community empowerment model for disaster preparedness		Creating a community empowerment model for local level disaster preparedness

Decentralisation triggered the proliferation (*pemekaran*) of new provinces and districts across Indonesia (Kimura 2013). At the local government level, decentralising political authority has caused some political instability (Hadiz 2004), the rise of a new predatory elite group, and much clientelism (Hadiz 2010). Locally, there-

fore, bureaucratic corruption can be rampant, and priority spending on basic services wanting (Booth 2005). Local elections turned into chaotic competitions among local elites. The original decentralisation laws of 1999 abruptly ended the hierarchical relationship between the provinces and the districts/cities (Takeshi 2006, p.139), which emasculated provincial governments (Booth 2005). It left them with no clear roles, mostly just minor coordination functions (Shah and Chaudhry 2004). Decentralisation did not reduce local governments' fiscal dependency on the central government either (Silver 2003; Silver et al. 2001). In fact, with sub-national governments still largely reliant on central government transfers for their expenditures, insufficient bottom-up accountability at the local level is a concern (Datta et al. 2011, pp. 34–38; Duncan 2007; Shah and Chaudhry 2004). It has widened regional disparities in budgets and economic output, fragmented regional development, and denuded the quality of public service provision (Firman 2009), as well as weakened local institutional capacity (Firman 2009; Silver 2003) and intergovernmental cooperation (Miller 2013).

On the other hand, it has empowered Indonesian cities to make decisions about their own needs and interests and promoted secondary cities as new urban centers (Miller 2013). The *Kartamantul* (Greater Yogyakarta) model is a rare example of effective intergovernmental regional cooperation, especially for coordinating and managing waste management infrastructure (Firman 2010). But such encouraging developments are sporadic, at best. It underscores the unmet need to expand CSO participation in local planning and governance—the likely missing link for attaining equitable local development (Antlöv et al. 2010; Das 2015a, b; Takeshi 2006; Soesastro 1999).

The post-decentralisation governance climate is vastly better than before and continually improving, which is reflected in Indonesia's inclusion among the world's fastest growing large economies (<http://www.mckinsey.com/global-themes/asia-pacific/the-archipelago-economy>). With an enlarged and empowered space for civil society today in Indonesia's democratized development processes, the potential to boost transparency, accountability, and equity is huge. Government projects allow increasing public scrutiny. Although corruption is rife in various sectors, a freer press exposes perpetrators and courts prosecute them more routinely. All this augurs well for another much-needed transformation—revamping DM institutions and infrastructures for reducing risks and raising resilience in this disaster-prone country.

### 4.3.2 *Transforming Disaster Governance*

#### 4.3.2.1 **The Evolution of Disaster Management Efforts**

Djalante, Chap. 1 in this book, comprehensively traces the occurrence of disasters and the evolution of DRR efforts in Indonesia. What follows is a purposefully laconic overview to situate the chapter's main discussion to follow. We recommend Djalante's chapter for gaining deeper historical insights.



A piece of Dutch colonial legislation in 1939 called the *Regeling op de Staat van Oorlog en van Beleg* (State Control on War and Siege) or SOB was Indonesia's first DM policy. It authorized the governor to act in emergency situations arising from the acts of external agents and extraordinary situations like wars (Lassa 2011; Hariyono 2008). After independence in 1945 the GoI, during President Sukarno's Old Order (*Orde Lama*) regime (1945–1965), created National Law 6/1946 on emergency management. It acknowledged man-made emergencies and, curiously, that CSOs (such as Islamic organizations) could be involved in emergency situations. The authority for emergency management lay with the National Defense Council, which comprised the prime minister, some ministries, three CSO representatives, and the military commander (Hariyono 2008). Two subsequent amendments, by Law 1/1948 and Law 30/1948, concentrated this authority in the hands of the president. In recognizing the potential/need for involving CSOs, these early efforts may now seem progressive<sup>3</sup>. But back then civil society was not viewed as independent of the state; before 1998 CSOs (especially NGOs) in Indonesia were merely the state's agents for executing development programs (Antlöv et al. 2006).

In 1955, GoI produced the first national Five Year Development Plan (*Repelita I*, 1956–1960), which recognized that disasters impact development plans. *Repelita I* articulated the importance and roles of forest ecosystem services toward mitigating disaster risk and providing rehabilitative assistance (Lassa 2013). In 1965 the Old Order gave way to the New Order (*Orde Baru*)—the long authoritarian rule of President Suharto that followed the ouster of President Sukarno. In 1966, through a Presidential decree (No. 256), the government also created an ad hoc organization called the Central Advisory Board for Natural Disaster Management (*Badan Pertimbangan Penanggulangan Bencana Alam Pusat* or BP2BAP) that was the responsibility of the Minister for Social Affairs. This was the first policy move to expand the DM paradigm, from being focused solely on man-made exigencies to including natural disasters (<http://www.bnppb.go.id/profil>).

The New Order issued several more policies related to DM, some of which attempted to move command and control of DM activities to lower levels of government. First, in 1979 the Presidential Decree 28/1979 created the National Coordinating Agency for Disaster Management (TKP2BA), and reinforced the threats from natural disasters and the need for systematic emergency management. It established a National Disaster Coordination Council (NDCC) that would steer systematic emergency management with the aid of the National Coordination Agency for the Management of Natural Disasters (*BAKORNAS PB* or *BAKORNAS*), the Provincial Disaster Management Councils (*Satkorlak*), and City/District Disaster Management Councils (*Satlak*) (Lassa 2011, 2013). All DM activities during this period were reactive, focused on emergency response and recovery. In fact, it took a disaster event to just activate the organizational structure for DM (Pujiono 2005).

In 1990, the Presidential Decree 43/1990 revised Presidential Decree 28/1979—from being focused solely on humanitarian emergencies and entirely post-disaster-

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<sup>3</sup> However, the mention of CSOs was only in the context of forest ecosystems.

response-oriented to also concentrate on non-natural hazards and the overall DM cycle. It established the National Coordinating Agency for Disaster Management for addressing both natural and man-made disasters, and emphasized inputs for DM's various stages—prevention, mitigation, emergency response, rehabilitation, and reconstruction (Lassa 2011). The New Order government began declaring 'national' disasters, quite likely because no local government of the day could deal with such exigencies. Also, the political instability of the Old Order made a wary New Order assume control and action of almost every aspect of development, including DM.

Almost a decade later, another Presidential Decree 106/1999 revised the one from 1990. The revision clarified that the mandate of the National Coordinating Agency for Disaster Management did not extend to handling emergencies like riots or mass violence. The 1999 *Reformasi* (Reformation) was the landmark political upheaval that enabled decentralisation, which altered Indonesia's DM framework by transferring more disaster responsibilities to local governments. This mirrors the larger objectives and implementation of decentralisation toward localizing development, planning, and governance. After decentralisation GoI continually revised extant DM frameworks with new laws and regulations. The Presidential Decree 3/2001 transformed the National Coordinating Council for Disaster Management into the National Coordinating Council for Disaster Management and Internally Displaced People. This 2001 regulation made the Vice President directly responsible for DM, and folded activities of the Ministry of Transmigration into the national structure for DM. Next we discuss specific changes to the DM framework and how they might affect the underlying objectives of DRR.

### 4.3.3 *The New DM Framework*

Law 24/2007 on DM (henceforth, also the New DM Law) is the most significant piece of post-decentralisation legislative reform related to disaster governance. It seeks extensive reform of Indonesia's architecture and apparatus for handling disasters—largely the vestiges of the DM structure established in 1979. The most visible change has been the creation of the National Disaster Management Agency (*Badan Nasional Penanggulangan Bencana* or BNPB), from the former National Coordination Agency for Disaster Management (*BAKORNAS*). BNPB replaced what was previously an ad hoc inter-ministerial council to deal with disasters (World Bank 2012, p.7). The New DM Law stipulates all levels of government to create their own DM plans. BNPB is in charge of creating and revising the National Disaster Management Plan (*Renas PB*), which also serves as a template and guide for sub-national governments to create theirs. To do this, BNPB coordinates with national government ministries and agencies with DM-related responsibilities. This plan is meant to serve as the guiding document for 3–4 years, after which a newer version should update it. National level DM planning, with its short to long term goals, appears to now have an incremental approach with more tangible targets.

**Table 4.4** Old and new disaster management institutions in Indonesia

Level	Old	New
National	National Coordinating Board for Disaster Management ( <i>Badan Koordinasi Nasional Penanganan Bencana</i> )	National Disaster Management Agency (BNPB)
	Legal Basis: Presidential Regulation 83/2005	Legal Basis: Law 24/2007 and Presidential Regulation 8/2008
Provincial	Provincial Coordination Board for Disaster Management ( <i>Satkorlak PB</i> )	Provincial Disaster Management Agency (BPBD-P)
	Legal Basis: Governor's Decree	Legal Basis: Local Regulation ( <i>Perda</i> )
City/district	Implementation Unit for Disaster Response and Refugee ( <i>Satlak PBP</i> )	Local Disaster Management Agency (BPBD-K)
	Legal Basis: Governor's Decree	Legal Basis: Local Regulation ( <i>Perda</i> )
Sub-district	Operational Unit for Disaster Management and Refugee (PBP)	None yet
	Legal Basis: Governor's Decree	
Village	Community Protection Unit for Disaster Management and Refugee ( <i>Satlinmas PBP</i> )	None yet
	Legal Basis: Governor's Decree	

The New DM Law also changed the sub-national DM institutions. Table 4.4 illustrates the main differences before and after the passage of the New DM Law.

It converted the Provincial Councils on Disaster Management (*Satkorlak*) into Provincial Disaster Management Agencies (*Badan Penanggulangan Bencana Daerah-Provinsi* or BPBD-P), and, likewise, the City/District Disaster Management Councils (*Satlak*) into Local Disaster Management Agencies (*Badan Penanggulangan Bencana Daerah-Kota/Kabupaten* or BPBD-K). Even 8 years after the new DM Law, local DM institutions are yet to be created; as of 2015, 468 districts had their own DM agencies, but 52 districts and 22 cities did not (Radar Banyumas Newspaper, 03/11/2015). Similarly, less than 60% of 'natural disaster prone' rural districts have mandatory community-based disaster preparedness units ("Govt to empower more disaster-prone areas" 2015). Nevertheless, the very creation of these new institutions characterise the potential for localized and democratized decision-making in post-decentralisation Indonesia. The legal basis on which the sub-national DM agencies are founded is the provincial or local level regulation (*Perda*), which itself is the outcome of deliberation involving elected members of the local legislature. In the older arrangement that had prevailed since the New Order, the legal basis was the Governor's decree, which was closely guided by the central government. The National Disaster Management Plan expects to be a model for all of Indonesia's DM activities—prevention, mitigation, preparedness, emergency response and recovery. Recognizing that the compounding threats and complexity of disasters in Indonesia will require a more integrated,

coordinated, and comprehensive approach to DM prompted the comprehensive restructuring of DM's institutional framework (BNPB 2010).

We will next briefly consider five relevant aspects of this institutional restructuring: organization; responsibilities and authority; financing mechanisms; participation by non-state actors; and development and spatial planning. In Table 4.5 we present the main differences, as discussed below, between the old and new institutional frameworks.

#### 4.3.3.1 Organization

The new DM structure has stronger legal basis under the New DM Law. The old top-down DM framework was based mostly on Presidential Decrees, but the new institutional framework allows for more democratic and localized policymaking. At the national level the parliament through legislative processes has instituted the New DM law, which was then approved by the President. Similarly, the regional and local legislative councils, whose members are elected directly by the people, will formulate sub-national DM laws and plans to be approved by the heads of the respective governments. The legal basis for all DM institutions and policymaking is now legislative processes enshrined in Article 4 of the New DM Law. It strengthens the directives of an earlier legislation (Article 6 of Law 24/2007) that stipulated several DM responsibilities of the state, including protection, rehabilitation, and funding, as well as integrating DRR into development programs and systematically recording and archiving disaster threats and impacts.

As the new bulwarks of DM, BNPB and BPBDs have greater authority. The older DM institutions were generally geared toward being reactive, i.e. they were active only during and after disasters. The new DM institutions are permanent entities with clearer mandates within a formal organizational structure. These institutions are expected to work not only during all the phases of the DM cycle but also operate outside the realm of DM by collaborating with other agencies on general development objectives and programs. The autonomous BNPB enjoys a status equal to that of a national level ministry, and BPBD agencies are just like any other agencies/departments at the sub-national levels. Having permanent staff and budgets gives these new DM agencies more teeth and underscores their legitimacy.

The BNPB and BPBDs are organizationally more streamlined with their responsibilities demarcated between two constituent entities—a Steering/Guidance Council (*Dewan Pengarah*) and an Implementation Council (*Dewan Pelaksana*). The steering councils consist of senior bureaucrats and professionals unaffiliated with the government—an effort likely meant to promote inclusive, transparent, and creative policymaking; whereas the implementation councils comprise of rank and file government officials. Policymaking, monitoring and evaluation are the ambit of the steering councils, and hence the provision for skilled professionals. Likewise, this division of labor accords implementation councils the responsibility to coordinate with other disaster related agencies or ministries. This bifurcation of responsibilities and roles is expected to improve the effectiveness of DM agencies by

**Table 4.5** Comparison between old and new disaster management frameworks

Aspects	Old (pre-2007)	New (post-2007)
Legal basis	Presidential Decree/Regulation	Laws produced by the parliament, and regional/local legislative councils
Paradigm	Emergency response (reactive)	Mitigation, emergency, rehabilitation and reconstruction (proactive)
Responsible entities	Mostly national government and its agencies (e.g. <i>BAKORNAS</i> , <i>SATKORLAK</i> , <i>Satlak</i> , etc.)	National, provincial, and city/district government and their respective DM agencies (BNPB, BPBD-P, BPBD-K, and other departments as needed)
Roles	Polycymaking, monitoring and evaluation, and implementation	Lead DM agency at each level comprises of a Steering/Guidance Council ( <i>Dewan Pengarah</i> ) and Implementation Council ( <i>Dewan Pelaksana</i> ) with demarcated functions  Steering Council: polycymaking, advising, monitoring and evaluation (consists of high level government officers and professionals,)  Implementation Council: implementation, including coordination, executes policy, as advised by the Steering Council
Type of organization	Non-structured (directly answerable to President); no permanent staff	Structured; non-departmental government agency—same status as ministry (under supervision of head of government at each level); permanent salaried staff
Leadership	National level: vice president of Indonesia  Provincial and city/district: governor and city mayor/regent	National level: head of agency, same level with minister  Provincial and city/district: head of agency, same level as other heads of agencies at provincial and city/district level
Membership	National level: high level government officer such as minister which related to disaster response, Indonesian Military Commander, Indonesian Police Chief, Head of Indonesian Red Crescent  Provincial and local (urban/rural district) level: secretary of the region, head of agencies, Indonesian Military Commander, Police Chief and some civil organizations	Steering/Guidance Council ( <i>Dewan Pengarah</i> ): bureaucrats (High level government officers) and professionals; Implementation Council ( <i>Dewan Pelaksana</i> ): government officers

(continued)

**Table 4.5** (continued)

Aspects	Old (pre-2007)	New (post-2007)
Funding and budget allocation	Earmarked funding through national government budget	Dedicated funding from budgets at every level of government
Non-state actor participation	Rare/ad hoc participation	Active participation of non-state actors sought Multi-stakeholder forum recommended at each level—national, provincial, and local (urban/rural district)
Development and spatial planning	Limited integration of DM in development plan	DM is now an integral part of development plans

allowing them to concentrate on appropriately identified functions and enable better internal checks and balances.

#### 4.3.3.2 Sharing Responsibilities and Authority

The new DM framework has also substantially revised how the national and sub-national governments share responsibilities and authority. Previously, the national government controlled all decision-making related to DM, but now the sub-national governments (provincial and city/district) share almost equal responsibilities and substantial authority. The new framework sees DM as a shared endeavor in three stipulated stages—emergency, recovery, and reconstruction (World Bank 2012, p.10).

As Table 4.6 indicates, the national and sub-national governments share responsibilities on most matters, which include integrating DRR into development programs, protecting society from disasters, extending material relief and upholding legal rights of victims/refugees, and allocating adequate funds for DM in their respective budgets. This distribution of similar responsibilities mirrors the autonomy that decentralisation reforms and the somewhat reemerging federalism induce (Ferrazzi 2000). A prominent distinction is the novel responsibility to properly curate and document disaster threats, impacts, and responses (now rightly acknowledged as a vital need)—i.e. assemble data, analyze them, and document—to enable sustained institutional and social learning (especially, given the emphasis on multi-stakeholder DM). Curiously, this responsibility rests only on the national government, with no acknowledgement of potential roles or contributions of sub-national governments. This is perplexing because the immediate impacts of disasters are mostly felt locally or regionally, and the relevant evidence is obviously found locally too; therefore, excusing sub-national governments from this highly apt responsibility is likely imprudent.

Just as the experiences of decentralisation reveal, problems may arise from the significant expansion of sub-national governments' DM responsibilities. The lack

**Table 4.6** Sharing disaster management responsibilities across levels of government

National	Sub-national
Integrating DRR into national development programs	Integrating DRR into local development programs
Protecting society from disaster impacts	Protecting society from disaster impacts
Guaranteeing the fulfilment of community and refugees rights to those affected by disasters, with fairness and in accordance with minimum service standards	Guaranteeing the fulfilment of community and refugees rights to those affected by disasters, with fairness and in accordance with minimum service standards
Allocating adequate funding in the national budget in the form of a Ready to Use Fund ( <i>Dana Siap Pakai</i> or DSP)	Allocating adequate disaster relief funds in the provincial/district budget
Curating and maintaining authentic and credible files/documents on the threats and impacts of disasters	

of capacity, clarity of purpose, guidance for adaptation, and cooperation might yet undermine the ambitious realignment of responsibilities under the new DM framework. Most local governments, which continue to struggle with quotidian tasks of planning and development, have scant experience, knowledge, skills, and resources for developing adequate DRR capacity. Moreover, decentralisation had already diluted the relevance of provincial governments. Besides, how the compounded responsibilities from new DRR and DM expectations will affect sub-national governments' perennial lament of insufficient funds remains to be seen.

In transitioning to the new institutional arrangement for DM, to overcome these likely impediments, it is imperative that there be clarity and guidance on how sub-national governments can build their necessary capacities, and how exactly will different levels of government execute shared responsibilities (i.e. whether, depending on the objectives, relationships among them will be more vertical or horizontal, why and how, etc.). So, for the national and provincial governments, there is still much work left in detailing out these plans and resolving confusions pertaining to collaboration and cooperation within (among various stakeholders) and across local governments.

Increasing responsibilities without providing requisite authority to support them is no stranger to decentralisation. It appears that the architects of the new DM framework foresaw the need to delegate adequate authority to the sub-national levels of government if they were to assume greater responsibilities (Table 4.7). In the new DM framework, ostensibly, the national and sub-national governments enjoy similar kinds of authority. This includes establishing DM policies that are aligned with development policies at the respective levels, infusing development plans with elements of DM policy, formulating policies for sustainable natural resources management, and controlling the collection and distribution of money or goods for disaster victims. The differences in authority across different levels of governments appear to be in regard to a disaster's status and severity, and the cooperation that its response demands. The authority to determine the significance level of a disaster and how sectors should cooperate is the national government's. Sub-national gov-

**Table 4.7** Sharing disaster management authority across levels of government

National	Sub-national
Ascertaining whether to deem a disaster as national or local	
Establishing DM policies aligned with national development policies	Establishing DM policies aligned with provincial/local development policy
Incorporating elements of DM policy into national development plans	Incorporating elements of DM policy into local development plans
Determining DM policy cooperation with other countries, agencies, etc	Facilitating DM cooperation among districts/cities, with the provincial authorities
Ascertaining and regulating potential threats or hazards from the deployment of specific technologies	Ascertaining and regulating potential threats or hazards from the deployment of specific technologies in the region
Formulating policies to prevent excessive depletion of natural resources, beyond nature's capacity to recover	Formulating policies to prevent excessive depletion of natural resources, beyond nature's capacity to recover
Controlling the collection and distribution of money or goods (donations) nationally	Controlling the collection and distribution of money or goods (donations) at provincial/city/district levels

ernments will accept and follow its terms and guidance. If the national government deems a disaster to be local or small-scale, then the concerned local government will lead the response; the national government will steer a national emergency.

Capacity asymmetries between the national and local governments may also hamper the sharing of authority. For instance, in determining whether a disaster ought to be deemed 'national' or 'local', i.e. 'major' or 'minor', and sometimes whether it is 'natural' or 'man-made,' it is possible for the national government to be prejudiced or less objectively or opaquely motivated. The protracted legal wrangle between a private corporation and the national government in the case of the Sidoarjo mudflow disaster in East Java exemplified such possibilities. Delays in identifying and disbursing funds, which can take up to several months, have been an avoidable challenge too (World Bank 2012). More collaboration between the local governments on determining disaster status, using unambiguous indicators and processes, is necessary to make this new sharing of authority purposeful and effective.

#### 4.3.3.3 Financing Mechanisms of the New DM Framework

Two national government policies—Government Regulation (GR) 22/2008 on Budgeting and Management of Disaster Aid; and GR 23/2008 on The Role of International Organizations and Foreign Non-Governmental Organizations in Disaster Management—guide the financing mechanisms for DM in Indonesia today. Prior to the issuance of the 2007 DM Law, the budget for DM came from each ministry/department/agency and/or the head of the Disaster Management Agency (then the vice president) as well as additional monies from different sources.



In the new DM framework, the national budget for DM—mitigation, preparedness, rehabilitation, and reconstruction—is allocated through a single entity, the BNPB (National Agency for Disaster Management). Now the national budget provides financing for major disasters through exceptional transfers to provincial budgets, upon the national parliament's approval (World Bank 2012). Post-disaster funding of minor disasters is the responsibility of provincial and local governments.

According to GR 22/2008, there are three types of disaster management funds. Contingency funds are earmarked for discretionary use during major future disasters, but can also be used preventatively during the pre-disaster phase. In the case of major national disasters the BNPB, with line ministries, provides emergency funding from contingency funds. If additional funds are needed during the emergency response and post-disaster stages, the government can also tap into Ready to Use (or 'On Call') funds (DSP) and social assistance funds. During any disasters, DSP monies are available for use until the emergency response phase ends. Social assistance funds are meant to assist in the post-disaster stages. If it is not a national disaster then the provincial and/or local governments respond using their contingency funds. Contingency and social assistance funds are included in and allocated by the national budget (APBN). DSP funds are part of APBN as well as the sub-national budgets (APBDs). Also, decentralisation Law 33/2004 stipulates how local authorities can request emergency funds from the national government (World Bank 2012). Albeit under-capitalized, the Rehabilitation and Reconstruction Fund, which is supported by the General Treasury (*Bendahara Umum Negara*) and requires parliamentary approval, is the national government's main instrument to fund sustained post-disaster reconstruction.

Although now every province and city/district must allocate monies to its DSP fund, most lack the capacity to do so. Disaster-prone areas with less financial capacity will find it even harder to create and sustain these funds, potentially exacerbating the impacts of future disasters. Therefore, rather than have some uniform rule, the logics to regulate DM financing should be more sensitive to the extant revenue generation capacity of local governments and their vulnerability to disasters. Again, there lies the risk, as with decentralisation, of making sub-national governments complacent or more dependent with weak economies or capacities. Lately, GoI has sought the World Bank's technical assistance for making the country's disaster financing capacity less cumbersome and more robust (World Bank 2012).

#### **4.3.4 Non-state Actor Participation**

The new DM framework also encourages participation by non-state actors, including multilateral donors, international and domestic NGOs, CSOs, universities, private foundations, and private firms. Government Regulation 21/2008 on Implementing Disaster Management as well as GR 22/2008 and GR 23/2008, mentioned earlier, emphasize this. GR 21/2008 particularly encouraged the participation of communities and the private sector as part of a multi-stakeholder forum

responsible for DRR processes. Earlier regulations like the Presidential Decrees 106/1999 and 3/2001 never cited the community or private sector in DM; Presidential Regulation 83/2005 merely mentioned that communities could aid disaster victims. But now the regulation on Public Participation in Disaster Management (No. 11/2014) issued by the BNPB chief highlights community involvement and public participation in DM. GR 22/2008 too encourages community participation in supplementing the provision of public funds, and Government Regulation 23/2008 allows international organizations and foreign NGOs to be involved in DM.

We have noted that several current provisions stress the need for greater public participation and community involvement. Yet, as with other aspects of the new DM framework, there are no definite guidelines to mainstream and routinise participation by non-state actors in DM. Furthermore, the objective for making non-state actors participate largely seems to be for increasing funding or offsetting costs, rather than making the DM process more inclusive or more effective by incorporating local wisdom and non-financial resources.

### ***4.3.5 Development and Spatial Planning and DM***

Spatial planning still dominates urban planning and development in Indonesia. For a very long time, until 1992, town planning ordinances and implementation regulations developed for Java during the Dutch colonial regime, which resembled physical master planning, guided spatial organization and infrastructure development nationwide (Hudalah and Woltjer 2007). Toward the end of the New Order, Law 24/1992 on Spatial Planning proposed the first post-colonial spatial planning guidelines. It laid down incentives and disincentives for utilizing space and proposed some unclear zoning regulations. Besides its flimsiness, the political and economic turmoil of the late 1990s in Indonesia that culminated in democracy and decentralisation quickly rendered this law redundant. So a new Draft Spatial Planning Act was introduced in 2005, which eventually became Law 26/2007 on Spatial Planning, the guiding legislation in effect presently.

There was no mention of DM in Law 24/1992. The new Law 26/2007 on Spatial Planning, however, spelled out ‘disasters’ as a prime consideration. It stresses that DM should be a prime focus in making national, regional, and local spatial plans, noting further that spatial planning should respond to the various physical conditions of different disaster-prone regions. It wants enhanced development control through zoning regulations, planning permits, incentives and disincentives, and sanctions. In fact, it required that local governments prepare spatial development plans for DRR within 3 years. At present 25 out of Indonesia’s 34 provinces, 329 districts out of 399, and 84 of the 93 municipalities have formally incorporated their spatial plans into local regulation or *Perda* ([www.penataanruang.net](http://www.penataanruang.net)). But, even in places with ongoing disasters and clear needs, such plans have tended to be unsatisfactory in terms of how spatial planning instruments enhance DRR (Rachmawati et al.2011). Another law that acknowledges the importance of the connection between spatial planning and DM, predicated upon the national, regional, and local

governments and communities sharing responsibilities, is Law 27/2007 (Management of Coastal Areas and Small Islands). It approves sanctions/penalties for actions that may raise disaster vulnerability.

The New DM Law 24/2007 also acknowledges the need for DM plans to address spatial planning, and presents local governments the opportunity to apply it toward different hazards. However, as with other aspects of DM, both the Spatial Planning Law 26/2007 and Disaster Management Law 24/2007 do not clearly articulate how DM efforts and spatial planning ought to be integrated, how such processes should work, and who should be responsible or accountable for it. Thus, to implement spatial planning in ways that will benefit DM, local governments will certainly need more careful inputs for improving coordination among agencies and changing institutional cultures from their silos-like status quo (Datta et al. 2011).

#### **4.4 Discussion: Weighing the Impacts of Decentralisation and the New DM Framework**

Decentralisation and the new decentralised DM framework have profoundly altered the institutions and institutional arrangements for governance, planning, and development, and how they relate to DM. The recent decentralisation legislation (Law 23/2014) cites clearly, albeit cursorily, the need for decentralised governance to engage more squarely with DM. On the other hand, the New DM Law (24/2007) suggests a new framework for DM that is now significantly more decentralised, and closely resembles the larger framework of decentralisation. Table 4.8 below facilitates a comparative summary of the similarities and differences between the current decentralisation structure and the new DM framework. Here we will recount the relevant key features of both, compare and critique their potential to be synergistic, and glean how experiences of overall decentralisation can be instructive for decentralised DM. To make both decentralisation and DM congruent and more effective, we identify and emphasize three aspects that require attention and action, i.e. the three C's—clarity; capacity; and civil society collaboration.

Ostensibly, in regard to six key dimensions (Table 4.8)—organizational structure; authority and responsibility; financial roles and responsibilities of government; multi-stakeholder institutional arrangements; and inter-regional coordination and cooperation—the frameworks of decentralisation and DM indeed appear similar. A closer look further suggests that after nearly two decades of continual reform decentralisation has now devolved authority and responsibilities down to even the village level. Although the new DM framework also devolves power to the city/rural district level, it is only the distinction between the national and sub-national levels that is clear; how the provincial and local levels share roles and responsibilities is yet fuzzy.

Even more so than basic development sectors like education and health, DM is largely a responsibility of the state, and therefore should naturally be a priority aspect/sector of planning and governance. Thus, comparing the framework of DM to that of overall decentralisation may seem odd at first. But it must be remembered that despite the extensive and comprehensive decentralisation that began in 1999,

**Table 4.8** Comparing contemporary frameworks for decentralisation and disaster management in Indonesia

	Decentralisation	Disaster management (DM)
Issues	(Laws 6/2014, 23/2014 and 33/2004)	(Law 24/2007; in part, also Laws 26/2007 and 27/2007)
Organizational structure	National, provincial, urban/rural district, sub-local, and village	National, provincial, and urban/rural district
Financial roles and responsibilities	National: generates revenues and transfer funds to sub-national levels (up to the village level)	National: has own budget
	Provincial: receives transfers from national government, generates own revenue	Provincial: has own budget, and receives funds from the national government
	Urban/rural district: receives transfers from national government, generate own revenue	Urban/rural district: has own budget, and receives funds from national government
	Sub-local: funded by urban/rural district government	
Village: funded by urban/rural district and national government, generate own revenue		
Multi-stakeholder institutional arrangement	Coordination Forum of Regional Leaders (parliament members, heads of police, chief prosecutors, and regional military chiefs)	DRR forum (government representatives, private sector, CSOs, and universities)
Inter-regional coordination and cooperation	Mandatory for aspects with regional externalities, and improving public provision efficiency	No specific instruction
	Voluntary for other aspects whose effectiveness and efficiency is deemed important	

which overhauled almost all development sectors and aspects of governance, DM was not included as a distinct area in Indonesia's decentralisation reforms. Concern about giving DM a coherent and robust structure grew as several large disasters ravaged Indonesia during the last decade, starting with the Indian Ocean tsunami in Aceh in December 2004. During this time, before BNPB's genesis, responses to large disasters were ad hoc and sporadic. Yet, the extensive impacts of large disasters of national significance necessitated specialized autonomous national DM agencies—BRR (*Badan Rehabilitasi dan Rekonstruksi*) for the Aceh tsunami; BPLS (*Badan Penanggulangan Lumpur Sidoarjo*) for the Sidoarjo mud volcano in East Java that began in 2006; and an arrangement involving BAKORNAS, BAPPENAS, and international agencies to respond to the Yogyakarta and Central Java earthquake of 2006. Such experiences paved the way for BNPB's creation.

Decentralisation caused substantial reorganization and restructuring, but the agencies and units of most ministries/departments of different sectors existed prior to decentralisation. However, as the previous section illustrated, this was not as true of DM, agencies for which were inchoate and ad hoc. The creation of a robust nationwide DM framework (with DM Law 24/2007) began 8 years after decentrali-

sation—by when the original decentralisation reforms (Laws 22 and 25 of 1999) had undergone several incremental revisions, alterations, and clarifications. But the various incremental legislative adjustments of decentralisation had hardly considered DM responsibilities and their sharing until 2014. Therefore, to be effective the new decentralised DM framework needs to be congruent with, and eventually be governed by, the larger decentralisation framework that predates it.

An obvious difference between decentralised local development planning and local DM is in the degrees of autonomy that the concerned state institutions enjoy, and [potentially] the attendant public accountability. Political decentralisation, which mandates that even members of sub-city government units and villages be directly elected by the people, in principle, makes them highly autonomous and subject to public scrutiny and approbation. But even though cities and rural districts are required to have their own DM agencies, no similar mandate warrants their public scrutiny or accountability. Although they too are part of local government, their lack of resources, experience, and expertise means that the benefits of local autonomy are yet to accrue for new DM institutions. This brings into sharp relief the need to build the capacity for local DM. Table 4.8 highlights two emphases that are progressive and urgent for both the decentralisation and DM frameworks. These are multi-stakeholder arrangements for governance and policy advice, and the inclusion of non-state actors—such as private sector firms, CSOs, and universities—in various stages of DM. Expanding the space for participation in DM to include non-state actors should build capacity for and the effectiveness of local DM. But for local governments to be able to effect these changes in their institutional arrangements, the first step is calls for greater clarity in attaining the objectives of the new DM framework.

#### 4.4.1 *Clarity*

Creating a comprehensive new DM framework in Indonesia is ambitious but necessary, especially being a large archipelagic nation with a complex mix of terrains, ethnic groups, and disasters. However, these and other complexities such as uneven economic, social, and political development also make the task of creating a set of institutions that will operate efficiently and effectively at different levels of the government and across varied regions quite challenging. What is needed to minimize uncertainty and forestall foreseeable barriers, yet is always hard to achieve when institutions are undergoing unprecedented overhaul, is for the processes of reorganization and reconfiguration to have clarity. The experience of Indonesia's ambitious decentralisation endeavor is instructive for DM in this regard. Heaps of evidence now suggest that implementing almost every goal has faced unforeseen and predictable obstacles, and generated undesirable outcomes owing to confusion, contradiction, and lack of clarity in regulations, guidance, and implementation (ADB 2005; Casson and Obidzinski 2002; Datta et al. 2011; Duncan 2007; Holzhaecker et al. 2016; Miller 2013; Silver 2003; World Bank 2003).

The rush toward decentralisation was in part responsible for much of this lack of clarity—in terms of functions of different levels of government and their agencies, as

well as civil service management (World Bank 2003). The reasons for obfuscation were numerous, such as weak decentralisation laws, arcane sectoral laws and contradicting regulations, denuded central agency functions, and nonexistent minimum standards even for essential functions (World Bank 2003, p. 12). Incremental progress has been made in clarifying functions (Table 4.1), laws, and guidelines, yet this is likely to be an ongoing process. Forcing the present decentralised structure onto cities has actually eroded much complementarity that previously existed in regard to sharing public services and supporting livelihoods among urban and peri-urban areas; new autonomous local administrations now compete for scarce resources (Miller 2013). She further adds that a “rash of central and local government regulations and presidential and ministerial decrees” that tweaked the original 1999 regional autonomy laws served to compound confusion amidst contradictory interpretations of regional autonomy at the local levels (Miller 2013, p. 839). Even though asymmetric decentralisation may be inevitable in a diverse country, there should be a clear framework to separate central and local government responsibilities and maintain clear lines of accountability (Shah and Chaudhry 2004). In regard to fiscal affairs, especially central-local transfers for basic education, Crane and Prawiradinata (2004) had suspected whether the evolving expectations of increased local expenditures were even affordable, for any level of government; in fact, they felt that post-decentralisation revenue sources had become more centralized, and central ministries continued to spend large amounts locally, beyond local budgetary control (p.2).

The creation of the new DM framework has followed quite the same path as did decentralisation. In the longer historical perspective, the evolution of DM in Indonesia has been sporadic and erratic. As with decentralisation, the recent efforts that led to the new DM framework have been rushed, top-down, and lacking in clarity. For instance, many responsibilities are shared between the national and sub-national governments, but who does what, why, how much, how, and when is mostly fuzzy. Furthermore, with nearly identical prescribed functions, there is scant distinction on these matters between the provincial and local DM institutions. While the DM framework appears decentralised because most provinces and cities now have their DM agencies, the funding and knowledge creation structures are highly centralized; how the DM framework will eventually blend with the apparatus for everyday decentralised governance remains obscure. As we saw earlier, the new decentralisation law does little more than recognize and state the roles for DM. Much more guidance is needed on how sub-national governments should incorporate DM into their budgets, and how they should generate revenues for and earmark or allocate them to DM agencies.

Much of decentralisation’s shortcomings that stemmed from lack of clarity became apparent with time and implementation. Nevertheless, although decentralisation seeks to improve everyday acts of governance, yet the processes needed for evidence to accrue, analysts to utilize the evidence, and policymakers to react constructively are often also slow. On the other hand, disasters do not offer the opportunity, and thankfully so, to observe shortcomings on a regular basis. It is during the unfortunate occurrence of a disaster that DM’s effectiveness is tested and becomes observable. Thus, unlike decentralisation, for DM, inaction or ad hoc improvements come at a hefty but likely avoidable price. What is clear from the experience of

decentralisation, even without clarity in the overall DM system, is that building the capacity of local DM institutions is imperative and attainable.

#### 4.4.2 Capacity

Among other reasons, decentralisation is premised on the potential for local governance to resolve local problems and issues better, but its success depends heavily upon the capacity of local governments to assume effective policymaking and implementation roles as well as the central government's capacity to stoke, steer, and coordinate the process (Hutchcroft 2001). Capacity here means the adequate and appropriate availability of and the ability to simultaneously effectuate numerous inputs—for instance, its own financial, human, political, and informational resources, and those of non-state actors too. Besides the lack of clarity, in myriad ways weak capacity emerged as another prominent lacuna of Indonesian decentralisation (ADB 2005; Brinkerhoff and Wetterberg 2013). Since the elements and creation of Indonesia's new DM framework resemble its decentralisation's, it is natural that the new decentralised sub-national DM institutions will encounter significant capacity challenges. There is growing awareness of the importance of DRR and building local resilience to DM (Djalante et al. 2012). How well DM institutions integrate themselves with existing governance and planning institutions at sub-national levels will in large measure determine the success of DRR and DM.

The new DM Law provides the regulatory space to build capacity for DM in the country, and the National DM Plan highlights key needs in this regard (BNPB 2010). The new DM framework's emphasis on funding is much stronger and shared, with both national and sub-national governments required to contribute funds. The national DM agency, BNPB, is now the primary conduit for DM funding from the national to sub-national levels, and the types, conditions, and procedures of funding are specified (albeit lacking clarity in some areas, as mentioned above). Recognizing and responding to the financial challenges of DM is essential, as the mismatch between ambitious decentralisation objectives and fiscal and financial capacity amply demonstrates. Indeed, for a country where recurring disasters are a major concern, funding for preventing and responding to them is still paltry. The national government and local governments only allocate 0.02–0.03% of their total budgets for disaster-related activities annually (<http://www.cnnindonesia.com/>, 2014). According to the head of BNPB, governments at all levels need to allocate at least 1% from their total budget for DM (<http://www.cnnindonesia.com/>, 2014). Yet, even some provincial governments, such as Central Kalimantan's, had not allocated any funds for disaster-related activities in their budgets (<http://www.gatra.com/>, 2015). Two possible reasons why governments are loath to provide more funds for DRR and DM are little political will (<http://www.gatra.com/>, 2015) and inadequate fiscal capacity (BAPPENAS 2009).

The structure and mechanisms for post-disaster funding are now more streamlined with known sources. Yet, how sub-national governments should budget to pro-

mote general DRR activities and get various planning/development and service-provision agencies (such as planning, public works, public health, water supply, fire, DM, and others) to also concentrate on DRR and emergency response remains unclear. Trying to create a robust institutional infrastructure for DRR and DM will certainly require greater capacity of local governments, which are yet struggling to dispense just routine planning, development, and administration responsibilities. Achieving these desired levels of local capacity will also require the national and provincial governments to raise their own capacities to steward the required moves by creating a sound institutional architecture for offering guidance and technical support, coordinating local endeavors, and promoting and disseminating local innovations.

Funding is indeed a major constraint to building capacity, in terms of the needs discussed above, as our own research involving local planning and DM officials indicates. Local government planning officials of Sidoarjo regency, the site of a major and continuing disaster (Drake 2016), repeatedly cited *inter alia* how not having adequate funds impaired their desire and ability to undertake more rehabilitation efforts or simply be more proactive.<sup>4</sup> But funding is hardly the only thing to hamper DM capacity. Evidence from the decentralisation of education services also shows that the effectiveness of local government agencies depends hugely on their overall capacity and quality (Muttaqin et al. 2016). Creating an effective network of DM agencies across the archipelago will require another ingredient in abundance—quality human resources. The refinement of disaster research has illuminated how the success of DM rests on the quality of DRR and efforts to improve resilience, thereby making comprehensive capacity building both urgent and complex. The National DM Plan too loudly echoes this need: “Once [DM] bodies have been established, they need to be outfitted with the required resources and their personnel need to be trained. Relevant government offices need to be made aware of the importance of risk sensitive development planning and programming, as well as implementing disaster emergency and recovery that are well managed (BNPB 2010, p.71).”

Indonesia’s attempts to develop institutionalized and systemic preparedness to tackling disaster threats are still nascent. Therefore, making government agencies’ personnel ‘aware’ of the needs of DRR and risk sensitive development planning and programming and equipping them with the ‘requisite’ skills are easier said than done. For instance, to form BPLS GoI reemployed retired senior bureaucrats (many with little knowledge of disasters) to create the top management layer that guides the agency.<sup>5</sup> Indeed, the creation of new local DM agencies almost always involves staffing them with personnel transferred from other departments, with no relevant background or training. For building the capacity of DM personnel, the common *modus operandi* of the national and sub-national governments has been short training workshops. Bilateral and multilateral aid agencies, foreign and domestic univer-

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<sup>4</sup>Focus group discussion with officials of the local planning agency (*BAPPEDA*) of Sidoarjo, conducted by Ashok Das on August 8, 2009.

<sup>5</sup>Interviews conducted by Ashok Das with senior BPLS officials—Head, Pak Cahyono (August 2, 2009), and Deputy of Operations, Pak Soffian Hadi (January 2, 2013).



sities, and international NGOs are among the many actors who provide such training. Such training is useful but not sufficient.

To create a robust DM sector in Indonesia it is essential to develop quality educational programs at the university level to impart comprehensive training for DRR and DM. What is critical in this regard is to ensure that these programs emphasize and properly ground DRR's interdisciplinary nature. It is vital that those who work in decision-making capacities in DM agencies appreciate the significance of the social, political, ecological, cultural, and policy dimensions of DRR. Disaster-focused university programs have multiplied, but because they are mostly housed in engineering departments their curricula focus heavily, if not solely, on understanding the scientific and engineering aspects of disasters—volcanology, seismology, meteorology, geology, geophysics, communications technology, construction and structural engineering, etc. This is reflected in the capacity inadequacies of contemporary DM agencies and their outlook toward to DRR, and the emerging calls for meaningful disaster governance (Miller and Douglass 2016).

Reforming the approach to and content of disaster related higher education—by connecting more closely to contemporary shifts in planning and policy studies theories, for instance—is imperative for producing cadres of disaster professionals capable of practicing DRR effectively. Likewise, much more research is needed on establishing the effectiveness of higher education and the practice of DM. The new DM Law mentions the role of 'education' but this mainly alludes to educating citizens and communities about their rights in the event of disasters. Some research is beginning to study how children are learning about disasters in schools (Amri et al. 2016; Wilmott 2014), but university level curricula too need to be analyzed. Toward strengthening the capacity of DM as a sector, universities with DM programs should make it a strong priority to create opportunities for engagement with local communities and civil society.

#### **4.4.3 Civil Society Collaboration**

Since the onset of democracy and decentralisation Indonesia has witnessed a blossoming of its civil society (Hadiwinata 2003; Ibrahim 2006), which had been regarded as the missing link for progressive development and good governance (Soesatro 1999). However, the strong legacy of the New Order, which created the quintessential developmental state by suppressing civil society (Cowherd 2005), continues to sustain state distrust in civil society, especially NGOs (Antlöv et al. 2010), and it compromises the progressive potential of local efforts to make planning and development more collaborative (Das 2015a). While empowered CSOs like political and environmental watchdogs have helped to create and sustain a flourishing democracy, and various NGOs have made invaluable contributions to post-disaster recovery, the systematic and strong inclusion of civil society in local planning and development is negligible. However, for effective DRR and DM this gap will have to be overcome. Engaging CSOs can help the state to address most of the shortcomings related to clarity and capacity that we have discussed here.

Because of the high levels of latent civic engagement and interpersonal sociability that exist in Indonesia (Lussier and Fish 2012), CSOs can certainly be the bridge between the state and the grassroots for improving disaster governance and strengthening local DRR capacity.

The new DM Law sees the need to encourage community participation and CSO engagement for multiple objectives, particularly for creating multi-stakeholder arrangements for deliberating and guiding DM policy at national and sub-national levels. The new DM framework emphasizes the potential role of international NGOs for financial and other contributions during and after disasters. That CSOs and other non-state actors—for instance, NGOs like the Indonesian Society for Disaster Management (MPBI), universities, and international agencies such as UNDP, UNICEF, OCHA and IFRC—are already active in DRR endeavors in Indonesia is encouraging (Lassa 2013). However, even when calling for multi-stakeholder arrangements at different levels, the DM framework does not explicitly recommend expanding the role of local CSOs and NGOs in local DRR and DM, which is unfortunate. We believe, and evidence from cities like Solo and Surabaya suggests (Taylor 2015), that hitherto excluded CBOs, NGOs, and squatter communities must now be included. Their knowledge of grassroots conditions, networks and social capital, and innovation potential are indispensable for enhancing urban resilience and honing local DRR capacity. Of course, not just DM but the everyday practice of decentralised local planning and governance needs to aggressively encourage and engage CSOs.

Within the last decade several encouraging developments in Indonesian cities have showcased how NGOs can play a pivotal role in regard to resilience building, climate change adaptation, post-disaster rehabilitation, and creating citywide and inter-city networks of CSOs. Probably the most notable among these has been the role of the NGO, the Kota Kita (Our City) foundation ([www.kotakita.org](http://www.kotakita.org)). Its initial program called Solo Kota Kita assisted and empowered poor and squatter communities in the city of Solo to identify infrastructure needs through participatory budgeting (*Musrenbang*). Having begun during the visionary mayorship of Joko Widodo (now Indonesia's President), its success also represents how local governments can actively stimulate much-needed state-civil society cooperation. While the activities of Solo Kota Kita today are far more expansive and citywide (Taylor and Lassa 2015); the parent foundation now is engaged in urban resiliency programs on various other islands as well as in Mongolia.<sup>6</sup> Kota Kita also launched the annual Indonesia Urban Social Forum, which is now arguably the country's leading platform that brings together diverse CSOs from across and beyond Indonesia to share ideas, experiences, and concerns. The efforts of some long-established Indonesian NGOs like the Urban Poor Consortium (UPC) and international civil society federations like the Asian Coalition for Housing Rights (ACHR), as well as local CSOs like Community Architects Indonesia in Yogyakarta, *Paguyuban Warga Strenkali* (PWS) in Surabaya, smaller groups in Sidoarjo and other cities (Padawangi 2016), and new ones like *Architecture Sans Frontières* Indonesia (ASFI) in Bandung high-

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<sup>6</sup> Personal communication between John Taylor, Kota Kita's co-founder, and Ashok Das, Surabaya, July 26, 2016.

light the urgent need for the state to reconsider conventional approaches to dealing with the urban poor and squatters toward the larger objectives of building citywide resilience for DRR.

One of the widely observed weaknesses of DRR efforts is the inability to include all actors and disciplinary approaches that embody the complexity of disasters (Jabareen 2013; McEntire et al. 2002). For that to be feasible, for building resilience's adaptive capacity (Gaillard 2010), DRR elements of the new DM framework must be enmeshed in everyday decentralised governance (Bahar 2013). Including various kinds of CSOs in deliberation, decision-making, policy evaluation and analysis, and DRR implementation at national and sub-national levels will bring clarity to the functioning of the DM framework by encouraging different disciplinary approaches, and greater transparency and accountability (Witular 2013). Additionally, it will buttress local DRR and DM capacity by supplementing state resources, while CSOs' deep grassroots penetration will help generate effective feedback loops among communities and between them and DM agencies. Thus, provincial and local DM agencies should promote platforms at their respective levels that allow dialogue and collaboration among the state, civil society, and private sectors. Some private sector involvement in the form of corporate social responsibility does happen, but it is essential to systematically link such sporadic acts with government initiatives and available civil society assets.

## 4.5 Conclusions

The regulatory and institutional frameworks for disaster management have undergone significant transformation during the last decade. In many ways, these transformations resemble the larger shifts that came about with extensive decentralisation reforms that began in 1999. Even though disaster events have increased after the new DM framework came into effect in 2007, the disaster-induced deaths, injuries, evacuations, and damages have tended to decrease (<http://dibi.bnppb.go.id/>). This is likely the result of improved DRR efforts under the new framework. Still the mean yearly losses from disasters amount to Rp 30 trillion (about USD 2.3 billion), which is ten times the annual budget (Rp 3 trillion) of the national disaster management agency, BNPB ("VP Kalla: In Disaster Risk Reduction, Cooperation Crucial," 2016). Another Rp 1 trillion comes from international donors (Witular 2013). Thus, we caution against complacency because much still remains to be done in transforming the practice of DM—from being a mostly technical and reactive endeavor to comprehensive disaster governance focused on building resilience by mainstreaming DRR elements into the practices of quotidian planning, governance, and development.

Fortunately, Indonesia's decentralised institutions, which are organized down to the neighborhood level, are well suited to make effective decentralised disaster governance the cornerstone of DM. Unfortunately, as we discussed in the earlier parts of this chapter, the rush to decentralise exposed several persisting lacunae that do not lend themselves to easy or quick fixes. Likewise, the ostensibly extensive

reforms for DM and its expansively decentralised framework also suffer from similar potential pitfalls; although their efficacy will only be substantiated as and when Indonesia's new DM apparatus is tested by more and more disasters. We first analyzed the laws and other associated documents pertaining to the extant frameworks of decentralisation and DM in Indonesia. Then we compared and contrasted the two to point out their real and potential synergies and incongruences. Describing the shortcomings helped us identify three areas needing urgent action to fill the gaps that will help to realize the new DM framework's objectives. We call these the three C's—clarity, capacity, and civil society collaboration.

With both decentralisation and DM, a major shortcoming has been the lack of clarity in regulatory provisions as well as delegating functions, especially to the sub-national levels of the DM framework. Confounding, ambiguous, irrelevant or even contradictory regulations and rules; weak guidance; little prior experience or expertise; and scarce multi-stakeholder arrangements all impair capacity (financial, fiscal, technical, human resource, trust, etc.) of concerned sub-national governments as well as their agencies. It is true that financial inadequacy greatly hampers capacity, but equally important is to build the human resources capacity by concentrating on the role of disaster education to produce appropriately skilled professionals to work in DRR and DM. Another demonstrated and widely recommended way to build institutional capacity for local planning and development to build resilience and deepen DRR efforts is to embrace civil society. But the lingering legacy of the New Order continues to sustain widespread misconceptions about CSOs' motives, abilities and relevance, as well as distrust of the state among poor and marginalized communities. We strongly recommend that all levels of government actively encourage and embrace CSOs as partners in local development and DRR. The national and provincial governments, especially, have a stronger guiding role to play to encourage local governments to leverage civil society's potential to be the necessary glue in multi-stakeholder arrangements. We are also hopeful that Indonesian civil society will keep growing more diverse, tighter, and stronger so that significant pressure for more inclusive governance, and therefore for DRR, will also rise from the bottom up.

Indonesia's shift from a centralised to a decentralised system is still in complete, so it will be awhile before the new DM framework is realized, and longer still before robust and inclusive disaster governance and resilient communities become the rule. It is important that progress be steady albeit incremental, focused on maximizing clarity, capacity, and civil society collaboration.

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## Chapter 5

# Disaster Risk Reduction (DRR) Capacity and Capability of Local Government in Indonesia

Esti Anantasari, Michele Daly, Phil Glassey, Emily Grace, Maureen Coomer, and Richard Woods

**Abstract** Local government has a critical role to play in reducing risk for its communities. This has been recognised by the Government of Indonesia which has allocated responsibility for managing hazards and risk to local government in recent disaster management law reforms (Law 24 / 2007). However, the capacity and resources at provincial and district government levels to plan for and implement risk reduction measures are limited and there are few professional development and training opportunities currently available. To help identify specific strengths and opportunities for improvement, and to provide a disaster risk reduction (DRR) capacity and capability benchmark, a Local Government Self-Assessment Tool for DRR (LG-SAT-DRR) and an associated scoring system have been developed. Based on the Badan Nasional Penanggulangan Bencana (National Disaster Management Agency) self-assessment tool for disaster risk management (DRM), it has been expanded for DRR and a scoring system developed for benchmarking and communication purposes. To date the tool has been applied in eight districts in Indonesia. Results show a need for improvement in understanding hazards and risks, risk reduction activities, regulations, strategic planning, building development and controls and education and training. Community development, funding and networking generally scored higher. The districts have appreciated the snapshot of their current capacity and capability that the tool provides. The data gathering process and presentation of results provides an opportunity for further discussion and raising awareness about DRR. It also provides a focus for future action to reduce the risks of the community.

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**Keywords** Disaster risk reduction • Local government • Capacity • Capability • Local Government Self-Assessment Tool

## 5.1 Introduction

With funding support from the New Zealand Aid Programme, Universitas Gadjah Mada (UGM) has partnered with GNS Science (New Zealand's Geological Survey) in a 5 year programme, called *Strengthening Indonesian Resilience: Reducing Risks to Disasters* (StIRRRD), which supports the Indonesian Government to reduce the impacts of natural disasters through increasing the disaster risk reduction (DRR) capability of local government and local universities. The programme assists ten cities and districts and local universities to understand their local DRR issues and priorities, helps develop their capability to understand and manage these issues, and then helps to develop an Action and Implementation Plan. A key part of the programme involves cementing relationships between local government and local universities who will develop teaching and research programmes in aspects of DRR and disaster risk management (DRM) to support their local communities. The cities and districts involved in the programme are also providing peer support to each other on the learning journey. StIRRRD is supported by the Indonesian National Agency for Disaster Management (BNPB) and the Ministry for Villages, Rural Development and Transmigration (*Kemendesa*). Other national agencies involved include the National Planning Agency (*BAPPENAS*) and the Ministry of Home Affairs (MoHA).

To assist with monitoring and evaluating the programme, a Local Government Self-Assessment Tool for DRR (LG-SAT-DRR) has been developed. This tool provides a snapshot in time of the perception of local government staff working in functional areas (e.g. emergency management, planning, public works) that contribute to DRR outcomes at the district level, of the capacity and capability in DRR in individual districts. This tool has been used to collect baseline information from eight of the ten StIRRRD districts. Combined with information collected in workshops and focus groups, an analysis of the capacity and capability of local government in Indonesia has been formulated. This information is being used to help guide the development of Action and Implementation Plans for each of the eight districts.

This chapter aims to present the results of the overall capacity and capability of local government through comparing the eight districts, and give analysis for each of the LG-SAT-DRR category. The chapter is organised as follows. Section 5.2 presents the StIRRRD districts and their characteristics. Section 5.3 reviews the DRR context in Indonesia, examines the role of local government in DRR, discusses conceptualisation of capacity and capability, and reviews the Local Government Self-Assessment Tool for DRR (LG-SAT-DRR). After discussing the methodology, Sect. 5.5 presents the results of the revised LG-SAT-DRR in the different categories adopted. Finally, the conclusion outlines recommendations for increasing the DRR capacity and capability of local government in Indonesia.

## 5.2 StIRRRD Districts and their Characteristics

The ten districts of focus for the StIRRRD programme are listed in Table 5.1 and their location shown in Fig. 5.1. These districts were selected based on a number of criteria including having a high risk index (Table 5.2), an established local disaster management agency (BPBD), a commitment to DRR and having well established connections between UGM and the local university. The advice of BNPB was sought on the final selection. The districts represent a reasonable spread geographically, vary in area and population, have a range of hazards and risk, and are a mix of urban and rural areas.

**Table 5.1** Characteristics of StIRRRD districts

Province	Supporting University	City/District ( <i>kota/kabupaten</i> )	Population (as at 2013)	Classified as 'disadvantaged' by <i>Kemendes</i>	BNPB Risk Index 2013 (Rank/496)
West Sumatra	Andalas (UNAND)	Padang <sup>a</sup>	876,680	No	33
		Agam	467,000	No	35
		Pesisir Selatan	440,740	No	79
Bengkulu	Bengkulu (UNIB)	Bengkulu City	334,500	No	168
		Seluma	181,170	Yes	73
Central Sulawesi	Tadulako (UNTAD)	Palu <sup>a</sup>	356,279	No	110
		Donggala	287,920	Yes	80
		Morowali	108,870	Yes	136
Nusa Tenggara Barat (NTB)	Mataram (UNRAM)	Mataram	419,641	No	302
		Sumbawa	426,130	Yes	293

<sup>a</sup>Palu and Padang were part of a pilot programme before the LG-SAT-DRR survey was developed and are included in this table and Fig. 5.1 for completeness



**Fig. 5.1** Location of StIRRRD districts in Indonesia

**Table 5.2** Risk index breakdown per hazard in SIRRDR targeted areas

District	Threat																			
	Overall risk		Earthquake		Volcanic eruption		Tsunami		Flood		Landslide		Extreme waves and abrasion		Land and forest fires		Extreme weather		Drought	
	Rank/ index score	Risk index score	Rank/ index score	Risk index score	Rank/ index score	Risk index score	Rank/ index score	Risk index score	Rank/ index score	Risk index score	Rank/ index score	Risk index score	Rank/ index score	Risk index score	Rank/ index score	Risk index score	Rank/ index score	Rank/ index score	Risk index score	Rank/ index score
Kota Padang	33	209	137	22 <sup>a</sup>	n/a	n/a	2	24 <sup>a</sup>	93	36 <sup>a</sup>	92	24 <sup>a</sup>	252	23 <sup>a</sup>	60	36 <sup>a</sup>	17	20 <sup>a</sup>	158	24 <sup>a</sup>
Agam	35	209 <sup>a</sup>	2	32 <sup>a</sup>	72	7 <sup>b</sup>	44	24 <sup>b</sup>	138	36 <sup>a</sup>	366	12 <sup>b</sup>	249	24 <sup>a</sup>	78	36 <sup>a</sup>	120	14 <sup>b</sup>	183	24 <sup>a</sup>
Seluma	73	191 <sup>a</sup>	254	22 <sup>a</sup>	n/a	n/a	31	24 <sup>b</sup>	146	36 <sup>a</sup>	200	24 <sup>a</sup>	222	24 <sup>a</sup>	360	24 <sup>a</sup>	260	14 <sup>b</sup>	253	24 <sup>a</sup>
Pesisir Selatan	79	190 <sup>a</sup>	168	22 <sup>a</sup>	n/a	n/a	26	24 <sup>b</sup>	183	36 <sup>a</sup>	120	24 <sup>a</sup>	187	24 <sup>a</sup>	321	24 <sup>a</sup>	123	14 <sup>b</sup>	324	22 <sup>a</sup>
Donggala	80	189 <sup>a</sup>	17	32 <sup>a</sup>	n/a	n/a	114	19 <sup>a</sup>	357	12 <sup>b</sup>	157	24 <sup>a</sup>	51	36 <sup>a</sup>	131	36 <sup>a</sup>	198	14 <sup>b</sup>	363	16 <sup>b</sup>
Palu	110	181 <sup>a</sup>	12	32 <sup>a</sup>	n/a	n/a	124	19 <sup>a</sup>	244	12 <sup>b</sup>	11	36 <sup>a</sup>	188	24 <sup>a</sup>	134	36 <sup>a</sup>	163	14 <sup>b</sup>	472	8 <sup>b</sup>
Morowali	136	177 <sup>a</sup>	35	32 <sup>a</sup>	n/a	n/a	122	19 <sup>a</sup>	352	12 <sup>b</sup>	204	24 <sup>a</sup>	61	36 <sup>a</sup>	361	24 <sup>a</sup>	262	14 <sup>b</sup>	378	16 <sup>b</sup>
Kota Bengkulu	168	170 <sup>a</sup>	224	22 <sup>a</sup>	n/a	n/a	23	24 <sup>a</sup>	234	34 <sup>a</sup>	475	11 <sup>b</sup>	262	22 <sup>a</sup>	446	22 <sup>a</sup>	283	14 <sup>b</sup>	328	22 <sup>a</sup>
Sumbawa	293	150 <sup>a</sup>	401	11 <sup>b</sup>	n/a	n/a	109	22 <sup>a</sup>	n/a	n/a	124	24 <sup>a</sup>	14	36 <sup>a</sup>	90	36 <sup>a</sup>	429	14 <sup>b</sup>	471	8 <sup>b</sup>
Kota Mataram	302	149 <sup>a</sup>	404	11 <sup>b</sup>	n/a	n/a	211	8 <sup>b</sup>	237	34 <sup>a</sup>	276	22 <sup>a</sup>	89	34 <sup>a</sup>	300	34 <sup>a</sup>	n/a	n/a	491	7 <sup>b</sup>

Key: <sup>a</sup>High, <sup>b</sup>Moderate, n/a = not assessed

**Table 5.3** Frequency of hazards in StIRRRD areas, 2003–2015

District	Hazard				
	Flood	Landslide	Earthquake	Drought	Storm surge and erosion
1. Padang	29	12	4	0	8
2. Agam	14	20	3	1	2
3. Pesisir Selatan	21	3	6	1	3
4. Bengkulu City	10	0	2	1	0
5. Seluma	6	0	13	0	1
6. Mataram	4	0	0	0	5
7. Sumbawa	30	1	1	17	2
8. Palu	6	1	1	0	0
9. Donggala	14	3	0	2	2
10. Morowali	14	2	0	0	0
<b>TOTAL</b>	<b>148</b>	<b>42</b>	<b>30</b>	<b>22</b>	<b>23</b>

Source: Data and Disaster Information Indonesia in 2015 (BNPB 2015)

Compared to other districts in Indonesia, the West Sumatran districts of Padang and Agam have a relatively high risk, ranked at 33 and 35 respectively. Padang, a city of about 1 million people, is extremely vulnerable to tsunami (ranked 2nd), as well as earthquakes, floods and landslides. In the context of Indonesia's risk profile, Agam is very vulnerable to earthquake, tsunamis and volcanic hazards. Of the ten StIRRRD districts, Sumbawa and Mataram City have the lowest risk index scores but have other unique socio-economic factors which exacerbate the impacts of disasters. These include the potential for social conflict between different religious and ethnic groups, and existing hierarchical social structures such as class and gender which can increase the vulnerability of some groups to disasters.

It is possible to extract information on the frequency of hazard events (Table 5.3) in each district. The range of hazards present in a region is heavily dependent on its geographical position and physical characteristics. Physical characteristics include (1) topography and slope of the land, (2) hydrology, (3) climate, (4) geology, and (5) morphology.

This hazard and risk information, together with the fundamental understanding of DRM policies and regulations in the districts, provides a basis for self-assessment of DRR capacity and capability. With the high risk rankings and frequent occurrence of some hazards, one might expect these districts to have at least a reasonable understanding of hazards and have undertaken some steps to reduce or mitigate risks.

## 5.3 Conceptual and Practical Underpinnings

### 5.3.1 *Indonesian Context for Disaster Risk Reduction and Disaster Risk Management*

Indonesia is the world's largest archipelago and its location within the Pacific Ring of Fire makes Indonesia constantly at risk from natural disasters. As well as geophysical hazards (earthquakes, volcanoes and tsunamis) affecting the mountainous and coastal regions, droughts and floods affect an even greater proportion of the country. Compared to other hazards, floods have the largest risk when considering the cumulative impacts on GDP and mortality (Earth Institute 2016). Indonesia has undergone major reforms in the area of disaster risk management largely in response to the 2004 Indian Ocean earthquake and tsunami. This single event had an unprecedented impact on Indonesia and created a tipping point in terms of disaster management reform and initiatives. The government introduced new disaster management legislation (Law 24/2007) which made local government<sup>1</sup> responsible for DRR and its integration into regional development programmes as well as requiring local government to allocate sufficient funding to do so (Article 8, Law 24/2007). The government developed a National Action Plan for DRR (2010–2012) (Article 8, Regulation 21: 2008) and a National Disaster Management Plan (2010–2014) (Article 6, Regulation 21: 2008). Disaster Management is one of the national priorities in the National Medium-Term Development Plan 2010–2014. All provinces have since established a Regional Disaster Management Agency (BPBD) as legally required (Part Two, Law 24/2007) and over 80% of districts/cities have also established local (district/city) BPBDs.

### 5.3.2 *The Role of Local Government in DRR*

Local government has a key role in DRR via the formulation and implementation of regulations, policies and plans that reduce exposure and vulnerability to natural hazards, while at the same time trying to meet local development goals. A better understanding of the societal and local government context for DRR is required in order to improve DRR outcomes. While local government in Indonesia has a critical role to play in reducing risk for its communities, its capacity and capability to plan for and implement risk reduction measures is relatively weak (Triutomo 2013; Djalante et al. 2012; BNPB 2014).

Improved capacity and capability for DRR of local governments was a recommendation of Djalante et al. (2012) in their review of Indonesia's progress in implementing the Hyogo Framework for Action. The BNPB (2014) report that;

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<sup>1</sup>Local government in this context refers to both provincial and city/district/sub-district levels of government.



Awareness and understanding of DRR have not been inclusive, particularly among members of the national and local legislatures. Most decision makers still consider DRR to be non-essential and it is more important to allocate budget for emergency and post-disaster recovery programs. Also, the cost-benefit of DRR investment has not been commonly agreed by the majority of decision makers and,

Capacities both at the central and local levels have been much enhanced. However, much still has to be done to strengthen capacity particularly at the district/city level.

### 5.3.3 *Capacity and Capability*

#### 5.3.3.1 Definitions

There are a myriad of definitions for capacity, capacity development and capability in a DRR context with no apparent consensus among stakeholders as how to define them (e.g., Hagelsteen and Becker 2013; Hagelsteen and Becker 2014; Lucas 2013; Scott et al. 2015). Capability seems to have been absorbed into definitions of capacity in a DRR context, despite them being inherently different constructs (Keijzer et al. 2011; CaDRi 2011; Baser and Morgan 2008). Keijzer et al. (2011) define five core capabilities as a pre-requisite for organisations to achieve capacity development goals and Baser and Morgan (2008) have a similar view where they define capability as:

The collective skill or aptitude of an organisation or system to carry out a particular function or process either inside or outside the system. Capabilities enable an organisation to do things and to sustain itself.

Capabilities are referred to as “individual level capacity” in the CaDRi (2011) approach. There are many different definitions of capacity, the most commonly cited ones being:

The ability of individuals, institutions and societies to perform functions, solve problems and set and achieve objectives in a sustainable manner” (UNDP 2008).

The ability of people, organisations and society as a whole to manage their affairs successfully” (OECD-DAC 2006).

That emergent combination of individual competencies, collective capabilities, assets and relationships that enables a human system to create value (Baser and Morgan 2008).

For the purposes of this chapter we will use the terms capacity and capability to mean different constructs and use definitions as used in the New Zealand disaster risk management sector (MCDEM 2014):

Capability means that an organization is able to undertake functions, such as provide a service or fulfil a task. This implies that it has the required staff, equipment, funding, systems and resources to do this. Organisations are likely to have a number of capabilities.

Capacity means the adequacy of resources in terms of quantity, and suitability of personnel, equipment, facilities and finances.

We will use both terms to collectively mean a combination of or parts of both capacity and capability. Where just capacity or capacity development is mentioned in the text, we infer this to include aspects of capability as well.

### 5.3.3.2 Measuring DRR Capacity and Capability

There are few resources available that specifically focus on assessing capacity and capability or monitoring and evaluating capacity and capability development for disaster risk management, and even fewer for DRR, and no common methodology or indicators (Scott et al. 2015; Hagelsteen and Becker 2013). Capacity and capability development is considered a central strategy for reducing disaster risk (CaDRi 2011). Capacity and capability, and their development, cannot be measured simply by using quantifiable indicators alone, and must include an analysis of less tangible organisational factors, and utilise qualitative observations and a range of tools. Lucas 2013 summarises the most prominent new approaches to monitoring and evaluating capacity development.

There are methods for evaluating the disaster resilience of communities (IFRC 1999, 2007; Kafle 2011; Twigg 2009). Capacity is only one of five dimensions that are considered to define resilience (Twigg 2009; Oddsdóttir et al. 2013). At the other end of the spectrum, there are global frameworks such as Hyogo 2005–2015 and Sendai 2015–2030 which provide evaluation criteria and assessment at a national level (Djalante et al. 2012; UNISDR 2008). The BNPB has an existing self-assessment tool for Local Government (LG-SAT) developed with the support of the United Nations secretariat to facilitate the implementation of the International Strategy for Disaster Reduction (UNISDR), that focuses on disaster risk management.

In Indonesia, as in New Zealand, much of the responsibility for DRM and DRR has been delegated downward to local government. Risk reduction strategies are often imposed upon local government by national governments and global forums without additional knowledge and resources to implement them and importantly ensure they are sensitive to local conditions (Gaillard 2010; Hagelsteen and Becker 2013; BNPB 2014). Capacity and capability development projects frequently are shorter term interventions and involve training individuals (and counting people trained to report back to the donor) without paying enough attention to organisational issues, structures, and how the organisations interact. Natsios (2010) states that *“Development programs that are most precisely and easily measured are the least transformational, and those programs that are most transformational are the least measurable.”*

### **5.3.4 Local Government Self-Assessment Tool for DRR (LG-SAT-DRR)**

The LG-SAT-DRR tool was designed to include key criteria of such measurement tools (Lucas 2013; Scott et al. 2015), namely, to capture the perspectives of as many stakeholders as possible across a range of organisations, be simple and easy to apply, and have a local context. Most importantly its purpose aligns with many of the purposes of self-assessment tools as outlined by the UNDP (2008) such as:

1. Provide a starting point for formulating a capacity development response;
2. Act as a catalyst for action;
3. Confirm priorities for action;
4. Build political support for an agenda;
5. Offer a platform for dialogue among stakeholders;
6. Provide insight into operational hurdles in order to unblock a programme or project.

While the BNPB have an existing self-assessment tool for local government (LG-SAT), developed with the support of the UNDP, it focuses on Disaster Risk Management i.e. incorporating both disaster (or emergency) management and DRR. The tool is a formal survey evaluation method which is useful for providing baseline data against which the performance of a programme can be compared. It is also a useful method for comparing different groups at a given point in time and comparing changes over time in the same group (World Bank 2004).

The StIRRRD programme has developed a separate but complimentary tool which draws on the risk reduction questions of the existing BNPB LG-SAT tool and adds more questions drawing on indicators from UNISDR and the New Zealand Ministry of Civil Defence and Emergency Management Capability Assessment Tool (MCDEM 2014) for a more comprehensive assessment of DRR capacity and capability. The LG-SAT-DRR provides more granularities at a local government level in assessing the current DRR capability and capacity and enables action plans to be developed based on gaps and issues identified. In addition, the tool will be applied again to measure the trend in the DRR capacity and capability of local government over the 5 year timeframe of the programme as one measure of progress and programme effectiveness.

The resulting LG-SAT-DRR is a questionnaire which covers topics grouped into nine main categories and 32 indicators as listed in Table 5.4.

## **5.4 Methodology**

The questionnaire was deployed in each of the eight new StIRRRD districts between November 2014 and February 2016, at the end of the first of three action plan workshops. Rather than assuming the participants had knowledge of the topic, the

**Table 5.4** The nine main categories covered by the LG-SAT-DRR and summarised list of indicators within each

Category	Indicators
1. Understanding hazard and risk	1. Hazards have been identified and are monitored over time
	2. Hazard Maps are available
	3. Risk Assessment has been undertaken
	4. Risk Maps are available
2. Risk reduction activities	5. Risk Reduction options are assessed and prioritised
	6. Local social, economic and environmental vulnerabilities are identified and understood
	7. Vulnerable groups are identified and involved in DRR planning and initiatives
3. Regulations	8. DRR regulations exist
	9. DRR regulations are integrated into existing planning frameworks
4. Strategic planning	10. DRM Strategic Plan exists and is regularly updated
	11. DRM Strategic Plan includes DRR provisions
	12. Local (cultural) knowledge is incorporated into planning for DRR
	13. A range of organisations/agencies are involved in developing plans
5. Building and development control	14. DRM Strategic Plan is communicated publicly
	15. Structural mitigation of buildings and infrastructure occurs
	16. Building and construction is monitored and enforced
	17. Land use and environmental management are factored into risk reduction
	18. Risk impacts from development projects are assessed
6. Funding	19. Utility agencies are involved in risk reduction planning
	20. The DRR role in reducing response and recovery costs is understood
	21. Specific budget is allocated for DRR
	22. DRR spending is able to be separated from other disaster related spending
	23. Specific budget is allocated for contingency purposes
	24. Funding from non-government sources has been obtained
7. Networking	25. Coordinated planning across all government sectors occurs
	26. Coordinated budget allocation across government sectors occurs
	27. A range of organisations/agencies are involved in planning and discussion forums
8. Education and training	28. Public awareness activities include risk reduction
	29. Public awareness activities are multi-media
	30. DRM programme exists in schools and includes DRR
9. Community development	31. Local communities are engaged in DRR
	32. Livelihood diversification strategies are in place
	33. Community DRM Forums exist and include DRR
	34. Forums are multi-level (regional, district, sub-district, village)

workshop provided participants with a basic level knowledge of DRR concepts. Participants were then better able to complete the questionnaire. The questionnaire was completed by local government staff across three main functional areas (disaster management, planning and public works), although respondents also included a range of staff from other functions such as health, education, fisheries, etc. Non-governmental agencies and private sector organisations also completed the survey in some locations, although the number of these agencies was small overall.

The questionnaire is a self-assessment, that is, each questionnaire records the respondent's perceptions of the local government's capacity and capability in DRR. There will likely be some bias in each individual result, and also within each functional area. The different responses between functional areas can provide useful information for training purposes. For example, the questionnaire might show that staff from a particular department might have inaccurate perceptions of hazards present in their district. Training can then be targeted to increase hazard awareness.

The data from the questionnaires were analysed using two different methods, in order to provide both specific (fine-grained) and high-level (coarse) results. Specific results for each individual question, in tabular and graph format, were obtained through the use of Software Package for the Social Sciences (SPSS). High-level results for each category of DRR (i.e. aggregation of all the questions in each category) were obtained by using a scoring system (Grace et al. 2016) that produced one radar diagram for each district (Fig. 5.2). While the SPSS analysis provides a fine-grained level of detail on perceptions of DRR, the radar diagrams provide a coarse level of detail (per category of DRR) and give a pictorial representation of overall strengths and weaknesses.

## 5.5 Analysis of Results

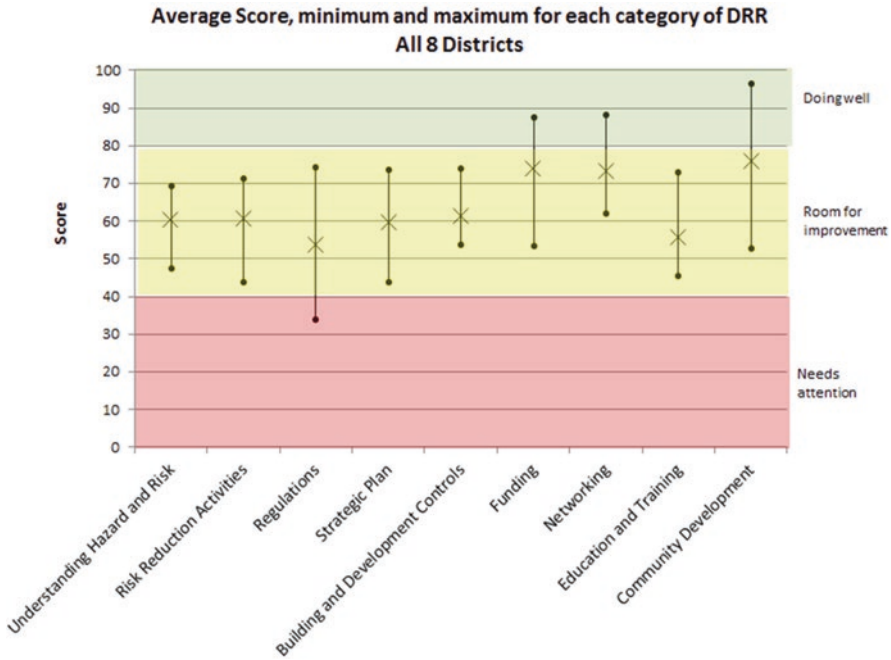
### 5.5.1 *Overall Results: Radar Diagram Trends and Average District Scores*

While the radar diagrams (Fig. 5.2) and the average district scores (Fig. 5.3) show a degree of variability across the districts, there are some trends. However, a detailed analysis of the responses to the different questions, along with additional sources of information from focus group discussions, workshops and interviews, is needed to gain a deeper understanding of the data presented. The radar diagrams do not replace the graphs and tables of data which can produce a narrative to support what the radar diagrams show. However, the radar diagrams are a useful visual tool and have been used in district workshops to generate discussion on the results and inform subsequent action plan development. The information in the radar diagrams can be further analysed to produce average scores across all eight districts for each category.

Among the nine indicators that have been measured by the LG-SAT-DRR and referenced in the radar diagrams, the six indicators that show the greatest need for



Fig. 5.2 Radar plots of performance for the nine assessment categories for the eight StIRRD districts



**Fig. 5.3** Average scores (x) for the eight StIRRRD districts involved in the survey across all nine categories. The minimum and maximum district scores for each category are also shown

improvement, based on the average scores in Table 5.3, are: Understanding Hazard and Risk, Risk Reduction Activities, Regulations, Strategic Planning, Building and Development Controls, and Education and Training. We have selected three for further discussion here; Understanding Hazard and Risk, Regulations, and Education and Training. These have been selected as categories requiring particular attention based on additional evidence from interviews and focus discussion groups. Funding, Networking and Community Development score consistently higher than other categories. This was somewhat surprising given anecdotal evidence from focus group discussions, workshops and interviews to the contrary. An analysis of these better performing indicators is also presented.

### 5.5.2 Results for Each Category

#### 5.5.2.1 Understanding Hazards and Risks

The type of hazards that impact a district is heavily dependent on the geographical location and its physical characteristics. Natural hazards that frequently occur in StIRRRD districts are floods and landslides (see Table 5.2). The results of LG-SAT-DRR show that respondents are generally aware hazard assessments in their regions (Fig. 5.4), which is a critical first step in identifying potential disaster and related

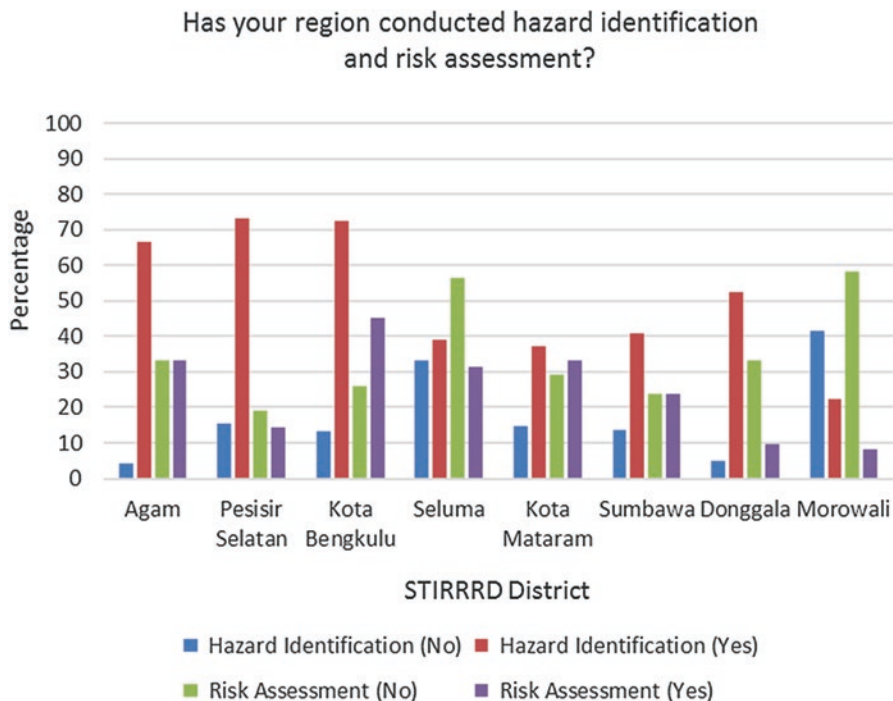


Fig. 5.4 Hazard identification and risk assessment in StIRRRD districts

DRR efforts required. In Seluma and Morowali, it seems that many of the participants are not aware that a hazard assessment exists. Fig. 5.4 illustrates that even though the respondents have an awareness of the hazard assessments of their districts, particularly Agam, Kota Bengkulu and Pesisir Selatan, this does not necessarily translate into an awareness of a risk assessment. From workshop discussions in some districts, risk assessments have not been carried out, and that understanding of risk as opposed to hazard is not well understood. Most respondent’s explanations for the lack of risk assessments relate to budget constraints of the BPBD. However, other information gathered from workshops and focus group discussions indicate that there is an expectation that provincial or national government will provide risk assessments, and that there is not always the capability within local government to carry out risk assessments, to understand them, or implement them in policies and plans.

### 5.5.2.2 Regulations

Each district is required to have a Regional Disaster Plan (RAD) (Act No. 24/2007: article 35 and 36). This plan, in conjunction with a Long Term Development Plan, Medium Term Development Plan (RPJMN, Rencana Pembangunan Jangka Menengah), and Spatial Plan (RTRW, Rencana Tata Ruang Wilayah - Act No. 26/2007),



along with local regulations (Perda) is intended to ensure effective and integrated implementation of the development for each district, taking into consideration hazards and risk.

The existence of plans and local regulations does not guarantee that all districts have implemented policies related to DRR in their respective areas. The results of studies that have been conducted by *Kemendesa* (2014), supported by interviews by the StIRRRD team, indicate that existing disaster management policy is not always risk reduction focused. Furthermore, and as shown in Table 5.5 and Fig. 5.5, many districts do not yet have local regulations in place to implement and enforce their plans and actions. For example, Morowali district does not yet have a Regional Disaster Plan and the local Emergency Management Office (BPBD) aligns its annual activities with the district's Strategic Plan.

Figure 5.5 also indicates that the drafting of DRR regulations in particular, has not been a priority in most districts, and generally has not been well communicated. Agam may be the exception to this where a large number of respondents knew that regulations were being drafted. At the time of the survey in 2015, Agam, Kota Mataram and Sumbawa had started to develop DRR Regulations, and in 2016, Kota Mataram and Sumbawa gained approval from their parliaments for local regulations on DRR.

A good national framework for DRR exists in Indonesia and it is a national priority to mainstream DRR into plans and policy (BNPB 2014; Gordon 2013; Darwanto 2012), but district regulations are still lagging behind in development and implementation. There are a number of factors as to why this is the case, such as the national framework is relatively new, the low capability of the sector, the length of the policy and planning cycle, limited socialisation of the framework, and competing priorities for local government. More analysis is required to determine the relative mix of causes in each of the districts.

### 5.5.2.3 Funding

DRR efforts can also be measured in terms of funding allocated to it, provided it is specifically identified. For most districts, about half of the respondents indicated that budget for the purpose of DRR is not accounted for separately (Fig. 5.6). Sumbawa would be the exception where DRR funding for the most part appears to be accounted for separately from other spend on disaster related activities. DRR budgeted activities should be appropriately coded (Darwanto 2012; Gordon 2013) so they can be separately accounted and this would seem an imperative under the Sendai Framework 2015–2030.

Financing from the state budget (APBD) refers to the budgeting system regulated by decree of the Minister of National Development Planning/Head of BAPPENAS and the Ministry of Finance. Figure 5.7 shows the funding sources for DRR activities from government (APBD) and non-government sources. The proportion of these two types of funding sources varied significantly and there are several districts whose funding mostly comes from the government (Kota Mataram

**Table 5.5** Disaster policies and related plans in SUIRRRD districts (2014–2016)

Policy/Plans	West Sumatra			Bengkulu		NTB		Central Sulawesi		
	Kota Padang	Agam	Pesisir Selatan	Kota Bengkulu	Seluma	Kota Mataram	Sumbawa	Kota Palu	Donggala	Morowali
<i>Policies</i>										
RPJMD	1	1	1	1	1	1	1	1	1	1
RTRW	1	1	1	1	1	1	1	1	1	1
Perda	2	2	2	2	2	1	2	2	2	3
On Call Budget	1	1	1	1	1	1	1	1	1	1
<i>Plans</i>										
<i>Renstra</i> BPPBD	1	1	1	1	1	1	1	1	1	1
Rencana Aksi Daerah (RAD)	1	1	1	1	1	1	1	1	1	3
Contingency	1	1	1	1	2	1	1	1	1	3

Key: (1) Exist, (2) Being drafted, and (3) Don't exist

*RPJMD* Region Medium Term Development Plan, *RTRW* Spatial Planning and Regional, *Perda* District Regulation, *Renstra BPPBD* BPPBD Strategic Plan, *RAD* District Action Plan

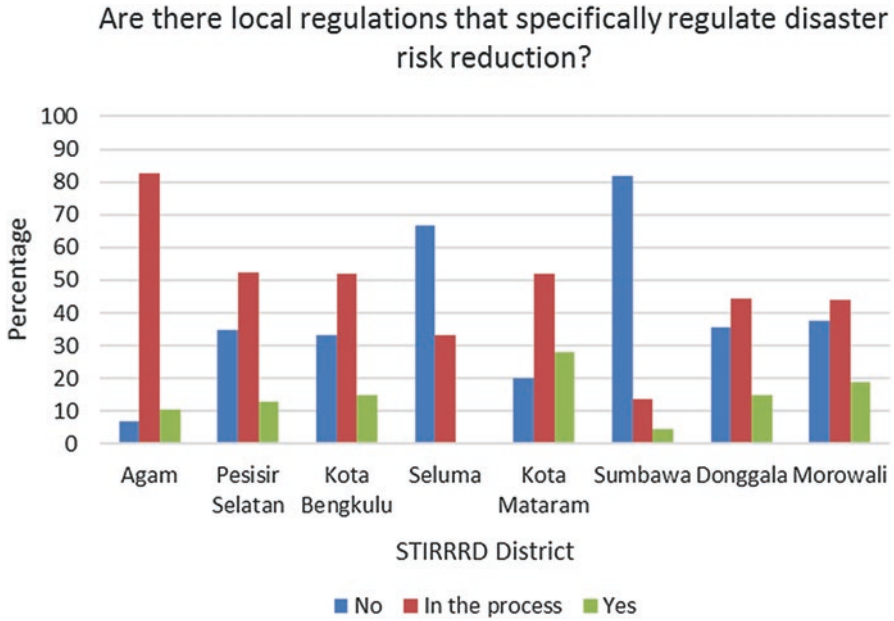


Fig. 5.5 Local Regulations on DRR

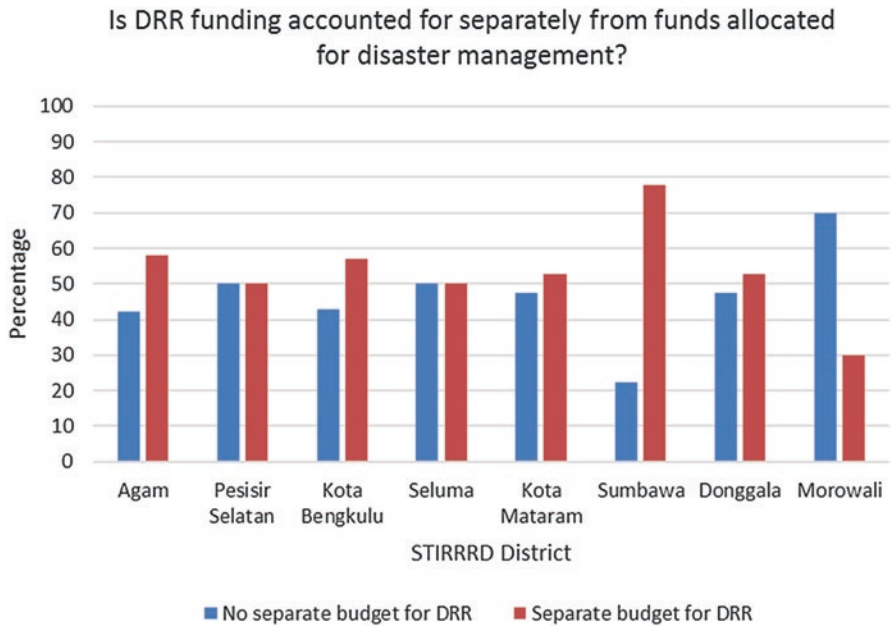


Fig. 5.6 Separate accounting of DRR funding

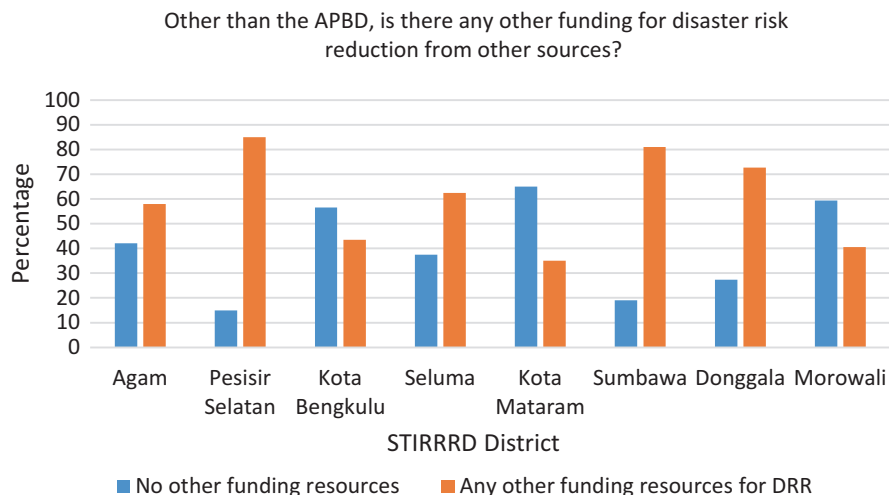


Fig. 5.7 The availability of funding resources for DRR

and Morowali). Surprisingly, other districts (Agam, Pesisir Selatan, Seluma, Sumbawa and Donggala) derive their funding largely from other sources (e.g. NGOs, donors, business). However, given that many of the respondents do not separate out DRR budget allocation from other activities (Fig. 5.7), it would be difficult to get a clear picture of how much DRR funding is from government or from other sources.

While there is legislation and commitment to allocate funds for disaster management, the challenge is changing the general mindset to one that believes the allocation of funds for DRR has real value. DRR activities should be understood as an investment that will reduce the cost of disaster response and recovery. However, local government does not always understand that investment in DRR increases community resilience as they cannot readily see the benefits (Benson and Twigg 2007) and believe that spending on other social areas has priority.

Figure 5.8 shows that most of the StIRRRD districts allocate budget for DRR activities, and in general, appreciate the value of DRR. Seluma, Kota Mataram, Donggala and Morowali still require some education across the responding sectors as to the benefits of investment in DRR. In Morowali however only half of the respondents had an appreciation for DRR and allocated budget for DRR activities.

### 5.5.2.4 Networking

Figure 5.9 indicates that coordination among related government agencies (e.g. Local Disaster Management Agency (BPBD), Regional Public Works (PU), and Regional Development Planning Agency (BAPPEDA)) exists. Anecdotaly, from workshop and focus group discussions, coordination and cooperation among local

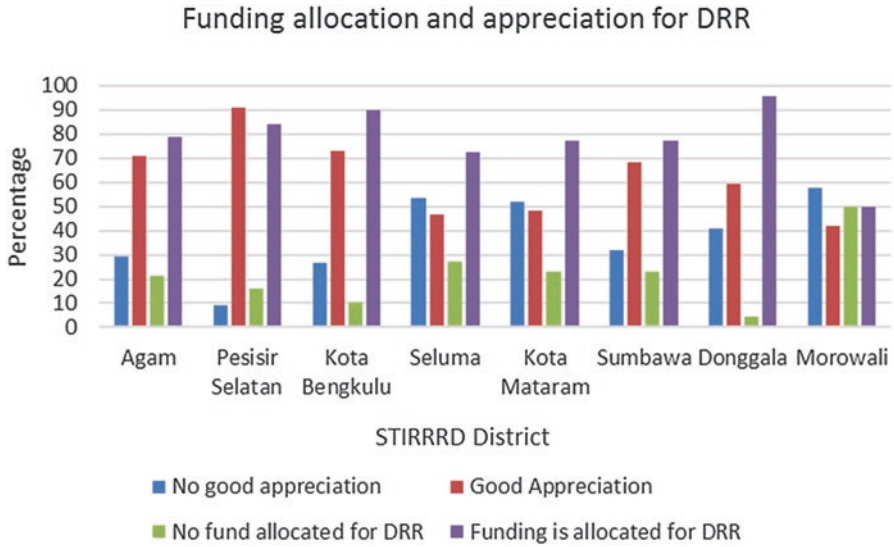


Fig. 5.8 DRR funding allocation and appreciation of the investment in funding for DRR

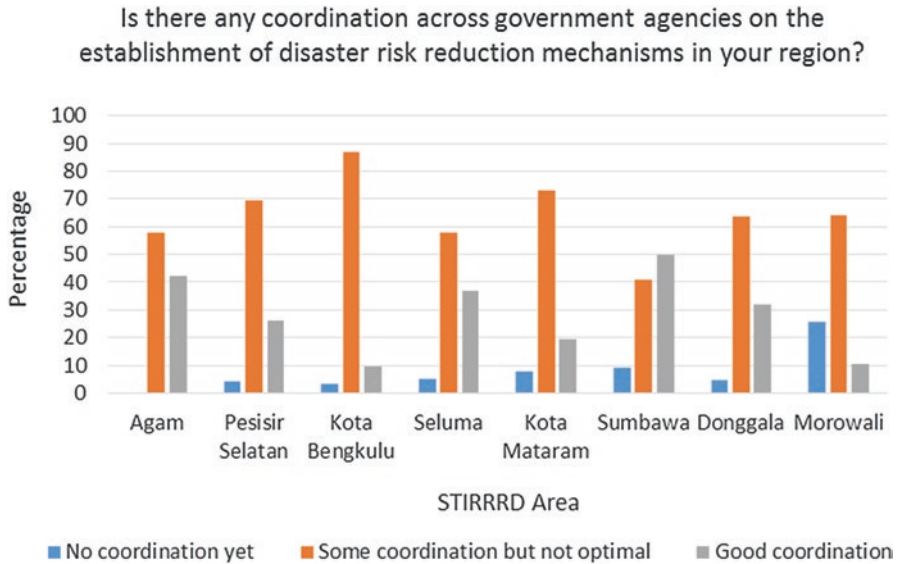
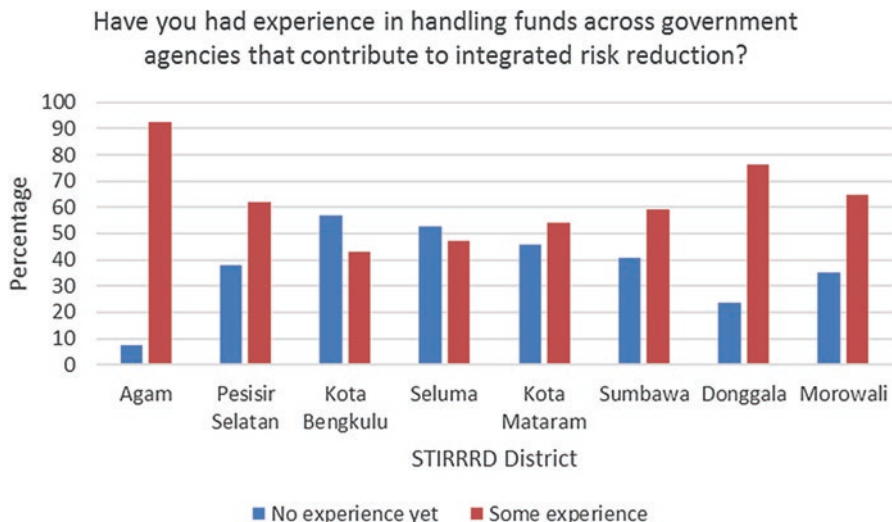


Fig. 5.9 Coordinated planning across all government sectors



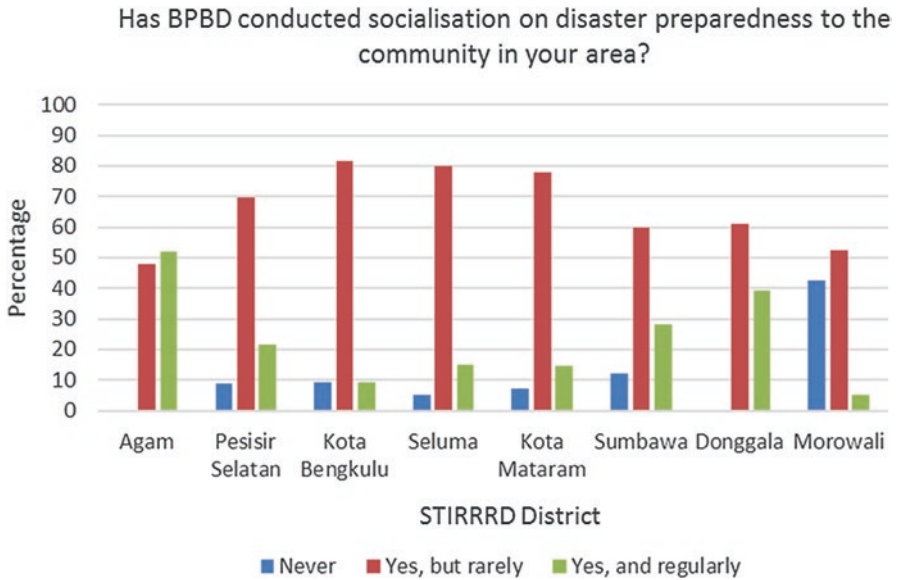
**Fig. 5.10** Coordinated DRR budget allocation and management across government sectors

government departments and other stakeholders is mostly done during emergency response so in practice the relationships between the government agencies are still not optimal. Therefore it is necessary to encourage regular coordination amongst government agencies, as well as other community organisations. Disaster management agencies should be working with various parties so that both DRM and DRR can be done in an integrated manner. Sumbawa seems to be better coordinated than other districts. The head of BPBD Sumbawa utilises the strategy of frequent direct meetings with each government agency at which he outlines what has been done by the BPBD and what still needs to be achieved by working together.

Figure 5.10 shows that some districts are already coordinating budgets across government agencies with respect to DRR activities, but somewhat less so in Kota Bengkulu and Seluma.

### 5.5.2.5 Education and Training

Education and training can improve the capacity and capability of a person, organisation or community. Education and training activities can enable the transformation of knowledge related to hazards and DRR into practical interventions by communities. The Law 24/2007 on Disaster Management reinforces the importance of community education and involvement in risk reduction. Article 26 Paragraph 1 Item B for example, states that everyone is entitled to education, training, and skills in disaster management. In the same paragraph, Item E affirms that every person has the right to participate in decision making in disaster management activities, particularly with regard to themselves and their community.



**Fig. 5.11** The frequency of organised socialisation, or public awareness, on disaster preparedness

Figure 5.11 shows that most of the StIRRRD districts are undertaking socialisation (public awareness) on disaster preparedness, either regularly or occasionally. Morowali is a notable exception because it is a relatively new administration, and has not yet fully engaged with its communities. The results from Agam indicate that there are regular community education and training initiatives, but not all the respondents are aware of the programs. From the workshop discussions it became apparent that these initiatives are regular in some sub-districts, but have not been initiated in others.

Generally, the socialisation initiatives include concepts and practices related to DRR, although less so in Seluma and Morowali (Fig. 5.12). More importantly, the data indicate that information on DRR has not been specifically delivered into the school curriculum in most districts. Our perception is that better engagement between the local BPBDs and the Ministry of Education is required.

There are a lot of media that can be used as a means to educate the public. The survey indicates that seminar/outreach/discussion (or public meeting) was the most utilised media to deliver public awareness messages (Fig. 5.13). Donggala predominantly uses this medium to deliver its public awareness messages. Seminars (or public meetings) are chosen because they are perceived to be effective and are an easy method of allowing direct interaction with the public. At the time the questionnaire was compiled, use of social media as a communication mechanism by BPBD was low. Evidence from workshops and focus group discussions (FGDs) shows that BPBD are starting to use this medium more. It will need to be added as an option to the next LG-SAT-DRR questionnaire.

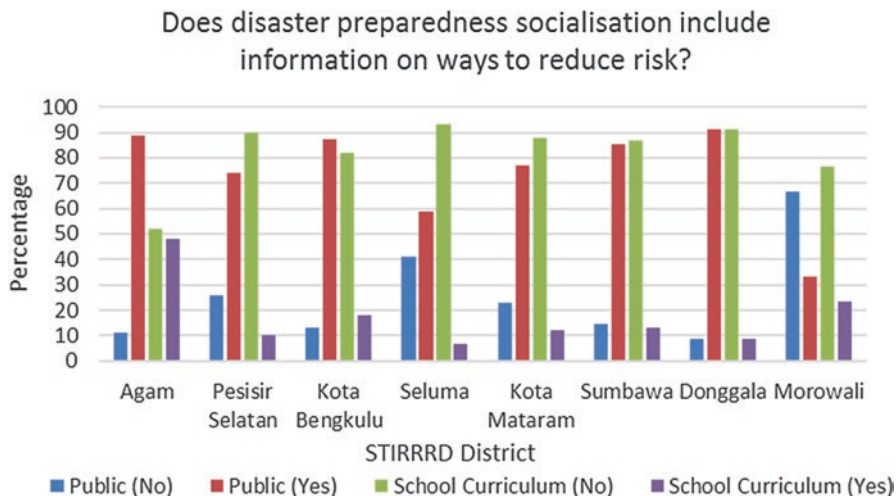


Fig. 5.12 Inclusion of risk reduction information in public awareness activities

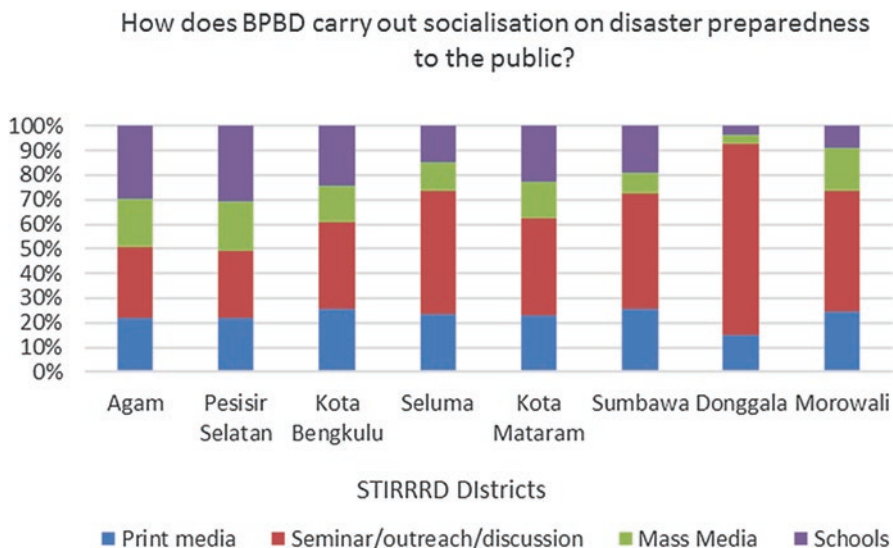


Fig. 5.13 Public awareness activities through multi-media (Note: Print media = leaflets; seminar/outreach/discussion = public meetings and other direct public engagement methods; mass media = TV, radio, newspaper; schools = outreach conducted in schools and/or material in the school curriculum)



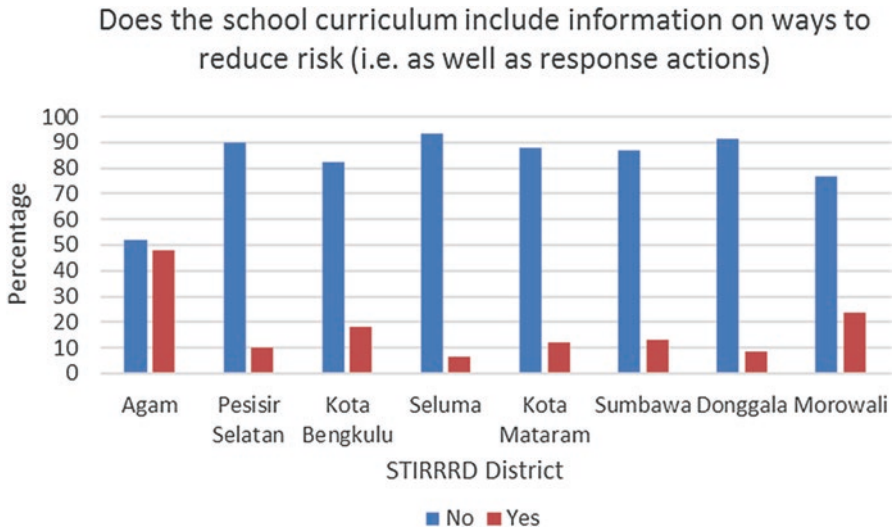


Fig. 5.14 DRR information included in school curriculum

Figure 5.14 shows that most of the STIRRRD Districts do not introduce DRR in the school curriculum and education in schools is therefore underutilised as a means to improve community preparedness. School education is very effective at increasing community resilience (Ronan and Johnston 2005) because schools play an important role in preparing young people to understand the hazards and risks in their area and to pass the knowledge on, particularly to other family members. The awareness of the importance of schools education is increasing in the districts. All of the district Action and Implementation Plans that have been developed as part of the StIRRRD programme now have an action related to improving education about hazards and risks in schools.

### 5.5.2.6 Community Development

DRR activities are more likely to succeed if local communities are actively involved in identifying solutions to reduce risk (Gaillard 2010; IRFC 2004). Figure 5.15 summarises the amount of local community involvement in risk reduction activities in the StIRRRD districts, and the data indicates that the local community is involved. Morowali would be the obvious exception where at the time of the survey in 2015, Morowali was establishing itself as a new district and fledgling disaster awareness initiatives were top-down and one-way. However, following subsequent workshops and training through StIRRRD, a community-based initiative involving more engagement with the community has been proposed in 2016.

The data indicates that community forums are active, although not all respondents are aware of them (Fig. 5.16), except for Agam where all respondents were aware.

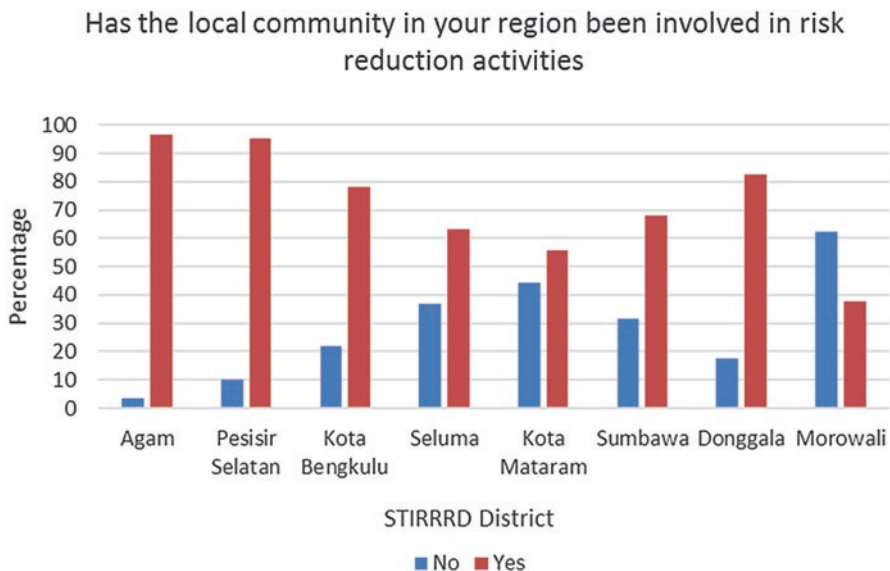


Fig. 5.15 Involving local community in risk reduction activities

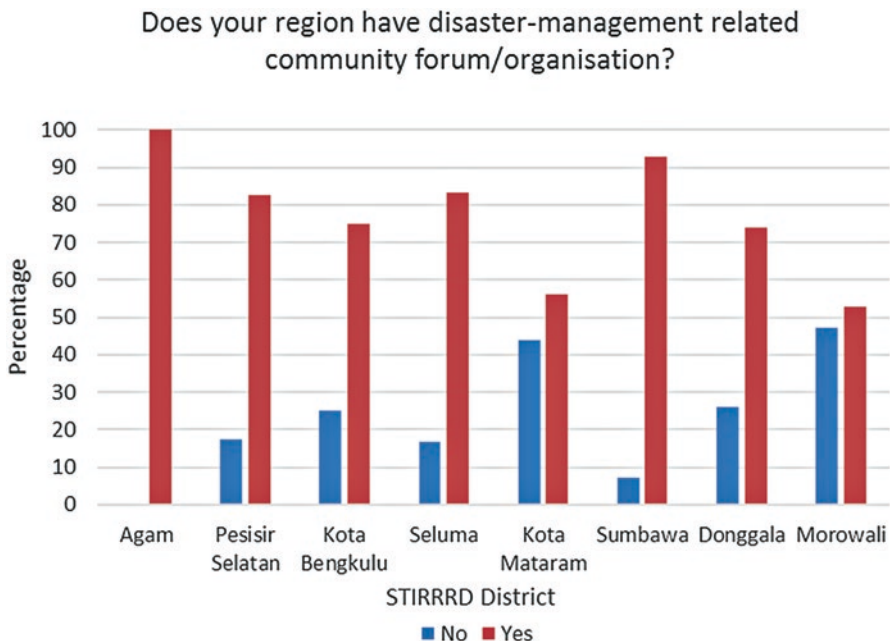


Fig. 5.16 Existence of disaster management related community forums/organisations

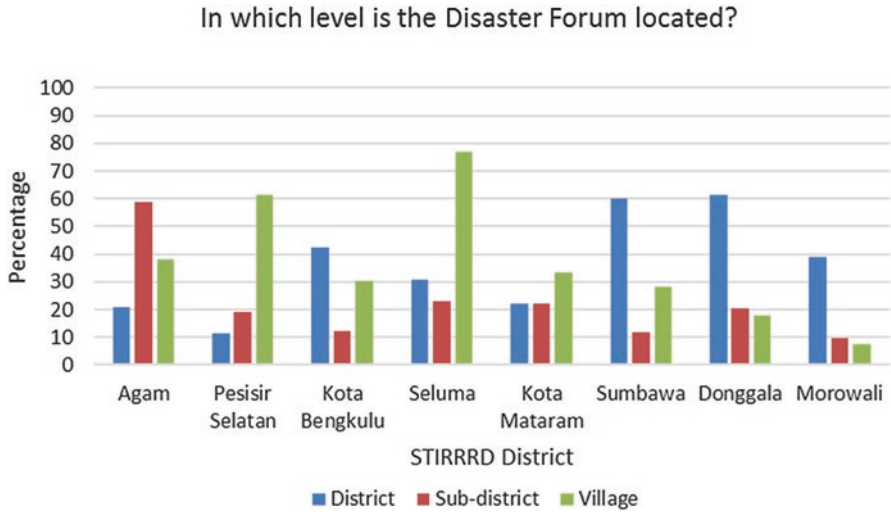


Fig. 5.17 The level at which the DRR Forum is located

Analysis of the survey indicates that the respondents included local organisations working in disaster management including those in villages, sub districts (Disaster Resilient Village or Village Disaster Preparedness groups) and at a district level (Fig. 5.17).

### 5.6 Conclusions

The StIRRRD programme aims to increase the DRR capacity and capability of local (district) government. To help assess the capacity and capability of the districts and provide guidance on priorities for action, a Local Government Self-Assessment Tool for DRR (LG-SAT-DRR) has been developed. The self-assessment was designed to capture the perceptions of many stakeholders, be simple and easy to apply, and have a local government context. The tool was also designed to be used as a measure to evaluate the success or otherwise of the StIRRRD programme over its 5 year implementation.

The first deployment of the tool has provided useful information for the districts. A number of areas have consistently emerged as needing attention. Many of these are in alignment with the key needs identified in the Sendai Framework process (Aitsi-Selmi et al. 2016) around capacity and capability.

The lack of local regulations specifically addressing DRR seems to be an impediment for local government in implementing many DRR initiatives. However, many districts are now formulating and legislating such regulations and this impediment is starting to be removed.

Other areas requiring attention as shown by the results include the need for education and training for local government staff, and the need for basic hazard and risk assessments, including assessments of community vulnerability. Regulations themselves will not necessarily improve the capability of the districts to undertake risk assessments or utilise existing risk assessments and put them into policy. Investment in education and training is an opportunity to raise the capability of local government staff in DRR.

Focussed efforts are needed to improve the capacity of local government and society in DRR and this should be a priority for central government. The local disaster management agencies (BPBDs) have a mandate to coordinate in a disaster management situation, and as agreed during StIRRRD workshops, also have this role for DRR activities. No other local government agency has this coordination role. Currently however, BPBDs are not resourced to provide this function adequately and do not always have the capacity to do what's required in terms of coordinated planning and consequent budget negotiation.

While networking and community development generally scored well, there are opportunities to improve coordination across government agencies and also improve the format of community-based engagement by being more inclusive of the local communities, and by utilising a variety of techniques and media. Local government is starting to realise the importance of meaningful engagement of their local communities. Often engagement stops at socialisation or sharing of basic information on hazards and response actions. Engagement needs to be more frequent and also move to a more active participation of communities in taking ownership of risks and devising and implementing their own risk reduction solutions.

The StIRRRD programme is using the LG-SAT-DRR as one of the tools to help focus DRR Action Plans in the target districts. Combined with workshops, focus group discussions and interviews, the LG-SAT-DRR provides a snapshot in time of how the districts perceive their own progress. The Action Plans are currently being finalised, and will be implemented over the coming months and years. Specific areas for attention in the Action and Implementation Plans, as identified by the LG-SAT-DRR tool and complimentary workshops, focus groups and interviews, include:

1. Strengthening DRR policy and regulations, such that national policy can be operationalized in the districts. This includes education for local government staff about national DRR policy and expectations of local government in this area.
2. Strengthening the capacity and capability of local government staff in DRR through training and professional development. The tertiary education sector has an important part to play in this regard.
3. Enhancing partnerships among stakeholders to integrate initiatives in DRR and reduce silos.
4. Strengthening community participation in DRR activities in order to form self-reliant and disaster resilient communities.

It is important to remember that the LG-SAT-DRR provides a self-assessment only and as such is not an 'objective' reflection of the actual capacity and capability of local government. However, it can be used as a guide and can be taken to more-or-less provide an indication of strengths and weaknesses. The LG-SAT-DRR tool is not a comprehensive set of questions on DRR. It was important to maintain a link between this tool and that already in use by BNPB for disaster risk management (LG-SAT) by utilising relevant DRR questions from the BNPB tool. These questions were augmented so the survey was more comprehensive for DRR, although it also needed to be of a practical length so respondents were able to complete it in a reasonable length of time. The radar diagrams have proven to be a good visual tool to stimulate discussion and guide the DRR action planning in each district. The results of four of the districts (Seluma, Morowali, Sumbawa and Agam) were presented in a combined district workshop session which generated a spirited discussion on reasons and possible actions for improvement.

The LG-SAT-DRR will be redeployed in all eight districts in 2019, in part to assess the effectiveness of the StIRRRD programme in improving local government capacity and capability in DRR. The data will be combined with other indicators, such as increase in DRR funding, changes to policy and regulations, number of people trained etc., to evaluate actual progress made. The tool will also provide another snapshot in time of the perceptions of DRR practitioners as to the situation in their respective districts. This information can be used again to guide the development of second generation DRR Action and Implementation Plans.

The results will be used as one measure to evaluate the effectiveness of the StIRRRD programme, amongst a number of other result measurement indicators. It is important to achieve a balance between monitoring and evaluation, and implementation of activities. Reducing risk requires an integrated approach across agencies and one which addresses a number of complex causative factors. The focus needs to be on developing transformational approaches if change is to be effected, but these are not always easy to measure. In addition to its use as an evaluation tool, the main benefit has been to focus the districts on their performance and stimulate discussion and debate on issues and solutions. Use of the tool in this way has more than demonstrated its value as a means by which DRR can be examined and addressed.

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## Chapter 6

# Examining the Adequacy of Legal and Institutional Frameworks of Land and Forest Fire Management from National to Community Levels in Indonesia

Laely Nurhidayah and Riyanti Djalante

**Abstract** Land and forest fires are increasingly becoming annual disasters in Indonesia and have a significant impact on biodiversity, health, the economy and carbon dioxide emissions. Human activities such as the clearing of forests and land for plantations and agriculture have been attributed as the major causes of these fires. They have also been associated with the impacts of El-Niño.

This chapter aims to examine the adequacy of current legal and institutional frameworks for land and forest fire risk management (LFFRM) in Indonesia, from the national to local level, through utilizing a disaster risk management approach, and thereby assess progress and challenges in managing land and forest fires during the prevention and mitigation, emergency response and post-fires rehabilitation and recovery phases. This study involves a literature review of related government regulations and academic publications, as well as interviews with government officials, the community and NGOs at the local level, conducted in two provinces: South Sumatra and Central Kalimantan.

The study has three major findings. First, the institutional and regulatory framework for managing land/peatland fires is not integrated with that of forest fires. Second, a lack of law enforcement hinders prevention and mitigation. Third, current institutional and regulatory frameworks are still very much focused on emergency response. Moreover, progress is slower at lower levels of governance and community livelihood has failed to be integrated into the process. We recommend that governments, from the national to sub-national and local levels, develop a more comprehensive and multi-sectoral approach with community-based livelihood

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activities at its core, and commit to stricter law enforcement, especially for those private sector companies responsible for large-scale fires.

**Keywords** Land and forest fires • Governance • Land and forest fire risk management • South Sumatera • Central Kalimantan

## 6.1 Introduction

Indonesia is one of the countries that has experienced large-scale land and forest fire disasters (EM-DAT 2016). Since 1900, the EM-DAT CRED has recorded 10 fire events, 319 deaths, which impacted 3,444,421 people and caused damages totaling US\$ 10,329,000 (EM-DAT 2016). Fires are increasingly becoming annual environmental disasters in Indonesia. For instance, the 2015 forest fires in Indonesia lasted more than 3 months from the period of July and September (EM-DAT 2016). The prolonged period of fires up until early 2016 is believed to have been strongly associated with the El-Niño season in the region. Most of the fires are located in peatland areas on the islands of Sumatra and Kalimantan. Human activities such as forest and land clearing for plantations and agriculture have been attributed by various researchers as the major causes of these fires. Fires on peatland are extremely difficult to fight since they burn non-stop, underground and in remote locations until monsoon rains come (Field 2015). Peatland fires are the major sources of haze pollution which have a negative impact on the economy, ecology and society. The impacts include damage to biodiversity (Harrison and Paoli 2012), public health and the national and regional economy, as well as contributing to global climate change through emissions of CO<sub>2</sub> to the atmosphere. Forest fires damage in 2015 is reported to have caused 19 deaths, 500,000 cases of respiratory-tract infections and the financial damage to the economy was estimated in the order of \$47 billion (Balch 2015). Their impact on ecosystems has been mainly consisted of loss of vegetation and wild animals. While there have not yet been any studies that measure the impacts on vegetation (Ferrarini 2012), it is estimated that around 50,000 orangutans are at risk as a result of the 2015 forest fires (Taipei Times 2015). The fires did not only impact Indonesia, but also the South East Asia region especially Singapore and Malaysia, as a result of the haze, the fires have caused tension between Indonesia and the impacted countries in the region. (Kuppusamy 2013; Majid 2009; Ramesh and Sharon 2013; BBC 2012).

There have been several major studies and initiatives that examine causes and implications of forest fires in Indonesia from the legal and institutional perspectives e.g. (e.g. Nurhidayah 2013; Herawati and Santoso 2011; Bowen et al. 2000). While these studies have contributed significantly to the understanding of governance or rather lack of it, there is still little analysis on how these regulations and institutions differentiate their mandate and responsibilities prior to the occurrence of fires or during the recovery phase. This study builds on those earlier studies through the examination of governance of land and forest fires (LFF) from a disaster risk

management (DRM) perspective. That is, the study aims to assess progress and challenges in managing forest fires in the prevention and mitigation, emergency response and post-fire rehabilitation and recovery phases. Specifically, this study aims to review the current gap in the existing legislation and institutions between forest and land fires in Indonesia, along with an analysis of the challenges in the current management of forest fires, with the outcome of suggesting strategies to strengthen the capacity of different institutions, mainly at the local level.

This study involves a literature review of related government regulations and academic publications, as well as interviews with local government officials, the community and NGOs in two provinces in South Sumatra and Central Kalimantan. We argue that failure to address LFF management from the perspective of disaster risk management (DRM) has led to inefficiencies within the current legislation and institutional arrangement. By having specific guidelines in each phase, the subsequent legislations will not only be able to ensure stronger law enforcement during the mitigation, recovery and rehabilitation phases, but also specify clear mandates and responsibilities at the emergency and prevention phase. We propose that successful and effective implementation of land and forest fires risk management (LFFRM) in Indonesia requires multi-sector regulatory frameworks which address specific strategies for mitigation, emergency and rehabilitation, with a stronger commitment to law enforcement, supplemented with better equipped and capable local governments and a focus on community-based livelihood activities.

This study is important and timely considering that, in order to respond to the large scale 2015 fire event, disaster management agencies at the national and local government levels (BNPB and BPBDs) were mandated for fire-fighting activities. This has helped speed up the emergency response to put the fires out, but it also added more layers of complexity within the institutional and legal arrangement for fire management in Indonesia. Moreover, the Sendai Framework for Disaster Risk Reduction (SFDRR) has further called for more comprehensive assessments of risks and disasters not only caused by natural hazards but also by biological and technological hazards. Fires in Indonesia have not only been the result of natural cycles of warming temperatures or prolonged draughts, but the majority have been due to rampant deforestation, burning and land clearing activities to make way for agriculture land or palm plantations (FAO 1999). Moreover, as the impact of warming temperatures is increasingly felt, it is also expected that forest-fire events will continue in the future.

The chapter is outlined as follows: Sect. 6.2 examines Indonesian legal and institutional frameworks from LFFRM perspectives which follow the disaster management cycle; namely prevention and mitigation, emergency and response, and rehabilitation and recovery phases. Section 6.3 examines LFFRM in two case study areas of South Sumatra and East Kalimantan provinces. Finally, Sect. 6.4 presents a conclusion and general recommendations for improving existing legal frameworks and strategies for strengthening the institutional capacity for LFFRM at the local government level.

## 6.2 Land and Forest Fires Risk Management at the National Level

We analyze the existing legal and institutional frameworks for land and forest fires in Indonesia, using LFFRM. This framework is based on DRM which is defined as

The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster”, which aims to “avoid, lessen or transfer the adverse effects of hazards through activities and measures for prevention, mitigation and preparedness. (UNISDR 2009b)

We analyse how each of the above regulations have adopted strategies within risk management phases (Table 6.1), outline advances and most importantly factors which still hinder effective implementation.

The Food and Agriculture Organization for the United Nations (FAO) released voluntary guidelines for formulating national legislation on fire management (Morgera and Cirelli 2009). The guidelines suggest that robust and effective LFF legislation should address the key elements inter alia: definitions, institutional set-up, coordination, planning, monitoring and assessment, prevention, suppression, controlled fire use, participatory and community-based approaches, rehabilitation and law enforcement (Morgera and Cirelli 2009). The framework for LFF management is regulated by several legislations and sub legislations as listed in Tables 6.1 and 6.2.

The following sub-sections are organized into the three phases of LFFRM. For each phase, we discuss progress in development of the legal framework, issues which challenge implementations and finally the progress of the institutions.

### 6.2.1 Prevention and Mitigation Phase

The above discussion has outlined the legal and institutional framework for preventing and mitigating LFF. It shows that legislations are more focused towards mitigating risks from land/forest fires than peatland fires. While Peatland fires occur and impacting Indonesia more than land/forest fires, there is no yet special regulation

**Table 6.1** Disaster risk management phases and strategies

DRM phase	Strategies
Prevention and mitigation	Making disaster risk policy priority, institutional strengthening, risk assessment and early warning, education, information and public awareness
Emergency response	Preparedness for effective response
Recovery and rehabilitation	Reducing underlying risk factor (post emergency action)

Source: UNISDR (2009b)

**Table 6.2** Regulatory framework related to land and forest fire risk management (LFFRM) in Indonesia

Legislation	Issues specific to fire	Types of fires		LFFRM (PM = preventions and mitigation, ER = emergency and response, RR = recovery and rehabilitation phase)		
		Land fires	Forest fires	PM	ER	RR
Law No. 32/2009 on Environmental Protection and Management	Main legislation/umbrella legislation on environment protection in Indonesia	X		x		
	Art 69 (h) it is prohibited to open the land with burning					
Law No. 41/1999 on Forestry	Main legislation on forest management in Indonesia		x	x		
	Art 50 (3) (d) (l) prohibition burning forest					
	Art 78 (3) criminal sanction, imprisonment for 15 years and IDR 5 billion fine					
Law No. 39/2014 on Plantation	Main legislation on the management of plantations including permits for oil palm plantations	x	x		x	
	Art 67 (3) (c) statement of company to provide equipment and facility for emergency response to control land/forest fires					
Law No. 24/2007 on Disaster Management	Main legislation on disaster management system in Indonesia. No provision specific to forest fires	–	–	x	x	x

(continued)

**Table 6.2** (continued)

Legislation	Issues specific to fire	Types of fires		LFFRM (PM = preventions and mitigation, ER = emergency and response, RR = recovery and rehabilitation phase)		
		Land fires	Forest fires	PM	ER	RR
Government Regulation No. 4/2001 Concerning Control of Environmental Degradation and/or Pollution Related to Forest and/or Land Fires	Art 11,12, 13, 14, 15, 16 prohibition and prevention on land/forest burning	x	x	x		
	Art 17, 18,19 forest fires control/repression		x	x		
	Art 20, 21 forest fires rehabilitation		x			x
	Art 23–33 institutional framework in controlling land/forest fires at national, provincial and regional level	x	x	x		
	Art 34–41 monitoring and reporting			x		
	Art 42 community awareness					
	Art 43–46 the role of community			x	x	
	Art 52 criminal sanction Specific sub-legislation addressing land/forest fires					
Government regulation No 45/2004 on Forest Protection	Article 18–31 on prevention, repression and post-fire management		x	x		x
	Regulation on forest protection from deforestation and forest degradation					

(continued)

**Table 6.2** (continued)

Legislation	Issues specific to fire	Types of fires		LFFRM (PM = preventions and mitigation, ER = emergency and response, RR = recovery and rehabilitation phase)		
		Land fires	Forest fires	PM	ER	RR
		Presidential Instruction No. 16/2011 on Improvement in Controlling Land/Forest Fires,	The first part is a general mandate, obligating 15 government institutions at the central and local government levels:	x	x	x
	To improve land/forest fire control through several activities:					
	Prevention of land/forest fires;					
	Fire fighting;					
	Post-fire rehabilitation;					
	To cooperate and coordinate in controlling land/forest fires;	x	x	x	x	
	To improve community involvement and the involvement of other stakeholders in controlling land/forest fires;	x	x	x		
	To improve law enforcement and apply strict sanctions to individuals or corporations involved in burning land/ forest fires	x	x	x		
	The second part contains a specific mandate to each government institution listed in the regulation			x	x	
	Regulation on improving the efforts in controlling land/ forest fires					

Source: Authors

dealing with peatland fires. Therefore, the authors suggest that the government needs to regulate peatland fires in the new legislation addressing land/forest fires. New comprehensive legislation dealing with forest fires will replace the current scattered sub-legislations. Institutionally, there have been multi-sectoral collaborations amongst institutions, but there are still drawbacks in terms of cooperation and coordination. The key findings in the prevention and mitigation phase is that despite adopting zero burning and controlled burnings and provisions on prevention already incorporated in various legislations, LFF still continue to occur due to inconsistent policy implementations, lack of law enforcement and corruption. A case study on prevention and mitigation at the local level is given.

### 6.2.1.1 Legal Frameworks

Indonesia adopts a zero burning and controlled burning policy in the legislation as a means to prevent LFF (Art 69 (1) (h), 69 (2), Law No 32/2009). The zero burning policy targets plantation companies and timber concessionaires, while the controlled burning policy targets local communities or small holders and shifting cultivators (Haze Action online 2016).

In Law No 32/2009 on Environment Protection and Management, which adopts a zero burning policy, it states that “*It is prohibited to conduct burning activities in opening land for plantation*” (article 69(1) 7(h)). Failing to adhere to this provision will lead to a sentence of a minimum of 3 years and a maximum of 10 years imprisonment, and a fine of a minimum of 3 billion rupiah and maximum of 10 billion rupiah (article 108). However, there is an exception in article 69 (2) which suggests that the implementation of zero burning should consider local knowledge which in the explanatory paragraph 69 (2) stated local knowledge as stipulated in this paragraph is allowing local people to burn the land maximum 2 ha (Ha) per household for local variety planting and firebreaks are implemented in the surrounding burned area.

Local people in this legislation are referred to *adat* law communities. As stated in article 1 (31) an *adat* law community is a group of communities living traditionally in a specific geographic area because they share same origin of ancestor, strong relations with the environment as well as a system of values determining economic, political, social and legal structures. However, allowing local *adat* people to conduct burning activities in this law has created debate and criticism during the forest fire crisis in July–Oct 2015 (DW 2015). Who can be categorized as *adat* people is not clearly stated in the legislation. Therefore, local government regulation in Central Kalimantan addressing land/forest fires identified local people is local people as whole and not specifically the *Dayak* people. The permit to burn 2 ha of land for local people was cited as the cause of the LFF in Central Kalimantan in 2015 (Tempo 2015). Therefore, some called for the regulation to be revoked or revised (CNN Indonesia 2015). To reduce the incidence of burning practices by local people, the government plan to revise and delete this provision. However, until now the legislation is as before. On the other hand, activists of *adat* (customary rights)

believe that local people's *adat* practices of land burning are not the main cause of the LFF but instead it is due to company practices. They insist that this knowledge and practices of burning should be recognized in law (AMAN 2015).

Government Regulation No. 4/2001 on Control of Environmental Degradation and/or Pollution Related to Forest and/or Land Fires also adopts a zero burning policy. The regulation states the obligation in article 11 that every person is completely prohibited from conducting land/forest burning activities. It is stated in article 17 that every person has an obligation to control and mitigate forest fires and land in the location of their activities (Government Regulation No 4/2001). Moreover business owners are responsible for the occurrence of land/forest fires in the location in which they operate, and must ensure that mitigation is conducted as soon as possible (article 18). The regulation states that the person responsible for a business whose activities may have a significant impact on the environment also has an obligation to prevent land/forest fires in the area in which he or she operates (article 13). Furthermore, article 14 states that the person responsible for a business also has an obligation to possess adequate facilities and infrastructure to prevent wildfires, including early detection systems, preventive equipment and periodic training, as well as standard operating procedures and an organisational unit for wildfire prevention and mitigation. In addition, that person has an obligation to monitor the implementation of preventive measures and periodically, at least once every 6 months, convey a written report of the monitoring results of fire prevention—including hotspot data in the concession area in which the business operates, the existence of fires based on hotspot data monitored and efforts made by business operators to prevent forest and land fires—together with satellite imagery to the governor, regent or mayor and the relevant technical agency (article 15).

The second policy adopted through Government Regulation No. 4/2001 is raising community awareness as a preventative action to reduce LFF risks. It mandates that governors, regents, mayors, institutional and technical leaders and ministries, raise community awareness within their respective jurisdictions (art 42 Government Regulation No 4/2001). This includes educating government officials on their rights, duties and capabilities to prevent land/forest fires (article 42(1)). Other requirements include: developing and keeping values, *adat* institutions and traditional customary practices of the community to support land/forest protection (article 42(2)).

In addition, Government regulation No 45/2004 on Forest Protection also contains provisions on LFF prevention and mitigation. This regulation was issued to implement further the provisions in articles 46–51, 77, 80 of Law No 41/1999 on Forestry. The provisions on forest protection from fires are set out in article 18–31 of Government Regulation No 45/2004. The provision consists of prevention, repression and post-fire management. Article 23 of government regulation No 45/2004 (Table 6.3) states preventive actions such as:

Despite the progress described previously, we find that factors that challenge implementation of fire prevention and mitigation include: inconsistent policies, lack of law enforcement and corruption. Much research (e.g. Tacconi and Vayda 2006; Chokkalingam and Suyanto 2004; Dennis et al. 2005; Mayer 2006), including government reports (BAPPENAS 1998), and has shown that peatland conversion for oil



**Table 6.3** Government Regulation No 45/2004 on forest protection

Level of government	Preventive actions
At national level	To create forest fire risk zone mapping nationally
	Developing information on forest fires
	Develop partnerships with communities
	Develop standardization for forest fire control equipment
	Develop campaigns and community awareness programs on forest prevention
	Develop training on forest fire control
At provincial level	To create forest fire risk zone mapping provincially
	Develop socialization, campaigns and community awareness
	Conducting training on forest fire control
At regency/city level	Evaluating locations of forest fire risk zones
	Conducting campaigns and awareness raising for communities
	Creating technical guidelines for forest fire oppression
	Provide equipment for forest fires
At the level of forest production, protected forest and conservation forest, forest concession, and right forest	Inventories for the location of forest fire risk zones
	Identify the causes of forest fires
	Prepare fire brigades
	Provide fire equipment
	Provide the procedure for forest fire repression
	Establish fires breaks

palm plantation has caused massive LFF in Indonesia. Despite these findings, there is still legislation adopted which allows such land conversion. Government regulation No 71/2014 on Peatland Ecosystem Management and Protection allows the license holder to continue to operate in protected peatland until the license expires. For some environmental activists, this regulation is inadequate for protecting peatland as it compromises the interest of companies with the interests of peatland protection by effectively allowing companies to further degrade peatland. Following the LFF in 2015, Wetland Indonesia urged the government to issue a permanent moratorium on peatland conversion (Lingasari 2015). In fact, on the contrary, the president issued a Presidential Instruction 8/2015 that issued new and extended licenses for peatland conversion for the next 2 years from May 2015.

Lack of law enforcement is a major challenge, especially with regards to the governments' monitoring of companies practicing zero burning. Palmer and Engel (2007) suggested that the government has failed to regulate or monitor the environmental performance of Forest concession (HPH/HTI) operations. The management of the forest sector is weak. Staffs of the forestry administration are largely reliant on concessionaire reports to determine allowable cuts and thus, poor logging practices and breaches of regulations are difficult to detect (United Nations Center for Human Settlement 2000). Forestry legislation mandates limiting the granting of concession rights by considering the sustainability of forests and the certainty of business (article 31). However, this is often disregarded in the issue of concession rights by central and local government. This is perhaps because the legislation does not limit the number of permits to be granted. Zulkifli Hassan, the Minister of Forestry, stated in January 2011 that the Indonesian Ministry of Forestry issued almost 3 million hectares of new plantation concessions to 44 firms (Lang 2011).

Corruption in the forestry sector is rampant (Perdana 2015). According to the survey conducted by KPK in 2012, the Ministry of Forestry is considered the country's most corrupt institution (Dewan 2014). The forestry sector is susceptible to corruption in several ways, including: the misuse of the reforestation fund, concessions and permits for forest related activities and illegal logging (Dermawan et al. 2011). It has become a major issue which hinders forest fire reduction efforts, and takes place in the form of issuance of concessions and permits or ignorance for taking actions against offenders (Dewan 2014). The causes of corruption in Indonesia are facilitated by a number of factors including: large amounts of public resources derived from natural resources, vested interests and politically connected networks, poorly paid civil servants, low and weak regulations and poor law enforcement (UP4 Anti-Corruption 2012).

### 6.2.1.2 Institutional Frameworks

We argue that currently there are too many redundancies in the current institutional arrangements for preventing and mitigating LFF. There are too many agencies with unclear mandates in the previous regulation. The Presidential Instruction No 16/2011 is considered as a means of improving coordination between government institutions in controlling land/forest fires, which was not clear in the previous Government Regulation No. 4/2001. This regulation is indeed a significant improvement from the previous one, particularly as it improves the institutional framework. While the Presidential Instruction clarifies the roles of each agency, it is not yet enough on the coordination and cooperation between the national and local governments.

Presidential Instruction No 16/2011 contains a specific mandate to each government institution listed in the regulation. This regulation uses the framework of a multilevel governance approach in which addressing land/forest fires requires cooperation from various levels of government, vertically between central government institutions and horizontally between local and central government institutions.

The vertical dimension of multi-level governance recognizes that the national government cannot effectively address land/forest fires without working closely with local government, and expects local government to act in accordance with the legal framework at the higher level and enact the local regulation addressing land/forest fires (Morlot et al. 2009). The horizontal dimension of multi-level governance recognizes that improving coordination between sectoral institutions will deliver greater effective outcomes in addressing land/forest fires. The horizontal institutions in this regulation are, inter alia: the Ministry of Forestry, the Ministry of Agriculture, the Ministry of Environment, the Ministry of Research and Technology, the Ministry of Home Affairs and the BNPB (National Disaster Management Agency).

In this regulation, the Ministry of Forestry (Currently the Ministry of Forestry merged with the Ministry of Environment) has the specific tasks of: improving coordination with other institutions in controlling land/forest fires; improving the quality and quantity of human resources in controlling land/forest fires (through the fire fighting brigade *Manggala Agni*); to order forestry license holders to provide human resources and infrastructure in controlling land/forest fires; to give sanctions to license holders who do not implement activities in controlling land/forest fires; and to improve the performance of the *Penyidik Pegawai Negeri Sipil* (PPNS, civil service investigators) and *Polisi Hutan* (Polhut, forestry rangers) in enforcing the laws (Presidential Instruction No 16/2011). The Ministry of Forestry Regulation No. P12/Menhut-II/2009 on the Control of Forest Fires has mandated the establishment of institutions in national, provincial, regency and forest units which are called brigade forest fires control or *Manggala Agni* (article 22). The Ministry of Forestry has *Manggala Agni*, the fire brigade which is primarily mandated to protect and control land/forest fires in protected forest or conservation areas managed by the Ministry of Forestry, while other forest areas or community lands are a lesser priority. In order to coordinate forest fire control, the Ministry established the Center of forest fires control operation (article 24. The Ministry of Environment is appointed to improve coordination and provide technical assistance for regional and international cooperation related to land/forest fires. They also have a duty to coordinate rehabilitation of the environment following land/forest fires and to improve the performance of the *PPNS* and *Polhut* in enforcing laws related to mitigating and responding to LFF.

The Ministry of Research and Technology has a mandate to coordinate and provide assistance for prevention and recommendations of technology in opening land without burning. In addition, the Ministry of Research and Technology is mandated to coordinate assistance of fire fighting activities using weather modification such as cloud seeding to accelerate rain.

The Head of National Disaster Management is mandated to coordinate activities that reduce the risk of, and disaster preparedness in case of LFF; to give assistance in fire fighting operations at the municipal and provincial levels based on the condition and needs of local regions in controlling LFF; and to have a function as the leading institution in coordinating and mobilizing resources in controlling land/forest fires at the national level.

The Chief of the Indonesian Army has a duty to provide and mobilize army forces to help combating land/forest fires and the Chief of Police has a duty to increase the pre-emptive, preventive and repressive measures of law enforcement and to coordinate the process of forest fire investigations conducted by PPNS (Presidential Instruction No 16/2011).

The above discussion has outlined the legal and institutional framework for preventing and mitigation LFF. It shows that legislations are more focused towards mitigating risks from forest fires that from peatland fires. Institutionally, there have been multi-sectoral collaborations amongst institutions, but there are still drawbacks in terms of cooperation and coordination.

## ***6.2.2 Emergency Response Phase***

The key findings in the emergency and response phase are that while national governments have been more advanced in terms of outlining mandates and actions, different institutions and local governments, especially those in high risk areas, tend to have limited strategies for LFF emergency and response. They also lack the capacity to implement those strategies and decision making processes which involve vertical coordination between national and local governments are still too slow, bureaucratic and uncertain.

### **6.2.2.1 Legal Frameworks**

Government Regulation No 4/2001 stated the procedures on how to control forest fires. The regent or mayor is responsible for the control of wildfires in a region (article 30) and, in the event of a wildfire, must take the following actions:

- Checking the health of the community in the area affected by land/forest fires
- Measuring the impacts
- Informing the public about the fire's impact and the steps necessary to minimize such fires (Art 31).

However, it is suggested that the obligation of the regent/mayor in controlling land/forest fires does not therefore decrease the obligation of every person or business (article 31(2)). In conducting mitigation activities, the regent or mayor may seek assistance from the nearest regent/mayor (article 32) and must establish or appoint an institution authorized for controlling the wildfire (article 33). The regent/mayor conducts monitoring of efforts to control land/forest fires in their area (article 34(1)); the governor conducts monitoring of efforts to control land/forest fires that have an impact or are likely to have an inter-regency/city impact (article 34(2)); and the Ministry of Forestry conducts monitoring of efforts to control land/forest fires that have an impact or are likely to have an impact in adjacent provinces or neighboring countries (article 34(3)). The monitoring activities are conducted in a periodic

manner to prevent damage or pollution due to land/forest fires, and intensively to tackle the impact of fires and rehabilitate the environment following land/forest fires. If monitoring indicates a violation by a person responsible for a business, the governor/regent/mayor may order that person to stop the violation and act to save, handle and rehabilitate the area affected by the violation (article 38).

Every person who assumes and knows of the occurrence of land/forest fires must report the event to the local government authority in their area (article 39). The local government official in that area who receives the report should record the identity of the reporter, the date of the report, the time and location of the fire event, the cause of the land/forest fire and the assumption of impact of the land/forest fire (article 39(2)). The local government official should pass this report to the governor/regent/mayor within 24 h of receiving it (article 39(3)). The governor/regent/mayor should then verify the report's accuracy with local government within 24 h of receipt (article 39(4)). If, from this verification, it is indicated that there is an occurrence of a land/forest fire, the governor/regent/mayor must order the person responsible for the business to control the land/forest fire and to mitigate its impacts (article 39(5)). If the person responsible for the business does not conducting fire fighting, the governor/regent/mayor can ask a third party to fight the fire at the cost of the person responsible for conducting the business (article 40). Every person responsible for a business involved or a third party appointed to control the land/forest fire and rehabilitate the area afterwards should make a report to the governor/mayor/regent.

This procedure on reporting land/forest fires is overly bureaucratic and slow in responding to fires. The role of government institutions in these provisions is minor. The main actor in controlling land/forest fires is the person responsible for a business. This procedure could also be ineffective, as the cause of the land/forest fire might be due to local community activities rather than a business's activities. It is clear that the regulation places too much emphasis on the responsibility and obligations of business entities rather than responsibility of local government.

Similarly with Government Regulation No 4/2001, article 24 of Government Regulation No 45/2004 on Forest Protection suggested that, in response to fires, the concession holders have an obligation to extinguish fires by the following actions:

- To do early detection of fires
- To use all available resources to extinguish fires
- Create fires breaks to isolate fires
- To mobilize the community to control the forest fires quickly.

The concession holders should also make coordination with relevant institutions and community leaders to quickly extinguish fires, evacuation and litigation and prevent disaster and report the forest fires to mayor or regent. Based on this report, the mayor/regent mobilizes the fire brigade and coordinates with relevant institutions and community leaders. The regent/mayor then reports the forest fire to the governor and ministry as well as any action that was conducted to extinguish the fire. Based on this report the governor and ministry mobilise the fire brigade. Article 26 states that, in order to avoid the spread of forest fires, every person in the vicinity

of a forest is obliged to report forest fires to the village head, forest rangers or concession holders.

The governor/regent/mayor also has an obligation to make information available to the community on land/forest fires and their impacts (article 43(1)) Government Regulation No 4/2001, and provide results of monitoring (art 45). Finally, every person has the right to control land/forest fires in accordance with the law (article 46). This information should be distributed through print, electronic media and/or a public announcement board and should include details on the location and size of land/forest fires, actions to be taken to minimize the impacts, the danger to community health and the ecosystem, the impacts on community life and steps to take in reducing and mitigating the impacts. Furthermore, every person has the same right to information on controlling land/forest fires, including:

- Maps of fire prone areas
- Rankings of dangerous land/forest fire areas
- Documents of licensing or forest/land concessions
- Environmental Impact Assessment documents
- Plans on opening land/forest
- Regular reports from the person responsible for a business on the compliance of requirements for licensing

The weaknesses of the current legislation, is that it does not specifically mention when the local government should seek assistance and help from central government or when the evacuation needs to be conducted to minimize victims. The 2015 fires response was too slow as it prolonged more than 3 months. In addition, the slow responses indicated by the central government that they do not want to announce disaster status as a national disaster. The government argues that the announcement of forest fires as a national disaster will give advantage to the companies who conduct burning activities to be free from legal suit. Law No 24/2007 on Disaster Management states that it is the authority of central government to announce the status and degree of disaster, i.e. whether it is a national disaster or only a local disaster. The key to success in LFFRM is making it a national crisis, so all stakeholders and society may have the same attention and commitment in forest fire risk reduction. However, it is not possible to do since there is a dilemma when the government announces a national disaster, the culprits or offenders from companies can escape responsibility and legal liability.

### **6.2.2.2 Institutional Frameworks**

According to Presidential Instruction No 16/2011, the leading institution to coordinate all institutions in controlling land and forest fires is the Coordinating Ministry for People's Welfare. Even though in practice during forest fires in 2015 year, the Coordinating Ministry of Politic and Security was more dominant in coordinating forest fire responses (Nofitra 2016).

A more effective approach was taken by the president during the 2015 firefighting efforts. It was the first time that the National Disaster Management Agency (BNPB) was involved in firefighting. Previously, based on Government Regulation No. 4/2001 the Ministry of Forestry was the leading institution for controlling land/forest fires. BNPB was mandated to coordinate activities to reduce the risk of, and disaster preparedness in case of, land/forest fires; to give assistance in firefighting operations at the municipal and provincial levels based on the condition and needs of local regions in controlling land/forest fires; and to have a function as the leading institution in coordinating and mobilizing resources in controlling land/forest fires at the national level (Presidential Instruction No 16/2011). Mandating BNPB to do the job was considered more effective since they have greater capacity in terms of personnel, equipment and established plans of actions (Nurhidayah 2014).

The leading institution at the local government level is the BPBD (sub-National Disaster Management Agency) which falls structurally under the governor and reports its activities directly to the governor. There is no vertical responsibility between the BNPB and BPBD. For this reason, the BPBD only receives funding from the local government budget. According to the secretary of BPBD for South Sumatera, in an interview with the researcher, limited funding is one of the problems faced by local disaster management agencies in effectively controlling land/forest fires (Junaidi 2012). Greenpeace also states that investment in forest fire protection is low in terms of human resources such as forest fire-fighters, forest investigators, equipment and early warning systems, (Deen 2013). Usually, local government allocate only 0.02% of the *APBD* budget for disaster management (Maharani 2015). In fact, local governments who anticipate forest fire disaster can increase their budget, for example, in 2016 the Riau province was allocated an increase to 20 billion from 2, 1 billion Rupiahs (Ryan 2015). In terms of enhancing the capacity of BPBD, there should be a specific task for BPBD based on the characteristics of the vulnerability of the region, for example in Riau, Jambi and central Kalimantan the BPBD should focus on improving LFLM capacity. BPBD handle all kind of disasters, including fires. Due to the wide scope of their remit, controlling fires has not been a top priority.

The governor is mandated to enact Governor Regulations for controlling land/forest fires and to maximize the role and function of the BPBD as a coordinating institution in controlling land/forest fires. In provinces in which the BPBD has not been established, governors should maximize the role and function of local leading institutions in controlling land/forest fires, allocate funding from the provincial budget for controlling land/forest fires and strictly sanction businesses that do not control land fires. At the municipal level, the mayor/regent has a mandate to enact Mayor/Regent Regulations to control land/forest fires, maximize the role and function of the BPBD as the leading institution in controlling land/forest fires, control land/forest fires in their area and allocate a budget for the implementation of land/forest fire controls.

Many institutions are involved in disaster management in Indonesia. These include the institutions that conduct risk assessment and risk mapping by the National Coordinating Agency for Surveys and Mapping (Bakosurtanal), issue early

warnings mostly by the Meteorological Climatologically and Geophysical Agency (BMKG), and undertake land-use/spatial planning by various agencies. However, not all institutions are listed in the Presidential Instruction No 16/2011. The Meteorological Climatologically and Geophysical Agency was not mentioned despite its mandate as the agency to conduct early warning during El-Niño season (BMKG 2016). In addition, the Ministry of Health was not mentioned despite its crucial role in mitigating the impact of haze pollution on community health (Depkes 2015).

The above discussion has shown that there has been much progress in the legal and institutional frameworks that deal with LFF in the emergency and response phase. However, fragmented and lack of strong legislation, specifically addressing land/forest fires and peatland fires as well as detailed cooperation and coordination in the regulation between all these institutions, hinders the effectiveness of the regulation. In addition, lack of local government funding, capability and resources hinder firefighting activities on a large scale.

### ***6.2.3 Recovery and Rehabilitation Phase***

There are two key findings for this phase. First there is a lack of law enforcement to major offenders, and also second, rehabilitation of degraded land is still done comparatively on small areas only. Companies that open land using fire are rarely brought to justice, as there is generally not enough evidence to prove that the company is guilty of conducting burning activities. In terms of rehabilitation, reforestation has never reached its targets and is far below the area logged and cleared.

#### **6.2.3.1 Legal Frameworks**

Concerning rehabilitation, article 20 of Government Regulation No 4/2001 states that every person who has caused a land/forest fire is required to conduct rehabilitation. In addition, article 21 states that a person responsible for a business has an obligation to carry out rehabilitation of areas affected by wildfires in their operations. Further, technical guidelines on environment impact rehabilitation should be issued by local regulation. If these general and technical guidelines have not yet been provided, the rehabilitation should be in accordance with existing valid regulations.

Article 27 of Government Regulation No 45/2004 states that, in post-fire rehabilitation several activities should be conducted, including identification and evaluation, rehabilitation and law enforcement. Article 30 states that the concession holders are responsible for forest fires in their work location. Their responsibility includes: criminal responsibility, civil responsibility, paying for damages and administrative sanction.



Previous environmental protection law has suffered from a lack of enforcement, which remains a major problem with the new law. Tan (2005) argues that in *‘Indonesia the judiciary is frequently paid-off to prevent conviction of high profile figures behind illegal logging and forest fires’*. In the aftermath of forest fires in 1997, for example, of 176 companies identified as violators, only five were brought to court, and only one was found guilty (Tan 2005). Based on these cases of forest fires, it is clear that only small numbers of companies have been brought to justice since 1997. Therefore, there is a need to encourage the use of sophisticated technology for monitoring LFF and using it as legal evidence to bring offenders to justice, for example, by using Unmanned Aerial Vehicle (UAV) technology, or drones, complemented by high resolution imaging and radar for monitoring and mapping (Pradana 2014).

### 6.2.3.2 Institutional Frameworks

According to Presidential Instruction No 16/2011 on the improvement in controlling land and forest fires, the Ministry of Environment (currently the Ministry of Environment and Forestry) is mandated to improve the coordination in rehabilitation of the environment due to land and forest fires. In addition, as a result of land/forest fires in 2015, Joko Widodo will establish a new special institution to rehabilitate, restore and recover peatland damage due to forest fires. This Peatland Restoration agency was established to work for a 5 year period until 2020 by Presidential Regulation No 1/2016. The government has estimated that peatland restoration needs a fund of around 25 billion Rupiahs to rehabilitate 2 million hectares in 5 years in Riau, Jambi, South Sumatra, West Kalimantan, Central Kalimantan, South Kalimantan and Papua (Sawit Indonesia 2016). The priority for implementation is in the Pulang Pisau regency, Central Kalimantan, Musi Banyuasin and Ogan Komering Ilir South Sumatra and Meranti island Regency Riau. This agency is led by the head and appointed by the President. This agency’s work is supported by technical teams from various departments include the Ministry of Home affairs, the Ministry of agriculture, BAPPENAS, the Ministry of Public Works, The Ministry of Spatial Planning and Agraria and teams of experts (e.g. from universities, research centers, professionals and communities).

## 6.3 Land and Forest Fire Risk Management at the Sub-national and Community Level: South Sumatera and Central Kalimantan Provinces

The study complements the research to examine legal and institutional progress at the local government level in Indonesia. Law No 23/2014 on local government further complicates efforts in LFF management, as according to this law, in article 14,

governance of forests is divided between central government and provincial government. This means that from this provision, the regency/municipal level is only responsible for managing *Tahura* (forest park conservation area) and will not be responsible for managing protected forest. The reduction of this authority will have an impact on forest fire prevention and emergency response in extinguishing fires. The disadvantage is that the provincial level now has a huge task to control all prevention and emergency response and rehabilitation activities, while previously this responsibility was also managed at the regency level. Lack of staff at provincial level for monitoring and law enforcement will make it difficult to manage land/forest fires. The advantage is, however, that deforestation and forest degradation is expected to be reduced.

The findings suggest that, generally, a lack of plans for prevention and financial and technological resources has hindered efforts to manage LFF risks at the local level. Moreover, a lack of community engagement in community-based fire management programs and the failure of local government to provide sustainable livelihood options at the community level, have exacerbated the effort in mitigating forest fires. The two provinces in Sumatera and Kalimantan are selected since they are the two islands where the fires occurred.

### **6.3.1 South Sumatra Provinces**

In general the local governments in South Sumatra province have failed to effectively implement prevention and mainstreaming of DRRM into development processes. The authors find that a lack of resources and capability of institutions, mainly government, has hindered the government to effectively respond to forest fires on a large scale. Fires in South Sumatera occur due to development activities. Because commodity prices for rubber, pulp and oil palm products have risen since 2004, and this upward trend is continuing, both local community/smallholders and companies are interested in investing in these sectors. This has resulted in additional land clearing and massive burning of new areas for plantations. In addition, local villagers seek additional income by practicing '*sonor*'<sup>1</sup>, which results in a good and abundant harvest for low maintenance costs. Thus, the local governments have failed to effectively implement prevention and mainstreaming of DRRM into development processes as land clearing for plantations in peatland areas using fire occurs every year.

#### **6.3.1.1 Prevention and Mitigation Phase**

There is no specific local regulation in South Sumatra established to prevent and mitigate land and forest fires. Local government is mandated by Presidential Instruction No. 16/2001 to enact local regulation to address land/forest fires.

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<sup>1</sup> Sonor involves paddy cultivation in peatland areas using burning practices.

The only local regulation to date is a *maklumat* (announcement) imposing criminal sanctions for the burning of forest or bush (Taufik interview in 2012). This *maklumat* is released during dry spells or forest fire incidents. It is signed by the governor, local head of police, local head of army and head of attorney. The criminal sanctions of this *maklumat* are derived from the Criminal Code, Agriculture Law, Forestry Law and Environmental Law (Taufik 2012). The sanctions imposed on the offender are based on these laws. For example, article 108 in Law No 32/2009 on Environment and Management Act, states that every person who conducts burning and causes land/forest fires is given a minimum of 3 years imprisonment (maximum 10 years) and a penalty of at least 3 billion but up to 10 billion rupiah.

The prevention of forest fires was the most important measure in fire management, and sought to secure the participation of, and give roles to, rural communities and stakeholders (Setyono 2007). Local government through Forest fire control unit Forestry Department established *Regu Desa* (village groups) containing ten local people in particularly fire prone villages and trained them. Based on the interview with the head of South Sumatra Forest Fires Control in Palembang, there are 210 villages in fire prone areas in South Sumatera, mostly in the Musi Banyu Asin, Banyuasin and Ogan Komering Ilir regency's areas, and 2500 local community members have already been trained (Taufik 2012). However, the lack of continued funding for the project, lack of a sense of stewardship or ownership and a lack of community decision making, indicates the failure of these types of Community Based Fire Management projects.

### 6.3.1.2 Emergency Response Phase

BPBD is the leading agency in extinguishing forest fires and providing support in terms of coordination between all actors involved. In regards to fire prevention and suppression in the overall disaster management system, there is a lack of capacity, as the BPBD lacks financial and technical resources. These factors effectively contribute to the failure in controlling land/forest fires. In the event of massive fires, local government usually requires help from the BNPB to control fires and from BPPT to make artificial rain by seeding clouds. In addition, the Indonesian army may also be deployed during massive forest fires to help the local government to extinguish fires. However, in El-Nino season, the coming of monsoon season is the only effective way to extinguish fires as cloud seeding is difficult.

While villagers do have local knowledge, particularly on the suitability of land for cultivation (Achyar and Kimman 2007), sometimes local practices only focus on short-term socio-economic purposes, without taking into account the preservation of natural resources and environmental protection (Achyar and Kimman 2007). Fires occur due to uneven distribution of knowledge in the community and a general lack of equipment and budget (Achyar and Kimman 2007).

According to Hasanuddin, (during an interview in 2012) long-existent local knowledge has disappeared or been degraded. For example, '*Simbur Cahaya*', written customary laws that regulated farming, were inherited from the Palembang Kingdom.

Based on these laws, whenever members of a village proposed to conduct burning practices they were required to give notice to everybody in the village. The notice was delivered by hitting a *kentongan* (warning tool), which produces a distinctive sound. A fine of 12 Ringgit was imposed if a villager violated this regulation. If the fire leapt into the forest and caused damage, the offender was also given a fine of 12 Ringgit. However, according to Purna (during an interview in 2012), a forestry official in South Sumatera Province, this customary law is no longer in use.

### 6.3.1.3 Recovery and Rehabilitation Phase: Government and Community

The local government has limited funding/budget to carry out rehabilitation programs after forest fires. Only Central government allocates land and forest rehabilitation at a cost of around 4–5 million rupiah/hectare. For forest restoration, this is not enough. Consequently, many land and forest rehabilitation programs were never successful. According to the Forestry Provincial Agency, the scope of land that has been rehabilitated due to land/forest fires is only 200 ha per year (Admin Palembang 2016). This figure is far below the area of land degraded due to land/forest fires. According to LAPAN, the area burned because due to forest fires in 2015 in South Sumatra is 359,100 ha (Puspitasari 2015). Therefore, the local governments invited assistance from international donors in the Netherlands, the UK and Norway to restore the peatland (Ujang 2016).

In terms of law enforcement, there were three companies suspected of conducting burning practices during land and forest fires in 2015: PT Roselindo Putra, PT Bumi Mekar Hijau, and PT RPS. One of the companies, PT Bumi Mekar Hijau, has been brought to justice. However, the judge dismissed the legal suit from the Ministry of Environment and Forestry to seek compensation from PT BMH of around 7, 9 billion rupiah (BBC 2016). The judge, Parlas Nababan, stated that it is not proven the PT BMH did damaging activities to the environment, and that burning activities do not cause damage to the environment as plants can grow again in the affected area (BBC 2016).

The community is part of stakeholders in the recovery and rehabilitation phase. In a REDD + pilot project, for example, the government together with the community conducted a program called Community-Based Rehabilitation of Peatland Forest. However, this program is not sustainable as when the project ended, the community rehabilitation project also stopped. To date, there has been no continuation of the rehabilitation project.

In summary, the discussion on the LFFRM in South Sumatera Province shows that in terms of prevention, local governments in South Sumatra province have failed to effectively implement prevention and mainstreaming of DRRM into the development processes. In terms of emergency response, the authors find that a lack of resources and capability of institutions, mainly government, has hindered the government to effectively respond to forest fires. In terms of the recovery and rehabilitation phase, the local government has limited funding/budget to carry out rehabilitation programs after forest fires.

### **6.3.2 Central Kalimantan Provinces**

Similarly with South Sumatra, local governments in Central Kalimantan province have failed to effectively implement prevention and mainstreaming of DRRM into development processes. This is despite local government being more advanced than South Sumatra in terms of regulations and institutional framework. However, the local regulation in controlling land/forest fires is not enforced and emergency response is reactive in approach. A lack of capacities and funding hinder the local government to effectively put out fires and recover and rehabilitate peatland.

In Kalimantan, land/forest fires are often triggered by shifting cultivation practices and the clearing of land by local people seeking to claim ownership of the land. Conversely, according to Arie Rompas, (during a fieldwork interview in 2012) the executive director of Walhi, an NGO concerned with environment in Central Kalimantan, forest fires are not down to the practices of local people at all (Rompas 2012). Rather, he suggests that government policy has created an environmental disaster (Rompas 2012). He states that there are three main problems: Forest degradation from forest conversion. During 1997, a massive conversion of peatland into a 1 million hectare Mega Rice Project ended up as a failure and ecological disaster (Rompas 2012). This ex-Mega Rice Project was located in a peatland area where fires reoccur every year because the area is already open. This expansion of land clearing by companies is the major cause of haze pollution and forest fires.

It is clear that the community is not to blame for this disaster; before this project, the Dayak community practiced slash-and-burn activities, causing no land/forest fires until recent times. Arie Rompas (2012) suggested that local people are being used by investor/company to do slash and burning on the company concession land. Local people themselves seemed quite unsure about the causes of land/forest fires. Some stated that the fires are caused by people from outside their village; others thought the fires originated from other villages (Syahrir 2012). They could not identify the persons who conducted the burning or the source of the fire due to the vastness and remoteness of the area (Syahrir 2012). The head of the village of Jabiren Syahrir, during interview in 2012, gave the cause as the ignorance of local people of the impact of using fire in clearing land. There is no sense of stewardship. He further stated that these fires are both intentional and accidental, such as from the activities of farmers clearing land for rice fields using fire and/or discarding cigarettes butts without extinguishing them (Syahrir 2012).

#### **6.3.2.1 Prevention and Mitigation Phase**

The local government in Central Kalimantan has established local regulations in controlling land and forest fires. This regulation is intended for communities not companies. However, the local government caused criticism during the massive forest fires disaster 2015 as it allows local people to do burning activities. Local Government Regulation No. 5/2003 concerning Controlling Land/Forest Fires

assigns some permits to conduct burning activities. Article 2(1) state that every person is prohibited from conducting land/forest burning activities. However, according to article 2(2) for special purposes, land/forest fires can be conducted if a government permit is obtained. To implement this controlled burning policy, the local government enacted Governor Regulation No. 52/2008 on the Guidance of Opening Lands and Yards for the Community in Central Kalimantan as amended by Governor Regulation No 15/2010.

Article 2 of Governor Regulation No. 52/2008 states that every person can open land and yards in new locations both in and outside *adat* territory by considering spatial planning. Every person who opens the land using fires should conduct controlled burning after getting a government permit. Land opening for the purpose of plantations can be conducted by controlled burning in the first year only and in the second and third year, the land should be managed without burning. For rice fields or farming, controlled burning should be conducted. After the rice field is free from tree or biomass debris, it should be managed by opening land without burning. In addition, for peatland areas, every person who opens peatland for rice fields, farming or plantations should note that, when burning shallow peatland for the first time, controlled burning can only be conducted outside the dry season. No burning activities are permitted on deep peatland; that is, peatland more than 50 cm deep. Every person who conducts land clearing not for farming, plantation or rice field purposes should apply controlled burning and not conduct it in the dry season.

As mentioned, before conducting controlled burning, farmers are required to obtain a government permit, generally from the regent/mayor. However, for a land area less than 2.5 ha, the authority to give a permit is the head of district for 0.5–2.5 ha, head of village for 0.1–0.5 ha and head of *RT* (neighborhood association) for up to 0.1 ha. The permit proposal should include the consent of the owners of the land adjacent to the area of proposed controlled burning. Governor Regulation No. 52/2008 also regulates in detail how to conduct controlled burning. For example, the person who conducts controlled burning is not allowed to leave the land until the fire has stopped and is to inform the owner of neighboring or adjacent areas before conducting controlled burning. Controlled burning is conducted through *gotong royong* or mutual aid from 15.00 to 18.00 o'clock. Despite these provisions, according to an interview conducted by the researcher with Unjung (2012), a *Sekdes* (secretary of village) of Tanjung Taruna village Central Kalimantan, the regulation is not enforced, and no permits are sought by the community before conducting burning activities (Unjung 2012). In addition, no permits are available at the village level, as required in the [Appendix](#) to the Regulation (Unjung 2012).

There is a lack of local engagement in Community Based Fire Management (CBFiM). The communities are busy earning money to support their livelihood (fieldwork interview with Syahrir 2012). It is observed that poverty rates in peatland areas are much higher than elsewhere in Indonesia, and without alternative sustainable development options local communities will be forced to over-exploit the remaining peatland, increasing the fire risk (Harisson et al. 2009). In addition, the lack of awareness of local people is contributing to the failure of current action to eliminate forest fires. Based on interviews with local peoples in Central Kalimantan,

many local people are unaware of how their actions contribute to the problem (Nurhidayah 2012), and adequate preparations for early fire control are generally not in place (Harisson et al. 2009). Aswin Usop (fieldwork interview in 2012) suggests actions that governments need to take to reduce land/forest fires: improve the incomes of local people; utilize abandoned land as a source of income, using technology or agriculture to open the land; and educate the local community.

### 6.3.2.2 Emergency Response Phase

In terms of forest fire response at the local level, there is also an attempt to apply an integrated multi-governance approach where many sectoral institutions are involved in combating land/forest fires. For example, Central Kalimantan enacted Governor Instruction No.188.44/228/2012 on integrated institutional structures in addressing land/forest fires. However, arguably the structure is a more reactive approach. Someshwar et al. (2013) argue that the current institutional structure and capacities in Central Kalimantan present several challenges in achieving the needed collaboration across agencies, and the scales for anticipatory action. Specifically, current institutions are set up exclusively to react to the occurrence of fires rather than anticipating and seeking to reduce fire risks. In practice, the governance of fire suppression is a one-way and top-down approach: regulations are promulgated at the provincial level, policed at the district level and acted upon at the village and farm level. However, risk and rewards for villagers in fire management are not fully appreciated at the provincial and district level. Unreliable access to communication and the high diversity of local fire situations contrast with the use of a hierarchical approach to information dissemination and use. There is a propensity to work through government agencies, and a reliance on a '*command and control*' approach, rather than an approach characterized by participation and stakeholder value maximization. There is also an undue emphasis on penalties, rather than incentives, for the use of fire (Someshwar et al. 2013).

Community response takes the form of individual or group efforts to prevent and control peatland fires on their own land (e.g. on plantations). Community fire brigades, established by the local government to put out peatland fires, are slow to act. In Central Kalimantan, particularly in Pulang Pisau district, in Jabiren, Pilang and Taruna villages, many local communities own rubber plantations. When the fires spread during the dry season, the land/plantation is protected by the owner (fieldwork interview with Deni 2012). They do their own monitoring and try to extinguish the fires by themselves, as individuals or in groups (Asok 2012). The community usually asks for help from *Manggala Agni*, but this rarely comes.

The owners of rubber plantations usually hire people to help put out and monitor fires to save the plantation (fieldwork interview with Asok 2012). Usually, five people are hired (Asok 2012). These workers are paid and given food, and can be expected to work for three or 5 days, depending on the nature of the fire (Asok 2012). Rubber farmers also buy their own firefighting equipment, such as water pumps, fire hoses and hose reels, or they use traditional equipment such as water buckets. No help comes from the village or government institutions (Deni 2012).

### 6.3.2.3 Recovery and Rehabilitation Phase

In terms of rehabilitation, it is not conducted properly. It is suggested that reforestation has never reached its targets and is far below the area logged and cleared (Rompas 2012). The same applies in Kalimantan. According to an interview the researcher conducted with Suseno (2012), a local government official in Palangkaraya, despite Presidential Instruction No. 2/2007 on Acceleration of Rehabilitation of the ex-Mega Rice Project in Central Kalimantan, implementation is very slow. Suseno (2012) further argues that there is a lack of funding for this rehabilitation, suggesting that the central government is not committed to supporting it. According to the head of village for Jabiren, Shahrir, (fieldwork interview 20 September 2012) rehabilitation is also not conducted properly. It is conducted in forestry areas only, while open peatland areas are not yet being rehabilitated (Syahrir 2012).

The discussion on the LFFRM in Central Kalimantan Province shows that the local government failed to prevent and control land and forest fires through local government regulation as it is hardly enforced and implemented. In addition, a lack of capacity, resources and technology hinder the local government to effectively respond to forest fires and their recovery and rehabilitation.

To sum up the findings from both provinces, the discussion shows that the local government failed to address land and forest fires from every level of DRRM stages from prevention and emergency response through to recovery and rehabilitation.

In the prevention and mitigation phase, both provinces show that the government hardly enforced zero burning and controlled burning policies. Companies and communities are still practicing land clearing using fires in dry season. Burning using fire is the cheapest method in land clearing for plantation preparation and there is currently no alternative for this practice.

In the emergency and response phase, both provinces show a lack of capacity and resources, which hinders the effectiveness in controlling large scale land/forest fires e.g. due to el-Niño season.

In the recovery and rehabilitation phase, both provinces demonstrate a lack of funding and resources for rehabilitation, which hinders its effectiveness. Therefore, recovery and rehabilitation still focus on small areas of burnt and degraded land.

## 6.4 Conclusion

The following important points summarize the above findings and suggest recommendations for addressing the gap in the current legislative and institutional frameworks for LFRRM. In general, the current national regulations are fragmented; addressing different issues in different legislations and sub-legislations, while there is slower progress at the lower governance level at different stages of LFFRM.



At the national level, we specifically find the following. *First*, the institutional and regulatory framework managing land/peatland fires is not integrated with those of forest fires. *Second*, lack of law enforcements hinders prevention and mitigation. It is the major drawback to effectively implementing a zero burning policy as prevention and mitigation strategies. Indonesia's judiciary is frequently paid-off to prevent conviction of high profile figures behind illegal logging and forest fires. The moratorium of peatland conversion has been not effective since it is only valid to new concessions while old concessions still operate. This has lead to further degradation of peatland due to unsustainable oil palm plantation and has been the major cause of massive land/forest fires in Kalimantan and Sumatra. *Third*, the current institutional and regulatory frameworks are still very much focuses on emergency response, while recovery and rehabilitation is not conducted strategically. There are still huge areas of degraded land due to land/forest fires that have not yet been rehabilitated.

The *next* finding is that there is inefficient and slower progress at the lower governance level at different stages of LFFRM. Two provinces (South Sumatra and Central Kalimantan) generally have no specific strategies for different phases, lack the capacity to implement any existing strategies and local fire response strategies are slow, too bureaucratic and uncertain. Moreover, a lack of community engagement in community-based fire management programs and failure of local government to provide sustainable livelihood options have exacerbated the effort in mitigating forest fires. For forest fire response, local government lacks resources (funding, personnel, and technology) and the capability of institutions to control and extinguish massive peatland/ forest fires, and rehabilitation is not conducted properly.

In summary, this study has shown that the LFRRM framework enable us to do analysis of current progress and challenges of current legal and institutional frameworks for land and forest fires, at different stages from prevention and mitigation, to emergence, and rehabilitation, We have been also to point out current deficiencies in the relationships between national and local governments. We recommend that governments, from the national to sub-national and local levels, to develop more comprehensive and multi-sectoral approach with community-based livelihood activities at its core, and to have more commitment for and stricter law enforcement especially towards those in the private sector and companies responsible for large-scale fires. We call for improving the current institutional framework for emergency response, particularly concerning the coordination, provision of resources and capability of institutions in responding to land and forest fires. This study hopes to contribute towards the achievement of the Sendai Framework for DRR in reducing risks and losses towards disasters as well as the continuing progress in mitigation and adapting to climate change, which consequently contribute towards the achievement of the Sustainable Development Goals.

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## Appendix

### ***1. Central Kalimantan Governor Instruction No. 188.44/228/2012 concerning Integrated Institutional Structure in Central Kalimantan in Controlling Land/Forest Fires.***

No	Main position	Position in team
1	Governor Central Kalimantan	Team leader
2	Head of House Representative Central Kalimantan	Steering committee/adviser
3	Chief of Police Central Kalimantan	Adviser
4	Chief of Army Panju Panjung	Adviser
5	Head of Attorney Central Kalimantan	Adviser
Main team		
1	Vice Governor Central Kalimantan	Chairman
2	Secretary of Region Central Kalimantan	Daily chairman
3	Assistant Economic and Development Central Kalimantan	Vice chairman
4	Assistant Government and Welfare	Vice chairman
5	Assistant General Administration Setda Central Kalimantan	Vice chairman
6	Head of Dinas Pertanian dan Peternakan (Agriculture and Husbandry) Central Kalimantan	Coordinator in implementing opening the land without burning and controlling land fires in agriculture land, horticulture and husbandry areas
7	Head of Dinas Perkebunan (Plantation) Central Kalimantan	Coordinator in implementing opening land without burning and controlling land fires in big plantation areas and community plantation
8	Head of Environment Agency Central Kalimantan	Coordinator in implementing campaign and controlling air quality
9	Head of Regional Disaster Management Agency (BPBD) Central Kalimantan	Secretary
10	Head of Prevention and Preparedness section BPBD Central Kalimantan	Vice secretary
11	Head of Communication and Information Central Kalimantan	Member
12	Head of Health Service Central Kalimantan	Member
13	Head of Public Work Service Central Kalimantan	Member
14	Head of Food Security Agency Central Kalimantan	Member
	Coordinator	

No	Main position	Position in team
A	Early Warning System	
	Head of Meteorology Agency (BMKG)	Coordinator
	Coordinator Center of Environment Information	Member
	Environment Agency	
	Head of ORARI	Member
	Element of Korem (Army)	Member
	Element of Police	Member
B	Fire-fighting forest, land and yard	
	Head of Forest Service	Coordinator
	Head of BKSDA	Member
	Head of Social Service	Member
	Brigdalkar Polda (Police)	Member
	Brigdalkar KOREM (Army)	Member
	Kabid Emergency and logistic BPBD	Member
	Mangala Agni (Fire Brigade)	Member
	Tagana	Member
	Brigdalkar Bandara Tjilik Riwut	Member
	Brigdalkar Forest Service	Member
	Brigdalkar General Biro Setda Kalimantan Tengah	Member
	Cintrop UnparWWF Central Kalimantan	Member
	CARE Central Kalimantan	Member
	BOS Mawas Central Kalimantan	Member
	KFCP Kalimantan Tengah	Member
	Walhi Kalimantan Tengah	Member
MADN Kalimantan Tengah	Member	
	Member	

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# Chapter 7

## Disaster Education and School Safety Governance after the 2004 Indian Ocean Tsunami in Indonesia: From National Policy to Local Implementation

Mizan Bustanul Fuady Bisri and Aiko Sakurai

**Abstract** The 2004 Indian Ocean Tsunami incentivized policy change in Indonesian disaster risk reduction, including disaster education and school safety governance. However, much research focuses on the results of pilot projects and rarely addresses policy change comprehensively from national to local levels, and across sectors. As such, little progress has been made in designing policy that ensures all-schools implementation.

This chapter aims to review the progress of disaster education and school safety governance from the national and local levels. We focus on the elementary school level due to its importance in educating a new generation that may not have experienced disasters. Since disaster education and school safety is not an exclusive domain of disaster management policy, the state of policy convergence and coherence is assessed using discourse network analysis and content analysis. At the local policy level, the chapter describes a case from Banda Aceh city. It shows that although the city received various programs, implementation of disaster education and school safety is not attainable for all elementary schools, particularly due to the absence of city-wide policy.

Accordingly, this chapter identifies the necessary policy instrument to ensure city-wide implementation of disaster education and school safety. The findings show that the best solution is to have a ministerial-level regulation in the education sector, combined with a local regulation (*Perda*) or mayor/regent regulation, which can ensure the use of a public budget. Availability of a policy directives or action plans at school level could be useful in obtaining the money and technical capacity

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needed for all-schools implementation. This in turn, will ensure coherence and connectivity between various policies from local government, disaster management and education to close the gap between national policy and local implementation of disaster education and school safety governance in Indonesia.

**Keywords** Disaster education • School safety • Governance • Discourse network analysis

## 7.1 Introduction

After the 2004 Indian Ocean Tsunami (IOT), there were numerous investments made in structural and non-structural disaster risk reduction (DRR) in Indonesia, particularly in Aceh Province and Banda Aceh city (BNPB 2015). The IOT has proven to be Indonesia's 'focusing event', i.e. a sudden, relatively rare, harmful event that focuses policy makers and the public simultaneously on the possibility of greater potential harm for a definable geographical area or community (Birkland 1997), that initiated multiple policy changes. For example, the enactment of disaster management Law 24/2007 and subsequent establishment of the National Disaster Management Authority (BNPB) and its local counterpart (BPBD) at provincial and municipality level (Djalante et al. 2012)

Law 24/2007 asserts (disaster) education as the right of the people (article 26-1-b). In particular, education and training are stated as part of disaster management in a situation without disasters (article 35-g) and as part of disaster mitigation efforts (article 47-2-c). However, the law itself does not define clearly what constitutes disaster education, yet provides room for other governmental policy/regulation to make a working definition (article 43). In the area related to disaster education and school safety, the government of Indonesia (GoI) claimed general achievement on the integration of DRR into the education sector i.e., within school curricula, teacher training on DRR education and school preparedness (BNPB 2015). The country also joined the launch of One Million Safe Schools and Safe Hospitals as the global targets (UNISDR 2010) and has set a high-level policy on school safety, namely the BNPB Regulation 4/2012 on safe schools and *madrasah* (Islamic-based schools).

However, in reality disaster education and school safety is not only the 'policy domain' of the disaster management but is also contested with other governmental affairs, particularly with the education, and to some extent, public works. As this chapter is situated to assess the governance of disaster education and school safety in relation to implementation at all normal public and private elementary schools, it is limited to disaster management, education and public work sectors where related institutions and regulations have direct implementation power and authority. As such, up until now multiple pilot programs related to disaster education and school safety have not been translated into nationwide implementation or even at the local level. One possible cause is the complexity of polycentric governance in Indonesian disaster management (Lassa 2015), which requires follow up in a specific focus,



such as in disaster education and school safety. The authors would like to argue that the partial connectivity between regulations in disaster management, education and public works hinders nation-wide implementation of disaster education and school safety. Disaster education can also be viewed as a subset of the education sector in general. Thus, the general challenge in the Indonesian education sector to make its governance more responsive (OECD/ADB 2015) is also true for some specific issues, such as disaster education and school safety.

Furthermore, the country faces some challenges in scaling up programs and ensuring its sustainability, as shown by the lack of published research assessing challenges associated with the implementation of DRR within schools curricula (Amri et al. 2016). The Indonesian situation may be a typical case whereas internationally the guarantee of effective outcomes, sustainability and scaling-up are the main issues related to DRR implementation within the school curricula (Ronan 2014). From the government side, the issue of lack of coordination between central, provincial and local government was acknowledged, although the policies claimed to be in place at the national level (Suharwoto 2014). Out of 258,000 schools in Indonesia, 75% of them are located in disaster prone areas and built in the 1980s (MoE 2015) in contrast to the completion of 25,620 pilot safe schools (Suharwoto 2014). Clearly, the country needs to move on from a pilot project approach to an institutionalized one that may ensure full school coverage.

This chapter intends to answer the following key-questions:

- Does regulatory coherence and connectivity exist in the contested policy domain of disaster management, education and public works for ensuring disaster education and school safety implementation?
- And if not, what are the key and necessary policy instruments that should be introduced?

The objective of the chapter is to review current progress in policy and implementation of disaster education and school safety governance in Indonesia and to propose strategies to strengthen it. The aims of this chapter are threefold:

- To review Indonesian disaster education and school safety policy and identify current progress and gaps in regulatory frameworks (from the national to local level in Banda Aceh city).
- To identify and analyze local policies and implementation of disaster education and school safety at elementary school level in Banda Aceh city.
- To propose policy instruments and strategies to ensure more policy coherence on disaster education policy at different governance levels and to ensure continued disaster education and school safety at local and school level in Indonesia.

At both levels, the regulatory ties of the contested policy domain of disaster management, education and public works will be analyzed. In contrast to Amri et al. (2016) who stress the importance of scaling-up, the authors propose that, after tracking the current progress of disaster education and school safety governance, the most important element is the provision of indispensable policy instruments that implement disaster education and school safety in all schools throughout Indonesia.

As noted by Shaw and Oikawa (2014), it is important to look at policy and its evidence-based actions for measuring political commitments for safe schools and disaster education.

This chapter is structured into six sections. The first section introduced the context of this chapter and described the status quo of disaster education and school safety governance in Indonesia. The second and third sections respectively, outline the methodology and a literature review on the topic, based mainly from an Indonesian perspective and relevant scholarly works. Results on policy level analysis and regulatory network analysis on disaster education and school safety at both national and local levels are provided in section four. The final section is a conclusion and identifies sets of necessary policy instruments to ensure implementation of disaster education and safety measurements in all schools.

## 7.2 Methodology

Data collection involves semi-structured interviews with disaster management and disaster education officers and practitioners in Indonesia and particularly Banda Aceh City; i.e. the Ministry of Education, National Disaster Management Agency, disaster management and education agencies at Aceh Province and Banda Aceh City, as well as some non-government organizations. In a series of visits between 2014 and 2015, the authors also conducted in-depth interviews with headmasters and teachers in 47 public elementary schools within the inundation area of the 2004 IOT (Sakurai et al. 2015). The authors treat Banda Aceh city as case study on the implementation level of disaster education and school safety governance.

There are two foci in this paper, the national and local level, and the overlap of policy-domains between disaster management, education and public works governmental sectors. For each level, we have set specific methods for analysis. To analyze the long-term review and capture the current status of disaster education and school safety governance after the IOT, process tracing and qualitative content analysis is conducted to assess whether or not actual policy change and socio-political learning takes place. The authors compiled various policy documents to review disaster education and school safety governance, by using typology of evidence of learning (Birkland 2006), as presented in Table 7.1, e.g. 5-years strategic plan, annual working plan, annual performance report and school annual plan. Text mining on those documents was the main data input for the subsequent discourse network analysis (DNA). The most tangible evidence of policy change is new legislation and regulation (Birkland 2006), which is specific to disaster education and safe schools. Birkland (2006) noted that whether or not learning occurred is a qualitative judgment that must be made within the context of each case study. That being said, in the long-run measurements must be done by looking into implementation of policy instruments after a disaster for detecting policy decay and how it relates to other regulations and policies, as we have tried to show for the 2004 IOT.

**Table 7.1** Typical evidence of learning in the policy process

Organization or institution	Evidence of learning
Parliament (national and local)	Legislative change; i.e. introduction of Law ( <i>Undang-undang</i> ), Local Regulation ( <i>Peraturan Daerah</i> or <i>Qanun</i> for Aceh context); of which state budget also decided in this form
	Change in the substance of debate
	Change in the topic areas of hearings
Regulatory and implementing agencies	Issuance of new and proposed regulations; i.e. Government Regulation, Ministerial Regulation, Ministerial Circular letter, Governor/Mayor/Head of Agency Regulation, Governor/Mayor/Head of Agency Circular Letter
	Change in the nature and substance of the regulations being issued
	Change in procedures, interpretation and implementation of statutes and regulations
	Actual planning at school level

Modified from Birkland (2006), adapted to fit Indonesian context

For detecting the level of connectivity and coherence between policy and regulation on disaster education and school safety governance, a simplified DNA is used. Previously, such an attempt has been done for the complexity of polycentric governance of disaster management in Indonesia (Lassa 2010). The chapter is to further detail that complexity but limited to the interaction of the disaster education and school safety regulatory network for the decade after the 2004 IOT. DNA itself is a growing analytical tool for measuring discourse coalition and overlaps in contested policy domains (Muller 2015). At its root, DNA is a combination of category-based content analysis and social network analysis, which form a new type of relational perspective which mixes actor-centered and content-oriented approaches (Leifeld and Haunss 2010). It allows observing the discourse on the actor level, concept level (including regulations) and combined levels, thus provides the missing link between actors and concepts or concepts to concepts. To do so, visualizations and network-analytic models (Borgatti et al. 2002) can be used in analyzing DNA, not necessarily the discourse network analyzes software (Leifeld and Haunss 2010). One of the fundamental properties of network analysis is the ability to determine whether network members are connected one to another, and to what degree, in various relationships (Varda et al. 2009). Instead of modeling relationships between actors/organisations, the visualization will mainly concern regulations and policies related to disaster education and school safety. The relational assessment between regulations and organisations concerning disaster education and school safety is conducted using Ucinet version 6.355 (Borgatti et al. 2002). The ‘nodes’ within the network are documents that include laws, regulations, policies and program-related reports related to disaster education and safe schools. While, the ‘ties’ reflect general relations between documents including references, acknowledgements and

considerations, as well as sub-ordination relationship.<sup>1</sup> As such, the network analysis is performed in an ‘unvalued’ and ‘undirected’ mode, to show the simplest and objective model of relation between nodes.

### ***7.2.1 Literature Review on Disaster Education and School Safety***

This section reviews literature on disaster education and school safety on both the global and Indonesian level. Initially, it discusses the development of the topics within the international DRR framework over a period of time. It concludes with an update on the topics from an Indonesian perspective. In general, it can be understood that disaster education and school safety have been redefined several times along with the development of international frameworks on DRR. Despite the variety modalities, school-based disaster education and safe schools are still key for DRR (UNISDR and GADRRES 2014). The recent Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR) also demands more concrete implementation and monitoring at school level (UNISDR 2015a, b). Such demand will be complicated in an Indonesian setting, as disaster education and safe schools are becoming a contested policy domain between various governmental agencies.

Sakurai and Sato (2016) have extensively reviewed the educational aspects in international DRR strategies, from the Yokohama Strategy to the Hyogo Framework of Action (HFA) and recently SFDRR. Initially, the Yokohama Strategy simply pushed for ‘educational and information programs aimed at generating general public awareness’ (International Decade for Natural Disaster Reduction 2000). It was then followed by the birth of the HFA 2005-2015, which set a specific priority of action related to disaster education. The HFA Priority 3 was set specifically as ‘using knowledge, innovation and education to build a safe, resilient culture of safety and resilience at all levels’ (UNISDR 2005). It was followed by six specific education and training activities: (1) the inclusion of DRR knowledge into school curricula, (2) local risk assessment and preparedness at the school level, (3) promotion of activities to minimize the effects of hazards, (4) training and learning programs, (5) community-based training initiatives and (6) insurance of equal access to training and education. This gave rise to multiple similar projects in various countries despite differences in the education systems of each county, e.g. those related to ‘safe schools’ (UNICEF 2009; Consortium for Disaster Education 2011; Selby and Kagawa 2012; World Bank and GoI 2014; UNISDR 2015b) and the development of a disaster education curriculum (UNDP and GoI 2012). Furthermore, key national experiences in the integration of DRR in the curriculum, good practices

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<sup>1</sup>In Indonesian legal documents, the legal basis of a certain law, regulation and policy can be traced back by looking at the term *menimbang* (considering), *mengingat* (in reference to higher law/policies or acknowledgement), etc.

and issues on implementation have been provided from a mapping of DRR in school curricula from 30 countries (Selby and Kagawa 2012).

In the literature, along with the years of Yokohama Strategy and HFA, most disaster education focuses on measuring children's knowledge of disaster risks, protective actions and children's reports of preparedness actions (Johnson et al. 2014). Other scholars focus on determining the factors to promote actual actions for disaster reduction through education, which includes school teachers and government education offices for designing curricular for disaster reduction (Shiwaku et al. 2007) and the need to have a subject related to local context within the disaster education curriculum (Shiwaku and Shaw 2008). That being said, most of the research on disaster education, does not clearly describe the range of inclusion in the school milieu and few look into the actualities of how schools have been able to respond disasters, as well as challenges schools have confronted (Swamfield 2013). There is a need to understand the variation of school's own implementation on disaster education and school safety. To understand this, Swamfield (2013) categorizes the possible school milieu on education and natural disasters: curriculum integration, stand-alone courses (e.g. special courses on disasters), project work, incidental teaching opportunities (e.g. mention of disaster events during teaching hours), extra-curricular activities, supplementary material (e.g. books) and the hidden curriculum (e.g. the choice of classroom posters).

Outside of such categorization on disaster education and specific study on school actualities in implementing disaster education, less research inquires as to why or under what institutional arrangement schools can own and implement disaster education and deliver safe schools sustainably at a wider scope to significantly reduce disaster risk and potential damage. The need for this stream of research is important, parallel with the development in the SFDRR. The SFDRR 2015–2030 did not put independent priority of action on education, and yet the document mentioned education more frequently compared to the HFA. In essence education has become embedded in other priority areas for fulfilling global targets of reducing disaster risk, loss of life and various aspects of community wellbeing (Sakurai and Sato 2016). For example, educational facilities are included among seven global targets in substantially reducing disaster damage. As stated in the Sendai Framework for DRR 2015–2030 in article 18-d:

Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030.

Disaster management, education and public works are dealt with by separated institutions at the national and local level. As such, there are different authorities that can be exercised by national and local government within the function. The education sector has experienced a shift from a centrally driven to a decentralized service delivery that reached out to school-level. The government has transferred the power for decision-making to each individual school (OECD/ADB 2015, p. 76). And the same time, the national governments focus on setting national standards for education. Indonesian decentralisation brings about effect and opportunity on the

education sector, whereby local authorities can regulate organization and the teaching process, teacher management, structure and planning and resources (Alisjhabana 2000). A review of the decentralized education sector shows that in its inception, authority or autonomy for decision making transferred to local government and headmasters is expected to improve performance and school accountability (OECD/ADB 2015). Winingsih (2012) summarized different advantages for this transfer of decision making directly to local government and schools. For example, decentralisation gave schools permission to prepare their own education plans and tailor their curriculum to best suit the needs of their students, especially once the 2013 curriculum was established (OECD/ADB 2015, p. 269). Those authorities can be exercised as “entry points” for disaster education and improving school safety, but it requires further investigation at the policy level.

Indonesian Law 20/2003 on education does not define disaster education as part of formal education and yet identifies emergency education as part of the national education system. The same applies to Law 23/2002 on child protection and Law 26/2002 on building, which does not address specific protection for children in disasters as part of building regulation. On the other hand, Law 24/2007 acknowledges (disaster) education as the right of the people and is part of disaster mitigation, although it does not provide a clear definition. Subsequently, Government Regulation 21/2008, Article 14, states that education and training in disaster management aims to improve people’s awareness, concern, skill and preparedness against disasters; which can be implemented by national or local government and non-government organisations through formal and non-formal education, trainings, simulations and exercises. Recent development shows a straight forward definition of safe schools from the BNPB regulation 4/2012 which says that disaster safe schools/*madrrasah*(s) are schools which plan, implement, utilize and provide facilities necessary in order to protect school members and its surrounding environment from disasters and hazards. However, this alone cannot directly become the umbrella regulation, as we will describe in the following section and that the governance in disaster education and school safety is at an intersection of sectors between education, disaster management and public works policy domain.

### **7.2.2 Results**

This section reviews regulations and policies related to disaster education and school safety in Indonesia, as well as Aceh Province and Banda Aceh City.

### 7.2.2.1 Mapping the Regulations and Policies Related to Disaster Education and School Safety in Indonesia: From National to Local Level

Following historical and content analysis on the policies and regulations, an inter-connectivity model is produced to map the regulatory networks on disaster education and school safety. The study has three major findings:

- The balance of disaster education and school safety governance is weighted more on disaster management without balancing policies and regulations in education and public sector works, at all levels.
- A strong national policy, BNPB regulation 4/2012 on safe schools, does not have a pairing policy in the education sector, which only has a ministerial circular letter on these matters and thus makes wider implementation of disaster education and school safety difficult to achieve.
- Disconnection between disaster management and education policy domains is even more obvious at the local levels, in this case provincial and city, and thus disaster education and safe school initiatives stopped at the pilot projects stage.

Stakeholder identification found key organisations related to disaster education and school safety are diverse. At the national level, it includes the BNPB, Ministry of Education and Culture (MoE), Ministry of Public works and Housing (MPW), National Secretariat of Safe schools, NGOs, donors, universities and private entities. At the local level, province and city, it includes BPBDs, education agency, public works agency and local NGOs and universities. Those stakeholders have in the past 12 years developed laws, regulations, policies and initiatives related to disaster education and school safety governance in Indonesia, as can be seen in Fig. 7.1. These include the following laws and regulations: Law 23/2002 on child protection, Law 20/2003 on the national education system, Law 24/2005 on teachers, MoE regulation 24/2007 on school facility and utility standard, MoE Circular Letter 70a/2010 on safe schools, MoE regulation 28/2010 on school headmasters as

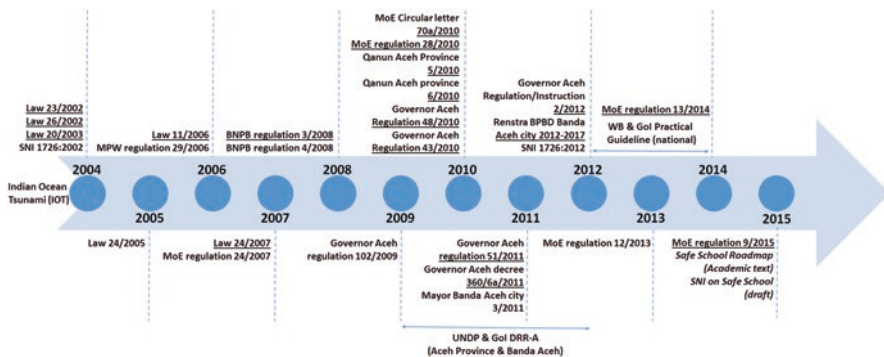


Fig. 7.1 Laws, regulations and other major policy initiatives on disaster education and safe schools (National and Local: Aceh Province and Banda Aceh City) (Source: Authors)

well as MoE regulation 12/2013, MoE regulation 13/2014 and MoE regulation 9/2015 on the guideline for education-specific allocation fund (*DAK Pendidikan*).

On the other hand, from the disaster management side the basic law is Law 24/2007, and direct regulations are Government Regulation 21/2008 on disaster management implementation, BNPB regulation 4/2008 on BPBD and BNPB regulation 4/2012 on the Guideline for safe schools and *madrasah*. While in the public works sector, the related regulation is the Law 28/2002 on building followed by ministerial regulations-MPW (29/2006) as well as the Indonesian National Standard (SNI) 1726–2002 and its updated version SNI 1726:2012. The authors recognized that during 2014–2015 there were great efforts to establish a Safe School Roadmap, inclusion of safe school indicators to school facility standards, which eventually will become a ministerial regulation, and an SNI for safe schools (MoE 2015), however, to date none of them have materialized as legalized policy.

Note that there are cross-cutting laws and regulations that influence the extent to which disaster education can be exercised, e.g., on local government (Law 23/2014), spatial planning (Law 26/2007) or on the government setup in Aceh (Law 11/2006 on Aceh). However, these are omitted since it will give distortion to the DNA modeling and unnecessary complexity. As for the non-government initiatives, the authors only include those with concrete products or efforts for influencing policy change, e.g., guidelines, modules, and not only implementation of disaster education or school safety improvement activities.

For one, the BNPB regulation 4/2008 requires all local governments to establish a disaster management plan (RPB), which includes prevention and mitigation to address “internalization of disaster management into local content in teaching activity”, although without clear reference to education at the elementary school level. Thus, the authors identified the key policy that clearly connects both disaster management and education domains is BNPB regulation 4/2012. The regulation gives clear reference to Law 24/2007 and Law 20/2003, particularly acknowledging the clause that the national education system guarantees the need of disaster education as part of “special and additional subjects”, including that of education for students in peripheral areas and those affected by disasters. It also puts clear reference to MoE Circular Letter 70a/2010, MPW regulation 29/2006 and SNI 1726-2002; i.e. despite disconnect with its revised version of SNI 1726:2012. From various interviews, it was also found that in practice efforts have been done to provide assurance in the form of another BNPB regulation for monitoring and evaluation of the safe-school initiative. However, until to date the academic text and draft of the regulation have not translated into a policy.

From the non-government initiatives, in Aceh Province and Banda Aceh city, the Government of Indonesia partnered with the United Nations Development Program (UNDP) on ‘Making Aceh safer through Disaster Risk Reduction in Development’ (DRR-A) in 2009–2012. The initiative was intended to promote and sustain DRR public awareness, with a key achievement being the development of a DRR curriculum for school children from elementary to high school levels, including *Madrasah* (UNDP and GoI 2012, p. 8). Furthermore, in 2014 a Practical Guideline for making schools safer from natural disasters for school principals and school committees



was developed (World Bank and GoI 2014). The document was a joint effort between the World Bank, MoE, MPW, BPPT and National Secretariat of Safe Schools, but did not include BNPB. However, the document clearly referred to BNPB regulation 4/2012, MPW regulation 29/2006, SNI 1726:2012 and MoE Circular Letter 70a/MPN/SE2010. The authors note that there are a number of disaster education and safe school initiatives taking place in the last decade, however only these two clearly have strong-evidence to influence public policy at a national level and/or in Aceh.

After the IOT recovery period, disaster management in the province started with the Governor Aceh Regulation 102/2009 on the establishment of BPBD Aceh (BPBA, Aceh province disaster management agency), followed by the legally binding local regulation of Qanun 5/2010 on disaster management in Aceh province and Qanun 6/2010 on BPBA. In 2010, Governor Aceh Regulation 48/2010 on Action Plan for DRR 2010–2012 and Governor of Aceh Regulation 43/2010 on early warning system and tsunami emergency response in Aceh were also developed. It was followed by Governor Regulation 51/2011 on Aceh Disaster Management Plan 2012–2017 (RPB Aceh). One strategy in RPB Aceh 2012–2017 is to ensure internalization of local wisdom in the creation of people's collective memory of disaster through formal education (Governor Regulation 51/2011, p. 53). The Education Agency of Aceh Province was acknowledged in the document as having an important role for the planning and control of emergency education, recovery of education infrastructure and facilities and the coordination of disaster awareness education (ibid, p. 57). The plan includes a specific policy focus on “disaster education in formal education institutions for improving the resilience of people and government”, achieved through two programs (Creation and implementation of disaster education curriculum in Aceh, and Internalization of local wisdom and resilience of Aceh people into disaster management) and eight activities (ibid, pp. 68). Reference to education agency and city BPBD was identified for all eight activities (ibid, pp. 80–81), although, on people preparedness, the program for disaster simulation does not target schools specifically. (ibid, pp. 72–73) Furthermore, Governor Aceh Regulation 1/2012 on school operational support (BOS) fund and Governor Instruction 2/2012 for integrating DRR into the provincial education system were built upon experience of the DRR-A (UNDP and GoI 2012, p. 9). Clearly, progressive legal development at the provincial level was due to the existence of the DRR-A program whereas it was independently verified to have a direct impact in the creation of Qanun 5/2010, Qanun 6/2010, Governor Regulation 43/2010, Governor Regulation 48/2010, Governor 51/2011, and Governor Instruction 360/6a/2011 (Meirio 2012).

On the other hand, the city government was rather late in disaster management. For example, the city disaster management agency (BPBD) was formed in 2011, 7 years after the tsunami, through Mayor Regulation 3/2011. It was followed by the development of BPBD Banda Aceh city Strategic Plan 2012–2017, as an umbrella policy for programming and budgeting. On prevention and preparedness, BPBD defines its own tasks for providing seminars and simulations for the public, government and private sectors as well as schools (BPBD Banda Aceh 2012, p. 20).

However, looking at the annual report of 2012, only one activity was conducted using state-budget at around IDR 200 million on general disaster awareness activity and without specific targeting of schools (BPBD Banda Aceh 2013a p. 35). Afterwards, in the span of 5 years, the authors did not find significant legislation from the disaster management side. Furthermore, the limited resource allocation on disaster education can be seen from the budgeting. For example, in the 2013 Annual Working Plan of BPBD Banda Aceh city, out of IDR 1.7 billion, only IDR 150 million was used for one activity on improvement of disaster awareness activity and still without specific targeting of schools (BPBD Banda Aceh 2013, p. 29). These findings give clear evidence of limited capacity for direct disaster education in schools from the disaster management agency.

Using the input listed above, the first DNA governance model on disaster education and school safety in Indonesia is developed (Fig. 7.2). The authors registered regulations and policies of the national and local governments on disaster management (orange), education (green) and public works (black) with school safety, as well as those that serve as cross-cutting both disaster education and school safety as one-set of policy or regulation (blue). In addition, we include initiatives by non-government actors that enrich policy creation of disaster education and school safety, both at national and local levels. That being said, non-government initiatives that only contain implementation of disaster education and school safety without

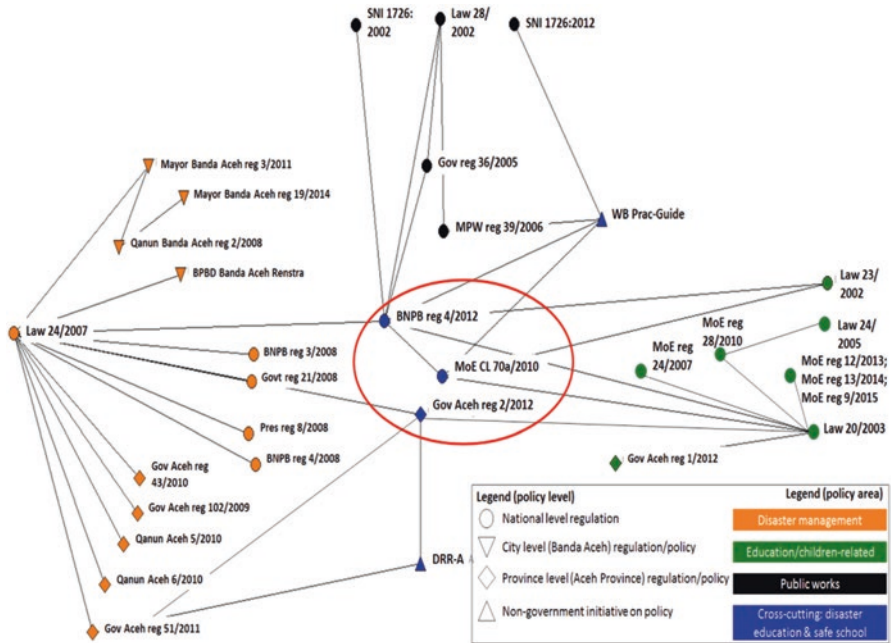


Fig. 7.2 Regulatory network on disaster education and school safety in Indonesia, at different levels (Source: Authors)

attempts to modify or create policy instruments or inform the regulatory aspect are excluded.

The relationship between policy/regulation nodes is visualized through 'ties' that reflect a general relation between 'documents', i.e. in the form of reference, acknowledgement, consideration and sub-ordination based on the 'text' written in the document. Again in this particular visualization, we exclude policy and regulation documents which serve as background law, e.g. Law 11/2006 and Law 23/2014, since including those would distort the DNA model on disaster education and school safety. As such, the network analysis is performed within an 'unvalued' and 'undirected' mode, to at least show the simplest model of relation between nodes.

There are some interpretations validated by Fig. 7.2 on understanding the governance and regulatory network of disaster education and school safety in Indonesia, Aceh Province and Banda Aceh city. First, the figure shows partial convergence and coherence on disaster education and school safety as contested policy domains of disaster management, education and public works (see the centre of the network, within the red-circle). While from the disaster management policy domain a strong ministerial-level regulation was being set (BNPB regulation 4/2012), from the education policy domain there is still no change on its highest policy statement, MoE circular letter 70a/2010; although the former references the latter. The recent development of the Safe School Roadmap (MoE 2015) has not been finalized as a policy instrument with legal power. That being said, BNPB regulation 4/2012 will not be able to be fully implemented at all schools, unless a follow up from the education side is done at least at the same policy level, i.e. a ministerial-level regulation. The MoE circular letter is only a recommendation in nature without mandatory power or clear expression that at least it should be implemented in disaster-prone areas (Amri et al. 2016). Furthermore, from the public work policy domain, there is still no specific policy instrument to ensure safety of school buildings, and even the BNPB regulation 4/2012 did not include the regulatory content in the public work sector, the MPW regulation 29/2006. BNPB regulation 4/2012 also still refers to the old national standard on earthquake resilient buildings (SNI 1726:2002), instead of the most-recent one (SNI 1726:2012) despite being developed in the same fiscal year.

Law 20/2003 put emphasis only on emergency education in disaster settings. The same goes with Law 23/2002 on child protection, which did not specify disaster as one of the major risks against the living right of children. On the other hand, Law 14/2005 on teachers did not put any clause on ultimate responsibility for safety of the students and instead put emphasized teacher's protection to various threats, including against natural disasters. Similarly, Law 28/2002 on building does not regulate specific conditions for school buildings.

At the regulatory level, MoE regulation 24/2007 on school facilities and utility standards already regulates schools to be equipped with safety facilities, early warning, exit doors, evacuation routes against fire and other disasters. However, it is too general and outdated in comparison with the content in BNPB Regulation 4/2012. Similarly, MoE regulation 28/2010 on school headmaster has no article that put ultimate responsibility on the shoulders of the headmaster for school safety or students' protection. On the other hand, MoE regulation 12/2013 and its updated

versions, MoE regulation 13/2014 and MoE regulation 9/2015, on education-specific allocation fund (*DAK Pendidikan*) state that the fund can be diverted from its original use for local governments affected by disasters to resume its basic education activities. To do so, the disaster must be officially stated by mayor/regent/governor, and subject to approval from the minister. The *DAK Pendidikan* is to be used mainly for procurement of text books, and the remaining funds can be used for improving education infrastructure (school, classrooms, etc.) and tools for improving quality of education (model/tools for school subjects). In addition, the technical guideline of *DAK Pendidikan* for elementary school level only includes the purchase of an Indonesian disaster profile map as one of the eligible uses of the fund related to disaster education (*Perdirjendikdas-MoE 144/C/KP/2015*, pp. L III-146 – 147). Based on text analysis, there is no clause stating the use of *DAK Pendidikan* for disaster education activities or safe school implementation, although MoE claimed that during 2012–2013, 180 pilot safe schools based on BNPB regulation 4/2012 were built using the specific allocation fund (Suharwoto 2014).

The first finding is that education sector regulations and policies are still response oriented instead of inclusive of DRR, disaster education and school safety assurance. The MoE Circular letter 70a/2010 remains the highest policy tool from the education sector governance, which integrates disaster education and school safety components, but it is a weak one, as has been explained before. Even so, there are still some articles in education sector regulations, at the level of the MoE regulation, where one could exercise greater disaster education and school safety contents. For example, MoE regulation 28/2010 on school headmaster candidate mandatory training and continuous professional development can be enriched with disaster education and school safety components; thus creative headmasters who integrate social innovations (such as disaster education) can receive incentives.

The second interpretation is the BNPB and MoE have not made the issue of children and DRR a connected policy domain, due to lack of policy or political will whereby implementation of DRR education in schools is perceived as hindrance. On this Amri et al. (2016) exhibited the following statement: "...we still have problems with the Ministry of Education and the Curriculum Centre. They still do not have the solid 'political will' for our [DRR] education system. So we could not expect the schools to sustain it" (Amri et al. 2016, p. 16). They further claimed that BNPB regulation 4/2012 and MoE circular letter 70a/2010 as ministerial endorsement on incorporation of DRR education into the national curriculum at primary and secondary school will not work since the Indonesian decentralized system gives central government less authority compared to the district government over education content, financial matters and school practice. The circular letter is not imposing but rather an encouragement (ibid, p. 20).

Third, Fig. 7.2 also shows that the balance of discourse related to disaster education and school safety leans more towards the disaster management policy domain than education or public works. Concerning this, there is greater availability of regulations and policy instruments in disaster management concerning implementation of disaster education and school safety, rather than in education and public

works regulations and policies, both at national and local level (Aceh province and Banda Aceh city).

Fourth, it partially confirms the government claim that policy is in place at national level, with coordination challenges between central, provincial and local government (Suharwoto 2014). Central government may have developed BNPB regulation 4/2012 and MoE Circular letter 70a/2010, however those do not guarantee implementation that ensure safe learning facilities, established school disaster management and DRR education. The complete absence of city-level (Banda Aceh) policy and regulation is one piece of evidence, and weak development of Governor Aceh Instruction 2/2012 that is only able to endorse mainstreaming of disaster education without integration of BNPB regulation 4/2012 provides secondary evidence. Overall, from our analysis, we found no strong regulatory basis for ensuring nationwide disaster education and school safety in the education sector that is fully connected with the disaster management and public work sectors.

### 7.2.2.2 Reviewing Implementation of Disaster Education and School Safety at the Local Level in Banda Aceh City

To further describe the importance of having connected policies for disaster education and safe schools, a case study will be presented from the experience of elementary schools in Banda Aceh City. This section will explore whether Banda Aceh city, after experiencing the IOT and becoming sites for multiple disaster education and safe schools, is able to provide itself with local regulations that resulted in city-wide implementation. The analysis found that although there are multiple programs and projects on disaster education and school safety, there has been no city-wide policy change in Banda Aceh City that enables all schools to implement disaster education and safe school assurances. One crucial factor identified was the absence of city-wide policy from the Mayor Office and education agency, as the main reference of school management, in addition to unclear authority on the subject between education and disaster management agencies. In terms of this factor, further analysis shows that city-wide implementation of disaster education and school safety may learn from other policy, i.e. the inclusion of mandatory Islamic Teaching and Norm and health-service unit in Banda Aceh city.

The city statistical office recorded that the 119 public elementary schools before the 2004 IOT (BPS Banda Aceh 2004) was dropped to 99 schools in 2005 (BRR and International partners 2005), and further reduced to 80 schools in 2007 (BPS Banda Aceh 2010) following the regrouping of schools due to ratio of the students and completion rate of reconstruction.<sup>2</sup> In 2014, based on data from education agency and religious affairs office, there were 95 schools at the elementary level; i.e. 72 public elementary schools (SD *Negeri*), 12 private elementary schools (SD *swasta*) and 11 Islamic elementary schools (*Madrasah Ibtidaiyah*-MI). Amongst these, 55 are

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<sup>2</sup>The reason for regrouping was confirmed in interview with a high-level officer of the Education Agency-Banda Aceh city, October 2014.

located in the 2004 IOT inundation area, particularly 2 km from the shoreline (Sakurai et al. 2015). As of 2014, there were 21,301 students, 71 headmasters, 1,253 general-subject teachers, 136 physical education teachers and 34 religious teachers, with total of 603 classrooms.

Within 10 years after the IOT, Banda Aceh city and Aceh province, have received multiple DRR assistance, including on disaster education and school safety improvement. Up until 2014, 34 schools at elementary level in Banda Aceh city were exposed to seven school-disaster preparedness (SSB) programs organised by various organizations, with some schools receiving more than one program.<sup>3</sup> However, this means there are 61 schools that have yet to receive any disaster-related programs. There is no record showing that the education agency attempted to implement disaster education or improve the school safety in the city as a whole. Rather education agency was more response-oriented, e.g., in 2014 it organized a meeting with school headmasters in ensuring preparedness of elementary schools during the period of heavy rainfall that resulted in flooding.<sup>4</sup> The extent of each program in fulfilling components of both Swamfield's school milieu (2013) and BNPB regulation 4/2012 can be seen in Table 7.2.

As it can be seen from Table 7.2, none of those programs fulfilled all of the components defined by Swamfield (2013) or BNPB regulation 4/2012, especially those on designation of a safe location and assurance on safe building structure. Almost all of the programs, in their reports or news, ultimately aim at one-time preparedness planning, disaster drills and installation of tsunami evacuation maps and signs. The content of the SSB-program is heavily decided by the organizer, its donor and implementing partners, due to the absence of city-level regulation and requirement of adopting national-level regulation. In addition, the authors found that none of those programs have influenced local policy instrument change at Banda Aceh city level.

Specifically on the DRR-A, the program trained headmasters and teachers (total of 23 persons) from ten elementary schools in Banda Aceh city. The initiative successfully developed a guideline on how to be prepared against disasters at school entitled '*Sahabat Siaga*' and two guidelines for integrating disaster content into the curriculum of elementary school, one each for grade 1–3 and grade 4–6. Outputs of the initiative were also endorsed by Governor of Aceh Instruction 2/2012 on integrating disaster content into the curriculum. However, from the five trained schools in DRR-A among 47 within the inundation area of the 2004 IOT, only one school clearly still referred to the curriculum guideline during our survey. In addition, the

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<sup>3</sup>Number of schools is based on author's calculation from various sources: (1) DRR-A list of participated schools in Banda Aceh city, (2) Susanti et al. (2014) who reported that all SSB programs that involving TDMRC until 2012 were able to reach 28 schools in Banda Aceh city, and (3) News reported in <http://bongkarnews.com/v1/view.php?newsid=3941>, This programs include those implemented by Indonesian Science Institute (LIPI), UNESCO, Tsunami and Disaster Mitigation Research Center (TDMRC) of Syiah Kuala University, Education agency of Aceh Province, BPBA of Aceh Province, BPBD of Banda Aceh City and their partners.

<sup>4</sup>Interview with a high-level officer of Banda Aceh City Education Agency, October 2014. Confirmed in multiple interviews with headmasters.

**Table 7.2** Landscape of school-disaster preparedness programmes in Banda Aceh city 2004–2016<sup>a</sup>

Government and non-government policy, programs and initiatives	Swamfield (2013)										BNPB regulation 4/2012							Inclusion of IOT experience
	Structural										Non-structural							
	SM1	SM2	SM3	SM4	SM5	SM6	SM7	S1	S2	S3	S4	NS1	NS2	NS3				
DRR-A program, (10 schools)	Y	N	Y	Y	Y	Y	Y	N	N	N	N	Y	N	N	N	N		
TDMRC, LIPI and UNESCO SSB-program	N	N	Y	Y	Y	N	N	N	N	N	Y	Y	Y	Y	Y	Y		
TDMRC and LIPI SSB-program	N	N	Y	Y	Y	N	N	N	N	N	Y	Y	Y	Y	Y	N		
TDMRC, ACT, PMI SSB-program	N	N	N	N	Y	N	N	N	N	N	Y	Y	Y	Y	Y	Y		
TDMRC and bank Indonesia SSB (3 schools)	N	N	N	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	Y		
TDMRC and ACT SSB-program	N	N	N	N	Y	N	N	N	N	N	Y	Y	Y	Y	Y	Y		
Education Agency Aceh province SSB program (5 schools)	N	N	N	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	Y		

<sup>a</sup> Y (Yes, full or partial fulfilment of the component), N (No, non-fulfilment and non-implementation of component)

curriculum developed through the DRR-A was not stimulating enough to keep attention of the students, unable to be supported by the existing teaching materials (books) for DRR teaching and unable to facilitate the ‘culture of safety’ in daily activities. Integrating DRR into the curriculum for all school levels cannot be taught through books alone without practical examples, experiences and simulations that help students to apply their knowledge in real-life situations (UNDP and GoI 2012, pp. 14–15).

From the perspective of the disaster management agency, the perceived role in situations without disaster is basically to coordinate efforts in increasing the preparedness and reducing the risk of the people through ordinary development sectors including education. The main concern of the agency is supplying DRR-related content and coordinating with the education agency for dissemination to schools, as captured in the following statement<sup>5</sup>

The leading is always the education agency and what we aspire is for each school to have self-evacuation training. Here, NGOs have prepared lots of curriculum module and package but it was not implemented by education agency (thus) not becoming a culture. We also have limitation since our authority ends in NGOs coordination, but not to ensure full adoption at all schools.

On the other hand, from the education sector perspective, it was admitted that the opportunity to fully include disaster education content in the curriculum actually broadened with the new 2013 Curriculum. The new curriculum provides space for “local content” for two teaching-hours per week in which schools and local government have the authority to decide which subject to teach at all schools. This put the Education Agency in the centre of attention to decide the local content, and with various stakeholders advocate their interest to them.<sup>6</sup> In this sense, disaster education must compete with other subject interests that want to be included in the local content, e.g. local culture and art, mandatory Islamic Teaching and Norm, environmental education.

In contrast to the inclusion of disaster education, the government of Banda Aceh city successfully added a two-hour mandatory Islamic Teaching once per week in all elementary schools since 2013. The basis for this was a mayoral regulation, which thus translated into a school order from the Education Agency and secured a dedicated budget from the city fund agreed upon by the city parliament.<sup>7</sup> A similar approach to the Islamic Teaching and Norm was taken by the recent improvement of the school-health unit (*Unit Kesehatan Sekolah*-UKS). Thus, to ensure city-wide application of disaster education, such a policy instrument is needed that enables funding support from the city budget or a multi-year external resource commitment.<sup>8</sup> As such, we then looked at the legislation program from 2010 to 2015 in the

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<sup>5</sup> Interview with a high-level officer of Aceh province BPBA, October 2014.

<sup>6</sup> Interview with a high-level officer of Banda Aceh city education agency, October 2014.

<sup>7</sup> Mayor Regulation 3/2012 on Islamic Teaching and Norm Education.

<sup>8</sup> Interview with a high-level officer of Banda Aceh city education agency, October 2014.



**Table 7.3** Legislation programme in Banda Aceh City 2010–2015<sup>a</sup>

Year	Proposed <i>Qanun</i> (city-regulation)	<i>Qanun</i> proposal related to:		
		Disaster management	Education/children	Public works
2015	30	0	2	4
2014	44	0	1	4
2013	37	0	1	1
2012	31	1	0	0
2011	39	1	2	1
2010	36	0	2	2

<sup>a</sup>Summarised from Law Information and Documentation Network of Banda Aceh city government, available at: <http://jdih.bandaacehkota.go.id/index.php/proleg>

Banda Aceh city where the mayor's office and city parliament priorities issues by area for law-making, as can be seen in Table 7.3.

In that period, only twice was local regulation (law) pertaining to disaster management successfully proposed and eventually passed i.e. in the establishment of the city-level disaster management agency (BPBD) in 2011 and the retribution on fire extinguisher quality checking in 2012. On the other hand, the deliberation of said mayoral regulation on Islamic Teaching and Norm actually failed twice, in 2010 and 2011, before eventually being enacted as a Mayor Regulation. Even then, the regulation was able to secured funds from the city budget from 2012 until 2015. While from 2013 to 2015, a proposal on the city education board and new organisational structure of the education-youth-sport agency of Banda Aceh city was still being deliberated and is not yet legalized. In terms of public works, those that proposed were related to building-permit retribution, revision to the 2004 local regulation on building construction, legalization on academic script of the Banda Aceh city general spatial plan 2009–2029 and the district-level detail spatial plan.

Therefore, table 7.3 also verifies the DNA modeling in Fig. 7.2 on the limited connection of local regulations and policies, specifically those over-arching disaster education and school safety in Banda Aceh city in the last 6 years. It also shows the missing link between disaster management and education policies at the city level. Two of the disaster management policies softly include disaster education at school as part of its disaster preparedness strategies, while on the other hand there were no specific policies from the education sector for this issue at the city level. In addition, Banda Aceh city also in the past has some 'out-of-box' *Qanun* proposal such as proposal on gender-based governance and development (in 2011), comprehensive waste management and city-capital investment (in 2012–2014), gender-friendly city (in 2013 and 2014), which either derived from national-level law (in the case of waste management) or donor-driven (in the case of gender-related issue). Disaster education and school safety policy domain has both national level law and also received interest of various donors, thus city-level policy development can be done.

During a group discussion with the headmasters of several elementary schools in Banda Aceh in March 2015, it was confirmed that the essential point for ensuring a basic and continuous implementation of disaster education activities in all schools lies at least in the provision of an Education Agency Circular Letter that provides justification for all headmasters to include it in the school annual plan. For example, encouragement to have a Quran recitation and prayer session on commemoration of the 2004 IOT day has shown to be effective in ensuring implementation, where 37 schools surveyed follow suit to carried out commemoration event on a voluntary basis, with various activities in each school, e.g. disaster-related poetry reading or tsunami video screening.

Some headmasters also stated that a stronger policy directive, for example a Mayor Regulation, with additional budget supported by city government will be necessary for ensuring a certain uniformity of disaster education or safety improvement for all schools throughout the city.<sup>9</sup> On this particular topic, for example, two mayor regulations ensure city-wide implementation of Islamic Teaching and Norm Education, and have additional teaching hours at all public elementary schools.<sup>10</sup> On the other hand, all public elementary school health units (UKS) in Banda Aceh city received equipment improvement and trainings after an education agency circular letter and external donor support became available in 2014.<sup>11</sup> That being said, it is essential to have a local government policy that can ensure uniform disaster education and school safety features in all schools and have it included in their annual school plan. Having a strong policy directive is important for school-resource allocation, as well as mobilizing external resources.

Of the 47 schools surveyed, only 4 stated routine budgeting in their school annual plan. Two of them included a routine budget of around IDR one million for IOT commemoration activity on December 26th. Another school stated they had budget allocation for disaster training for around 30 students, spending on the school-health unit, sending students to become environment ambassadors and composting. Another school that is known for having received multiple DRR programs, stated that out of IDR 365 million annual school budget, they allocated around IDR 53 million for disaster-related activities (14.5 %) whereby strong support from the school committee (including parents) was instrumental in securing such an allocation. In this particular school, the budget was used to make their own evacuation map, drills, mock-up and a model for teaching disaster (e.g. earthquakes and volcanoes), as well as sending students to join disaster-related events outside the city.

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<sup>9</sup> Interview with a headmaster of an elementary school in Banda Aceh city, female, March 2015.

<sup>10</sup> Mayor Regulation 3/2012 on Islamic Teaching and Norm Education, Mayor Regulation 4/2014 on Supplementary Education Fund in Banda Aceh. Accessible via: <http://jdih.bandacehkota.go.id/index.php/produk-hukum>

<sup>11</sup> Interview with high-level officer of Banda Aceh city education agency, male, March 2014. Confirmed in Authors visit to all 47 samples of elementary schools, that they received equipment and training for their health unit.

### **7.3 Conclusion for All-Schools Implementation of Disaster Education and Safe School: Necessary Policy Instrument**

Given the nature of the decentralized Indonesian governance system, which directly affects the implementation of disaster management, education and public work sectors, this chapter highlights the gaps to integrating governance and policy instruments that enable disaster education and safe school implementation in all schools. Within these gaps, various models, guidelines and pilot programs have been developed both for Indonesia as well as specifically for Banda Aceh. The applications of disaster education and school safety in Indonesia have a wide variety, from the comprehensive BNPB regulation 4/2012 to the 2004 IOT commemoration with very limited resources.

Nevertheless, this chapter clearly suggests that the necessary policy for ensuring city-wide, all-schools implementation lies with the political will of the local government, in the form of concrete policy instruments. A strong legal background in the form of a mayor regulation, at a minimum, can secure continuous public funding for all-schools implementation of disaster education and school safety; albeit the degree of implementation will be subject to resources available from the local government. Hence, even a 'soft policy' such as mayor or education agency circular letter can have a 'buy-in' effect for securing external resources (e.g. donors), as shown in the case of the school health-unit improvement in Banda Aceh city.

Indonesia has establishing a separate ministerial-level agency for coordinating disaster management affairs. The country cannot fully adopt the approach of others, such as Japan, where ministerial education, local education boards and schools have clear responsibilities and mandate for ensuring students' safety at the time of a disaster (Sakurai and Sato 2016). Thus, the potential policy change is through a stronger set of regulations from the education minister or education agency for wider adoption of disaster education and school safety measurement. Two high-level regulations that can be targeted for revision are: MoE regulation 28/2010 on headmasters which should include the importance of disaster education and school safety in general as a part of school management and enhancement to connect with the BNPB regulation 4/2012 and SNI 1726:2012. Furthermore, it is necessary to give legal power to the Safe School Roadmap into workable high-level regulation, as well as to develop specific SNI for safe schools that are more specific than SNI on (general) building.

Policy gaps and partial connectivity of regulations can also be seen as an opportunity, instead of problem, as local government can decide to include integration of local disaster content into teaching material or other school activities. Multiple national level regulations and policy instruments on DRR, education and public works, although without strong coherence, can still be exercised by local government and even headmasters for establishing their own initiative in school annual plans. Policy and regulation at national level are already available to justify the development of local regulation or governor/mayor instruction that can guarantee local resource mobilization or access external resources for all schools' implementation of disaster

education and safe schools. In addition, it is necessary to increase capacity and capability of school headmasters and school management to implement disaster education and to improve school safety.

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# Chapter 8

## Integrating Disaster Risk Reduction and Climate Change Adaptation into School Curricula: From National Policy to Local Implementation

Nurmalahayati Nurdin, Irina Raffiana, Sri Hidayati, Rina Suryani Oktari, and Riyanti Djalante

**Abstract** Integrating Disaster Risk Reduction (DRR) into formal education and curricular has been suggested as one strategy to help increase knowledge and understanding of disaster risks. While there has been some initial progress in initiating DRR integration into the school curriculum in Indonesia, this is mostly limited to the national level. There are however, few studies which try to analyze the integration of disaster knowledge and education into school curriculum comprehensively, from the national policy level to local implementation in schools.

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This chapter aims to review the current progress, challenges and strategies in integrating DRR and Climate Change Adaption (CCA) related content into the school curricular in Indonesia. We do this through content analysis of the 2013 national standard curriculum, a case study of schools in Aceh province and focus group discussions (FGD) with 26 chemistry teachers from 15 secondary high schools in Banda Aceh. Our findings show that concern about DRR and CCA has not yet been demonstrated or consistently addressed in the school curriculum in Indonesia. Particularly, challenges include a lack of teacher training, limited financial support and a relatively disintegrated system. Furthermore, teaching DRR is very challenging, especially in areas where customs are traditionally conservative and the teacher's knowledge on environmental hazards is still limited.

Challenges to integrating DRR and CCA into the curriculum can be addressed through improved teacher training, more financial support for DRR and CCA initiatives and the adoption of standardized and nationally approved disaster education guidelines. Improving disaster management knowledge and skills through integration of DRR and CCA into school curricular may save many more lives and equip younger generations with the ability to respond to natural disasters and significantly reduce losses of lives and property during a disaster.

**Keywords** DRR • CCA • Disaster education • School curriculum • Aceh

## 8.1 Introduction

Indonesia has long suffered from the impacts of disasters caused by natural hazards. This high-risk natural exposure is exacerbated by economic weaknesses and the political complexity of the country, making the population of Indonesia even more vulnerable to adverse impacts of natural disasters (Sassa and Canuti 2008). Geological hazards such as tsunami, earthquakes and volcanic eruptions are the deadliest types of disasters in Indonesia.

The importance of DRR education in Indonesia, a country with such levels of cultural and ethnic diversity, underpinned by a great distribution of hazards and socioeconomic characteristics, is irrefutable. High levels of poverty and population expansion, combined with the implications of climate change and rapid urbanization, present great challenges for the management of disaster risk in Indonesia (Kagawa and Selby 2014).

In the education sector, natural disasters have contributed to various impacts. It is estimated that three-quarters of all schools in Indonesia are located in disaster prone areas, comprising at least 40 million students. Most of the schools were built in the 1980s and did not consider DRR, resulting in damages to school buildings and human casualties among children. This condition adversely affected the quality of education, especially when there were no plans for alternative school locations and students were denied continuous schooling. Equally, psychosocial impacts occurred when students lost their hopes; depressed as their futures were destroyed



(UNISDR 2008; Suharwoto 2014; Shaw et al. 2012). Students can be among the most vulnerable victims of any catastrophes if they are not adequately prepared with knowledge. Therefore, integrating DRR into the school curriculum can be one of the most effective methods to reduce disaster impacts.

Natural hazards cannot be avoided, but with preventive measures, the impact of the hazard can be minimized. This is the reason why the curriculum must be incorporated with teachings on local hazards to reduce the risks so that the associated loss and damage of natural hazards can be reduced. Teaching about hazards in the classroom is a cost-effective method to reduce the risks, and it has long-lasting and far-reaching consequences (Campbell and Yates 2006). Thus, optimization of DRR education must then be considered high priority for long-term purposes.

There is, however, limited evidence of actual comprehensive implementation of DRR in Indonesian schools linking children's classroom experience and their engagement with safe school initiatives and community efforts to adapt and mitigate risk (Kagawa and Selby 2014). Moreover, decentralization, the central government and surrounding areas on the island of Java have attracted the most research in DRR, while other areas have received less attention (Djalante et al. 2012).

The aim of this chapter is to review the progress, challenges and strategies for integrating DRR and CCA related content into the school curriculum in Indonesia. Specifically, the chapter has four objectives:

1. To identify topics related to DRR and CCA in the Indonesian curriculum.
2. To identify progress and challenges for the integration of disaster and climate change related content into school curriculum at the policy level.
3. To identify progress, challenges and potential for integration in practice: through a case study of chemistry in Aceh.
4. To propose recommendations for improving the integration of DRR and CCA education into the Indonesian school curriculum.

The structure of the chapter is as follows: Sect. 8.2 describes the methodology for data collection and analysis. Section 8.3 presents a review of literature on the Indonesian education system, the integration of DRR and CCA and the options to integrate or mainstream DRR and CCA into the education system, particularly within the curriculum. Section 8.4 presents results of the Aceh case study on the successes and challenges of implementing a disaster education approach through curriculum interventions. Finally, the chapter identifies potential challenges and recommendations for the integration of DRR and CCA into the Indonesia education system.

## 8.2 Methodology

This study is developed through a literature review and document analysis, combined with a case study and FGD. The document analysis is conducted through a systematic review on the basic competencies provided by the National Curriculum

Centre to see whether knowledge of disasters has been included into the current curriculum, particularly the new 2013 curriculum (Ministry of Education 2013d), as it is the obligatory standard of teaching in Indonesia. This part will seek to understand how far DRR has been integrated into the syllabus in schools in Indonesia.

Moreover, this chapter adopts a case study approach to a particular area where DRR education requires most improvement. The authors investigated the case of Banda Aceh using a FGD to gather data on the implementation of DRR education in this area. The session was attended by teachers from secondary high school at grade X and XI levels. This focus group contributed ideas in relation to how DRR can be integrated into the teaching of chemistry in schools in Banda Aceh and what barriers would exist in its implementation. The questions put to them were structured as it allowed them to express themselves by giving more than one answer, hence broadening the discussion. Participants also gave some recommendations on the key issues raised during the FGDs. Notes were taken and recorded throughout the entire sessions.

### 8.2.1 Data Collection

The data were gathered from an extensive review of the national standard curriculum in Indonesia. The focus was to identify topics within the curriculum that are related to disasters or climate change issues. The data collection also benefitted from the experience of one of the authors in collecting information on the current progress and challenges of the implementation DRR and CCA into school curriculum in Banda Aceh. This city was selected as it was heavily impacted during the 2004 Indian Ocean tsunami.

The preliminary study was conducted with 26 chemistry teachers in Senior High School/Islamic Senior High School in Banda Aceh in October 2014 through focus groups. The subject of chemistry was selected since it is one of the key science subjects (along with biology and physics) adopted in Indonesia. The FGD was held for about 5 h in the Tsunami and Disaster Mitigation Research Centre (TDMRC) of the Syiah Kuala University building led by one of the authors and a person from LPMP (*Lembaga Penjaminan Mutu Pendidikan*/quality assurance of education institutions). Attended were 10 chemistry teachers grade X (first year in High School level), and 16 chemistry teachers grade XI (second year in High School level) – Table 8.1 shows the list of schools and the composition of participants:

The activities was intended to provide a general overview of the current issues in disaster education in Aceh and whether the DRR concept can be a part of a chemistry lesson in a Secondary high school in Banda Aceh. All public and Islamic secondary high schools (SMA/MA) adopted the same curriculum, except SMTI (*Sekolah Menengah Teknologi Industri*), which has a special curriculum by which chemistry is taught with more hours. The issues discussed in general include: (1) Strategies for integration into chemistry subjects, (2) challenges for implementations, and (3) recommendations for integration.

**Table 8.1** List of schools included in the focus group discussion

No.	Name of school	Type of school
1	SMAN 2	Public
2	SMAN 3	Public
3	SMAN 4	Public
4	SMAN 6	Public
5	SMAN 8	Public
6	SMAN 12	Public
7	SMAN 13	Public
8	SMAN 14	Public
9	SMA Muhammadiyah I	Public
10	MAN Model	Islamic
11	MAS Darul Ulum	Islamic
12	MAN 1	Islamic
13	MAN 2	Islamic
14	MAN 3	Islamic
15	SMTI Banda ACEH	Vocational

Finally, in order to propose recommendations for improving the integration of DRR and CCA education into the Indonesian school curriculum, we utilize results from two resources. First, the content analysis of the basic competencies in the syllabus of the national curriculum, and second, a review of the key issues rose during the FGDS.

### 8.3 Results

This present section provides the potential content for integrating DRR and CCA into the school curriculum as listed under the national standard curriculum. It includes the identification of topics related to DRR and CCA, a Lesson Plan, teaching methods and a learning assessment. These are discussed in detail below:

#### 8.3.1 Identification of Topics Related to DRR and CCA in the Indonesian Lower Education Curriculum

Formal education in Indonesia has two forms: public Schools (*SD/Sekolah Dasar, Sekolah Menengah Pertama, SMA/Sekolah Menengah Atas*) and Madrasah/Islamic schools (*MI/Madrasah Ibtidaiyah, MTs/Madrasah Tsanawiyah, MA/Madrasah Aliyah*). The difference between Public and Islamic schools is the total hours given

for teaching Islam (Ministry of Education 2003). The education system is divided into three school levels:

- Preschool (TK/*Taman Kanak-Kanak*), or kindergarten is designed for children from 3 to 5 years old. The school aims at providing an appropriate environment and preparing children to adapt to the school environment before entering compulsory education through various, entertaining learning activities.
- Primary/Middle Schools offer 6 years of primary school and 3 other years for middle school. The aim of this school level is to provide basic education for children aged 6–15 years old. It is compulsory for children in this age range to attend schools as part of the “Nine Years Compulsory Education Program” or “*Wajib Belajar Sembilan Tahun*”. Primary education begins at the age of 6, whilst middle schooling is delivered to children aged 12 and older.
- High schools mean to prepare students for further education and employment, coupled with equipping them with essential life skills. The secondary high school is aimed at students aged 16–18 years old (Ministry of Education 2003)

The National Curriculum is developed at the national level and sets the basic competency for primary to secondary level. However, at the local level, schools have the authority to develop their curriculum based on the characteristics of local needs. This curriculum is called School-based Curriculum or KTSP (*Kurikulum Tingkat Satuan Pendidikan*). The first KTSP was launched in 2006, called the 2006 KTSP curriculum. The KTSP is built and developed by each school according to the guidelines offered by the National Education Standards of Indonesia (BSNP/*Badan Standar Nasional Pendidikan*). Every school may develop the learning process according to the school’s situation and student’s character. The Indonesian curriculum has changed ten times since 1947. The last version of the curriculum, known as the 2013 Curriculum, replaced the 2006 KTSP Curriculum. The 2013 curriculum was implemented in all schools after the government released the Ministry of Education Regulation No. 32 Year 2013 on the Changing of the Previous Ministry of Education Regulation No. 19 Year 2005 about the Standards of National Education. Currently, Indonesian education uses the 2013 Curriculum and the 2006 KTSP after the government announced the Ministry of Education Regulation No. 160 Year 2014 on the Enactment of the 2006 KTSP and the 2013 Curriculum. The basic difference between the 2013 curriculum and the previous one is that the new curriculum has an improvement to the assessment of student performance. The 2013 Curriculum is more comprehensive and considers the attitude and skills of the students, as well as the process of learning. It covers four core competencies (*KI/Kompetensi Inti*) that comprise four dimensions of students’ learning: Spiritual attitude (KI-1), Social attitude (KI-2), Knowledge (KI-3), Skill (KI-4). In this way, the new curriculum gave more opportunities for addressing various issues and can be tied to extrinsic outcomes like changing attitudes towards climate change (Rozamuri and Suradi 2015).

We have identified strategies for integrating DRR and CCA into the Indonesian curriculum. We propose that integration needs to take place within four aspects of

**Table 8.2** Identification of potential subjects in teaching disaster-related content in the 2013 curriculum (Ministry of Education 2013a, b, c)

Education level	Subject	Grade	Relevant basic competency (Ministry of Education 2013a, b, c)
Elementary school	Bahasa Indonesia (language)	V	Having concern, responsibility and patriotism toward natural disasters, ecosystem balance and life of the nation through utilization of Bahasa Indonesia
Junior high school	Natural science	VIII	Understanding the earth's structure to explain earthquakes and volcanic phenomena and their connection with the diversity of rocks and minerals in some regions Provide the information based on data processing of earthquakes and volcanic phenomena in Indonesia
Senior high school/ Islamic senior high school	Geography	X	Evaluate the convenient actions in natural disaster mitigation

curriculum development: lesson planning, design of learning materials, design of educational methods and techniques, and a revision of assessment guidelines. All of these are discussed below:

### 8.3.1.1 Lesson Plan (RPP/Rancangan Rencana Pembelajaran)

The lesson plan is the first procedure to provide strategic steps in the implementation of the learning process. In the lesson plan, there is always a connection between the objectives, materials, methods/techniques, media, evaluation tools and schedule for each learning activity. The RPP compiled for each Basic Competence (KD/*Kompetensi Dasar*) can be implemented in one meeting or more. Teachers designed a piece of RPP for each meeting which is adjusted for scheduling in the education unit. The integration of DRR (Table 8.2) and CCA (Table 8.3) into RPP should be prepared based on the Basic Competency (KD) in the National Curriculum (Ministry of Education 2014 b, c)

### 8.3.1.2 Teaching Methods

The 2013 Curriculum mainly uses a scientific or science process-based approach in teacher-student interaction during the teaching and learning process. In implementing the scientific approach, learning materials based on facts or phenomena that can be explained by the particular logic or reasoning that deviate from the flow of logical thinking are used. This includes the activity of observing/asking; collecting information/trying; reasoning/associating and communicating. The learning

**Table 8.3** Identification of potential subjects for teaching climate change-related content in the 2013 curriculum (Ministry of Education 2013a, b, c)

Education level	Subject	Grade	Relevant basic competency (Ministry of Education 2013a, b, c)
Elementary school	Bahasa Indonesia (language)	V	Provide the report about the problems caused by the disturbance of natural balance because of human actions and predict the future problem where the problem was not overcome
Junior high school	Natural Science	VII	Describe the interaction between human beings and environment
			Describe natural pollution and its impacts on human beings
			Describe the causes of global warming and its impact on ecosystems
Senior high school/ Islamic senior high school	Geography	X	Show the action of concern towards environmental problems both in Indonesia and in the world
			Show responsive actions in preventing and solving environmental problems
			Show responsibility in keeping environmental sustainability
	Chemistry	X/XI/XII	Having an action of keeping the environment and thriftiness in utilizing natural resources.

outcomes have been set to produce effective, creative, innovative and productive behaviors to strengthen attitudes, skills and knowledge as a united aspect.

The attitude domain is purposed to make the students “know why”, while the skill domain aims to make the students “know how”. The knowledge domain seeks to make students “know what it is”. It is state in the curriculum that to achieve the quality that has been designed in curriculum documents, learning activities should promote: competence-based learning; integrated learning; skills-based learning; promotes cultivation and empowerment of students as long life learners; use the information and communication technologies to improve the efficiency and effectiveness of learning; and recognise the individual need and cultural backgrounds of students; and fun and stimulating (Hidayati and Sayekti 2015).

**8.3.1.3 Learning Material**

The development of learning material is needed to form the knowledge, creativity and attitude that must be achieved by the students to meet the specific basic competencies. The learning materials should be developed based on these following principles. First, relevancy: learning material should be relevant to the achievement of core competence and basic competencies. If the expected ability that is achieved by students is in the form of memorising facts, then the learning material that is taught

**Table 8.4** An example of learning materials on adaptation to climate change education in grade X (Hidayati and Sayekti 2015)

Chapter	Learning materials
Definition and impacts of climate change	Definition of climate change
	Factors causing climate change
	Impacts of climate change on energy consumption, biodiversity, water resources, transportation system, coastal areas, agricultural sectors, forests and health
Adaptation to climate change	Adaptation in agricultural, infrastructure, coastal area, fishery, water resource, transportation, energy, tourism and forest sectors
	Activity to change attitudes, such as saving energy and natural resources, planting trees, reducing emissions and using renewable energy
Mitigation of climate change impacts	Preventing carbon dioxide released into the atmosphere
	Reducing greenhouse gas production including learning the causes of climate change, early signs and further impacts of climate change

must be a fact, not a concept or principle or any other kind of material (Santiago-Fandino and Spiske 2016). Second, consistency: if there are four types of basic competencies that must be achieved by the students, then materials used should include these four competencies. Third, adequacy: the material should be sufficient to help students to achieve basic competencies in the lesson with consideration of the level of physical, intellectual, emotional, social, and spiritual development of students (Ministry of Education, 2013d) (Table 8.4).

### 8.3.1.4 Learning Assessment

The assessment for students in disaster education is considered even less developed. So far, in formal education, schools use formative, summative or a balanced assessment (both formative and summative assessments) to measure student understanding in the element of hazards (UNICEF 2012). Formative assessment is defined as processes for providing feedback to enhance student performance and to enable pupils to make an improvement during the teaching and learning process, while summative assessment is made based on judgments of learning outcome and teaching effectiveness (Schafer 1997; Bell and Cowie 2001). Nevertheless, the assessment tools should always be adapted to reflect information needed in specific contexts. By the end of the lesson, the understanding of knowledge can develop critical thinking, creativity, problem-solving and the capacity to share information, raise self-awareness, demonstrated moral and civic competencies and environmental awareness (INEE 2010). An example of a tool to assess School-based Preparedness (SSB) was developed by Indonesia Institute of Science (LIPI) in 2012 (Triyono et al. 2012). Nevertheless, the tools were only focused on preparedness aspects rather than the entirety of disaster risk management.

The Incorporation of DRR and CCA into the context of the school curricula in Indonesia should pay attention to basic competencies (KD) of the applicable curriculum. Assessment is conducted in the form of written or oral, observation of performance, attitude measurement, assessment of the work in the form of assignments, projects and/or products, the use of portfolios and self-assessment. The achievement assessment of students is conducted based on indicators with the goal of infusing important values (preparedness, adaptation and mitigation) for students in their everyday life, especially in a school environment and their families. However, there are few studies on student assessment in DRR and CCA in Indonesia that have been done so far.

### ***8.3.2 Progress and Challenges in Integrating DRR into School Curriculum at the Policy Level***

#### **8.3.2.1 Progress**

A diversity of research has pointed out that incorporating DRR into formal education can be an effective way of reducing risks (Petal and Izadkhah 2008). The Indonesian government has been aware of the urgencies of embedding the issues of disaster risk in the national education curriculum. In 2010, with the support from the Indonesian Disaster Education Consortium, the Ministry of Education and BAPENNAS (Planning Governance Body), the three collaborated to incorporate and integrate DRR knowledge into the school curriculum through the “*Circular of the Minister of National Education No. 70a/SE/MPN/2010 on Mainstreaming of Disaster Risk Reduction at Schools.*” The vision of this strategy is to realize disaster-awareness culture, preparedness, safety and resilience at the schools level in order to prevent and reduce potential losses from natural disasters (SCDRR 2011). To support the action, the Curriculum Development Centre has been working on revising the previous Curriculum (the 2006 KTSP Curriculum) and harmoniously integrating the topic of DRR and climate change into basic competencies in the 2013 curriculum. The circular addresses three aspects:

1. Enablement of the organized role and ability of school society;
2. DRR incorporation into formal educational curricula, both in the internal and extra-curricular;
3. Establishing shareholder partnership and a system to support the enactment of DRR at various schools (Ministry of Education 2010).

Another initiative to address the Circular Letter No.70a/MPN/SE/2010 on Mainstreaming of Disaster Education at School was conducted by the Tsunami and Disaster Mitigation Research Center (TDMRC), Syiah Kuala University in Aceh, was the integration of disaster education into the 2006 KTSP Curriculum for high school level (TDMRC 2010). Emergency Planning and warning systems were introduced through teacher training and also simulations or exercises, while resources mobilizations were introduced through school council meetings. The school model



showed relatively slow progress in its first years as the school lacked confidence being appointed as models, but gradually increase their initiatives when technical assistance was provided again in 2011–2012 (Rafiana 2012). Further, these schools had inspired other schools in Banda Aceh to establish SSB, with technical assistances from TDMRC Syiah Kuala University. Later, the SSB concept was adopted by the Consortium for Disaster Education (CDE), which incorporated it into the Education Minister’s Circular Letter for Mainstreaming DRR into Education (Rafiana et al. 2009).

Several pieces of research have shown the positive impact of disaster education on a population’s preparedness to disaster response and management. LIPI (Indonesia Institute of Science), TDMRC at Syiah Kuala University and UNESCO in 2008–2009, developed a school-based disaster preparedness model (SSB/*Sekolah Siaga Bencana*) using Banda Aceh as case study (Yulianto et al. 2009; Rafiana 2012). The models were developed with interventions based on the preparedness assessment parameters developed by LIPI and UNESCO with support from UNISDR. The critical parameters are knowledge and attitude, policy statement, emergency planning, warning system and resources mobilizations (Hidayati et al. 2006). A survey conducted with 372 junior high school students from SSB and non-SSB in Banda Aceh showed that students in SSB, who had a prior knowledge on disasters, were more actively involved in disaster preparedness activities such as first aid training, disaster meetings and also in disseminating information to their friends, family and neighbors (Oktari et al. 2015). A study in Jogjakarta, Indonesia, which involved 239 junior high school students from SSB and non-SSB schools, showed that students from SSB, who learnt hazard education through the earthquake module, had better knowledge on the level of risk perception, critical awareness and attitude toward earthquake preparedness compared to their counterparts. This evidence suggests that disaster education can be an effective method to increase knowledge, attitude and awareness towards disasters. Hence, it may be seen how implementation of curriculum-based disaster issues was effective in mitigating risks, enhancing disaster knowledge, increasing the level of risk perception and individual and school preparedness. The effect might play an important role in raising public awareness, spreading correct knowledge about disasters and promoting behavioral preparedness to disasters in the wider community rather than being limited to schools (Adiyoso and Kanegae 2013).

Some lessons learnt arose from the initiative, firstly, a lack of human resources in applying the integration of DRR into KTSP. Thus, it is important to improve the knowledge and skill of teachers toward KTSP development and implementation. Second, the integration should involve effective and continuous technical assistance to maintain the quality of KTSP implementation. Third, to ensure successful KTSP implementation, facilities and infrastructures are crucial. Fourth, the involvement of stakeholders is needed in order to get complimentary ideas and information (TDMRC 2010). Based on this experience, it is relevant to note that the integration of DRR into the school curriculum in Indonesia still experiences challenges such as lack of human competence, limited technical assistance as well as facilities and infrastructures.

### 8.3.2.2 Challenges

The section outlines challenges that Indonesian schools faced on the way to integrating DRR and CCA into the school curricula. The challenge identified includes limited teacher capacity, a lack of practical guidelines, limited financial support and a lack of a unified set of criteria and guidelines for DRR and CCA education. Each of these challenges is discussed in detail below.

#### Lack of Teacher Capacity

At the time the 2013 Curriculum was introduced, disaster education appeared more in primary and middle school curricula and was not well recognized in the secondary high school curriculum. Although environmental issues such as green house gas emissions, sea level rise, air pollution and earth formation is taught through biology, physics, chemistry and geography, which is closely related to teaching on hazard-related content, the inclusion of knowledge about hazards was still very limited. In this preliminary study, chemistry is considered as one of the tools for teaching DRR and CCA, although other subjects, such as art, language and math also have potential to be a tool in teaching the concept of DRR and CCA for students in Indonesia.

The integration of DRR and CCA into the curriculum needs appropriate support from the school community, especially teachers. The main problem that occurs during the implementation of the program is the lack of teacher's knowledge on the DRR and CCA. The study concluded that the difficulties in the implementation of a "new topic" in the curriculum are mainly down to lack of knowledge and guidelines. Nevertheless, if they have the adequate training and implementation guidelines, they believed that the integration process in the curriculum would be easier. The teachers believed that the infusion of the new topic such as disaster education and climate change adaptation would benefit students in Indonesia (Nurmalahayati 2015).

#### Lack of Practical Guidance

The implementation of the 2013 curriculum has given new tasks for the teachers. It needs enormous efforts for teachers to understand the change in the curriculum. If the integration of DRR and CCA required special attention from teachers, the implementation process in the field would be suspended. Thus, a lack of guidelines for developing the new syllabus, as well as guidance on the use of new media and teaching materials is a challenge that hinders DRR and CCA integration (Nurmalahayati 2015). Though the need to include DRR and CCA into the Indonesian education curriculum is evident, there is no explicit guideline on aspects of "what" or "how", which makes the implementation process unclear, especially given the absence of clear assessment metrics and benchmarks that could gauge whether the integration was successful or not.

### Lack of Financial/Policy Supports

Another main problem is the lack of financial and policy support in the implementation process. Even though schools in Indonesia have operational funds (*BOS/Bantuan Operasional Sekolah*), every school has its own priority. Moreover, the absence of the legal standing for the integration of DRR and CCA into the curriculum may have led to ineffective implementation. The legal standing of the Ministerial Circular Letter is also considered weak. The nature of the letter is merely ‘advice’ to include DRR into education, including into the curriculum, but there are no legal consequences if schools do not implement it. Therefore, it would be entirely up to schools to decide, as reflected in the school management system. That is why, intensive and continuous technical assistance from universities or non-government organizations is critical for sustaining such efforts.

### ***8.3.3 Progress and Potential for Integration at the Implementation Level: Case Study of Chemistry in the High School Level Curriculum in Aceh***

This section contains our results of an analysis based on the key themes during the FDGs. We first present the strategies for integration into chemistry identified by the teachers, then outline challenges for implementing those strategies.

Based on the overview of the presentation in the introduction of the FGD, respondents had a clear view what is meant by disaster in the research and they captured the possibility to do this in the subject of chemistry. It was suggested that any integration strategies need to consider local values that related to disaster events in the past. However, the participants mentioned that the integration of DRR into a chemistry lesson needs to be considered as a new knowledge for teachers and students, so it would be likely to integrate this within the well-defined tools for both of them. The participants also worry if their works might not be counted as a point for the teacher certification, which means there is no point of doing this even if they believe that this issue is very important for students who live in disaster prone areas.

Some topics have been considered as potentials in introducing DRR content in the chemistry lesson. This included the periodical system where students can work on hazard mapping by identifying the hazards from different resources. The idea would be similar to mind mapping learning. In particular, for example, when students learn the Chemistry periodical system, they will be asked to put the relevant hazard that they might think to be related or can be explained through chemistry. Climate change is likely to be one of the potential topics to develop student understanding about the impact of using fossil fuels, for instance.

In general, the teachers' discussion yielded that DRR is likely to be taught in chemistry curriculum and act as a tool to increase students' awareness to communicate the risk of disasters. The participants believed that the dissemination of the DRR concept into the chemistry curriculum has potential to be applied. For instance, looking at the chemical process of forest burning and air pollution, etc. which is a very common problem in Indonesia.

Table 8.5 shows the key topics discussed with the chemistry teachers, which include how they identify methods for integration, the selections of topics within chemistry subjects and the problems that teachers might encounter if they were to implement those strategies. The discussion goes toward identifications of disaster and chemistry related content based on the standard and basic competence in the curriculum.

Table 8.6 below summaries the discussion in this section, which list potential topic of integration DRR and CCA, progress and challenges for integration at the national and local level at different education level.

### **8.3.4 Recommendations for Integration**

Building on the results and especially on the theme derived from Table 8.6 previous, we propose three categories of strategies for future integration of DRR and CCA into school curriculum in Indonesia.

### **8.3.5 Support for Teachers**

Teachers are the key actors in disaster risk reduction education; as pointed out by Adiyoso and Kanegae (2013), however, teacher training is very poor in terms of effective DRR and CCA integration in Indonesia. Hence, improving the aspect of teacher preparation may contribute significantly to disaster preparedness and training at schools. To support the process, the following steps are recommended by the researchers:

1. Provide teacher training on DRR and CCA in a more practical way. For instance, the teachers of the subject of study should be asked to bring the developed syllabus, and during training sessions, teachers are taught to identify competencies related to disaster preparedness education that they can teach. Based on the identification of results, the teachers are guided to find out the method and media that can be used to teach about disaster response and management without changing the available syllabus. The training can be a platform for teachers to find various ways to teach a topic that relates to disasters.

**Table 8.5** Overview of discussion with chemistry teachers

Main issues	Description of discussion	Current mechanisms of responding to issues	Possible solutions
The potential methods for integrating DRR into chemistry	There are several options offered by teachers in addressing the topic i.e. discussion, experiment, demonstration, field visits (historical disaster sites and also giving support for affected people when catastrophes happened), using movies or other media	Most of the participants suggested that students should have an overview on disasters before integrating a new concept to the lesson	Teachers should be well trained about the disaster before introducing the topic to the students. Also it would need clear guidance so the learning goals will be achieved at the end of the lesson
		Linking to the most recent catastrophe event in a newspaper or television might increase student understanding on this topic	
The potential topic within chemistry that explains more about the facts of disasters	Teachers also work in small groups to give more opportunity to explore some topics that would be suitable to adopt DRR into chemistry. It starts with an analysis of the topic and basic competence that the student should achieve at the end of the learning process	Teachers have pointed out some chemistry topics which are relevant to introduce DRR, for instance; periodical system, chemical reactions, kinetic, thermo chemistry, hydrocarbons, reduction and oxidation, and laboratory safety	The mainstreaming of DRR into chemistry lessons should start by analyzing each basic competence. Selecting the specific themes in each grade to see the possibility where DRR can be covered more
The problems possibly encountered while teaching about natural events and disasters in chemistry	The teachers concern about the limitation of knowledge on the topic. This might lead the difficulty in how to teach effectively and what is a suitable media to be used for learning. It was also stated about time allocation for the topic. The teacher worried if they do not really understand what they would like to teach, it will be more time consuming and consequently it can adversely affect the achievement of the subject	By attending the discussion, teachers are getting more familiar with the importance of teaching DRR as part of the curriculum	For long-term purposes, teacher trainings are crucial to help them to gain a better perception on disaster issues and to develop the lesson plan
		However, they still need some assistance to develop the lesson plan, so they can properly manage the learning time and find out the most effective way to integrate the topic into the subject of chemistry	The teacher needs to spend extra time for searching the information from the internet and printing documents related to the topic Engaging students in collecting the information from media i.e., newspapers or internet, will probably help both teachers and students get a basic understanding of disasters around them

**Table 8.6** Summary of progress and challenges of integrating disaster risk reduction and climate change adaptation at national and local level (Authors 2016)

Education level	National		Local	
	Progress of integration	Challenges for integration	Progress of integration	Challenges for integration
Bahasa Indonesia (language) SD, grade V	Basic competencies on disaster related subjects have been included in the national curriculum where students are expected to have concern and responsibility towards natural disasters by providing reports	As each area has different types of disasters, which means the vocabulary they use cannot be generalized; the development of a lesson plan might be varied. This condition will give different results for understanding disaster contexts	There are some methods in delivering the information about natural disasters through local wisdom, for instance, using story telling from locals, and traditional songs like <i>Smong</i> from Simelue Island	An issue that might be raised is including a lack of capacity of teachers and students in developing the disaster related words <hr/> Teacher's knowledge on local wisdom
Natural science SMP, grade VIII	Basic competencies on disaster related subjects have been included in the national curriculum which focuses on understanding the processes of earthquakes and volcanic phenomena	Some possible barriers in the implementation are the lack of ability of teachers in understanding the topic and limited access to some materials needed to conduct the experiments to explain the process of the earthquake or volcanoes	Provision of mobile facilities for easy reach to large numbers of schools ( <i>mobil pintar kebencanaan</i> ) in educating school communities and gaining more information about natural disasters, such as demonstrating volcanic eruption processes	The availability of learning resources for teachers and students, especially in remote areas <hr/> The availability of learning materials which are needed for conducting experiments/ demonstrations of the processes of disasters <hr/> The ability of teachers to conduct experiments
Natural science SMP, grade VII	Basic competencies on disaster related subjects have been included in the national curriculum where students need to be able to describe the causes and impacts of global warming	In the implementation, teacher might use different contexts to explain the context of global warming as the impact of global warming might vary in each area which gives different results in understanding the issue of global warming for students	At the local level, as teachers and students become more aware about local impacts of global warming that are happening around them	The main issue in the implementation is the lack of teacher capacity in connecting the theme in the classroom with more updates on disaster issues at bigger scales than happen around them (national and international)

(continued)

**Table 8.6** (continued)

Education level	National		Local	
	Progress of integration	Challenges for integration	Progress of integration	Challenges for integration
Geography SMA, grade X	Basic competencies on disaster related subjects have been included in the national curriculum which addresses the ability to evaluate and have a concern toward environmental problems both in Indonesia and around the world	The competencies needing achievement do not provide enough relevant information about environmental problems they need to address in the teaching and learning process. It will give different perceptions for teachers for interpreting disasters in regional and global contexts	Even if there is no direct activity provided by schools, some areas in Indonesia has involved students in planting mangroves to support coastal zones and to educate them about the importance of coastal areas in their environment	The availability of learning resources and the ability of teachers to explain and associate the learning process with environmental problems and disasters that happened around them
Chemistry grade X/XI/XII	Basic competencies on disaster related subjects have been included in the national curriculum which address the focus on having an action of keeping the environment and thriftiness in utilizing natural resources	The issue about disasters is not clearly mentioned in chemistry. However, it can be delivered within various topics in chemistry. The condition might lead to different points of view in explaining about how to keep environments and how this is related to disasters	Teachers argued that chemistry can be one of the potential topics for explaining about disasters and climate change issues in the classroom. Some potential topics within chemistry such as fossil fuels, environmental chemistry and the periodical system can be a tool for teaching about disasters (FGD)	The limitation of knowledge on hazards and disasters and practical guidelines for developing disaster related issues in the lesson plan (FGD)

- Maintain sustainability by giving the rewards for teachers who demonstrate continuous efforts in teaching DRR and CCA, both in the class and through extra-curricular activities. An appreciation can be given either at school level or provincial level with the support from the education authority, BPBD or NGOs.
- Collaboration with teacher training centres and educational institutions to embed DRR and CCA materials in the training.
- Collaboration with a university to include DRR and CCA topics as a compulsory subject for first-year students in the education department.

### 8.3.6 *Materials for Teaching About DRR and CCA*

The classroom can be a starting point to pass valuable knowledge to children and society and to make the connection between knowledge and values. For example, in the Junior High School, students have been introduced to the concept of climate change and its impacts on ecosystems. It has been set as one of the core competencies needed to be developed by students during the learning process. By understanding this concept, students are expected to understand the risk of climate change for the ecosystem and improve their awareness about the issue. Another example is from the chemistry curriculum in grade XI in senior high school (SMA, age 16–18 years old). Students learned about fossil fuels and the cycles of CO<sub>2</sub> in the atmosphere, risks associated with global warming and aspects related to increasing acidification of the oceans from increased dissolved CO<sub>2</sub>. As a maritime country, Indonesia will be severely affected by the escalating level of ocean acidification and the condition will influence the economic sectors; hence, Indonesian students may benefit even more from DRR and CCA education by learning the ways in which the climate change affects their population directly (BKPM 2011).

However, based on the problem identified during the FGD, it is still unclear how teachers should work to fulfil all the competencies needed and address the issue of climate change/disaster preparedness at the same time. This chapter provides some examples of integrating vital DRR and CCA knowledge into the regular curriculum, including:

1. *Physics*. Thermal expansion, the learning process can be associated with the increase of sea level. Using hands-on experiments with a seawater sample, candle, thermometer and a beaker glass, students can observe how the temperature change can affect the water volume and make the association with the processes occurring in nature. Such insights may help students to analyse and forecast the consequences of rising water levels, and clarify the origin of natural disasters occurring in the region. To support such activities, teachers can write down keywords such as flood, landslide, drought and earthquake to help students identify the disaster related to sea level rise. Finally, students can be asked to reflect on why these phenomena happened, why seawater rises and what the population can do to prevent adverse climatic trends. In senior high school, the IPCC table can be used as an additional tool to conduct deeper academic analysis and make wider comparisons on the regional and international scale.
2. *Chemistry* (through such topics as environmental chemistry, hydrocarbons, acidic and basic). These topics can be used in education about DRR and CCA. Environmental chemistry and hydrocarbons can be associated to greenhouse gases (GHG) and their adverse impact on climate change, while acidic and basic data can be used to explain the change of seawater chemistry as a result of human activity. Students can be asked to explain the chemical compounds and reactions that contribute to global warming, and to measure the acidic and basic constituents of seawater. For this activity, teachers can provide flash cards and ask the students to make a connection between the chemistry and hazards in the environ-



ments associated with massive CO<sub>2</sub> emissions in the water stemming from human activity. The students can be asked to describe the greenhouse process, its reasons and mechanisms, and may also be asked to reflect on how the process can be prevented, mitigated or reversed.

Besides the discussed aspects of knowledge, the social aspect (attitude) can also be taught through some topics in chemistry. For example, the atomic bonding can be used as an example to teach mutual relationship during disasters and post-disaster, as a symbol of the relationship between human beings who need each other to become more stable. However, it is also vital to keep in mind that methods used in the teaching and learning process should be appropriate to the characteristics of students and the subject of study, and also with the scientific learning approach as mentioned in the 2013 Curriculum that includes observing, asking, trying/conducting experiments, analysing and then communicating. Various learning models can also be applied to teaching and learning activities so that pupils will get meaningful learning experiences that are relevant to their developmental age (Ministry of Education 2013a, b, c, d).

### ***8.3.7 Financial and Policy Support***

There is a need for serious effort from all parties to maintain the sustainability of the designed program for DRR and CCA integration (CDE 2011; USAID 2014). The local government and Ministry of Education at the provincial level should pay more attention to supporting the process of integration DRR and CCA in the curriculum. It can be achieved in several ways including:

1. Regular fund allocation from the National budget (APBN/*Anggaran Pendapatan dan Belanja Negara* and Provincial budget (APBD/*Anggaran Pendapatan dan Belanja Daerah*). Through regular fund allocation, the schools can be in a position to incorporate various programs that focus on training to foster knowledge on DRR and CCA for students, teachers and school societies.
2. Building a partnership with the local community. The local community, schools and the other partners need to join efforts and work towards seeing a reduction in climate change. As such, the integration of DRR and CCA can be achieved through ensuring a working partnership among the partners. As such, there is a need for programs where the schools can work with the societies in conserving the environment, such as in planting tree programmes.
3. University, Teacher Training Centre, and NGOs. As a national program, the climate change stakeholders must work towards ensuring that certain milestones are met. To achieve this goal, there is a need to ensure that the DRR and CCA information must be available across all platforms.
4. Formulation of a legal framework to regulate the incorporation of DRR and CCA into the Indonesian curriculum. On a similar note, the government and other stakeholders need to work together to come up with a firm legal framework to ensure the integration of DRR and CCA can be a part of a national agenda.

## 8.4 Conclusion

Indonesia is evidently progressing on its way to incorporating DRR and CCA into the national education system. Nevertheless, challenges and gaps are identified that need further action. As studied in several cases, with the intervention of DRR and CCA information into curricula, knowledge had significantly increased, both for students and for teachers. DRR integration into the 2013 Indonesian Curriculum is also mainly aimed at increasing knowledge, although there are other avenues to engage practices and shape attitudes, for example, through correlated subject or integrated subject approaches. Access for available materials is still one of the main issues. Yet, the increase of knowledge may not necessarily translate into action. Frequent revisions of the curriculum are also a huge challenge, as it would consume more time and resources for DRR and CCA to re-adjust.

It is obvious that once there is an inadequate policy support at the school level, there is also a lack of encouragement coming from the district, provincial and national levels. The current regulations are not binding teachers, principals, students or parents to enact DRR and CCA. It would heavily depend on the school's motivation to keep up and update their curricula, and seek relevant tools and materials proactively.

Overall, curriculum revision needs a lot of money and is time consuming. The integration of DRR and CCA into the current subject of study, local content and extracurricular activities would be a better without giving a new burden for students and teachers. Based on the identified challenges, the researchers propose recommendations for the improvement of DRR and CCA integration into the Indonesian curriculum. These are directed towards mitigating the negative impact of challenges currently faced by Indonesian schools in terms of aligning climate change and disaster response education with the current version of the Indonesian school curriculum. The outlined recommendations can help strengthening DRR and CCA adoption in Indonesian schools and may contribute to the achievement of a much greater level of disaster preparedness and climate change awareness.

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# Chapter 9

## Spatial Planning, Disaster Risk Reduction, and Climate Change Adaptation Integration in Indonesia: Progress, Challenges, and Approach

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**Abstract** Spatial planning (SP) is an essential element to reduce disaster risk, especially in rapidly urbanizing countries with high social vulnerability such as Indonesia. While the Indonesian government has substantially progressed with the integration of SP into development, Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) have not been specifically addressed at the same level. Integrating DRR and CCA with SP is very important to lay a foundation for long-term, forward-looking risk reduction, primarily through reducing exposure to natural hazards. There are, however, only few studies that have discussed the integration of DRR and CCA into SP in Indonesia.

This chapter addresses this gap and aims to explore the progress and challenges for integrating CCA and CCA into SP in Indonesia. The specific objectives of this chapter are threefold: (1) to review the literature on the role of SP related to DRR

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and CCA, (2) to review progress and challenges for integration, and (3) to propose an integrative approach in SP. These objectives are met through a detailed literature review of relevant studies, policy documents and unpublished report analyses.

The study finds that strategies to enhance integration include strengthening the institutional and policy dimension, which requires coordination, cooperation and collaboration among relevant stakeholders, as well as clear policy and guidelines for integration. There also needs to be more data and information to guide decision making especially at the local government level, whilst central government support is also required in terms of data availability and accessibility. Lastly, successful integration requires capacity building and empowerment for local governments and society. The authors propose a combined vulnerability risk assessment (VRA) which considers parameters such as climate stimuli, hazards and risk, and affected area, thus integrating DRR and CCA with SP aspects.

**Keywords** CCA • DRR • Indonesia • Integration • Spatial planning • Vulnerability and risks assessments

## 9.1 Introduction

Disaster and climate change have become two global issues that are significantly influencing environmental and socio-economic change, particularly in developing countries, due to their limited financial and technological supports and human resources capacity. Much evidence has shown the effect of disasters and climate change on the loss and damage of physical infrastructure and socio-economic conditions, for example the salinity intrusion affects rice production (Rabbani et al. 2013), flooding and drought affect rice production (Brida et al. 2013), flooding damages to houses and crops, the outbreak of diseases, and loss of livestock (Haile et al. 2013). The impacts of disaster and climate change have given attention to international concern as well as national and local governments addressing the issue. Indonesia is considered one of the most vulnerable countries in the world due to its geographical location and socio-economic matters, which significantly influences the impacts in several urban areas and regions. In addition, the country consists of many islands, with a large proportion of the population living in coastal areas, near volcanic mountains and between the active areas of the Australian Indian Plate and Eurasian Plate. Indonesia is also located in the tropics, which brings dry and monsoon seasons that dominate the climate in this region. These characteristics precondition Indonesia to some of the worst impacts of natural disasters and climate change, such as earthquakes, volcanic eruptions, flooding, extreme climatic events and rising sea levels. Indirectly, they have affected urban and regional development, causing economic loss, environmental damage and social conflict.

Government of Indonesia (GoI) has attempted to minimize these impacts by proposing measures for disaster risk reduction (DRR) and climate change adaptation (CCA). International agencies and non-government organizations (NGO) have been

involved in these measures to reduce vulnerability and to enhance resilience. Studies on the progress on DRR and CCA in Indonesia have been investigated by some scholars (e.g. Wijaya 2015b; Djalante 2013; Djalante and Thomalla 2011, 2012). Wijaya (2015b) studies barriers and opportunities for integrating CCA into urban development planning based on stakeholders' perspectives. Djalante (2013) has examined the drivers, barriers and opportunities for institutional arrangement of DRR and CCA. Djalante and Thomalla (2012) appraise DRR and CCA activities related to institutional aspect, meanwhile Djalante and Thomalla (2011) also conducted a study on natural hazards, climate change and the effects on community resilience. However, it is assumed that spatial planning (SP) does not yet strongly consider crossover with DRR and CCA. It can be found that the integration is either between DRR and SP or CCA and SP, as well as DRR and CCA. Lassa (2010) emphasizes that there has been limited interaction among SP, DRR and CCA regulation, practices and actor networks in the last decade. The integration becomes important because spatial plans are required for every area at local, regional and national levels based on the Spatial Planning Law 26/2007 as the guideline to ensure the planning area that is suitable for development. SP considers the land use pattern and structure as well as physical infrastructure in the planned area. SP aims to create harmonization between natural and artificial environments; to create cohesion in the usage between natural and artificial resources by considering human resources; and to create protection of spatial function and prevention of negative environmental impacts due to spatial utilization. Effective SP can help to minimize vulnerability to disasters and climate change. SP without consideration of climate change impacts and disaster risks will exacerbate the situation in the planned area, affecting physical infrastructure as well as socioeconomic conditions. Integration of DRR and CCA into SP becomes yet more challenging, especially in the current era of decentralization. Decentralization has brought immediate change to environmental management in Indonesia. The distributions of power and community security were the two pillars that emerged significantly for environmental management in the country. As Kartodiharjo and Jhamtani (2009) highlight, the issuance of local regulation (*Peraturan Daerah*) has a critical impact on the management of natural resources and the environment at the local level. Furthermore, the unique characteristics of each region stress the importance of tailored-made spatial planning. For that reason, this chapter has the following objectives:

1. To review literature on role of SP related to DRR and CCA,
2. To review progress and challenges for integrating DRR and CCA into SP in Indonesia, and
3. To propose an integration approach in the SP process.

The chapter is structured as follows: The next section explores the methodology, followed by a brief overview on the SP process in Indonesia in section three. The fourth section elaborates practical studies on current strategies to integrate DRR and CCA measures into SP. The fifth section describes the potential integration approach of a combined vulnerability and risk assessment into the SP analysis process. In the last section, a conclusion is given and recommendations are addressed.

## 9.2 Methodology

This study is mainly based on qualitative research. A review of related literature and policy documents is conducted. Additional sources consulted include, grey literature, GoI reports, management plans (strategic plans and local development plans), spatial plans and other archival data sources. This study also reflects on the author's experience in conducting a particular project related to integration of spatial planning, DRR, and CCA. Analyzing unpublished documents including meeting reports is also carried out in this study.

## 9.3 SP Processes Related to DRR and CCA in Indonesia: Progress Review

There are a handful of studies on the relationship between DRR, CCA and SP in Indonesia (see Sutanta et al. 2010, 2013; Djalante and Thomalla 2012; Djalante 2013; Wijaya 2015b). Sutanta et al. (2010, 2013) examine the important role of SP in DRR through better management, especially land allocation at the local government level. They argue that an effective spatial plan could contribute to reducing vulnerability and disaster risk. Djalante and Thomalla (2012) assess the integration between DRR and CCA planning and implementation activities, and how they are related to institutional arrangements in different government levels. They suggest that at the national level, a reorientation of institutional structure is required. Meanwhile at the local level, there is a need to strengthen technical and financial support. Djalante (2013) investigates the drivers, barriers and opportunities for integrating DRR and CCA in Indonesia.

Regarding CCA and SP, Wijaya (2015b) has explored the barriers for integrating CCA into urban development plans including spatial plans based on stakeholders' perspectives. Wijaya (2015b) argues that barriers including knowledge and information, social acceptance and institutional and financial dimensions, have been categorized as significant elements for integration. Strategies to overcome these barriers include: the need to build the capacity of all relevant stakeholders, increasing understanding and awareness of local authority officers and gaining acceptance and participation from the public. However, those studies are still limited by separate consideration of DRR and CCA, DRR and SP and CCA and SP. This study attempts to integrate both DRR and CCA into SP.

The implementation of decentralization has significantly affected the natural resources management sector, both economically and politically, including the issue of climate change and disaster risk. A recent study by Pepinsky and Wihardja (2011) suggested the importance of political stability and certainty within districts, in addition to productive resources, to ensure positive economic outcomes from decentralization. In addition, there are also questions regarding the capacities of local government to

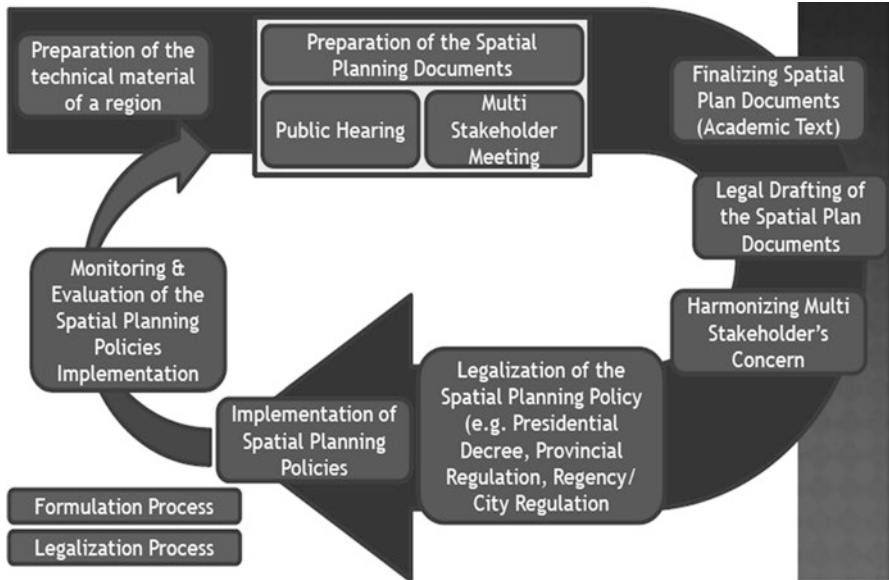


tailor their own policies. The early process of devolution highlights differences between levels of government.

In terms of SP in the decentralized system, there are two viewpoints. On the one hand, this is opportunity for local authorities to explore and develop their areas. On the other hand, it becomes challenge, because every local authority has different capacities based on local context. Areas with sufficient financial and human resources mostly engender the capacity to carry out SP according to regulation, whilst regions without enough resources still require support from national government. Thus, this is the entry point in which DRR and CCA aspects could be integrated into SP. As spatial plans are place and context specific, the approach for reducing risks is unique for each region (IPCC 2014). Land use policies and regulations that integrate consideration of climate change into settlement and infrastructure planning can be addressed in SP.

Scholars have emphasized the significant correlation between SP and risk management in terms of strengthening urban resilience. Fleischhauer (2008) stated that SP plays an essential role in reducing the vulnerability of societies to hazards, although challenges still remain in integrating both measures. Greiving argued that generally SP does not yet consider risk assessment analysis. There is lack of sharing, informing and integrating data and information among different actors (SP, sectoral planning, disaster management units, etc.). Schmidt-Thomé (2006) suggested that it requires assessment from single hazard to multi-hazard approaches, integrating potential climate change impacts in SP process. SP practices should also therefore consider being more interdisciplinary.

The emerging notion of risk management into SP in Indonesia took form after the catastrophic earthquake and tsunami disaster in Aceh in 2004, shifting the paradigm from one of disaster management to disaster risk reduction. Indonesian Law 24/2007 on disaster management is one of the government's efforts in enforcing disaster management that focuses on pre-disaster measures. SP has become one of the mitigation measures in the disaster management cycle, and its implementation and enforcement in law is conducted to reduce disaster risks. Throughout the Spatial Planning Law 26/2007, the term 'disaster' is initially used. This Law states that Indonesia is prone to hazard events and in order to determine spatial pattern and structure, data and information on disasters is considered. According to the Law, the prone area is allocated as a protected area, with one of its functions being to reduce the impacts of natural disasters. Meanwhile in spatial structure, the consideration of disaster mitigation is allocated by infrastructure planning such as an evacuation system. Regarding CCA, the Law does not state it explicitly in SP. Climate change is still a new issue to incorporate in SP, although there is statement for water management in the allocation of spatial pattern as a protected area, such as an upstream area or along a river, etc. Contradicting with the previous Law of SP 24/1992, the term disaster was not used explicitly. Meanwhile, the climate factor was used for planning that is related to water resource provision instead of to reduce climate change impacts. It can be assumed thus far that SP in Indonesia does not yet strongly consider DRR and CCA.

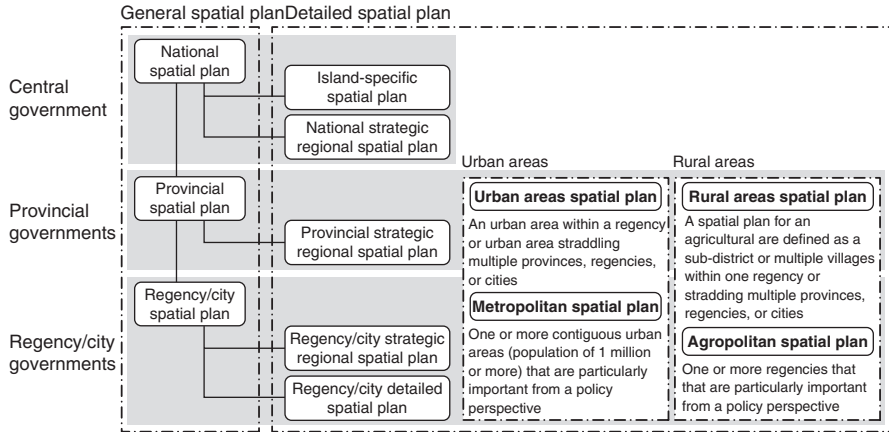


**Fig. 9.1** Common process of spatial planning in Indonesia (Source: Ministry of Public Work 2013)

In general, the process of conducting SP in Indonesia is still progressing slowly, especially with regards to SP legal policy. The process of SP in Indonesia is depicted in Fig. 9.1.

There are two processes, which are formulation and legalization. The formulation process starts with the preparation of technical material, then preparation of SP documents. Public hearings and multi-stakeholder meetings are conducted in the preliminary stage. After that, finalizing spatial documents are established. In the legalization process, legal drafting of SP documents is done, which then requires obtaining stakeholders’ concerns. The final product is the legalization of the SP policy that can be formed as provincial regulation or regency/city regulation. Then, the spatial plan policy is implemented with consummation of monitoring and evaluation activities. The process of legalization sometimes needs more time than the formulation process of the spatial plan itself.

The finalization of SP in Indonesia has different characteristics in each respective area. It mainly depends on political, financial and human resource conditions. The final date of the formulation process can be predicted, meanwhile the legalization process, particularly in the stage of harmonizing stakeholders’ concerns, requires political practice that is more time-consuming than the formulation process, and occasionally there legalization will be delayed due to a deadlock or lack of progress. Uncertainty of the legalization process in the establishment of SP in Indonesia will influence the policy implementation. SP functions as guideline for development in the planned area. Every region in Indonesia has to follow a spatial plan accordingly. Based on Law 26/2007, SP aims: to create harmonization between natural and built



**Fig. 9.2** Hierarchy of spatial planning in Indonesia (Source: Adapted from the Spatial Planning Law 26/2007)

environments; to create cohesion in the usage between natural and built resources by considering human resources; and to create protection of spatial function and prevention of negative environmental impacts due to spatial utilization. Presently, the establishment development of RTRW (*Rencana Tata Ruang Wilayah*/Spatial Plan) at province and regency/city (*kabupaten/kota*) level<sup>1</sup> has not yet fulfilled the attainment target that is assigned by the Law 26/2007 on SP. By 2010, all RTRWs at regency/city level were expected to be legalized, but until now only 35% have been legalized from all 491 regencies/cities in Indonesia (based on Decree of Regional Council 19/DPD RI/I/2013–2014 on monitoring results of the Spatial Planning Law implementation).

According to the Spatial Planning Law 26/2007, SP in Indonesia is consists of two plans: the general and the detailed spatial plan (see Fig. 9.2). The general spatial plan is prepared by three levels of government, in particular, central, provincial and regency/city governments. While the detailed spatial plan, despite also being prepared by different levels of government, is more specific. For example, at the central government level, the detailed spatial plans include island-specific SP and national, strategic regional SP. SP is based on the Spatial Planning Law as a plan-making process, plan implementation and development control. The provision of the SP includes the guidelines of the plan-making process, plan implementation and development control for multiple government levels.

In this section, we bring the contextual issue that although the process of SP establishment remains challenging, it can become an opportunity for local authorities in the era of decentralization to boost their understanding and capacity to

<sup>1</sup> Indonesia’s administration level consists of provinces, regencies and cities. They have their own local governments and parliamentary bodies. Provinces include regencies and cities. Both regency and city are at the same administration level. The difference lies in their demography, size and economy.

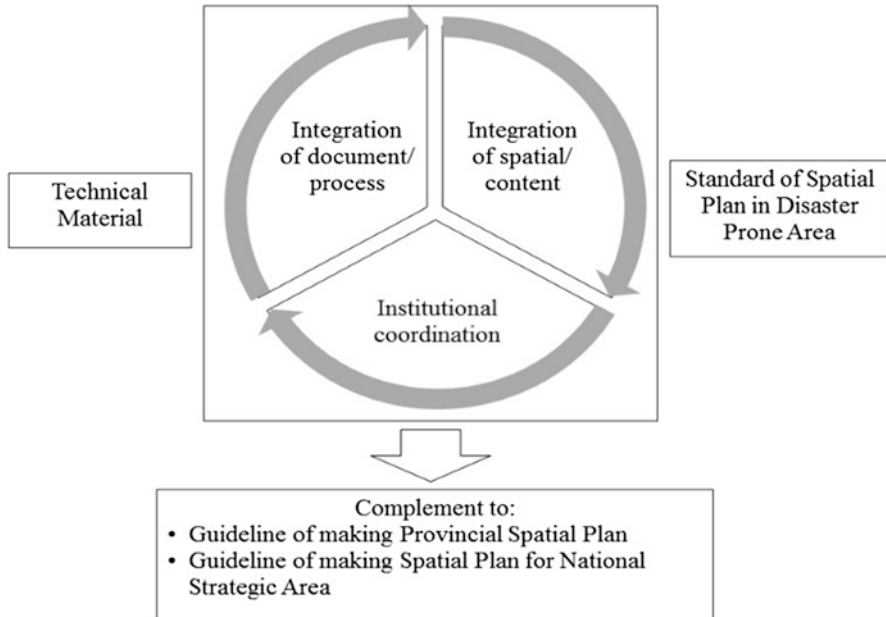
enhance the significance of SP for development of their territory. In this context, the issue of climate change and disaster risk that could contribute to the inhibition of the development process in areas such as infrastructure and housing, should be included in the formulation process of SP in order to achieve sustainable development generally, and enhance resilience and reduce vulnerability specifically. Although climate change may be unavoidable, effective SP and response that takes into account the integration of CCA and DRR measures can reduce its impacts.

#### 9.4 Current Strategies to Integrate DRR and CCA into SP in Indonesia

Presently in Indonesia, several cities and regencies have attempted to adopt CCA and DRR into urban development plans. For instance, Padang City has shifted spatial development planning to a new zone at the eastern edge of the current city center in order to reduce economic and urban activities. Studies show that the current city center, where is located in the coastal zone, is prone to natural hazards including flooding and earthquakes. In the Spatial Plan 2010–2030, the city development plan comprises a multiple-nuclei structure to avoid mass destruction of facilities and infrastructure in a concentrated city center (Pratiwi 2015). Another example in Sumatra Province showcases the risk assessment of climate change to formulate adaptation policies and strategies. In South Sumatra Province, Greater Malang Area and Tarakan City received assistance on establishing a Climate Risk Assessment and Adaptation (CRAA) study, whereby lessons learned feed into a guideline on mainstreaming climate change risk and adaptation into policy (Salim et al. 2012). On the other hand, Lampung and Semarang City were part of the Asian Climate Change City Resilience Network (ACCCRN), which through a combination of scientific and participatory approaches developed a city-resilience-strategy (Sutarto and Jarvie 2012).

However, at most in both cities the effort was to mainstream the agreed-strategies into the city RPJM (*Rencana Pembangunan Jangka Menengah*/Medium-Term Development Plan) and other non-spatial development sectors rather than to the RTRW (Spatial Plan). E.g. in the case of Semarang with the ACTIVED (Actions Changing the Incidence of Vector-Borne Endemic Diseases) program in the health sector (Bisri and Wardani 2016). Both the CRAA and ACCCRN initiatives have their own strengths and weakness, particularly when combining and communicating the result of technocratic risk assessments with that of stakeholder participation for securing local leadership commitment (Bisri et al. 2012).

In general, there is still limited implementation on the integration of both measures into SP in Indonesia. It can be found that the integration is either between DRR and SP or CCA and SP, for example, the effort of integrating DRR into SP (see Fig. 9.3), which is formulated by BAPPENAS (National Development Planning Agency) in collaboration with BNPB (National Disaster Mitigation Agency) and



**Fig. 9.3** Concept of integration between disaster risk and spatial planning (Source: BAPPENAS 2014)

the UNDP (United Nations Development Program). According to the concept of integration by GoI, there are three main aspects for integration between DRR and SP, which are the integration of document, spatial, and institutional coordination. In this concept, it is stated that institutional aspect becomes one of the essential components to achieve the main objective. However, it still remains challenging in the integration process.

At the national level some initiatives have been carried out by GoI to provide local government with a framework and guideline for integrating and mainstreaming DRR and CCA into their spatial and development planning. These include: (1) BAPPENAS-led Indonesian Climate Change Sectoral Roadmap (ICCSR) in 2010, (2) Ministry of Environment (MoE)-led CRAA, with support from GIZ and AusAid, in three areas and development of guidelines for mainstreaming CRAA into development planning policy in 2010–2012, (3) Indonesian Climate Change Council (DNPI)-led National Action Plan on CCA (RAN API) in 2011, (4) Ministry of Public Work (MPW)-led and owned National Action Plan for climate change mitigation and adaptation (RAN MAPI-PU 2012–2020) in 2012, which then was legalized as MPW regulation 11/2012, (5) MPW-led and owned national mapping of vulnerability against climate change in 2013, (6) MPW-led with support from JICA on mainstreaming CCA into SP policies in 2013–2014, and (7) BNPB-BAPPENAS-UNDP Guideline on SP development with DRR perspective in 2014. In addition, it should be noted that the Law 24/2007 was continued with BNPB regulation 2/2012 on guidelines for disaster risk assessment whereas seven initiatives each have a

different level of incorporation in the regulation. Regarding to the integration of risk assessment into SP, MPW (current name is Ministry of Agrarian and SP) is developing a guideline for SP in disaster prone areas.

From the above lists, some initiatives were actually sectoral-based, some of which have consequences for the SP dimension, i.e. the ICCSR (BAPPENAS 2010a), DNPI's RAN API, which then followed by the development of MPW's owned RAN MAPI<sup>2</sup> for public works sector, including on SP system. In the case of ICCSR development, it was parallel with the enactment of the 'Yellow Book' on Indonesia's response to climate change (BAPPENAS 2010b), i.e. developed as justification for channeling any official development assistance from abroad for any climate change mitigation and adaptation initiatives in various development sectors.

On the other hand, the CRAA of MoE-GIZ-AusAid analyzes climate change risk and proposed alternative adaptation strategies in health, agriculture, water and coastal area development in South Sumatra Province, Tarakan City and Greater Semarang. In essence, CRAA put 'spatial structure' and 'spatial pattern' planned in local government's RTRW (Spatial Plan) or RDTR (Detailed Spatial Plan) as vulnerability components in risk analysis in two time-settings (baseline year of 2010 and projection year of 2030 incorporating the emission scenario as the impact of climate change). Afterwards, the CRAA identified, some adaptation alternative that may have spatial consequences, thus proceed with a compatibility analysis between the proposed adaptation options with government pre-established development program within the RTRW or RDTR (Salim et al. 2012).

From the experience in the pilot sites, the CRAA initiative was able to identify entry points for the inclusion of CCA into spatial development planning at a local level. There are two entry points, the first is the concept of 'mainstreaming' for adaptation strategies that incompatible government-owned development planning document and the second is the concept of 'synchronization' for adaptation strategies that compatible with pre-established government program (Bisri et al. 2012). The challenge was since CRAA initiated by the MoE, thus its root legal basis is Law 32/2009 on environmental protection and management, and therefore has little power and authority to directly influence the SP system, procedure and practices. At most, the discussion was to exercise the concept and include it in the formal guideline (in a form of MoE regulation or government regulation) for Environment Protection and Management Plan (RPPLH) and the Strategic Environmental Assessment (KLHS), as prescribed in the Law 32/2009.<sup>3</sup>

Afterwards, the wave of studies and policies on CCA and DRR were organized by the Ministry of Public Works (MPW) and its implementing partners; i.e. with the legal basis stated in the MPW regulation 11/2012 on RAN MAPI-PU. Interestingly, the regulation did not acknowledge in reference to Law 24/2007 and Law 32/2009, but in addition to having its root in Law 26/2007 on SP, it directly refers to the Law 6/1994 on UNFCCC ratification. The ministry starts with conducting national

<sup>2</sup>Ministry of Public Works Regulation 11/2012 on National Action Plan for climate change mitigation and adaptation in public works sector.

<sup>3</sup>See Law 32/2009, article 10 and 16.

mapping of provincial vulnerability against climate change, which resulted in hazard, vulnerability and risk maps of all 33 provinces as well as a general adaptation strategy recommendation (MPW 2013). However, it should be highlighted that the integration of CCA and DRR into SP is still a work in progress. The national action plan on CCA roadmap in 2012 suggests that CCA and DRR will be integrated into general and detailed SP at the Regency/City (*Kabupaten/Kota*) level in the second period (2015–2020).

The authors that worked on the initiative stated challenges in detailing the limited nation-wide climate hazard and information for risk assessment in all provinces, and expressed the limitation of vulnerability analysis on provincial level land-use maps to create a meaningful spatial-based CCA policy.<sup>4</sup> As such it was followed by a study on integrating CCA with SP policies by MPW and JICA in 2014. The study included an analysis on climate projection, climate-induced hazard analysis (coastal hazard, flood, drought and landslide) and vulnerability-risk analysis to those four hazards in eight sites in Indonesia and was designed to be mainstreamed with each site's spatial plan document (MPW, ITB, and JICA 2014); i.e. North-coast of Java Island (to be fitted with the Spatial Plan for Java Island), East Java Province (Provincial Spatial Plan/RTRW), Cirebon City (City Spatial Plan/RTRW), Wonogiri Regency (Regency Spatial Plan/RTRW), Bojonegoro Regency (Regency Spatial Plan/RTRW), Mamminasatta Metropolitan Area (Spatial Plan of National Strategic Area), Makassar City (City Spatial Plan/RTRW) and Selayar Regency (Regency Spatial Plan/RTRW).

However, upon its completion there was no concrete assurance on the modification of each spatial plan since all of them require legal deliberation with local parliament. In addition, the intended development of guidelines for integrating CCA with SP policies using lessons learned from pilot sites was stopped due to the ministerial reorganization under the President Joko Widodo cabinet.

Interestingly, in the same year (2014), the guideline on SP development with a DRR perspective (BAPPENAS 2014) was being developed without the involvement of the Ministry of Public Works. The technical material of the study also clearly refers to multiple umbrella regulations of Law 26/2007 and various MPW regulations on the SP enactment processes, as well as the BNPB regulation 2/2012. Furthermore, it shows the process of mainstreaming DRR into the planning process of a national strategic area (RTRW KSN), Provincial RTRW, KLHS (Strategic Environmental Assessment) and zoning plan for coastal and small islands (RZWP3K). The issue with this study was that it focused more on the planning procedure instead of technicalities of integrating DRR into SP and the dimension of CCA was not discussed much.<sup>5</sup>

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<sup>4</sup>One of the authors was engaged as researcher/consultant of the MoE-GIZ-AusAid CRAA 2010–2012, MPW project on climate vulnerability mapping in 2013 and MPW-JICA Study of integrating climate change adaptation with SP policies (2014); the reflection stated in this manuscript is at a personal level although the notions have been expressed many times throughout the period.

<sup>5</sup>One of the authors attended the workshop of this study in October 2014, it was stated by the proponents that the technical guideline not intended to include superior risk assessment techniques and instead a simple one where all local governments, even with limited budget, can develop their spatial plan that includes DRR perspective.

## 9.5 Challenges of DRR and CCA Integration in Indonesian SP

The authors would like to describe the main challenges of DRR and CCA integration into Indonesian SP based on recent studies. Policy integration may refer to activities of cooperation, coordination and collaboration (Keast 2011). It can be seen from the concept of integration formulated by GoI (see Fig. 9.3), that institutional coordination has become part of integration elements. The concept of integration is also mostly related to policy and decision-making. The level of policy integration is dependent on the quality of information exchange or resources among related stakeholders. The greater the flow of information taking place, the more policy integration is carried out.

As a political and administrative arrangement, all levels of government (central, provincial and municipality/regency) are required to gain parliament's approval on public laws including SP (*Rencana Tata Ruang Wilayah/RTRW*). As such, in Indonesia, the inclusion of DRR and CCA in the RTRW is not only a scientific and bureaucratic process; it is also a political interest. Djalante and Thomalla (2012) argue for the need of institutional arrangements for integration in Indonesia. Thus, the concept of integrating CCA and DRR in SP is challenging for both academics and practitioners.

From the studies in previous section, generally it can be found that the challenges for integration are mainly related to policy and institutional dimensions. There is still no clear guiding principle and policy for integrating CCA and DRR into SP. Institutional capacity is also challenging regarding collaboration and roles of responsibility among institutions. Social, knowledge and information dimensions are also significant. Public participation and acceptance on the issue of disasters and climate change still needs to be addressed. Enhancing the understanding and sharing information among related stakeholders needs to receive attention as well. In this context, the availability, quality and accessibility of related spatial data and information are really required for integration.

In addition, data availability, quality and accessibility are still a challenge for a combined DRR and CCA assessment into SP for all cities/regencies in Indonesia. At the present situation, local governments in Indonesia are still struggling to provide fit-for-use (spatial) data for SP. Of the approximately 1,400 or more detailed spatial plans to be developed, only a few have passed quality control by the Geospatial Information Agency. Further, the availability of disaster data (maps) at an appropriate scale is also hindering the integration process.

There are several strategies that should be underlined in developing the integration concept. First, the concept should consider the institutional and policy dimension. It requires an apparent institutional role in each level of government, and both horizontal and vertical relations. The institutional arrangement will affect the implementation of coordination, cooperation and collaborating among relevant stakeholders. It also needs the support from clear policy and a guideline for integration.

Second, the concept will be mainly related to knowledge and information, as the notion of disaster management and climate change is fairly new globally, let alone in a developing country such as Indonesia. It was as recent as the Aceh earthquake



and tsunami in 2004 that the Indonesian government and its people realized the potential of natural catastrophes, whilst the ongoing floods in the capital city in the last decade and landslides in other parts of the country have introduced the country to the idea of climate change. However, as these notions are new, there is a growing importance for social, institutional and capacity building for the people of Indonesia to tackle ignorance and behavioral barriers. In addition, to overcome the issue of data and information, one of the measures needed is capacity building for local officers to improve their knowledge and skills related to data and information, including collection, analysis and presentation. Central government support is also required in terms of data availability and accessibility.

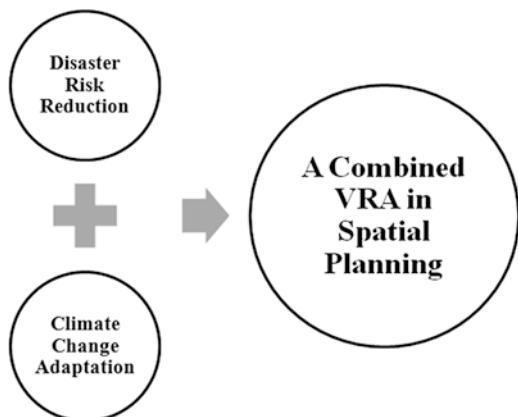
Third, it is also important to provide capacity building and empowerment for local governments and society, so these actors can understand the critical role of CCA and DRR integration into SP. Following three decades of authoritarian regime, public participation and social inclusion is a growing concept in urban and regional planning in Indonesia. Thus, the implementation of Law 26/2007 should be integrated with efficient and effective CCA and DRR. Despite these challenges, there are regions that have implemented these concepts such as Semarang City (Wijaya 2015a). In Semarang city, the spatial plan has included coastal land use, tidal flood prevention and a river and drainage system.

### 9.6 Potential Integration Approach: A Combined Vulnerability and Risk Assessments into SP

We propose an integrative approach by combining and streamlining DRR and CCA assessment into the SP analysis process through a combined vulnerability and risk assessment (VRA) (see Fig. 9.4).

The authors propose the analytical tool for integrating CCA and DRR with the SP procedure. Consequently, the objective of SP to achieve sustainable development and to reduce climate-induced and disaster risk is more attainable with a com-

**Fig. 9.4** A combined vulnerability risk assessment in spatial planning



bined CCA and DRR assessment. It is not only to enhance resilience of vulnerable area from the disasters and climate change impacts, but also to increase co-benefits. This can be achieved through a combined VRA, adaptation and risk reduction analysis into SP.

In essence, data compilation and analytical processes of the MPW, ITB and JICA's's (2014) study have been similar to those proposed by Greiving on calculation of an integrated risk index. Hazard and vulnerability indicators were assigned and weighted using a Delphi method in generating risk components (integrated hazard map, vulnerability map), and eventually a risk map. Moreover, the study by MPW, ITB and JICA has considered both baseline and projected data. For example, one of the indicators for baseline of social vulnerability analysis was a net population density, while for projection was the projected population density. On the other hand, when generating a physical economic vulnerability map, it looks into built critical infrastructure, road network, critical facilities and GDP (baseline); and for projection of economic vulnerability it uses the information on strategic area, planned infrastructure, planned road network, planned facilities and projected GDP under the scenario adopted in each areas of RTRW (MPW, ITB, and JICA 2014) (Fig. 9.5).

Meanwhile, Fig. 9.6 shows the integration of the concepts of climate change and disaster risks analysis and SP. This concept describes in more detail the connection between land use (e.g. agricultural and settlement area), which is affected by climate related risk. The resultant analysis is divided into different levels, such as high, medium and low. The concept has considered the projection of conditions in the future period; then it becomes an input for the climate change-risk reduction measure into SP.

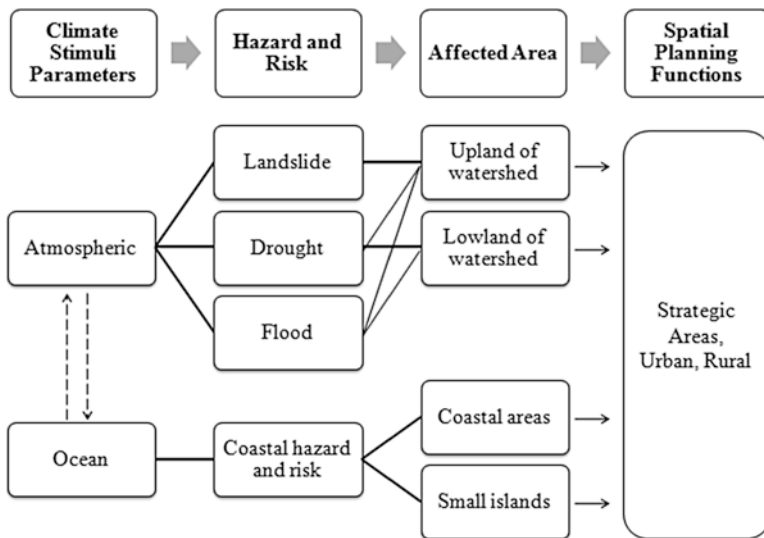


Fig. 9.5 Concept of integrating climate change and disaster risks into spatial planning (Source: Adapted from MPW, ITB and JICA study team 2014)

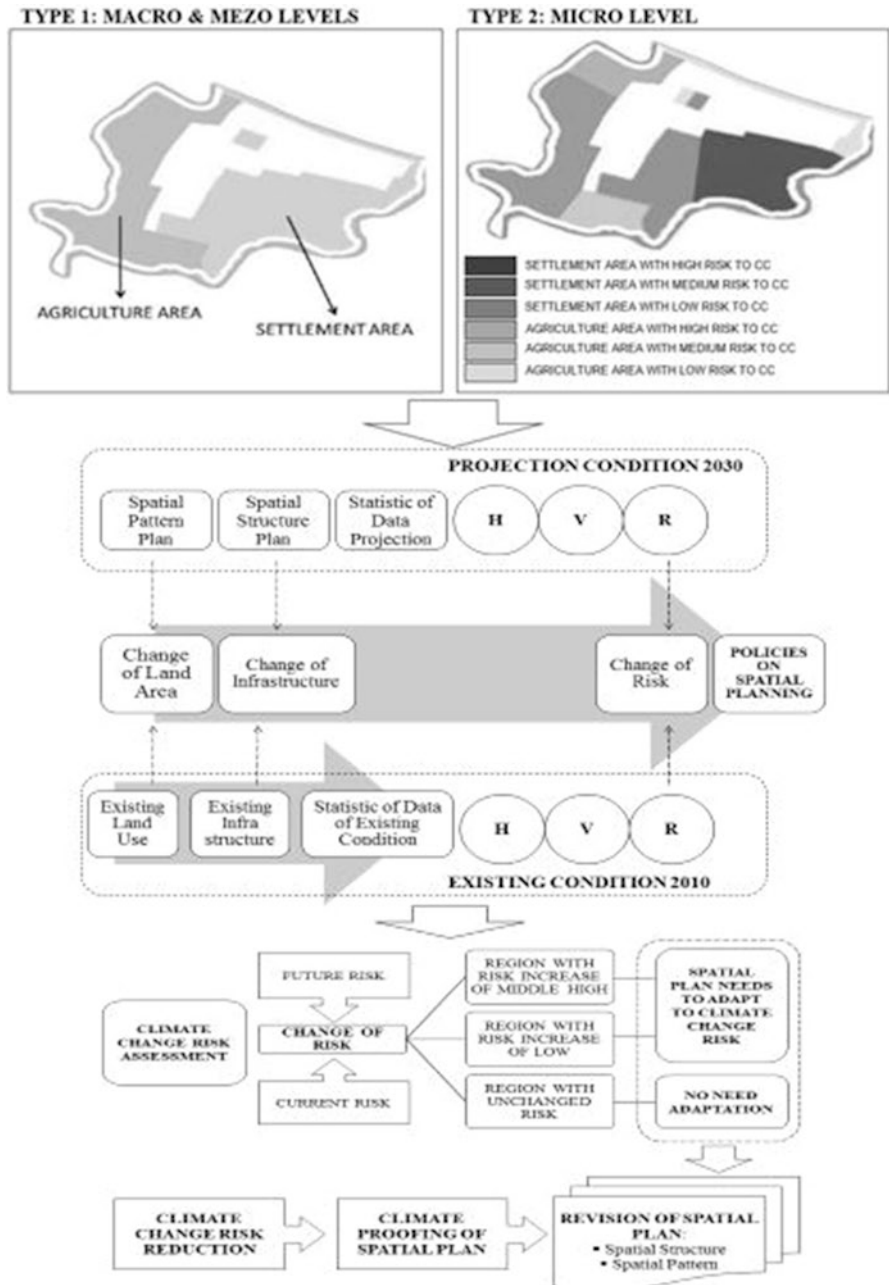


Fig. 9.6 The detailed concept of integration (Source: Adapted from MPW, ITB and JICA study team 2014)

The term '*Satuan Kemampuan Lahan (SKL)*' or 'Land Capability Unit' will be important for this integration, as it has been a workable concept in the SP process, and already the MPW Regulation 21/2007 and 22/2007 used it in relation to specific hazards. Therefore, it is important to develop series of SKL for multiple hazards, whereas for hazards that can be affected by the impact of climate change, the SKL must be developed by combining the content of Ministry of Environment 33/2016 and the technique from a study by MPW, ITB and JICA (2014), and can be proposed as SKL for climatic-hazards. Consequently for the vulnerability analysis, the data can be used for several SKLs assessments, with the exception of climatic-hazards that need to be calculated for both baseline and projection conditions.

## 9.7 Conclusion and Recommendations

Effective SP can help to minimize the vulnerability from the impacts of disaster and climate change. GoI has proposed several measures related to DRR and CCA; however, these are not yet strongly integrated into SP. In the meantime, the process of establishment of SP in Indonesia is still slow, especially the legalization process. Meanwhile, several cities and regencies have attempted to adopt CCA and DRR in urban development plans. A few previous studies on the correlation among DRR, CCA and SP in Indonesia have been realized.

The issue of integrating CCA and DRR into SP still remains challenging. Generally it can be revealed that the challenges for integration are related to policy and institutional dimensions. There is still no clear guiding principle and policy to integrate CCA and DRR into SP. Institutional capacity is also challenging regarding collaboration and roles of responsibility among institutions. Social, knowledge and information dimensions are also significant. Public participation and acceptance on the issue of disasters and climate change also still need to be addressed. Enhancing the understanding and sharing information among related stakeholders requires attention as well. The authors propose that SP could determine vulnerability levels at the local and regional level, without separate analysis of CCA and DRR, thus, a more efficient and effective CCA and DRR can be achieved. Although data availability, quality and accessibility are still challenging presently, building capacity and government support are required to maintain the proposed integration approach. It requires multi-level understanding and collaboration among related stakeholders.

In conclusion, the study proposes a potential integration approach through a combined VRA into SP analysis process in order to integrate CCA and DRR. The objective of SP to achieve sustainable development and to reduce disaster risk has higher potential, which is attainable by adopting an integrative approach. It is not only to enhance the resilience of vulnerable areas to disasters and climate change impacts, but also to increase co-benefits. However, the integration concept still requires a practical study pilot and benchmark for successful practice for further

studies to explore applicable and replicable concepts. This study could be useful for policy makers and planners in the planning and implementation of policy measures for CCA, disaster management and urban and regional development.

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**Part II**  
**Roles of Different Actors for DRR**

# Chapter 10

## The Role of Local Government in Post-Disaster Road Reconstruction: Assessment of Factors Affecting Local Government Road Maintenance Capacity

Ezri Hayat and Dilanthi Amaratunga

**Abstract** Disasters can cause major setbacks to achieving development goals but, at the same time, provide opportunities for development. In post-disaster reconstruction, the implementation of the ‘Build Back Better’ principle can result in improved road surfaces and wider road network coverage. However, the maximum benefit of such an investment can only be achieved if the road networks are properly maintained. Failing to provide the required maintenance needs may result in the investment made during the reconstruction period to prematurely diminish. As a result, the intended impact on the economic development of the areas concerned may not be achieved.

This study aims at identifying factors that affect local government capacity in the maintenance of post-disaster road reconstruction assets. Data were collected from documents, archival records and semi-structured interviews with 28 respondents representing the road stakeholders at the local, provincial and national level within three case study districts in Aceh province. The data were analyzed using NVivo 10.

The findings suggest that reconstructed road assets are generally neglected from maintenance needs. Factors which affect the local governments’ road maintenance capacity are grouped into three main categories: external, institutional and technical factors. The external factors are those which are beyond the direct control of the road authorities, such as local political and socio-economic conditions and conflicting roles between authorities. The institutional factors include financial capacity and human resources issues. The technical factors are accordingly those related to road design, traffic loading and other issues related to plant and equipment.

**Keywords** Local government • Road infrastructure • Post-disaster reconstruction • Road maintenance • Aceh

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## 10.1 Introduction

Disasters can cause major setbacks to achieving development goals by setting back the investment made in the social and economic sectors, as well as redirecting funds intended for development into disaster reconstruction efforts (UNDP 2004). However, disasters can also provide opportunities for physical, social, political and environmental development that may not have been available prior to the disaster (Pearson and Delatte 2005) as well as from higher quality and expanded road networks (Sihombing 2009).

Road infrastructure plays an important role in the development of the economic conditions of a society. A large number of studies have suggested that improvements in road infrastructure may lead to increased market agglomeration, productivity, labour supply (Crafts 2009), better trade, communication and economic and social growth, as well as increased international competitiveness (Anapolsky 2002). Speed, flexibility and the accessibility that a road infrastructure can offer in reaching virtually all points (Beilock et al. 2002) and in connecting other transport systems (Anapolsky 2002) appear to be the distinctive features of road networks compared to other means of transport. Nevertheless, maximum benefits from the investments made in the road infrastructure can only be achieved if the road networks are properly maintained. Failing to provide the required maintenance needs may result in premature depletion of investments made during the reconstruction period and failure to achieve the intended economic development in the areas concerned.

This study aims to identify factors which affect local governments' capacity in maintaining road infrastructure assets after a large disaster. This article provides a discussion on the results of a qualitative assessment of local governments' road maintenance capacity in a post-disaster context, based on case studies of three districts affected by the 2004 Indian Ocean earthquake and tsunami in Aceh province, Indonesia.

In this section, we have provided a brief overview of this chapter. In Sect. 10.2, we discuss the relevance of this chapter. A brief overview of the literature on the importance of road maintenance is presented in Sect. 10.3. The methodology of the research is explained in Sect. 10.4, followed by a detailed discussion of the factors which affect road maintenance capacity in Sect. 10.5. Section 10.6 presents the conclusions of the discussion presented in this chapter.

## 10.2 Research Relevance and Rationale

The 'Build Back Better' principal is generally applied in a post-disaster recovery situation. The principle aims at "using the opportunity of a disaster to leave societies improved, not just restored" (Fan 2013). The Sendai framework for disaster risk reduction 2015–2030, endorsed by 187 UN states in 2015, recognizes that

enhancing disaster preparedness is essential for effective responses and to 'Build Back Better' in recovery, rehabilitation, and reconstruction. This is one of the four key priorities of the Sendai Framework. The framework also identifies the need for accountability and preparedness to 'Build Back Better' and to use post-disaster recovery and reconstruction to "Build Back Better", supported by the strengthened modalities of international cooperation.

Improved road infrastructure quality and expanded network coverage are accordingly some of the opportunities which can be gained after a disaster. In the case of the 2004 post-tsunami reconstruction in Aceh, Indonesia, Subekti (2009) highlights that more than 900 national organizations from 55 countries were involved in the reconstruction effort in Aceh and Nias which attracted as much as US\$ 7.2 billion worth of pledges. As the funds were sufficient to restore the affected areas beyond their original condition, more than 3600 km of roads were reconstructed and rehabilitated within the 4-year period between 2005 and 2009 (Sihombing 2009).

On the other hand, such an achievement also raises a concern to the long-term consequence of the increased maintenance needs for such a road infrastructure. Firstly, the improved and expanded road network leaves the local government and the respective road management agency with the technical and financial burdens for the maintenance of the infrastructure. Since the local governments are responsible for the maintenance of the road networks in the long-term, there is a concern regarding the capacity of the local governments to maintain these reconstructed assets. This is particularly important as their capacity ultimately determines the sustainability and the value of the investment made in the reconstruction of the road infrastructure. Secondly, the roads in a post-disaster reconstruction initiative are built within a relatively similar period of time. Accordingly, there will be a sudden surge of maintenance needs during the life-cycle of these projects, assuming that these roads deteriorate at a similar rate. Road maintenance needs are also frequently neglected as typically two-thirds of pavement deterioration problems take place in the final third of the pavement's design life (Harral and Faiz 1988). Within the first 4–5 years after construction, a road may not show any deterioration at all. Failing to provide essential maintenance needs when required will then result in accelerated deterioration and likely require an expensive remedy for the premature rehabilitation as well as immediate loss of investment value.

Road maintenance activities are generally classified into three categories: routine maintenance, periodic maintenance and rehabilitation. Routine maintenance activities include all works that occur regularly and frequently and are carried out on an annual or monthly basis. These include vegetation control, drainage control, pothole filling and crack sealing. Periodic maintenance includes those activities which are required less frequently than routine maintenance activities. An example of periodic maintenance activity is resealing the pavement which takes place every 5 years. Even though routine maintenance activities are actually 'periodic' in terms of time scale and periodic maintenance is also 'routine' in terms of regularity of occurrence, the terms are given to distinguish the frequency of the required activity. Furthermore, even though routine and periodic maintenance activities are carried out regularly, pavements will still wear and deteriorate to a level where rehabilitation is required

to restore pavements' condition to their initial quality. An example of rehabilitation is the pavement overlay, which takes place approximately every 10–15 years, depending on the design life and maintenance level.

A vast range of studies on different road infrastructure issues has been undertaken. For instance, Kenley et al. (2014) identify the importance of the careful selection of road location in mitigating extreme flood maintenance. Qiao et al. (2015) assess the impact of climate change on road maintenance intervention strategies and road lifecycle cost. Perera et al. (2009) argue that road construction requires better project management strategies due to its exposure to various risks. Taylor and Philp (2015) investigate the impact of maintenance on road pavement design life. Furthermore, Wichan et al. (2009) develop a Neural Network model to forecast the final cost of a highway project and its duration, whilst Paul et al. (2009) try to eliminate delays through the development of a rapid construction decision-making system in order to accelerate preliminary road construction processes. Nevertheless, literature that links the issue of post-disaster road reconstruction and the capacity of local governments in maintaining the road assets is very limited.

This chapter, accordingly, aims to fill the gap by providing a discussion on the result of a qualitative assessment of local governments' road maintenance capacity in a post-disaster context based on case studies of three districts in Aceh, Indonesia. This study will present a discussion of the factors which affect the local governments' capacity in the maintenance of road infrastructure after a large disaster.

### **10.3 Literature Review: Road Maintenance in the Post-disaster Context**

The discussion of road maintenance in the post-disaster context merges the concerns identified in the normal development context with the peculiarity of the post-disaster condition. Consequently, the next paragraphs will provide an overview of road maintenance in general terms, followed by the distinct aspects of road maintenance in post-disaster context.

From the general perspective, road pavements deteriorate over time and their structural strengths will gradually decrease to a level where maintenance intervention is required in order to restore their condition and extend their service life. Deteriorated pavements eventually affect ride quality, safety and increase road user cost. Boamah (2010) summarizes that road deterioration is primarily affected by the physical environment, traffic, material properties, road construction quality, design standards, and the age of the pavement. For a road network to be sustained over its designed life period, adequate maintenance must be provided in accordance with its lifecycle (Robinson et al. 1998). If road maintenance is neglected, a number of consequences will occur. Martinez (2001) highlights that the most important consequences of road deterioration are:

- Exponential increase in vehicle operating costs and the resulting loss of efficiency in the road transportation system
- Increase in investment costs due to an earlier need for road reconstruction
- Increase in the number of accidents

Furthermore, from the financial point of view, a poorly maintained road infrastructure deteriorates faster and the required remedies cost more than the cost to provide adequate maintenance in the first place. A study by Harral and Faiz (1988) regarding road maintenance in 85 countries concludes that as much as US\$45 billion worth of investment in road infrastructure could have been saved by a provision of less than US\$12 billions of preventative maintenance. Another study confirms that the rehabilitation of a paved road after 15 years lack of maintenance may cost as much as US\$200,000 per km, whilst the provision of regular maintenance for the 15-year period will only cost as much as US\$60,000 per km (Heggie 1996).

Additionally, a poorly maintained road infrastructure may also increase road user costs. For instance, increased user cost can incur due to reduced travel speed, shortened vehicle parts' life caused by potholes and accidents, and due to longer detours as a result of blocked access during the rainy season. It is also argued that each dollar 'saved' on road maintenance may result in an increase in vehicle operating costs by US\$2 to US\$3 (Heggie 1996). Furthermore, as the road condition deteriorates and gets more dangerous to drive along, transport services will be less frequently available and more unreliable, before they cease completely (Done 2008). Poorly maintained roads may also increase the risk of accidents to road users. Potholes, cracks, a corrugated and polished pavement, as well as the absence of road markings may cause accidents and result in injuries or deaths.

From the disaster management point of view, the importance of road maintenance in the post-disaster context is distinctive mainly due to differences in the procurement and in the planning method as well as in the consequences which follow. Taking an example from the reconstruction of the disaster-affected areas in Aceh, Indonesia, the local governments were not actively involved in the pre-procurement (planning and design) and the procurement phase (tender and construction). These particular tasks appear to be performed either by the national government or by the donor agencies. The scale of the destruction and the rehabilitation and reconstruction activities required to restore the tsunami-affected area were overwhelming that it was beyond the capacity of the local and regional governments to cope with the impacts and lead the reconstruction process. Upon completion, the reconstructed assets were transferred back to the local governments for operation, maintenance and renewal (reconstruction) needs, with no regard for their capacity and ability to maintain such assets. Marks and Davis (2012) suggest that a sense of ownership can be stimulated by involving the community in the key decision-making process, in contributing towards the capital cost of the construction, and in participation in the planning and construction activities. As the local governments were not actively involved in the post-disaster reconstruction process, there were also concerns with regard to the local governments' sense of ownership

towards the reconstructed road assets and the consequences this could have on road maintenance performance.

In addition to the passive role of the local governments in the procurement process, the planning process in the post-disaster context is also constrained by the pressure to act quickly. The lifecycle of the road infrastructure generally consists of procurement, operation and maintenance, as well as renewal or the disposal of assets (British Standard Institute – BSi 2008). Prior to that, a range of feasibility studies will need to be performed to justify and support the needs for the project. For instance, the feasibility studies may include environmental, social and economic feasibility. Accordingly, the planning process will need to include and involve various agencies such as planning agencies, environmental bodies and finance agencies to assess the impact of a road project, as well as the benefits it offers. As an example, the World Bank (2009) requires that a project proposal should include an 'Indigenous People Plan' which identifies the impacts of the interventions on indigenous people and areas in order to ensure that the potential negative impacts on the people are kept to a minimum.

Even though such a process and steps are indeed necessary, the whole planning cycle may not be applicable in a post-disaster and emergency situation. The high pressure and the need to accelerate the reconstruction process may not allow for the undertaking of a complete range of feasibility studies prior to commencing a road reconstruction project, as such a process will normally take a long time. Moreover, as Sihombing (2009) suggests, the high level of uncertainty and changes in the geographical conditions also hinders the preparation of a final engineering design. For instance, in order to accelerate the reconstruction process, most post-disaster infrastructure projects in Aceh adopted a design review concept which determined only the basic concept, the tender documents and the estimated project value (Sihombing 2009). The ultimate project cost was measured based on the actual works performed.

The peculiarities of the road reconstruction process in a post-disaster context as discussed above justify the need to further study its impacts and consequences regarding the sustainability of the reconstructed assets. This is ultimately determined by the capacity of the local governments to maintain the road assets. Accordingly, it is argued that a strategy to adequately incorporate local government capacity into the post-disaster road reconstruction plan is the key to ensuring sustainability and to maximizing the post-disaster reconstruction investment value.

Having justified the need to conduct this study, the following section will elaborate upon the research methodology.

## 10.4 Research Methodology

As the study adopted a multiple-case study approach, replication logic was used in the selection of the case studies. As Yin (2013) suggests, the number of case studies in a qualitative study is led by the findings of the first case study. Two replication logics can be adopted: (a) theoretical replication which predicts contrasting results

but for anticipatable reasons, and (b) literal replication which predicts similar results. It is argued that theoretical replication is more suitable for studies with a relatively large number of resources. Due to the limited time and resources available for this study, the literal replication approach was adopted.

The three case study districts were selected based on a set of criteria:

- The district was directly affected by the 2004 Indian Ocean earthquake and tsunami,
- The district was established prior to the tsunami in 2004,
- The district had road reconstruction activities implemented under the post-tsunami reconstruction scheme, and
- Access to data was available.

As a result, three case studies were included in the study: Aceh Besar, Aceh Jaya and Aceh Barat Daya. All three districts are located in the west coast area of Aceh Province, Indonesia.

## 10.5 Data Collection and Analysis

The data were primarily collected through semi-structured interviews with twenty-eight respondents representing road infrastructure stakeholders and decision-makers at the national, provincial and local level. Additional data were also collected from documents and archives. The interviewees were selected using a combination of purposive sampling and the snowballing method. Prior to the interview, each respondent was asked to sign a consent form. The profiles and distribution of the interview respondents are presented in Table 10.1 along with the number of respondents from each group. The interviews were transcribed into NVivo 10 which was the main tool in performing the data analysis. A screenshot example of the NVivo coding structure used in this study is shown in Fig. 10.1.

The findings from the data analysis process were validated through a triangulation method by reviewing the literature and by undertaking consultations with five experts in the field of post-disaster reconstruction and road infrastructure management. The profile of the expert validation respondents is shown in Table 10.2.

The data analysis, followed by the validation process, resulted in the identification of factors which affected the capacity of local governments to maintain road infrastructure assets. Based on their nature, these factors are grouped into three main categories: external, institutional and technical factors. This is in accordance with Robinson et al. (1998) approach to classifying road maintenance problems and the underlying issues. The external factors are those which are beyond the direct control of the road authorities. On the contrary, the institutional and technical factors are internal factors which are within the control of the road management agency. The institutional factors refer to the organizational and managerial arrangements of the road authorities, whilst the technical factors refer to the capability of the road authorities to perform physical and engineering tasks (Robinson et al. 1998). In

**Table 10.1** Profiles of the interviewees and the number of respondents

No	Code	Organisation	Aceh Besar	Aceh Jaya	Aceh Barat Daya	Prov. level	Nat. level
1	CS01	Planning Agency	√	-	-	-	-
2	CS02	Public Works	√	-	-	-	-
3	CS03	Public Works	√	-	-	-	-
4	CS04	Public Works	√	-	-	-	-
5	CS05	Contractor	√	-	-	-	-
6	CS06	Contractor	√	-	-	-	-
7	CS07	Consultant	√	-	-	-	-
8	CS08	Planning Agency	-	√	-	-	-
9	CS09	Public Works	-	√	-	-	-
10	CS10	Public Works	-	√	-	-	-
11	CS11	Contractor	-	√	-	-	-
12	CS12	Public Works	-	√	-	-	-
13	CS13	Consultant	-	√	-	-	-
14	CS14	Public Works	-	-	√	-	-
15	CS15	Planning Agency	-	-	√	-	-
16	CS16	Public Works	-	-	√	-	-
17	CS17	Consultant	-	-	√	-	-
18	CS18	Consultant	-	-	√	-	-
19	PM01	Disaster Mgt. Agency	-	-	-	-	√
20	PM02	Disaster Mgt. Agency	-	-	-	-	√
21	PM03	Nat. Planning Agency	-	-	-	-	√
22	PM04	Disaster Mgt. Agency	-	-	-	-	√
23	PM05	Prov. Govt.	-	-	-	√	-
24	PM06	Nat. Planning Agency	-	-	-	√	-
25	PM07	Donor Org.	-	-	-	-	√
26	PM08	Donor Org.	-	-	-	-	√
27	PM09	Public Works	-	-	-	-	√
28	PM10	Dept. of Transportation	-	-	-	√	-
		Total	7	6	5	3	7

Author (2013)

many cases, the factors within these categories are inter-related and should not, therefore, be viewed in isolation. The following section provides a more thorough discussion on these factors.

In this chapter, unless documents are publicly available and provided as reference, identifying specific organizations and individuals is deliberately avoided. This approach is adopted to avoid undermining organizations and individuals who have put forward their best efforts in the very challenging circumstances. Thus it has been determined to preserve the confidentiality of the sources.

Name	Sources	References
1 Road maintenance capacity	26	297
11 External factors	25	140
111 Environmental	4	6
112 Legal and regulatory	4	5
113 Political	17	38
114 Socio-economic	16	53
115 Safety and Security	9	23
116 Inter-organisational relationship	7	15
12 Institutional factors	23	105
121 Financial Management	16	42
122 Human resources	12	36
123 Organisational management	11	27
13 Technical factors	11	52
131 Road design	10	17
132 Traffic loading control	4	26
133 Plant and equipment	2	9

Fig. 10.1 NVivo coding structure (Author 2013)

Table 10.2 Profile of respondents for the expert validation interviews

Code	Professional background
Val01	Academic
Val02	Consultant
Val03	Consultant
Val04	Academic
Val05	Consultant

Author (2013)

## 10.6 Results: Factors Affecting Road Maintenance Capacity Following a Disaster

The analysis of the data from all three case study districts suggests similar results across the case studies. Accordingly, the discussion in this section is based on the findings from all of the case studies. Whenever appropriate, contrasting findings between the case studies will be indicated and a necessary discussion will be provided.

The analysis of the data from all three case study districts suggests that the maintenance of road infrastructure has been generally neglected. The newly rehabilitated and reconstructed road networks in the three case study districts were abandoned from maintenance needs immediately after the construction was completed. Routine and periodic maintenance needs were not regularly performed. It appears that the road management authorities in the case study districts lacked a preventive



maintenance culture and the common approach to preserving the road infrastructure was to repair a road when it was broken.

ADB (2003) identifies that, in countries where road maintenance is not a culture, roads are repaired only when they are damaged. It also suggests that, in those countries, preventive maintenance is considered as a waste of resources and no links are acknowledged between the expensive premature rehabilitation remedy and the lack of regular maintenance. Maintenance needs were not politically attractive and the annual budget allocation for the road sector in the case study districts was focused on capital projects such as new road network expansion or surface upgrade.

The result of the data analysis suggests that the external factors (i.e. those which are beyond the road authorities' control) include environmental conditions, political and socio-economic conditions, safety and security and the inter-organizational relationships between the various government and private institutions involved in road management. The institutional factors include financial capacity, human resources and organizational management. The technical factors within road maintenance problems include road design and traffic loading control as well as plant and equipment. A summary of these factors is presented in Fig. 10.2.

The following section will discuss the external factors.

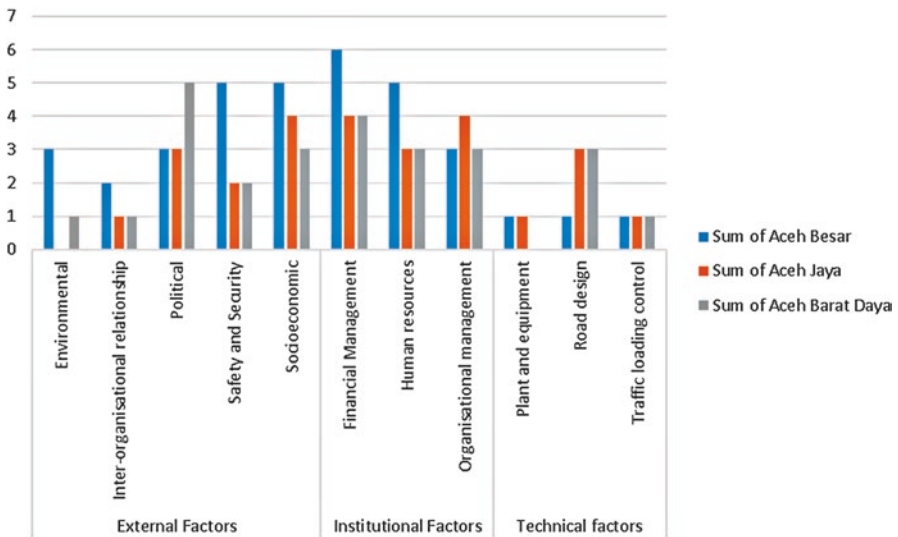


Fig. 10.2 Factors that affect road maintenance capacity and the number of responses (Author 2013)

### **10.6.1 Social Political Factors**

On the external side, it can be identified that the capacity of the local governments in the case study districts was primarily affected by the local political conditions, the socio-economic conditions of the areas, and the conflicts between the authorities. Hayat and Amaratunga (2014) Provide a thorough discussion with regard to the impact of the local political and socio-economic conditions on the local governments' road maintenance capacity in the case study districts. A summary of these impacts and a more detailed discussion of the other factors will be presented in the following section.

#### **10.6.1.1 Local Political Conditions**

The political condition of the case study districts affects the road maintenance capacity of the local governments in three ways: political interventions in development planning and priority, the poor interest in road maintenance works, and the implementation of the wealth distribution principle.

ADB (2003) suggests that, in the developing world, the decision-making process tends to be intentionally subjective and political, based on a consensus which requires discussion, committees and compromise. To some extent, this is in line with the purpose of a decentralized government system which is expected to be the instrument which encourages the broader participation of citizens and, ultimately, leads to more efficient and improved governance (Jütting et al. 2005). In turn, the decentralized system is then expected to provide the community with “much more independence in electing their own leaders, promoting their own interests, developing their own institutions, initiating their own policies, managing their own financial resources and mobilizing support from their own communities” (Rasyid 2004). With particular attention to Indonesia's decentralization process, Ahmad and Mansoor (2002) argue that the demand for decentralization in Indonesia is primarily driven by the desire to control resources and political and legal autonomy instead of by the perceived need to improve local service delivery.

In the case study districts, the study identified that the parliaments' political pressure in the decision-making process resulted in political intervention in the development programme proposed by the government. To ensure that political stability is achieved, and to avoid political disputes and delays in the budget approval process, the local governments tended to accommodate the local parliaments' pressure. Consequently, such pressure resulted in the budget proposal unnecessarily reflecting and conforming to the development plan and the priority prepared by the planners. As CS02 explained, due to the parliamentary pressure, the local governments had to distribute their projects quite evenly to the various election zones, regardless whether it was their development priority or not. This respondent further suggested that failing to do so would result in the budget proposal being rejected

and disputed. Donnges et al. (2007) also argue that such conditions are particularly affected by the limited tenure of politicians in their office.

In addition to the above issue, the global issue of politicians' greater preference for capital projects was also identified in the case study districts. As suggested by Levik (2001), project value, work sophistication level and the immediate impact of a capital project makes it politically and technically more interesting for a politician, as well as for the road engineers, rather than road maintenance works. Accordingly, the politicians' low interest in road maintenance needs was also made worse by the fact that road maintenance works are perceived as being inferior jobs by the road engineers and professionals. As highlighted by CS16:

The problem is that if there are damages to the road, the damages are small... What I mean is if we do it as a project, it will be small. (CS16)

Compared with a capital project, the value of a road maintenance project is considerably lower. The engineers, therefore, were more focused on allocating budgets for road expansion and surface upgrades, thus leaving the maintenance works to pile-up and reach a level when the project value is considered worthy of working on. Robinson and Stiedl (2001) argue that this condition is a consequence of a decentralized system which erratically places responsibility for road maintenance on incompetent organizations. In the road sector, decentralization is translated as the distribution or transfer of authority and responsibility to manage the road infrastructure assets. Accordingly, the national government is responsible for the national roads; the provincial government is responsible for provincial roads, and the local governments are responsible for the district/city roads – which also include the road networks at the sub-district and the village level.

Nevertheless, to a certain extent, the political considerations were also affected by the socio-economic conditions of the areas, which will be discussed in the next section.

### 10.6.1.2 Socio-economic Conditions

Heggie (2003) proposes that a rational approach to road maintenance problems is for roads to be professionally managed and treated as a business. In practice, this means that governments and the road authorities need to only build roads that can be maintained, and to maintain roads that have been built. Such an argument also forms the basis for the recommendation for the establishment of independent road authorities and the adoption of a 'road fund' mechanism as a sustainable source of maintenance funding (Zietlow and Bull 1999; Potter 1997; De Richecour and Heggie 1995) and the involvement of private companies in the operation or the ownership of road infrastructure (Ozbek and Jesus 2007; Carpenter et al. 2003; IndII 2010).

However, the way that local governments and road authorities perceive and respond to road maintenance needs in the case study districts is also affected by the socio-economic conditions in the areas. As highlighted by ADB (2003), in

developing countries, roads are regarded as an essential public service and, therefore, rational economic decision-making rules may not be applied. In the case study districts, wealth distribution to the community was considered as a more 'rational' approach to development and it was practically translated as the equal provision of access to the widest community possible. As quoted by PM06:

Maintenance is not considered a priority. Why? Because there are still many other roads which have not been paved... The budget allocation for construction is also not small. So it is considered that the priority should be there (for the construction). (PM06)

Additionally, as the rural road networks also play a vital role in the development of the agricultural sector in areas where farming and the mining industry are growing (such as the case study districts), limiting the expansion of the road networks to a maintainable scale was also perceived as restricting the potential economic growth of the areas. Regarding this issue, Donnges et al. (2007) acknowledge the impacts of rural road development on the economy but, at the same time, they argue that two basic measures need to be in place, namely the provision of basic minimum funding for road maintenance and an adequate capacity to effectively spend the funding. In the case study districts, however, the greater preference for the immediate and more visible impacts that businesses and industries contribute to the local economy is not accompanied by a sufficient road maintenance budget allocation nor the capacity to spend it. More discussion about the financial aspects is provided in Sect. 6.2.1.

Whilst agriculture and the mining industry may help improve the economic conditions of the areas, ignoring the consequences of heavily loaded vehicles on the road infrastructure may result in rapid deterioration and the premature rehabilitation and reconstruction of the road infrastructure. This may consequently outweigh the economic benefits gained from the industries' contribution to the local governments. On average, the tolerance limit of the vehicles' loading capacity is set to carry up to 60% more than the limit set by the law, causing a 6.5 times faster road deterioration rate (Saleh et al. 2009). The west coast areas of the Aceh province, where the three case study districts are located, are mainly dominated by palm oil agriculture and the mining industry. Consequently, trucks transporting raw products to the processing plants or to the ports greatly contribute to the rapid deterioration of the road networks, particularly where the roads were not structurally designed to cope with such heavy loads. Consequently, it is argued that the traffic loading control needs to be enforced to ensure that the vehicles do not transport loads which are beyond the road structural bearing capacity. Roads are structurally designed to cope with a certain vehicle axle loading capacity. In Indonesia, the capacity allowed for class III roads, the lowest road class, is 8 tons (Law 2009, article 19), although in certain circumstances the vehicle maximum axle loading capacity can be set to as low as 3 tons. Nevertheless, the study believes that the problems surrounding the traffic regulation enforcement appear to be beyond merely the dilemma to choose, that is between the immediate contribution of industries, and the rapid road deterioration resulting from overloading vehicles. In fact, the issue of corruption seems to be a greater barrier in the road traffic enforcement process.

In 2015, Transparency International's Global Corruption Perception Index report ranked Indonesia as number 88 out of the 167 countries surveyed (Transparency International 2015). Even though Indonesia's rank on the list has improved (it was ranked 114 out of 175 countries in 2013 – Transparency International (2013)), Indonesia is still suffering from the impacts of corruption. In the road sector, the World Bank (2009) argues that the transaction costs of capital works can range from 5% to 20% due to corruption. The World Bank (2009) further adds that corruption in capital works are most obviously detected in the process of selecting and awarding contracts in the form of bribes and kickbacks, bid rigging, and fraud. With regards to the transaction costs, respondent CS11 supported this indication as he suggested that the cost for bribing government officials involved in a project can reach up to 70% of the project value, which therefore has an impact on the work and on obtaining profit from the remaining 30% of the project's contract value.

The issue of corruption was also identified in the traffic loading control process. The traffic loading control, generally performed by means of weighing stations, was hampered by corrupted operators. Respondent PM10 suggested that working as weighing station operators was one of the favorite and most competitive positions for transportation agency staff due to corruptibility. Shleifer and Vishny (1993) describe such conditions as being the result of competition between both the officials and the consumers. They also conclude that the competition between officials for getting a certain job through an 'auction' mechanism – i.e., the position is given to the person offering the highest bribe – will ensure that maximal bribes are collected in return.

The World Bank and BRR (2006) produced a joint report which reveals the four forms of illegal payments collected from truckers moving in and out of the Aceh province: Police and Military Post fees, Weigh Stations fees, Convoy Fees, and 'Facilitation' Agencies' fees. The police and military posts and convoy fees are less relevant to this chapter as they are basically fees to provide 'protection' on the road and are charged by the police or military troops for transporting illegal loads. With regard to the weighing stations, truckers with overloaded capacity have to pay only as low as Rp.20,000 (US\$1.50) per overweight ton, instead of conviction and fines of Rp. 500,000 (US\$38) as stipulated in Law 22/2009, article 307. The facilitation agency fee, on the other hand, is a fee paid to freight transporter organizations operating in a mafia-like approach which provides reduced overweight charges for their members. Their members are provided with stickers to be attached to the front windshield.

The above sections have discussed the links between the local political conditions, the socio-economic conditions and road maintenance problems. The following section will discuss how the conflict of authority between the institutions involved in road and traffic management affects the local governments' road maintenance capacity.

### ***10.6.2 Conflicts Between Authorities***

To ensure that each of the institutions involved in road maintenance is accountable for their tasks and responsibilities, a clear division of tasks is essential. Heggie (2003) argues that such a division of tasks needs to be accompanied by an institutional framework as a prerequisite to overcome “the numerous technical, organizational and human resource constraints that hamper the introduction of better road performance policies”.

With regards to poor road conditions, conflicts and disputes between the public works and the department of transportation have frequently occurred. The public works, as the agency responsible for the construction and the maintenance of the road networks, felt that they could not be held accountable and refused to take responsibility for the poor road conditions. Public works argued that the poor road conditions are a consequence of poor traffic loading control which is undertaken by the transportation agency. On the other hand, the transportation agency refused to take responsibility and felt that they could not be held accountable for the poor road conditions as they refer it to the poor initial construction quality. The study suggests that both institutions have reasonable causes for their claims. The road infrastructure had been poorly constructed due to corruption, security threats, and poor supervision quality. The latter factor is frequently affected by the first two causes in addition to personnel’s poor capacity. On the other hand, the transportation agency has also failed to monitor and control the traffic loading enforcement due to corruption and lack of weighing station facilities. In addition, the national law which regulates the enforcement of a zero loading excess policy – no overloading vehicles can pass and no charges can be imposed on the overloading vehicles (article 307, Law 2009), has not been respected by the authorities at the regional level. As highlighted by PM10, the zero overload policy could not be implemented at the regional level as the regions have made their own policies and set their own tolerance limits. He stated:

The instruction could not be implemented nationwide all over Indonesia... because the reality is that each region allows a tolerance limit. A certain percent (of overloading capacity) will be tolerated. Each region has their own policies. (PM10)

The above statement concludes the discussion on the external factors which affect the capacity of local governments in terms of road maintenance. The following sections will discuss the internal factors.

### ***10.6.3 Institutional Factors***

On the internal side, the institutional factors which affect local governments’ road maintenance capacity include financial capacity, human resources and organizational management capacity. Each of these factors will be discussed in the following section.

### 10.6.3.1 Financial Capacity

From the financial aspect, ADB (2003) states that financial problems in the road maintenance sector can be traced back to four issues:

- Funding is not allocated in sufficient amounts,
- The allocated funding is not spent,
- Funding allocation is not spent effectively and
- Funding allocation is not spent efficiently.

Similar results were also found in this study. Moreover, the findings of this study on the financial management aspects also indicate a close causal relationship between financial management and human resources issues.

The vast areas covered by the districts, the extensive length of the road networks, as well as the limited budget availability, indicate that the budget allocation for road maintenance will never sufficiently cover the maintenance needs of the entire road network. In fact, global experience confirms that the financial resources for road maintenance are rarely sufficient to cover all road networks (UNESCAP 2005; ADB 2003; Zietlow and Bull 1999). Nevertheless, it is important to note that even though the whole maintenance needs can never be met, the available road maintenance funding can be spent effectively. Accordingly, Donnges et al. (2007) conclude that the need to improve capacity at the local level has to be addressed properly in order that the limited funding available can be effectively spent. The local road authorities require the capacity to produce priority-based road maintenance planning and to distribute the limited budget on roads which provide the best cost-to-benefit ratio for both the communities and the local economy.

Furthermore, the allocation for road maintenance needs in the case study districts had to compete with other sectors, as well as against other activities in the road sector such as the construction of new roads. Gupta (2006) emphasizes that channeling the road maintenance needs from the general budgetary allocation procedures will only result in an inconsistent and insecure flow of maintenance allocation, particularly when the approval requires political debates. Nevertheless, the inadequate allocation of road maintenance funding has been worsened by the poor capacity of local governments in spending their annual budget allocation. Table 10.3 below shows the annual budget spending ratio of the case study districts between 2006 and 2013.

The study identified that the inability of local governments to spend their annual budget allocation was rooted in two main causes which are interrelated to each other. Firstly, there is the poor technical and financial capacity of the local governments' personnel to implement projects and programmes that they have included in the annual budget proposal. Respondent Val04 added that this condition was also affected by the bureaucratic process which has a fairly restricted use of budget expenditure mechanism whereby certain fund allocations can only be used for certain types of works. As a result, some areas might have leftover budget unspent when other areas are suffering from insufficient funds. The second cause is due to delays in the budget approval process. The financial year in Indonesia starts on

**Table 10.3** Unspent budget allocation of the case study districts (x Rp. 1 billion)

Year	Kab. Aceh Besar		Kab. Aceh Jaya		Kab. Aceh Barat Daya		Nat'l Avg. (%)
	Unspent budget	Spending ratio (%)	Unspent budget	Spending ratio (%)	Unspent budget	Spending ratio (%)	
2006	Rp.0.04	99.99	Rp. 7.63	94.75	Rp.-4.40	101.64	94.30
2007	Rp.48.38	91.14	Rp.203.73	59.07	Rp.23.56	92.95	89.57
2008	Rp.58.04	90.37	Rp.114.14	76.92	Rp.6.72	98.06	88.47
2009	Rp.68.18	88.56	Rp. 51.34	116.17	Rp.7.69	97.52	90.95
2010	Rp.56.65	90.95	Rp. 30.89	92.65	Rp.19.15	94.48	91.03
2011	Rp.28.03	96.07	Rp. 44.31	90.32	Rp.49.18	88.66	91.03
2012	Rp.64.73	92.15	Rp. 66.86	85.95	Rp.26.60	95.14	89.49
2013	Rp.134.1	86.56	Rp. 72.37	87	Rp.57.75	90.07	97.88
Avg.	Rp.57.27	91.97	Rp. 61.07	87.82	Rp.23.28	94.81	91.59

Source: Analysed from raw data obtained from Directorate General of Fiscal Balance – DJPK (2014)

**Table 10.4** Budget approval date of the case study districts

Financial year	Aceh Besar	Aceh Jaya	Aceh Barat Daya
2005	June 13th, 2005	June 3rd, 2005	July 20th, 2005
2006	May 1st, 2006	July 7th, 2006	June 19th, 2006
2007	April 12th, 2007	March 27th, 2007	May 5th, 2007
2008	April 8th, 2008	May 14th, 2008	April 1st, 2008
2009	–	–	–
2010	–	April 5th, 2010	Jan 28th, 2010
2011	–	April 2011	–
2012	–	April 2012	–
2013	–	May 2013	Feb 8th, 2013
2014	–	Jan 10th 2014	Jan 23rd, 2014

Source: GoA and Syiah Kuala University as cited in World Bank (2008) and Public Works

Note: “–” data not available

January 1st each year. Accordingly, the annual budget proposals should be approved before the commencement of the financial year. Nevertheless, as shown in Table 10.4, the annual budget proposals within the case study districts, between 2005 and 2014, generally experienced delays. Some of the annual budget proposals were approved as late as July in the running year – a 7 month delay. Consequently, the remaining period for implementing the budget was significantly shortened since, regardless of the date of the budget approval, the budget will expire by the end of December in the running year.

In addition to unspent budget allocation, the financial issues surrounding poor road maintenance capacity were also affected by the inefficient use of the annual budget allocation. Firstly, a large proportion of the annual budget allocation was



inefficiently spent in paying salaries and travel expenses. Respondent PM07 concurred with this as he said:

We also need to see it from the budgeting perspective. What percentage is used for development? In Aceh, on average 60 % to 70 % (of the budget) is used for routine expenses, so the remaining fund is so little. (PM07)

A similar complaint was also raised by PM09. He argued that the government should start to improve their budgeting efficiency, particularly by increasing personnel efficiency. He said:

Their general expenses are bigger than what is allocated for the development. Around 60% to 70% are used for salaries, official trips, paper, and so on. For the development there is only 30%. In fact, why don't they increase personnel efficiency, right? (PM09)

The study identifies that financial capacity, nevertheless, is affected by the capacity of the human resources. Accordingly, the issue of human resource capacity as one of the internal factors which affect road maintenance capacity will be discussed in the following section.

### **10.6.3.2 Human Resource Capacity**

The next factor on the institutional side concerns human resources. The study identified that the human resource capacity is one of the greatest barriers to proper road maintenance. The lack of skilled personnel, inappropriate educational backgrounds and the poor recruitment system within the district road authorities are put forward as the main human resource issues. There is an apparent need to improve the capacity of local personnel, particularly with regards to procurement and road maintenance planning capacity. Respondent CS02 argued that this condition was affected by the poor recruitment system. He explained that many of the public works' agency's personnel in the Aceh Besar district were children of the retiring personnel who were recruited as a good gesture by the agency in order to honour them. As he explained:

So, a lot of the employees at the branch offices replace their parents. They do not necessarily have engineering skills, even though the parents were technicians. As the kids graduated from high school they were then accepted and work to replace their parents. (CS02)

Furthermore, the road authorities in the case study districts appeared to lack the skills and willingness to produce a well-justified budget proposal for the parliament. The lack of any initiative, and also support, to produce a road information management system which was required in order to justify the road maintenance plan consequently resulted in road maintenance needs being neglected, particularly due to the unreliability of the submitted road maintenance planning proposal. As stated by CS02, due to the lack of a proper information management system, the public road agency could not identify in advance which road sections required maintenance interventions and when the required interventions should be performed. Accordingly, the annual budget proposals were commonly prepared as a slightly modified budget

allocation upon that of the previous financial year. It comes as no surprise that it was hard to convince the parliament of the maintenance work plan proposed nor it was possible for the road authorities to use the budget proposal as a reliable reference for their road maintenance activities.

This condition conforms to Donnges et al. (2007) findings which suggest that the capacity of the local road authorities is frequently insufficient to deal with the responsibilities to which they have been assigned. They further list the requirements needed including technical staff, a thorough knowledge of the road network, sound procedures for road condition inventories, efficient planning procedures, effective procurement systems, good supervision, adequate logistical support, transparent and up-to-date reporting and reliable financial management. Donnges et al. (2007) further argue that performing efficient and timely maintenance requires the capacity to properly plan and execute the works in a timely manner, preserving investment with effective and efficient solution with available funding.

In addition to the aforementioned issue, the poor capacity of the local governments' personnel was aggravated by the low political interest in capacity building programmes. Road authorities' personnel in the case study districts lack the political support to secure funding for capacity building programmes. Budget allocation was primarily spent on programmes and physical construction activities which can attract public interest and yield more immediate and visible benefits, highlighting that the benefit of having a decentralised road management system can only be achieved through long-term investment in establishing an effective system at the local level and in building local capacity. Capacity building programmes at the local level are very limited and invitations from external institutions to participate in training and workshops are frequently rejected due to the lack of a budget to cover the basic costs such as accommodation and travel fares. In response to such conditions, Donnges et al. (2007) refer the main cause of the problem to the lack of effort to ensure that local authorities possess the required knowledge and skills to effectively perform road maintenance activities in the initial phase of the decentralisation process.

Accordingly, this study concludes that the challenges in capacity building in the case study districts are rooted in four factors which are interrelated to each other: poor political interest, poor budget allocation, poorly planned capacity building programmes and personnel's capacity issues. The latter issue is due primarily to the fact that technical and engineering positions are frequently filled with personnel with no engineering educational background. Poorly designed capacity building programmes consequently result in a reliance on informal interactions between colleagues as the main provider of learning and skills. The process of knowledge transfers between personnel is, therefore, highly dependent on the personal relationships between individuals, instead of resulting from a well-established support system. Additionally, the capacity of local consultants can also be argued as being inadequate as a source of seeking expert advice. As stated by CS14, the transfer of knowledge from the interaction between the road authorities and the local consultants did not yield the expected outcome. In many cases, as respondent CS14 complained, the road authorities' personnel had to give instructions and

advice to the consultant personnel regarding work methods and implementation, instead of vice versa.

The institutional factors which affect local governments' road maintenance capacity have been presented and discussed in detail in this section. The following section will provide a discussion on the technical factors.

### **10.6.4 Technical Factors**

The identified factors within the technical category include road design, traffic loading control and plant and equipment issues. All three technical factors were perceived similarly in all three case study districts. In comparison to the external and institutional factors, the technical factors are of less significance with regard to local governments' road maintenance capacity.

#### **10.6.4.1 Road Design**

With regards to road design, the main issue is related to the use of the expensive Hot Mix Asphalt (HMA) surface as a 'new' road standard by the local governments. The use of HMA for the local roads was introduced in the case study districts in the post-tsunami reconstruction, as it has better surface quality and durability. Accordingly, as CS14 stated, the local governments have now started to use HMA in their road projects. He said:

Obviously, prior to BRR (reconstruction period), we did not have a single meter of roads with hot mix asphalt except the national roads. When BRR was here, since the policy was that road (reconstruction) must use hot mix (asphalt), we look for road section that needed hot mix pavement. Particularly roads providing access to the community. (CS14)

Apparently, the trend to construct new roads with HMA or upgrade the existing network to HMA has continued and has become one of the development targets of the local governments. Respondent CS02 confirmed:

So now we are still upgrading roads. What was macadam (road) we upgrade them to Hotmix (HMA). (CS02)

Consequently, as shown in Table 10.5, the number of local roads with hot mix asphalt surfaces in the Aceh Besar districts rose from just over 240 km in 2006 to more than 630 km in 2012.

As most of the road networks have been rehabilitated and reconstructed into HMA surface, as expressed by CS16, the local governments now have much improved road conditions and the travel time has been significantly reduced compared to the pre-tsunami conditions. Nevertheless, the wide application of HMA surface comes with severe consequences. Although the use of HMA appears to be reasonably justified (as the HMA has a better surface quality and durability, prolonging the road design life), road pavements deteriorate over time and the design

**Table 10.5** District road sections with hot mix asphalt surface

Year	Number of road sections	Length (km)	% of total road length	Total road length
2006	120	242.70	25.97%	934.50
2007	145	289.00	30.93%	934.50
2008	175	351.80	37.65%	934.50
2009	206	479.40	36.32%	1,320.00
2010	228	534.90	40.52%	1,320.00
2011	260	601.90	45.60%	1,320.00
2012	269	638.00	48.33%	1,320.00

Source: PU Aceh Besar (personal communication)

life can only be achieved if the roads are maintained. As identified by Karim (2011), road designers often ignore a very important aspect of road management which is the need to maintain the networks in the future.

Consequently, instead of providing regular maintenance for their existing road networks, upgrading the roads to hot mix asphalt (HMA) pavement was perceived as the solution to road maintenance problems and to extending the road serviceability period. ADB (2003) refers to this problem as the road agency poverty trap: building more roads or improving roads to the wrong standards; approving only asphalt road projects even though they are expensive to build; failing to recognize that some roads are no longer maintainable and thus now need to await reconstruction. Accordingly, as the higher road specification is more expensive to build, more financial resources are potentially wasted because of a lack of maintenance. Such conditions also ignore the necessity for, and the economic advantages of, different pavement types. Accordingly, this chapter argues that the road authorities need to take into account the cost-benefit ratio of the various road pavement types that should be applied in their area, particularly for the low volume traffic roads. The implementation of high-quality pavement alternatives, such as HMA, as a shortcut to prolonging the road maintenance schedule, does not justify the higher investment cost and the abandonment of regular road maintenance needs.

#### 10.6.4.2 Traffic Loading Control

With regard to the traffic loading control aspect, this issue has arisen primarily due to the limited number of weighing stations that were operational after the tsunami. There were only two weighing stations that remained functional in Aceh. The first one was in Semadam, near the border with the North Sumatra province. The second one was in Jontor, in the west coast area of Aceh (Dirjenhubdat 2014). As there were only two weighing stations that were operational, and both were located near the border of the North Sumatra province, the transportation agency could only practically control the interprovincial traffic which passed along the routes where the weighing stations were located. Accordingly, the overloaded traffic moving within the province of Aceh was virtually untouched. As explained by PM10:

So indeed (the control) is weak. If there are only those two, the control is weak. If for instance, a ship hauls in Tapaktuan, it (the goods-transporting truck) does not go through Singkil (Jontor). It may be travelling to Calang (Aceh Jaya) or Takengon (the middle part of Aceh), which can't be monitored. (PM10)

As the equipment to control the overloading traffic is limited, overloaded vehicles are one of the significant factors which affect the rapid deterioration rate of the road infrastructure in Aceh.

### ***10.6.5 Plant and Equipment***

The next technical factor regards supporting plant and equipment. In performing road maintenance works, the adequacy of the plant and the equipment for maintaining roads will largely contribute to the road maintenance performance. Different responses were identified across the case study districts. In Aceh Besar and Aceh Barat Daya, technical issues arising from plant and equipment availability were not discovered. In Aceh Jaya, however, the amount of equipment is considered insufficient, as CS10 complained:

Both the human resource capacity and the equipment are very limited. So far we only have two motorised graders and 2 compactors. Those are the only equipment we have. (CS10)

However, financial problems were also experienced in the maintenance of plant and equipment. In Aceh Besar, the lack of an equipment maintenance budget allocation was partially solved by renting out the equipment to private companies. In Aceh Jaya, however, the proposal to buy more equipment had always been rejected by the parliament.

The analysis of the technical factors in this last section concludes the discussion on the factors which affect local governments' road maintenance capacity.

## **10.7 Conclusions**

The study concludes that the road infrastructure within the case study districts has been generally neglected in terms of maintenance. The local governments within the case studies lacked a preventive maintenance culture and the general response to preserving road infrastructure was to repair roads when they are broken. The newly rehabilitated or reconstructed road networks were abandoned in terms of maintenance immediately after their completion. Road rehabilitation and reconstruction were perceived as the necessary repair interventions. Dirt and gravel roads were left to deteriorate until there were enough funds available to upgrade the surface. Similarly, paved roads were also neglected and not given maintenance interventions until rehabilitation works were considered necessary and the funds became available to undertake this.

This chapter has presented a detailed discussion of the factors that affect local governments' road maintenance capacity. It was found that these factors, separated into the three categories of external, institutional and technical factors, need to be addressed properly and accounted for in post-disaster road reconstruction plans. The external factors appear to be the most important category. This is particularly because other affecting factors are highly dependent on factors in this category (e.g. the political condition, budget allocation, and regulatory arrangement). As the road maintenance works do not require advanced technological equipment, the technical factors also appear to be the least determining category.

Failing to provide for the required maintenance needs may result in the investment that is made during the reconstruction period prematurely diminishing and thus the intended impacts on the economic development of the areas may not be achieved. The findings of this study have provided essential inputs to assist in both solving the district road maintenance problems and the post-disaster road infrastructure reconstruction. Crucially, the identification of the factors that affect road maintenance capacity has produced a list of concerns that practitioners involved in the road maintenance sectors need to take into account in their road infrastructure project planning and programming.

Furthermore, the establishment of linkages between road maintenance capacity and the post-disaster reconstruction process offers a comprehensive overview of the process and experience of post-disaster road reconstruction efforts which focus particularly on maximizing the value of investments made in the reconstruction. Such an overview provides lessons learnt and recommendations for any road reconstruction activities in a post-disaster context.

This study has thereby demonstrated that the reconstruction phase, which needs to be prepared ahead of a disaster, is a critical opportunity for 'Build Back Better', including integrating DRR into development measures, with the end goal of making nations and communities resilient to disasters.

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# Chapter 11

## Manufacturing Firms' Adaptations to Floods and Proposal for Integrative Adaptive Regional Development in Jakarta

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**Abstract** Jakarta has long been affected by floods and the social and economic impacts are enormous. There has been extensive research focusing on the impacts and actions by the government. However, flood adaptation strategies by manufacturing firms, as the most affected business sector, have been largely neglected. This chapter fills the gap firstly, by examining firms' individual adaptation through their perception of flood risks and business decisions, and secondly, firms' collective roles within Jakarta's regional flood risk governance systems. We put forward recommendations toward integrative adaptive regional development (IARD), ranging from resistance to resilience and transformation or collapse.

The study involves a review of literature on floods and their impacts in Jakarta as well as a case study with in-depth interviews of firms' owners or decision-makers. We argue that based on the integration of different actor-specific adaptive capacities, interests and responsibilities, existing trajectories are adjusted or changed. Positive outcomes can be a sustainable regional economic growth and social welfare and negative outcomes can lead to socioeconomic downgrading.

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The findings show that firms' production processes are heavily disrupted by floods. Firms' adaptation strategies, individually and collectively, do not lead towards IARD. Firms primarily concentrate on individual adaptation that is orientated towards resistance and resilience. They mostly undertake technological adaptation to reduce flood risks and cope with its consequences. Collective adaptation is rarely undertaken, except by larger firms, due to self-interest and institutional barriers, which hence orientate them towards resistance (with the danger of collapse), and resilience rather than towards more fundamental transformation. Recommended strategies for achieving IARD include improving cooperation amongst firms and with government authorities, and to strengthen law enforcement.

**Keywords** Jakarta • Floods • Manufacturing firms • Governance • Adaptation • Integrative adaptive regional development (IARD)

## 11.1 Introduction

The Indonesian capital Jakarta is both the economic center and the most flood-prone region of Indonesia (Firman et al. 2011; Yusuf and Francisco 2009). Impacts on seasonal flooding caused by tidal inundation (*rob*) or rain (*banjir*) affect the area and also the Indonesian economy as supply chains become disrupted. Consequently, a lack of effective flood risk reduction measures in Jakarta will also have negative effects on the entire Indonesian economy (Sagala et al. 2013). However, up to now authorities on all administrative levels have been overwhelmed to implement appropriate risk reduction measurements, although lately more progress for risk reduction can be seen (Padawangi 2014; van Voorst 2016).

While floods have been commonly seen as threats to economic development in Jakarta, exposure to floods also enables opportunities to shift current (negative) regional economic trajectories into positive directions by using flood adaptation as a trigger for wider restructuring and transformation. This shift can improve the entire local condition of weak infrastructure and institutional setting towards better living conditions and better conditions for improving the firms' competitiveness.

Existing literature regarding adaptation to floods is mostly focused on analyzing the impacts on the community and household level (e.g., Birkmann et al. 2012, 2014; Chan et al. 2012; IPCC 2014) or the calculation of economic costs of disaster (e.g., ADB 2014; Hallegatte 2014). Yet, the perspective on firms as actors at the individual and regional levels has typically been neglected, such as whether and how firms themselves anticipate and adapt to floods, and how firms can contribute to advanced regional development in Jakarta and Indonesia. Competitiveness and survival of firms are significant to maintain and improve the socioeconomic development in hazard-prone areas in Indonesia.

The objective of this chapter is to understand the perception of manufacturing firms to the impacts of floods, and review strategies taken to deal with those floods, either individually or collectively. The chapter aims to:

1. Review firms' exposure to floods and their perception of future flood risk
2. Examine firms' activities on individual and collective adaptation
3. Propose a concept of integrative adaptive regional development (IARD) and utilise the concept to develop recommendations for sustainable regional economic growths and social welfare.

IARD is defined as the regional adaptive capacity of the socio-economic and institutional configurations to respond to market and environmental stress (Perrings 2006). IARD strategies are those whose outcomes attempt to reconfigure prevailing local risk-prone situations. They are outcomes of the multiple firms' individual adaptations and collective adaptations jointly with other stakeholders. It is suggested that the coordination and combination of individual and collective adaptation will lead to an adaptive regional development.

The study involves a review of literature on flood impacts and flood risk reduction strategies in Jakarta, in addition to expert interviews to test empirically which types of IARD can be seen in Jakarta. We conduct interviews with firms in Jakarta to examine their perception of floods and the impacts, adaptation strategies, and perceived paradigms of IARD. The chapter is structured as follows: The next section presents the conceptual framework of IARD. The third section describes the methodological approach for data collection and analysis for firms' adaptation to floods in Jakarta. The fourth section reviews flood risk and government flood risk reduction strategies. Section five presents the empirical results on the firms' exposure and their individual and collective adaptation actions. Section six discusses our proposals and recommendations for IARD.

## **11.2 A Proposed Concept of Integrative Adaptive Regional Development (IARD)**

We develop the concept of IARD in order to examine whether firms' adaptation efforts lead to a change of risk reduction trajectories (Fig. 11.1). The concept combines three major fields of interest regarding firms' adaptation and their impact on regional development.

The following three sub-sections explore the three elements of the framework in more detail and provide a theoretical background.

### ***11.2.1 Firms' Decision-Making Under Risk***

The framework is developed based on the following assumptions regarding firms' decision making under risk. First, it is assumed that firms anticipate floods and develop respective individual adaptation strategies to enhance their competitiveness.

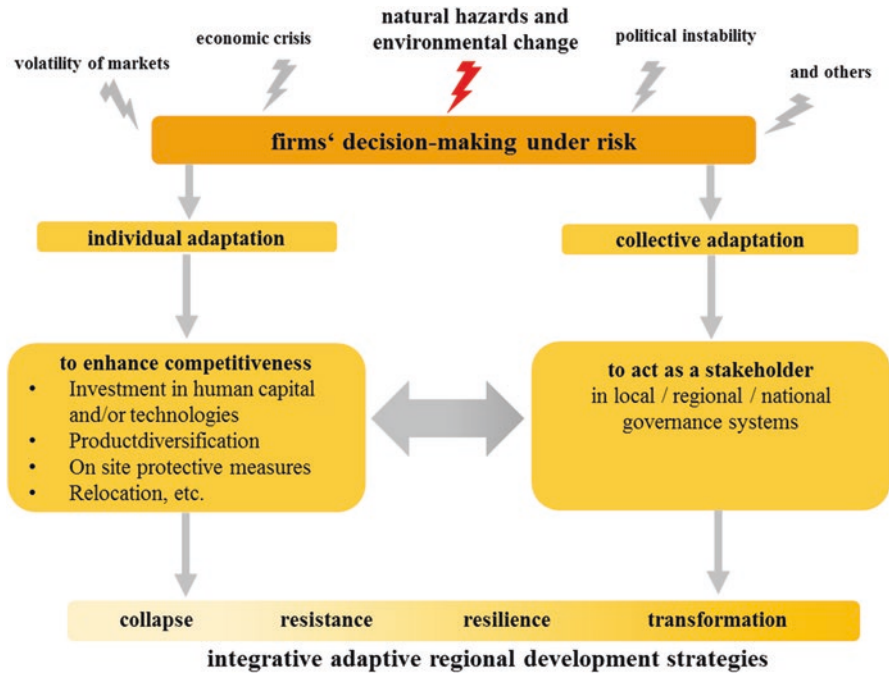


Fig. 11.1 The concept of integrative adaptive regional development (IARD) (Source: Authors)

Second, firms are embedded within collective adaptation processes. Within them firms might play a pivotal role as a stakeholder among other stakeholders within local governance systems, such as government agencies, civil society organizations and international development organisations. Another possibility is that firms passively assume that the authorities manage the risk reduction and do not proactively undertake their own adaptation actions. Both perspectives on firms' engagement are interlinked and combined to analyze, third, how firms take effect on the wider intended or unintended risk reduction paradigms predominant in the system which are, in accordance with Solecki et al. (2015), conceived to exist on a continuum between collapse, resistance, resilience and transformation.

### 11.2.2 Individual Adaptation

Individual adaptation is defined as the firms' specific routines which primarily aim to maintain the continuation of business and enhance the competitiveness. These actions are achieved if firms use and modify their knowledge and technological and

financial capacities (i.e. adaptive capacities) to respond continually and be prepared to the uncertainty by flood exposure. Furthermore, the routines have to be flexible and require a certain risk-taking behavior in order to for instance change the production process and market or investment strategy. However, it is also hypothesized that also the opposite can occur; firms are not able to react accordingly, because they are overwhelmed by the exposure to floods, do not hold sufficient routines and act in a weak institutional environment. Individual adaptation put emphasis on the firms' specific abilities to accommodate flood risk in order to maintain the continuation of business and enhance the competitiveness. Furthermore, it is outlined which impact individual adaptation has on the IARD.

Evolutionary economic geography approaches uses the idea of routines to explain the dynamic of firms' behavior (e.g. Frenken and Boschma 2007; Nelson and Winter 1982). Firms' adaptive behavior is described as pattern of routines, which determine the kind and scope of their adaptive capacities. Routines are firms' specific structures and actions which derive from former behavior (e.g. experience, skills or tacit knowledge) and determine future behavior. Routines have a dynamic character and are influenced by the institutional setting (Frenken and Boschma 2007). They are modified and adjusted if firms experience new situations or common behavior has failed (Berkhout et al. 2006; Nelson and Winter 1982). The effectiveness of routines is determined by the firms' capability to reproduce or modify its routines during changing market and environment circumstances (Scott 1995), such as the impact of floods on their business. The danger of lock-in of particular (formerly successful) routines is also important. The exclusive usage of successful routines may endanger that the ability to learn or the attempt of new ideas will get reduced so that the firm can be locked-in (Lawson and Lorenz 1999). As part of the analysis the chapter aims to examine the relationship between firms' routines and their adaptation behavior. The key question here is whether this relationship changes with changing risk reduction paradigms (between resistance and transformation). In other words, does a resistance paradigm lead to adaptation that cements existing routines – even though they might be unsustainable in the face of increasing flood risks? Or does adaptation lead to reconsideration and breaching of routines in order to engage in transformative adaptive trajectories?

The outcome of individual adaptation will primarily affect the firms' own competitiveness, but the outcomes can positively alter other firms and stakeholders who imitate these effective activities. So, firms can play a pioneering role. Additionally, individual adaptation can have side-effects for other actors. For instance, a pump can also decrease the inundation for the surrounding or might increase their inundation. Furthermore, if firms can compete well on the market it will have positive effects on employment, tax revenues etc. Negatively, the individual maladaptation will maintain or increase the risky situation and a decreasing competitiveness (worst-case scenario: bankruptcy) will also have negative effects on the socio-economic conditions (e.g. employment, tax revenues).

### 11.2.3 *Collective Adaptation*

Collective adaptation focuses on examining how firms engage as stakeholders within a governance system. It means the collaborative activities of broader flood risk reduction measures in which firms take part. Therefore, the following section addresses the term of governance and which feature of the various actors favor effective large-scale risk reduction schemes. In addition, the consequences of collective adaptation are discussed.

Individual adaptation also determines collective actions (Tompkins and Eakin 2012). Hence, individual adaptation does not take place autonomously, it is rather shaped by governance structures and influenced by strategies, activities of all stakeholders and supported or limited by institutions (Adger et al. 2005; Bristow and Healy 2015; Nelson et al. 2007). This results in a broader perspective (governance perspective) as it addresses the complex adaptive system idea that firms are acting in disharmony with other regional actors.

Collective adaptation is characterized as collaborative activities that firms are initiating or within which they are participating together with other firms, the community, NGOs and authorities (i.e. governance system). The goal of these activities is to implement risk reduction measures which cover broader areas, for instance an entire neighborhood. Displaying collective adaptation requires that the members of the governance system minimize their pure self-interest by negotiation and punishing free-riding. Engagement on collective adaptation is not cost-neutral for firms, but broader risk reduction measures will be more effective than individual ones, thus will increase the benefit of the firms' investment on adaptation. It is assumed that firms who possess sophisticated adaptive capacities and a conscious risk-taking behavior will be the driver (i.e. institutional entrepreneurs) of such collective adaptation.

The outcome of collective adaptation is particularly necessary to tackle large-scale risk-causing factors such as widening rivers or implementing a polder system. Individual firms can hardly finance and legitimize their action without having the support of the members of the governance system. Such joint realizations will more likely lead to a transformation of risk-prone conditions or at least develop resilience. However, self-interest and disagreement of the members of the governance system over favored risk reduction schemes might cause the omission of risk reduction, leading to persistent flood exposure.

Therefore, the concept of IARD suggests further that collective action takes place within a regional adaptive governance system. The question is whether multiple actors achieve more or less effective adaptation (Pendall et al. 2010). Adger et al. (2005) argue that the success of adaptation depends on heterogeneous adaptive capacities of diverse stakeholders and a balanced power relation among them. As part of the governance system and as institutional entrepreneurs, firms will bring in their routines and contribute to shape governance processes in order to try to change institutions (Boschma 2014). On the contrary firms can benefit from the knowledge of the other actors. The variety of different perception, knowledge and power of the

various actors in the governance system enable a self-organizing behavior which might induce an institutional change and attempt to reduce the exposure to floods (Simmie 2014). Accordingly, collective adaptation depends on the institutional setting in which particularly informal institutions shape the regional business culture through trustful personal networks and no-opportunistic behavior (Ostrom 2000).

Furthermore, it is important to examine which impacts the firms' adaptive capacities have on the firms' willingness to (re-)create regional trajectories. The concept of IARD assumes that firms with better adaptive capacities and conscious risk-seeking behavior are more likely institutional entrepreneurs to initiate path creation, i.e. changing rigid institutional settings (see DiMaggio 1988; Garud et al. 2007).

### ***11.2.4 Integrative Adaptive Regional Development (IARD)***

IARD strategies are those which outcomes attempt to reconfigure prevailing local risk-prone situations. They are outcomes of the multiple firms' individual adaptations and collective adaptations jointly with other stakeholders. It is suggested that the coordination and combination of individual and collective adaptation will lead to an adaptive regional development.

The actor-specific adaptive capacities, different interests and responsibilities have to be synthesized to accomplish an integrative, tailored risk adaptation scheme. Moreover, it is perhaps required the change of the prevailing trajectory towards a more sustainable one that enhance the regional economic growth and social welfare (Martin and Sunley 2015).

However, the negative outcome of avoiding individual and collective adaptation or undertaking failed ones will lead to a socioeconomic downgrading. Crucial is hereby to foster the flexibility and pro-activeness of all members of the affected regional system (cf. Renn and Klinke 2013). In addition, both strands can have spillover-effects on each other. For instance, on the one hand the implementation of a polder system for the entire neighborhood will first reduce the firms' specific risk and second influence the individual adaptation activities. Firms might reduce their own activities or will be able to use their resources on other adaptation activities or their direct business performance. Instead of maintaining pumps the firms can focus on delivery constraints which arise on the way to the harbor or strengthen their product portfolio or increase the productivity. On the other hand, as firms' effective individual adaptation serves as good practice of risk reduction, it can increase the engagement of other firms and stakeholders. If firms acting as an institutional entrepreneur they could raise the commitment to change ineffective institutional arrangement.

The outcomes can have diverse forms and follow different paradigms, ranging from resistance to resilience and transformation – or collapse as unintended effects of inaction or the incapacity for effective (joint) adaptation action (Solecki et al. 2015). All these forms are described in the following paragraphs.

#### 11.2.4.1 Resistance

In this context, resistance addresses that actors try to maintain the current system and its configurations (e.g. power relationships) stable, despite increasing external stress. This often involves a higher input of resources or slight adjustment of existing routines or optimizing their efficiency; for instance, protecting the infrastructure and strengthening rigid institutional structures. A typical example of resistance can be increasing the amount of pumps to decrease the inundation level or purchasing generator to cover the electricity shutdown.

#### 11.2.4.2 Resilience

Resilience entails slight adjustments of the current system to increase its ability to handle external stress and crises situations (Handmer and Dovers 1996; Solecki et al. 2015). Resilience can be the result of risk anticipation or experience. However, even with these adjustments implemented in the system, the main system configuration is not questioned. The goal is to stabilize the core structure of the system through some essential incremental changes (Handmer and Dovers 1996; Solecki et al. 2015).

Regarding floods firms could adjust their production process, for instance by ordering raw materials in advance to cover infrastructure constraints. However, the danger is that these minor changes hinder or delay essential major ones (e.g. construction of a polder system or relocation). Under such conditions, the resilience paradigm can be the enemy of adaptive change (Handmer and Dovers 1996; Holling and Gunderson 2002) and even work against more fundamental change.

#### 11.2.4.3 Transformation

In contrast, transformation means a form of adaptation that fundamentally questions the setup and fit of current system configurations (Pelling 2011). A typical example could be implementing a polder system which is funded by the local fees of all concerned actors. The underlying threats of extreme events are addressed more likely directly by adaptation to consequences of change and uncertainties (Pelling 2011). Therefore, the goal of transformation is to find alternative ways of system configurations, i.e. applying new routines that increase the system's long-term sustainability through minimizing risk or rigidity traps and collapse, and through establishing co-benefits from new development trajectories (Handmer and Dovers 1996; Pelling 2011). This paradigm requires more flexibility and willingness to change behavior and institutional setting. Perhaps, also shift of the governance system, such as type of leadership or power relations, have to be changed (Folke et al. 2010).



#### 11.2.4.4 Collapse

The collapse paradigm entails the most severe consequence, if no adaptation or maladaptation is undertaken. The firms will retain on their business strategies and just wait until the inundation will disappear. During this period, the business survival is threatened as the production is stopped or reduced. Also realized risk reduction scheme can be a maladaptation. For instance, the construction of a dyke can increase the flood risk of a higher amount of actors than those you will benefit from it. Furthermore, other stakeholders are also not engage to solve the flood risk. By this “wait-and-see” strategy the entire system will be locked-in and cannot adapt effectively to the exposure (Solecki et al. 2015). The regional economic consequences might be a total (slightly) socioeconomic downgrading.

In terms of the continued stress to flood risk it is suggested that regional development and the engagement of the actors of the governance system needs a change of persistent trajectories. Thus, a more adaptive approach is suggested which yields to increase the risk awareness and willingness to question the current behavior and identify and negotiate solutions reduce the flood risk. Each of these paradigms will have different consequences on the trajectory of regional development. It is argued that resilience and particularly transformation are the most beneficial outcomes to achieve a more effective regional development which also increase the opportunity to reduce the risk. Cooperation and questioning prevailing risk behavior are important features to achieve those outcomes. Moreover resistance and particularly collapse are seen as non-favorable outcomes that evolve if the current trajectory is carried on. The consequences are constant socioeconomic downgrading as the flood risk is not addressed effectively.

The paradigms of resilience (partly) and transformation should be thereby the favorable options. They increase the probability that the exposure to floods will be tackled effectively sustainable. Improving the infrastructure and increasing the cooperation within a governance system will also have direct effects on “normal” economic stress. Resolving transportation constraints will reduce the shipping costs for all firms (even if they are competitors).

Cooperation can foster that firms jointly use their power to address for instance the reduction of bureaucratic or corruption issue to local authorities in order to improve the institutional environment. Furthermore, cooperation can foster the establishment of local business networks, where firms together innovate and develop new products and services. Overall, this improvement will also have positive side-effects for the community and authorities. The employment situation will be improved, tax revenues will increase and the authorities can relieve their budget on risk reduction scheme.

In contrast, the paradigms of collapse and resistance do not aim at change. Taking these strategies is just a continuation of the trajectory and cannot be seen as adaptive regional development. The exposure to flood will not vanish. At the worst outcome it will deteriorate completely the local living and economic conditions which will lead to a socioeconomic downgrading (e.g. bankruptcy of firms, abandoned settlements, rising poverty).

### 11.3 Methodology

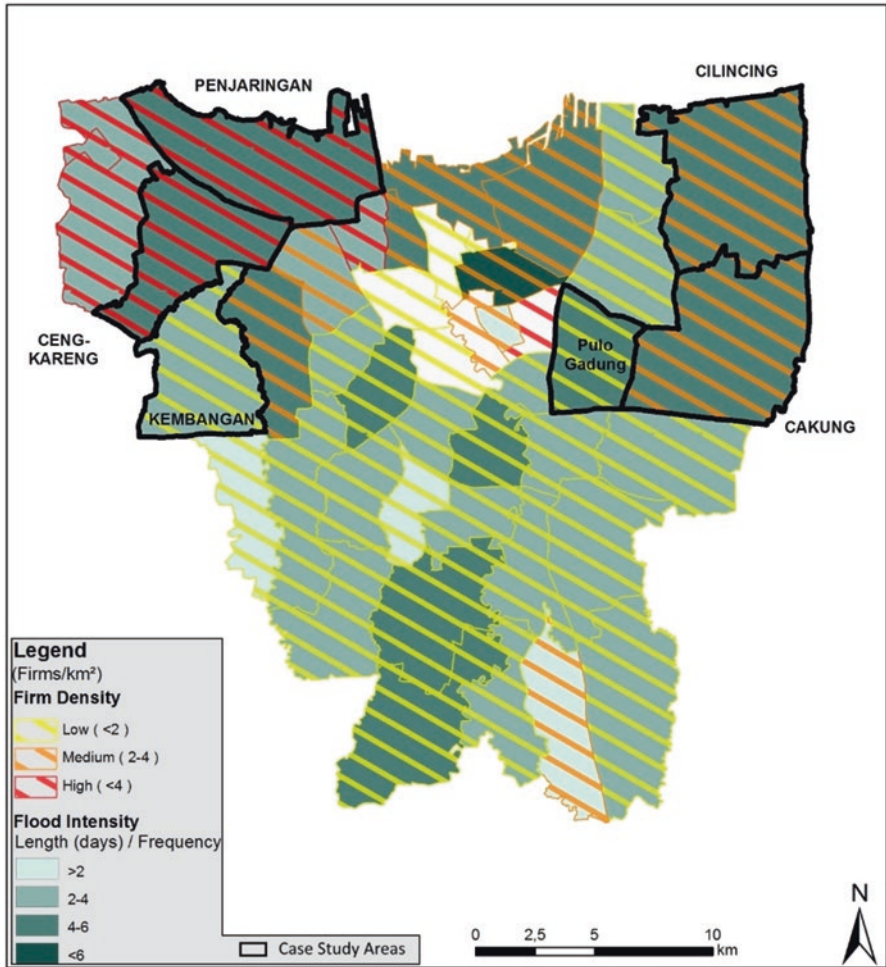
All these steps were applied in order to examine first the firms' specific exposure and the firms' activities on individual and collective adaptation. Second, the interview statements were used to analyze which types of IARD-strategies are taking place on flood risk reduction in Jakarta to achieve an adaptive regional development.

A case study approach (see e.g. Yin 2003) with qualitative in-depth firms' interviews was applied in several highly flood-prone industrial areas in Jakarta. The interviews were conducted between August and November 2015.

The research process followed the grounded theory approach (see Strauss and Corbin 1996). The complete empirical design consists of five steps.

First, flood-prone areas in Jakarta were identified based on data of the Disaster Management Agency of Jakarta (BPBD DKI Jakarta 2015). Data about the daily occurrence and duration of flood on the district level (*Kecamatan*) between September 2013 and August 2014 were analyzed. The result was merged with data of the directory of medium and large manufacturing firms 2014 (BPS 2015a). The aim was to identify areas with a high density of manufacturing firms. Second, the explanatory step: suitable case study areas with a high exposure and density of manufacturing firms were visited during a preparatory field trip in March 2015 in order to get impressions, estimate the exposure and strengthen our theoretical ideas. Third, the outcome of the statistical analysis and the field observation is shown at Fig. 11.2. The *Kecamatan* in the Northeast Cengkareng, Kembangan and Penjaringan and in the Southeast Cakung, Cilincing and Pulo Gadung were selected as case study areas. Fourth, within the selected areas a total of 27 interviews were conducted. The interviews followed a combined approach, linking explorative-inductive elements with theory-deductive ones. Within the interview sample the entire range of business size and ownership were taken into account in order to be able to distinguish possible different exposure and adaptation efforts. The size (based on the number of employees) of the interviewed firms ranges from small to large businesses (see Table 11.1).

The selection of a broad range of business size was done in order to examine which kind of firms are engage more or less in individual and collective adaptation. The interviewees were the business owners or manager of the respective firms. Particularly at large firms employees who are responsible for environmental or security issues joined the interviews. Additionally, eight interviews with flood experts (e.g. BPBD DKI Jakarta, Mercy Corps) and the manufacturing sector (e.g. Chamber of Commerce Jakarta, consultants) were carried out. All interviews were conducted by an Indonesian-German research team in order to prevent language and intercultural misunderstanding. The interviewees could answer either Indonesian or English. The interviews were recorded and transcribed in English; in Indonesian conducted interviews were transcribed in English based on the original Indonesian



**Fig. 11.2** Selection of case study areas (Data source: BPS 2015; BPBD DKI Jakarta 2015; design: Fabio Pruß and Thomas Neise)

**Table 11.1** Size of interviewed firms

Size	Number
Small ( $\leq 20$ employees)	9
Medium ( $\leq 500$ employees)	8
Large ( $\geq 500$ employees)	10
Total	27

Source: Authors

answers. Additionally, if the firms gave permission, the production plants and their flood reduction infrastructures (e.g. pumps) were visited.

Fifth, the interviews were analyzed following the principles of the structured qualitative content analysis (e.g. Mayring 2015). The analysis served to test empirically the proposed concept of IARD.

## 11.4 Governments' Flood Risk Reduction Strategies in Jakarta

Jakarta is the most densely populated area in Indonesia, with about 10 million inhabitants in 2010 (BPS 2015b) and the most important economic center of Indonesia. Pressure caused by population increases and economic development has resulted in extensive land use changes (Firman 2009). The expansion of urban space at the coast, river and flood plains, the reduction of nature such as mangroves and the intersection by 13 rivers results in making flooding the most pressing natural hazard (Firman et al. 2011; Hallegatte 2014a; van't Klooster et al. 2012). According to the study about the climate change vulnerability of Southeast Asia by Yusuf and Francisco (2009), the districts Central, East, North and West Jakarta are part of the most exposed areas to various natural hazards in Southeast Asia (Yusuf and Francisco 2009).

Jakarta is particularly exposed to two kinds of flooding: First, the coastal area is predominantly exposed to tidal floods (*rob*) as large parts are located below the sea-level. Second, large parts of the city are affected by flooding in form of heavy rains (*banjir*). Land use change (i.e. deforestation and urbanization) in the Southern mountainous hinterland of Jakarta causes that rain water from the upstream flow into the city's rivers. Heavy rainfalls within Jakarta deteriorate the situation. Besides the "natural" reasons the uncontrolled rapid urban development in the last two decades increase the occurrence and magnitude of floods in Jakarta. For instance, formerly designed water retention areas have been converted into settlement and industrial areas which reduce the absorption of rainwater (Firman et al. 2011; Sagala et al. 2013; Steinberg 2007). Lack of sufficient water catchment infrastructure and their reduction due to clogged river and canals by garbage further increase the risk of floods. Severe flooding, for instance, like that occurring in 2002 and 2007, can last up to 3 weeks. Two-thirds of Jakarta was inundated and caused damage of at least 1 billion USD. In 2002 the share of direct damage on the manufacturing sector was 25% and in 2007 29% (see Table 11.2).

Severe floods have roughly occurred once every 5 years in the region. But lately they seem to happen more often; for instance, floods occurred in 2013 and 2014. In addition, minor flooding occurs several times per year (BPBD DKI Jakarta 2015, Peters et al. 2015; Sagala et al. 2013). Land subsidence is also increasing, in amounts on average of 4 cm per year in North Jakarta. Yet locally, it can reach up to 20–28 cm per year (Abidin et al. 2011). Consequently, the number of risk-prone areas is

**Table 11.2** Economic losses by floods in Jakarta in 2002 and 2007

Impacts	2002		2007	
	Current value	Share on GDP (%)	Current value	Share on GDP (%)
Total losses	9.9 trillion IDR	3.7	8.8 trillion IDR	1.6
Direct losses	5.4 trillion IDR	2.0	5.2 trillion IDR	0.9
Indirect losses	4.5 trillion IDR	1.7	3.6 trillion IDR	0.6
Manufacturing	2.5 trillion IDR	0.9	2.9 trillion IDR	0.5

Source: BAPPENAS (2007); calculation by authors

increasing. Scenarios by the Center for Development of Coastal and Marine Areas (PPKPL-ITB) projected that the sea level on the waterfront of Jakarta will increase 0.57 meters per year; hence, most of North Jakarta is projected to be submerged by 2050 if no adaptation action is taken (Firman et al. 2011).

Over the last decades the Jakarta authorities were overwhelmed by the “natural disaster” of floods. Sufficient prevention measurements were not undertaken. For instance, the construction of the, now finished, East and West Flood canals have been delayed over decades, mostly by the lack of commitment by national authorities (Simanjuntak et al. 2012). But their effectiveness is solely limited to nearby areas and does not solve the flood risk completely.

The political paralysis to tackle flood risk has been reduced lately. Since the governorship of Joko Widodo in 2012 and his successor Governor Basuki Tjahaja Purnama discernible progress in Jakarta’s flood risk reduction can be noticed. Notably, the political leadership has changed (van Voorst 2016). The government is now more focused on a dialogue with the stakeholder and the flood exposure is addressed finally by government along with international aid (e.g. Government of Rotterdam or Japan International Cooperation Agency) (Padawangi 2014; Wardhani 2015) and by decentralized disaster management agencies (van Voorst 2016). Local authorities have been strengthened in order to better tackle the drivers of floods (e.g. clogged river and canals) and the public is sensitized towards their responsibility to prevent floods and informed about the governmental engagement in flood reduction. Nevertheless, floods have not vanished.

Furthermore, since the democratization process in 1999 the political and civil institutions have been strengthened through the devolution of political power on the local and regional level (so called regional autonomy program) (Astiyah et al. 2011; Birkmann et al. 2014). This big institutional reform had also the hope for better governance, e.g. empower local authorities to respond to local needs, reshape the interaction of the government and the community and increase the trust of the public on the government for instance to increase the willingness of paying taxes (Alm et al. 2001; Firman 2009; Suharyo 2009). Besides the benefits of local-customized policy the decentralization process has also caused negative effects like the fragmentation of regional development, establishment of strong sub-national institutions and local egoism (Ananta et al. 2011; Firman 2009; Hudalah et al. 2014). Low cooperation between different government departments further leads to big

constraints on the governance of regional issues (Hudalah et al. 2014). Particularly, the flood management of Jakarta's rivers has to be solved together with the neighboring Provinces of Banten and Jawa Barat and its respective local authorities. This is especially urgent as the downstream of rain water from the Southern highlands often overloads the capacities within Jakarta, particularly during high tide and heavy rain in Jakarta. However, up to now integrative collaborative river management fails due to local egoism (Firman et al. 2011).

Overall, effective risk reduction measurements are still challenged by institutional and legal shortcoming and hampering governance capacities (Fuchs 2010). Although Indonesia has been implemented specific laws about risk based spatial planning in 2007 their enforcement remains insufficient (Hizbaron et al. 2012; Sagala et al. 2013). The existing risk reduction strategies by the authorities show that firms were not an active part of those. Regarding these insufficiencies the following empirical part will show how firms adapt to floods and how firms might attempt to overcome these lacks.

## 11.5 Results and Discussion

### 11.5.1 *Firms' Exposure to Floods*

Direct exposure to floods that are affecting the firms are particularly that (parts) of the plants are inundated and production has to stop or be reduced. On the longer term the machines can get damaged by the water. Firms who do not possess sufficient financial resources to replace the machines have to reduce their productivity and endanger the firms' survival. In addition, firms are affected if the transportation ways are inundated and consequently, the shipping takes longer or has to stop temporarily until the inundation recedes. Another indirect effect is that their supplier or employers are exposed to flood. The power shutdown is also affecting the firms' production indirectly, because it causes production to stop. This manifold consequence by the exposure to flood is also happening to the firms in Jakarta.

Exposure to floods and land subsidence is not a new topic in Jakarta, also not for manufacturing firms. Since the colonial time, Jakarta (the formerly Batavia) is exposed to floods. The first appearance of land subsidence was in 1978, when cracks on construction were observed, the groundwater levels went down, flood areas expanded and seawater penetrated into the urban area (Marfai and King 2007). Accordingly, firms have been experiencing floods for a long time. In the past the inundation of the plants just lasted for hours up to 2 days at maximum. The interviewed firms had found ways to handle this type of flooding and the production was not seriously affected. Extensive adaptation measurements were not undertaken, the firms rather drew on small-scale measures like pumps or simply waited until the water had receded. However, for about 15 years the firms consider floods as a serious business impact:

It is a shame for us if we have to stop the production due to something [i.e. floods] that we haven't prepare. Even though the production is low but if the production stops it is very shameful (Firm F).

Particularly the large floods in 2002 and 2007, when more than the half of Jakarta was inundated, affected the firms heavily for weeks. At its peak, the inundation depth was up to two meters. One owner of a small textile factory explained the consequences of the flood in 2007:

[It took] around two weeks. We couldn't distribute, and we couldn't produce since we couldn't buy the materials needed for the produced items. [...] We could only wait until the flood recedes (Firm Q).

Even after the large incidents, firms are usually exposed to floods once per year during the rainy season (October – March). The firms are more exposed to floods caused by heavy rain and the rain water flow downstream from the Southern highlands of Bogor area, than by tidal flooding. The magnitude depends on several factors. First, the location of firms: Firms close to rivers and canals or main streets face a higher magnitude and level of inundation. Second, the local conditions of the canals and rivers, i.e. whether they are maintained to keep their discharge capacity. The local inundation ranges from 50 cm until up to 1.5 m.

The consequences which the firms have to face by floods are manifold. Direct business perturbations result from the fact that the production has to be stopped or reduced as plants get inundated. Further flooding has been reported to cause damage of raw materials or machines. In addition, the shutdown of power due to safety reason or flood-affected power stations hits the production process. Some firms also shut down their machines in advance during heavy rain as they are afraid that sudden power shutdown will cause damage. Furthermore, even those firms that have no direct perturbations of their plant or production, the streets in front of the plant or to their customer or harbor might be inundated. For instance, as mentioned by firm L: *"Everything slows down, especially the transportation and distribution process."* Consequently, the firms have difficulties to deliver their products. In particular, the firms typically have to pay a fine for late delivery or in some cases even lose their customers.

### ***11.5.2 Firms Main Focus on Individual Adaptation***

As mentioned in the previous section, the big floods in 2002 and 2007 affected the firms heavily. Before these events proactive adaptation was not sufficiently undertaken by the firms. These events can be described as tipping points as the damage inflicted by these events exceeded the previously benign levels of impacts by far. The firms thus changed their procedure dealing with inundation. The interview results suggest that instead of "wait and see" the firms now engage more strongly in flood adaptation. Nonetheless, they rather act merely reactively than anticipatorily, since a comprehensive assessment of potential future exposure rarely takes place.

Overall, the adaptation actions can be differentiated between technological and soft adaptation. Soft adaptations are those activities that do not have direct consequences on the production process. They are activities which support the continuation of the production and sale. The firms' individual adaptation is primarily focused on technological solutions. Soft adaptations are undertaken rarely and just by large scale firms. Nearly every firm still relies on pumps and generators to protect their plant from inundation. If their capacity is not sufficient, the firms usually invest in higher capacity. Firms also enlarged their flood protection system with higher walls to prevent water from entering the plant. Some firms even built small canals, dams or dyke systems. A high number of firms even invest in the uplifting of their entry gate, street in front of their plant or the entire plant. Uplifting can address single pieces of the firms' area or the entire space, depending on the financial capacity. Some firms also uplift in a step-by-step-approach. The reasons are at first to postpone the costly investment and secondly to wait and see whether the uplifting is sufficient to protect the plant from inundation. The investment costs on small-scale measures, such as pumps are mostly between 1,000 and 10,000 US-Dollar, but large scale protection measurements like a dyke system cost several 100,000 US-Dollar.

More comprehensive change of the firms' procedure with flood only happens once they engage only in soft adaptation measures. Most importantly, those firms take action on flood preparation, starting before the rainy season. Firms with sufficient storage capacities order earlier and a higher amount of raw materials to sustain possible supply chain interruptions during floods. Shipping time frames are scheduled earlier or later. In addition, machines and raw materials are put on an upper level or valuable parts of machines are removed to prevent damage. Particularly large firms formed emergency response teams and back-up plans. In addition, the employees take part in evacuation training. Especially, the security staff, technicians and the assigned emergency team are sensitised to maintain pumps and other flood protection systems as well as anticipate flood risk by monitoring meteorological data during the rainy season.

### ***11.5.3 Firms Lack of Engagement in Collective Adaptation***

Altogether, the interviews show that most firms do not engage in collective adaptation. Their focus lies solely on their own protection of their business and often they claim that it is the responsibility of the authorities to prevent the area from flood. For instance, the manager of a large multinational firm explained:

So after 2007, we have done a lot of improvements because we had learned from our experience in terrible floods. [...] Certainly we are no longer affected by flood. But actually the real problems are the river and water canals. If the river couldn't accommodate water flood, it's useless. Why? Because we only can covering our areas, and outside this area is a government responsibility (Firm W).



Additionally, the firms expressed dissatisfaction with the engagement of the authorities to prevent flooding in the area:

Government is always late to anticipate flood (firm A) and As long as I stay in here, I never saw the government dig the river or uplift the road. [...] I can say, that until now, [there are] no activities from government (Firm D).

Furthermore, the firms face the uncertainty and unreliability of political administration. Changing political strategy which occurs by leadership change complicates firms' decision-making to undertake long-term investments (Firm P and U). Consequently, these investments are often omitted. Furthermore, authorities force firms to implement broader risk reduction scheme to renew their production permission or get overtaxed. It can be shown that non-engaging firms tend to have of accepted the flood exposure and do not believe that the authorities will soon improve the local conditions. Although the firms are afraid that the conditions will get worse if there is no further adaptation.

However, there are some firms, particularly medium- and large-sized firms, who actively engage in collective adaptation. In contrast to the individual adaptation, the collective adaptation depends mostly on soft adaptation. These firm representatives stress that the most severe local cause of flooding, i.e. the clogging of canals and rivers with waste, can only be solved collectively. The problem of clogging was emphasized in nearly every interview. However, the willingness to eliminate this risk does not exist at every firm. Many firms claim that they pay money to the local authority in the *Kelurahan* office (sub-district) so that they have to clean the canals or rivers. However, the sewage water system is not (or just rarely) cleaned in most of the neighborhoods. Despite this situation many firms are not willing to clean the sewage system. They claimed it is the responsibility of the government. Nevertheless, the engagement of cleaning the sewage system is also the most occurring collective adaptation effort by the firms. Particularly, firms which are small and strongly embedded in the neighborhood engage in weekly or monthly cleaning, i.e. *gotong royong/kerja bakti* (community service) day. Larger firms tend to either donate money to the neighborhood for hiring people or send of their own employees to clean the sewage water system. Furthermore, medium and large sized firms give assistance if their employees' home or the neighborhood is inundated. The employees have the opportunity to stay home during flood or they can take their family to the plant if they need a shelter. In addition, the neighborhood residents are offered the plant as a shelter. Moreover, firms donate food, medicine or blankets for affected people.

Large-scale technological collective adaptation is only undertaken by large scale firms. Commonly, firms do not think that it is their duty to use their knowledge and extend their effective individual adaptation strategies in order to prevent the neighborhood from inundation. In addition, they have hoped that the efforts of the government are sufficient in reducing their (indirect) exposure (e.g. infrastructure bottlenecks) or claim on the duty of the government. Despite the majority of the firms remaining passive, there are also promising cases where firms attempt to realize collective adaptation. One very promising example can be found in the industrial area Cakung-Cilincing (cf. Fig. 11.3).



**Fig. 11.3** Example of firms' initiated collective adaptation (Source: Interview with Firm F; Design: Fabio Pruß and Thomas Neise)

The industrial area consists of many medium and large-scale manufacturing firms and is exposed to floods by the Cakung River and Cakung Drain. The informal settlement on the riverbank and the uplifted toll road *Jalan Lingkar Luar Timur* further increase the risk of inundation. In the past, most of the firms built their own canal systems or ponds which surround the plants for drainage. As a consequence, however, the water used to flow into other plants or the nearby settlement and streets, hampering transportation of goods and materials. One large multinational firm started to seek for another large-scale flood protection measurement. Together with consultants the firm's environmental department developed several solutions. After the internal search the firm approached the nearby firms, particularly a state-owned industrial park management which hosts many medium-sized firms and the community leader of the settlements to present and negotiate the planned flood reduction scheme. Achieving the commitment of the firms took 3 years and some firms were not joining:

It's flooding on the road, not in my facility, let government thinks about that, why do you care? (Firm F).

Although these challenges, the core group came to agree to build the proposed canal which will connect with the East Flood Canal. The cost will be covered by the firms that will also carry out the works with their own machines. However, the sophisticated project was delayed over years as the authorities did not give their permission implementing this large-scale adaptation. Eight years after starting this initiative, the authorities finally gave their permission in March 2016 and the firms started immediately with the construction work.

The findings show that firms primarily rely on individual adaptation. Collective adaptation is rarely undertaken and mostly focused on soft collective adaptation. Large-scale technological solutions are just undertaken by a few large-scale

manufacturing firms. The majority of the firms claim that large-scale risk reduction scheme have to be realized by authorities.

### ***11.5.4 Applying the Concept of IARD on Jakarta***

This part discusses why the firms' commitment to flood adaptation is not leading to an substantial integrative adaptive regional development. The empirical results reveal that the individual and collective adaptation efforts lead to various outcomes of IARD.

#### **11.5.4.1 Firms' Individual Adaptation Primarily Orientate Towards Resistance and Resilience**

Firms that do not undertake adaptation or do just target slight adjustments tend to lean towards resistance in order to protect the current location and business mode. They perceive the flood risk as a "normal" major force or just slightly adjust their measurements for instance in increasing the capacity of pumps. While other measures are closer to a resilience paradigm like the construction of higher walls, canals or the uplifting of entry gates or (parts of the) plant. Those activities show change at the margins to prepare for risky events (Solecki et al. 2015) without, however, putting the sustainability of the system as such into question. Consequently, the technological adaptation solutions hardly improve (i.e. transform) the entire flood risk-prone conditions. The soft adaptation activities, like for instance the preparation of rain seasons or formation of an emergency response team show characteristics of transformation. The firms questioned their organizational plan to withstand flood risk, extend their preparation and attempt to minimize the production bottlenecks to achieve a smoother production process during floods. Overall, the undertaken individual adaptation solutions hardly address sufficiently the economic and environmental stresses that affect the firms' competitiveness. Thus, a decisive impact towards an adaptive regional development does not occur. The firms try to maintain their business operations. These actions are not resolving the risk-causing factors, but just cover the consequences of the flood risk. Also it is unlikely that those actions improve the firms' competitiveness and social welfare fundamentally.

#### **11.5.4.2 Firms' Collective Adaptation Orientate Towards Resistance (with the Danger of Collapse), Resilience and Rarely Towards Signs of Transformation**

The interviews reveal that particularly large firms engage in collective adaptation. While the majority of the firms claim that is the duty of the authorities to solve the flood exposure at a broader scale. Moreover the firms engage in soft adaptation

activities, e.g. donating money, offer their plant as a shelter or support their employees during floods. As the majority of the firms are not engaging in collective adaptation it endangers that the flood risk is not tackled at a broader scale. The firms persist in their behavior which can increase the danger of a collapse outcome and are not showing signs of prosper adaptive regional development. The socioeconomic conditions deteriorate slowly and it is likely that soon the conditions are so worse that a relief strategy will be very costly or perhaps unfeasible. However, some firms attempt to adapt at least to the consequences by soft adaptation. The firms donate money to the authorities or supplies to affected communities and offer their plant as a shelter. These activities show characteristics of a resistance paradigm as the consequences of the inundation are addressed by spending financial and material resources but not attempt to change the causing factors. The commitment in community service can be seen as resilience. The firms engage by financial funding or deploying employees to clean the clogged canals or rivers to increase their water capacity. Signs of transformation are shown by large firms who attempt to change the existing institutional setting of flood governance and drove forward a new scheme of collective adaptation by building a shared canal for drainage (see Fig. 11.3). However, the example has shown that the realization is hampered by the bureaucratic burdens. Overall, the firms' collective adaptations also show that IARD is hardly to perceive. Although, the promising case in Cakung-Cilincing reveal that firms' engagement can lead to adaptive regional development. The future will show whether the scheme will have positive effects on the socioeconomic conditions in this area.

The non-occurrence of a sophisticated adaptive regional development can be explained as the weak institutional setting leads to an inadequate governance arrangement. The weak institutional setting causes that firms have the opinion that it is the responsibility of the authorities to prevent the community and businesses from the flood risk. The interviews show that firms do not trust the authorities sufficiently and are tired of the rigid, fragmented governmental system. Thus, firms do not experience and expect effective governmental flood risk reduction. As they do not perceive any benefits of possible engagement in collective adaptation and particularly the small firms are not willing to invest the coordination costs by organizing joint activities.

The results show clearly a typical social dilemma. The actors rather maximize their own benefit (individual adaptation) instead of perceive the overall benefits (collective adaptation). This non-cooperative behavior makes it unlikely that effective risk reduction strategies are realized. According to Ostrom (1990, 2000) successful governance systems have to implement monitoring and sanction principles to restrict free riding and achieve long-term self-interest for each member. The research suggests that such principles in order to strengthen cooperative behavior are difficult to implement in Jakarta, where law enforcement is typically discussed as a major policy problem. Moreover, the authorities are reluctant to simplify regulations and acknowledge firms' motivation to address risk-causing factors also at a broader scale. Rather adaptation is hindered by overregulation and unreliability of authorities. Similar findings provide von Luebke (2009) within his analysis of an

Indonesian business survey and in-depth interviews. He shows that particularly small firms have to face corruption and ignorance by local authorities. Furthermore they are more risk-averse. All these lead that firms do not see any incentives to collaborate. A crucial reason of these insufficiencies is that Jakarta's leadership is still lacking to develop transparency and true partnership between authorities, firms and residents (Steinberg 2007). Rather, the authorities still force firms paying compensation or overtaxing to contribute to regional economic development. All these weaknesses appear to be a crucial barrier of adaptation, particularly collective ones. Fuchs et al. (2011) argue in a similar way and outline that constraints on governance may one of the main reason of effective adaptation. The lack of proactive efforts by the authorities and the territorial and sectoral fragmentation of responsibilities as well as sometimes conflicting responsibilities hamper effective risk reduction to natural hazards. More integrative risk reduction may also reduce the expenses of the city budget and may streamline DRR activities amongst different government agencies.

## 11.6 Conclusion

The chapter has examined how firms are exposed to floods and engage in individual and collective adaptation. The study also proposes an IARD concept as an analytical framework to investigate how the firms' engagement on individual and collective adaptation is influenced by the flood situation and will lead to more advanced adaptive regional development. The empirical investigation was carried out as a case study approach with in-depth interviews with firms' decision-maker and experts.

The results show first that firms are exposed directly and indirectly to flood. Inundation or blackouts during floods cause interruptions in production. Furthermore, inundated infrastructure hampers the firms' supply chain. Despite the long history of flooding in Jakarta, the big floods in 2002 and 2007 lead to a change of firms' engagement in adaptation. Before these events, adaptation was rather ad-hoc and piecemeal. Since those incidents, however the firms increased their commitment in technological and soft adaptation, as part of their individual adaptation efforts.

Second, only a few large firms engaged in collective adaptation efforts. Many firms claimed that large-scale risk reduction is the duty of the authorities. One promising example shows that firms can be a pivotal player within collective adaptation.

Third, the case also has shown that institutional barriers hamper the realization of risk reduction scheme. The firms' managers stressed that overregulation, unreliability and patrimonial conventions have to be addressed to change the governmental focused risk reduction approach to a collective adaptation approach. Within such an approach firms and other stakeholders will be more willing to engage in collaborative flood adaptation and turn Jakarta into a less flood-prone area. The outlined example in Cakung-Cilincing has shown what can be achievable by firms' engagement if the authorities acknowledge and endorse such initiatives. Lean and trustful

regulation by authorities might be an important step to increase the firms' willingness to collaborate in risk reduction. Furthermore, protection measurements (e.g. a local polder system) might be funded by implementing a local tax and the managed by a public-private partnership. Firms and the local community will be more likely take care of their maintenance, if the funding is transparently used solely for this measurement.

The case of Jakarta shows that an IARD is unlikely taking place at the moment. Thus, it is necessary to change these attitudes in order to firstly integrate firms' and other stakeholders' engagement in joint risk reduction strategy and secondly, to increase the probability that firms voluntarily engage in collective adaptation. Besides probable more effective risk reduction, it may reduce the expenses of the city budget and the authorities overwhelming of addressing the flood risk can be relieved by stakeholder engagement, for instance by firms. However, firms' engagement is not a panacea of effective risk reduction. Furthermore, the cooperation of the authorities on different scales and responsibility has to be strengthened. Neither the Jakarta' authorities or stakeholders can solve the flood risk by their own. Especially, the actors at the upstream area have to be included. In addition, empowerment like started by the Jakarta' leadership have to be continued and strengthened. Law enforcement that reduces the uncertainty for engaging actors is also a decisive issue which has to be improved. As this will not just reduce the flood risk. It will also improve the firms' competitiveness and of the entire region. The establishment of an adaptive regional development can foster the economic growth and social welfare in the long-run.

Looking ahead, risk reduction schemes which utilize the adaptive capacities of firms will increasingly be required to develop and implement IARD strategies and set a course towards sustainable adaptation either through making existing systems more resilient or transforming them towards new adaptive development trajectories.

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## Chapter 12

# Media and Visual Representation of Disaster: Analysis of Merapi Eruption in 2010

Muzayin Nazaruddin

**Abstract** Mass media increasingly play an important role as the foremost source of information for general society, including in the disaster period. Newspapers typically feature cover-filling headline photos of disasters. It signifies the main discourse strategy and represents the disaster discourse of the newspaper on the whole. This chapter aims to discuss the discourse on disaster in Indonesia based on a study of two newspapers that covered the Mt. Merapi eruption in 2010. This study applies the method of visual discourse analysis, paying special attention to how images construct certain views of the social world.

The author argues that such media representation is rooted in the modern scientific discursive formation on Mt. Merapi and its eruptions, which is mainly sponsored by the state, and the discourse formed to promote some truth claims which are based on some binary-opposition views. Five main themes are found, i.e. the eruption of Merapi, evacuation processes, evacuation team, evacuation center, and damaged and ruined houses. The author finds that representations include: Mt. Merapi as a signifier of God, as a powerful-sacred subject, powerless and weak people, and mixed perceptions on the government ability to handle the emergency processes. Concerning the picture of the Mt. Merapi eruption, it is typically portrayed as a powerful natural phenomenon that claimed fundamental assets of local people. The second theme concerning the evacuation processes represent the despair of people who believe they have evacuated too late. The third theme concerns the evacuation center and shows helpless survivors waiting for external aid and suffering a lack of adequate shelter and aid management. The damaged and ruined houses theme also represents that the eruption has claimed the most fundamental assets of local people who have shown an 'eccentric' attitude by refusing to be evacuated. Lastly, the theme concerning the representation of the evacuation team shows the state performing strongly in emergency response; depicted as always prepared to evacuate the residents, while community volunteers are largely ignored in the printed media.

This study has important contributions for policy, formulating and developing early warning systems, mitigation strategies and emergency plans, as well as post-

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disaster recovery actions that holistically take into account cultural, social, economic and environmental capitals of affected societies.

**Keywords** Disaster discourse • Merapi eruption • Visual discourse analysis

## 12.1 Introduction

Indonesia is one of the most disaster-prone countries in the world. Geologically, the Indonesian archipelago is located along the Pacific Ring of Fire, from Sumatra, Java and Nusa Tenggara to North Sulawesi. Indonesia is also located amidst several tectonic plates: the Australian plate, the Eurasian plate, the Pacific plate and the Philippines Sea plate. Consequently, Indonesia is prone to natural disasters such as volcanic eruptions, earthquakes, and tsunamis. As a country with tropical humid climate, Indonesia is also vulnerable to floods, landslides and several diseases (Sudibyakto et al. 2012: 7).

In an uncertainty situation caused by disaster, the demand for disaster information increased sharply. Media enthusiasm to report disaster is basically caused by the character of disaster itself, which has high news value in terms of scale, impact, importance, and human interest (Wenger 1985). The broader spectrum of disaster would be followed by the longer and more intensive media coverage. At the moments of disaster, media would gain substantial increase of audiences (Fernando 2010). In this condition, mass media hold great power because their news would usually be the most referred source of information.

This study is based on theoretical assumption that media play an important role in forming the public discourse on the disaster. Discourse is defined as the way to think as well as to act based on that thinking that goes beyond, even forms and regulates the subjects in the discourse itself (Macdonell 1986: 87). Discourse consists of various statements and is always articulated through various forms of texts which are connected and support one another, in certain regularity. The order constructs what is said as discursive formation, “systems of dispersion, in that they consist of the relations between parts of discourse” (Foucault 1972: 37). Discourse is powerful, not because it is supported by strong institutions, but because it always has truth claims of its produced knowledge. Discourse becomes powerful because of its productivity: creating knowledge, subject and object, as well as the claims of truth of such knowledge (Foucault 1979).

This chapter focuses on media texts about disasters, taking the news of Mt. Merapi eruption in 2010 as a case of study in order to reveal the underlying disaster discourse. The last eruption of mount Merapi was chosen for several reasons. First, Merapi is the most active volcano in Indonesia, erupts effusively (non-explosive) every 3–5 years, explosively every 8–15 years, and violently every 26–54 years (Thouret et al. 2000). Thus, the study is very important for the development of the future media coverage on the eruption.

Second, many scholars argue that the 2010 eruption was an extremely big eruption, a ‘100 year’ event, not the regular eruption that occurs every 3–5 years (Surono et al. 2012). This long-period eruption, from October to November 2010, had significant socio-eco-

conomic impacts. For instance, 386 people became victims and no less than 356,816 people were evacuated (*Kedaulatan Rakyat*, 11 December 2010); while the official data from government only mentioned 15,366 displaced people (Hudayana et al. 2012: 36).

Third, as it differs from the previous eruptions, it was intensively covered by mass media (Fauzanafi 2012). During the emergency crisis period in November 2010, almost all mass media, both local and nation-wide, covered the eruption day to day, hour to hour, with very long news duration. A nation-wide television station created a special report for the eruption and allocated special broadcast time, while another station produced breaking news every hour to update on the condition of the eruption.

The presence and role of mass media was crucial as well as problematic. Because of strong competition among mass media for news speed, accuracy was often ignored. For example, one television station, on the basis of paranormal divination, broadcasted a message that the huge eruption will soon occur and the material will run up to 60 km from the peak, destroying almost the entire territory of the province. Naturally, this was followed by panic and chaos among local people. Eventually, the television programme was banned from broadcasting anymore for an unspecified period of time by the Indonesian Broadcasting Commission. Thus, this study attempts to answer the following questions:

1. How do Indonesian newspapers construct knowledge about disasters, especially about the eruption of Mt. Merapi in 2010?
2. What are the discursive formations underlying disaster knowledge construction?

For the purpose of complementarity, this study examines the photograph headlines representing the eruption in two Indonesian newspapers: *Kompas*, the largest national newspaper, and *Kedaulatan Rakyat* (KR), a local newspaper in Yogyakarta Special Province in which Mt. Merapi is located. The study limits the issue period from October to December 2010, and considers three stages of disaster coverage, namely pre-disaster (including mitigation and preparation), disaster emergency time and post-disaster recovery. Mt. Merapi began to erupt in late October 2010, and continued until early November 2010. Pre-disaster coverage that emphasizes an early warning system should have been started from the beginning of October 2010 when Mt. Merapi's status was raised from 'normal' to 'beware'. Meanwhile, after the eruption, the emergency phase lasted until December 2010.

Photo headlines are chosen for several reasons. First, in general, people tend to believe that 'the camera never lies'. The camera image is a reflection of objective reality. Photography, with its technological capabilities, offers 'true image' and 'truth-value' of the facts recorded (Hamilton 1997: 83). Second, photography brings the sensation of 'being there', as if the reader were at the location when the photographer took the image. Rothstein (in Hamilton 1997: 83) states, "The lens of camera is, in effect, the eye of the person looking at the print". A photograph is not only information, but also involves emotional experience with the sensation of 'being there'. Stryker (in Hamilton 1997: 83) said, "Good documentary should tell not only what a place or a thing or a person looks like, but it must also tell the audience what it would feel like to be an actual witness to the scene". Thus, disaster photos are very important in disaster coverage and play a crucial role: telling the experience of exposure to a disaster, as if the reader is experiencing it directly.

## 12.2 Method

This study is a piece of qualitative research, which aims to describe and analyses social phenomenon of disaster photos in Indonesian newspapers.

The data were collected through two slightly different ways. First, collecting issues of the two newspapers, *Kompas and Kedaulatan Rakyat*. Second, collecting empirical data about the 2010 eruption of Mt. Merapi, through observation and interviews, which are very instrumental for interpreting headline photographs. This relied on my firsthand observation and involvement as a volunteer. During November – December 2010, I became a volunteer of *Jalin Merapi*, a group of volunteers who deal with the management of disaster information, which optimizes all media, especially new media, such as mobile phone and social media, to reduce disaster risk and impact. I was the editor as well as the reporter for online media, specifically dedicated to the mitigation of the Mt. Merapi eruption. At that time, I interviewed many local people, volunteers, donors and government officers, as well as observing many survivor camps and destroyed villages. The work, including news archives, can be seen at <http://Merapi.combine.or.id/> (Nazaruddin and Habibi 2012).

In the data analysis phase, the study employs a critical discourse approach which focuses on how disaster discourses are formed through the objects, ideologies and power relations within. This research applies a visual discourse analysis method, as outlined by Rose (2007: 141–171). To dismantle the discourse in visual text, Rose advises to observe and identify the dimensions of rhetorical and social production of text, by following these steps: identify the main themes of the text, analyze the truth proposed by the text, observe the complexities and contradictions in the text, and search for the omitted or invisible dimensions in the text, as well as the visible.

## 12.3 Literature Review on Disaster and Media Representations

The research fills a gap in disaster studies, especially related to media representation of disasters. Previous studies related to media representations of disasters can be categorized into different topics, namely disaster journalism, the effect of disaster coverage, media roles during a disaster and media representation of disasters.

Disaster journalism studies were developed after the 2004 Indian Ocean Tsunami but studies on the effect of media coverage of disasters are still rare. Jurriens (2014) stated that disaster journalism is a new genre in the era of Indonesian press freedom.

Gama (2009) researched the effect of media coverage on the Surakarta flood in 2007 and concluded that media coverage had an emotional effect on the audience. Yusuf (2006) focused on the ambivalent roles of media during disasters, covering the sadness of disaster news, while at the same time period, often broadcast happiness and celebrations.

Media were also absent in the mitigation and early warning system (Rahayu 2006), as well as non-existent during the recovery phase, as they had moved on to

another issues. Thus, disaster coverage is incomplete, fragmented, lacking deep understanding, and has no vision towards recovery (Nazaruddin 2007; Hermawan 2007; Masduki 2007). Jurriens (2014) studied the alternative media, either journalistic or artistic, and concluded that Indonesian community radio, popular theatre, performance art and community video have a positive contribution to disaster relief and community resilience. Unfortunately, they have been undermined by mainstream Indonesian commercial media.

The other discussion is about the relation between media coverage and disaster aid. Masduki (2007) has criticized the Indonesian mass media trend for having a dual role when covering disasters, i.e. the primary journalistic role of broadcasting disaster news and the charity role of collecting and distributing disaster relief as the secondary one. According to Masduki, both of these roles are not necessarily in line and sometimes even contradict each other.

The next topic often discussed by Indonesian scholars is the media representation of disasters. Wahyuni (2008) argued that media coverage on disaster tends to create what is called as media event, which could provoke and make the crisis situation worse. Media events could be defined as public ceremonies or extraordinary historical situations which are planned outside the media and broadcasted in real time on television, integrating the attention of dispersed society and highlighting a specific set of values (Katz and Liebes 2007; Jimenez-Martinez 2014). Lukmantoro (2007) criticized the common label of various disasters, such as “Aceh Tsunami”, “Jogja Earthquake”, or “Jakarta Flood” as commodification and simplification. Purwoko (2007) who has analyzed media coverage on the 2007 Jakarta flood concluded that the media framed the flood as a social disaster, not a natural disaster. Laksono (2007) discussed the photographs of the Yogyakarta and Central Java earthquake in 2006 and concluded that issues of social equality were prominent in the media coverage. Laksono also argued that the media frame is similar to the state’s formal discourse, characterized by much simplification through statistical data, especially after the first week of the crisis period. Novenanto (2012) who has studied alternative social media about *Lapindo mud spill* disaster in East Java and argued that such alternative media have sharpened the ongoing social conflicts amongst people and the respective companies cause the spills. Cholil and Astuti (2012) who have studied an online forum concerning the Yogyakarta and Central Java earthquake in 2006 identified two kinds of discourse, namely religious and humanity discourse, in which the latter is more dominant than the former.

Nazaruddin (2007) criticized the practice of disaster journalism and proposed some ethics, namely accuracy, voice of the voiceless, especially the survivor, commitment to recovery, and control and advocacy. On the other hand, Badri (2011) proposed disaster sensitive journalism, i.e. prioritizing public interest and empathy towards the survivor, which should always be related to the disaster management at each stage, from pre-disaster to emergency and rehabilitation stages. Hermawan (2007) argued that the media have a strong attitude similar to that of a ‘jumping louse (*kutu loncat*)’, jumping from one issue to the other based on its popularity. Other scholars emphasize their criticism of the dramatization and sensationalization of news (Nazaruddin 2007; Masduki 2007; Yusuf 2006). Arif (2010) described and analyzed

his experience as a journalist in covering the 2004 Tsunami. The title of his book, “Jurnalisme Bencana, Bencana Jurnalisme” already lays clear the important conclusion of the book, that the practice of disaster journalism could be the disaster itself.

There are also some studies that are closely related to this chapter. Ahimsa-Putra (2000), who has studied media coverage of the 1994 eruption of Mt. Merapi, argued that there are three groups of interpretation of the Mt. Merapi eruption which compete with each other in Indonesian newspapers, namely ‘warning interpretation’ as proposed by spiritual leaders, ‘temptation interpretation’ as suggested by government, and ‘destiny interpretation’ as believed by the survivors. Hidayana (2012) concluded that the discourse of the 2004 eruption in *Kedaulatan Rakyat* (KR) represents the mystical world-view of Javanese people about natural disasters. Even KR becomes the source for the Javanese to get mystical interpretation of the disaster, including its social political implications from the mystical perspective. Fauzanafi (2012) categorized 1456 photographs on the 2010 Merapi eruption in four Indonesian newspapers. According to Fauzannafi, the frequent themes of the photos are survivors and emergency camps, the ceremony of aid distribution and the face of a popular person such as actress or political leader. Focusing on the television coverage on 2010 Merapi eruption, Astuti (2011) concluded that there were various problems in the media report, caused by the weakness of the news gathering processes, the low quality of journalism, and the lack of media awareness of public interest in the disaster report.

## 12.4 Results and Discussion

This study finds 43 headline photos about the Mt. Merapi eruption in *Kedaulatan Rakyat* during the period from October to December 2010. Meanwhile, in the same period, *Kompas* had 17 headline photos of Mt. Merapi. In this chapter, the author discusses the five most adopted themes which represent the emergency handling of disasters, starting from the eruption of Merapi itself, evacuation processes, evacuation teams involved, the handling of survivors in the evacuation centers and lastly the damages incurred from the eruption. For each sub-section, the author presents pictures from both newspapers, describes the pictures and presents the analysis of representation.

### 12.4.1 *Merapi Eruption Photographs: A Theme of Representation That Merapi Is Great, and People Are Weak*

The Mt. Merapi eruption became the most frequent theme in *Kedaulatan Rakyat* as well as *Kompas*. Altogether there were 15 headline photos on the theme, 11 photos in *Kedaulatan Rakyat* and 4 photos in *Kompas*.



Fig. 12.1 Close up photographs of the eruption

When categorizing the photo based on its technique, there are three types of image presentation, namely close-up (Fig. 12.1), long shot (Fig. 12.2) and extreme long shot (Fig. 12.3). The author proposes that these pictures are symbolic of the divine and sacred power of Merapi through the close up and long shot techniques. Mt. Merapi is a single subject in the photographs, which represent a very strong, powerful, even terrible and deadly subject. The presence of a human figure in photojournalism is a requirement to represent the subject of the event or action. The author proposes that people are represented as weak by the use of the extreme long shot technique. Both are discussed accordingly:

#### 12.4.1.1 Merapi Is Divine and Sacred

The study finds that there are two main objects presented in almost all the eruption photos: the peak of Mt. Merapi and the ash clouds or loosely termed '*wedhus gembel*' (referring to the shape of the ash clouds that looks like a sheep or *wedhus gembel* in Javanese).

The close up technique focuses on the peak of Mt. Merapi whereas the long shot technique highlights the *wedhus gembel* in order to show that it is as large as the volcano itself, while the extreme long shot technique is used to indicate the eruption from a long distance by capturing the mountain in the background and either human or other objects in the foreground.

In the first category, a close-up of the peak of Mt. Merapi (Fig. 12.1) no other object in the photos is represented except the peak of Merapi with red lava or with ash clouds coming out of the dome. It sends a 'horror' message of the Mt. Merapi eruption. Horror discourse is also produced by the long shot photos (Fig. 12.2), featuring *wedhus gembel* entirely. The size of the ash clouds is compared to the size of Mt. Merapi itself. Thus, Mt. Merapi is represented as a very powerful volcano. The discourse could also be concluded from the pan down technique, by which the photos were taken from below with the camera facing up, which signifies the power of the pictured object (Berger 2013).





3. KR, Tuesday, 2 Nov 2010



4. KR, Saturday, 30 Oct 2010



5. KR, Wednesday, 3 Nov 2010



6. Kompas, Friday, 5 Nov 2010

**Fig. 12.2** Long shot photographs of the eruption

The metaphor of Mt. Merapi as a divine power and humans as profane, could also be further observed in the traditional myths about Mt. Merapi that are deeply rooted in Javanese culture. For example, local people believe that Mt. Merapi is not just a mountain, but also a kingdom of unseen spirits with the crater as its palace. Thus, for the local people, the crater of the mountain is '*kraton makhluk alus*' (the palace of the spirits), while the slopes of Mt. Merapi are the place for human beings (Triyoga 2010: 56–70; Schlehe 1996: 404; Dove 2008: 332; Donovan 2010: 122; Hudayana 1993: 13). In this sense, the photographs help to reproduce the myth of the sacred Mt. Merapi.

Kress and van Leeuwen (1996: 199) emphasize that the composition of 'top down' is very important in visual text because it shows the real versus the ideal dimensions, sacred versus profane, or another dichotomy in accordance with the particular cultural context. Thus, in the eruption photos, we can infer the composition of the top down as a metaphor for the divine versus secular, or sacred versus profane. Mt. Merapi, which occupies the topline of the photo, is a sacred symbol of divine power. While humanity and its culture, which occupies the bottom side of the picture, is a symbol of the powerless profane world subject to or governed by the sacred.



7. KR, Saturday, 23 Oct 2010



8. KR, Wednesday, 27 Oct 2010



9. KR, Saturday, 13 Nov 2010



10. KR, Thursday, 11 Nov 2010



11. KR, Wednesday, 15 Dec 2010



12. KR, Monday, 15 Nov 2010

Fig. 12.3 Extreme long shot photographs of the eruption



13. Kompas, Saturday, 30 Oct 2010



14. Kompas, Thursday, 11 Nov 2010



15. Kompas, Tuesday, 2 Nov 2010

Fig. 12.3 (continued)

### 12.4.1.2 People Are Weak

The third technique is the extreme long shot, in which people or other objects become the foreground and the volcano and its eruption are used as the background (Fig. 12.3). Interestingly, there are some similarities in representing human figures. First, the man is shown in the bottom of photos at a small size. Second, the figure is not staring at either the camera or the audience, but is looking at the volcano.

Instead of being the subject of the photograph saying something to the reader, the human figure in the photographs mostly looks at the volcano. Burgin (2003) states that the gaze is very important in photography. Who sees, who is seen, and how to see, indicate the subject and object in the photo. Thus, the photographs confirm that Mt. Merapi is the subject, while human is the object. Actually, the human presence in some of the photos, though very small, becomes the focus of the camera and the centre of reader’s attention. People become the dominant element in the text, or details that absorbs our attention. Thus, human presence is indeed important, not as the centre of attention, but rather to reinforce the myth that they are powerless objects facing and looking at the powerful subject: Mt. Merapi.

This discourse is coincident with the modern rational Islamic teaching which believes that eruptions are God's destiny and cannot be predicted by people. This kind of teaching is deeply rooted in Indonesian society. Ahimsa-Putra (2000), who has studied the interpretation of the 1994 eruption of Mt. Merapi in Indonesian newspapers, said that one of the important interpretations which are commonly delivered by mass media are religious-based interpretations which understand the eruption as a warning from God to people. At the moment of the 2010 eruption, such religious-based interpretation was also popular in the Indonesian mass media. Recently, the exposure and influence of religion is growing, including in the local communities on the slopes of Mt. Merapi (Humaidi et al. 2012).

### ***12.4.2 Evacuation Process Photographs: Representation of the People in Despair***

During the research period, there were four photos with the evacuation theme, which have three important signifiers: trucks as transportation for evacuation, sad facial expressions, and injured survivors (Fig. 12.4). They produce a discourse of emergency evacuation, survivor's sadness, survivor's togetherness and autonomy in the evacuation process. This discourse is based on a discursive formation claiming that state is great, has prepared to evacuate citizens, and that people were unprepared and did not listen to the government, refused to be evacuated, and eventually wound up getting injured.

Kedaulatan Rakyat displayed two photos on the evacuation theme; both of them have the same main signifier, a truck being used in the evacuation process. The truck in the photo represents togetherness as well as the autonomy of the survivors in the evacuation process. The trucks pictured in the photos were not trucks prepared by the government for the evacuation, but instead owned by local residents. The use of private trucks represents autonomy while the many people being transported represents togetherness.

Photo 19 accurately represents the deep sadness of survivors. All parts of the woman's facial expression, as the focus of the picture, are a symbol of pain: the wistful gaze, tears and shining lips. Meanwhile, the dreamy gaze of the man at her side is a signifier for disbelief at what he had just experienced or the now unclear future. However, regardless the specific meaning of this gaze, it still signifies pain. Scattered dust over the entire body is a sign that they have not yet cleaned up. Thus, it also signifies that the photos were taken at the time of the emergency evacuation process.

In general, evacuation themed photographs show the emergency situation and the survivors' sadness. Furthermore, the photos actually represent the 'eccentric' attitude of local people, who did not believe and listen to the government's advice to evacuate earlier. They were eventually evacuated when the condition was really critical, i.e. when the volcano had been very dangerous. In these conditions, they were evacuated by force, even at night. Local people eventually evacuated after they were injured, either by ash flows or clouds. Here, the state apparatus is represented



16. KR, Thursday, 4 Nov 2010



17. KR, Saturday, 27 Nov 2010



18. Kompas, Wednesday, 27 Oct 2010



19. Kompas, Saturday, 6 Nov 2010

Fig. 12.4 Evacuation photographs

as helpful and prepared. This is where a dichotomy raised. The headline photograph seems to create a discourse that local people did not listen to the government, refused to be evacuated and therefore were injured, while authorities, in contrast, had prepared to evacuate.

The cultural beliefs are strongly related to the attitude of *Mbah Maridjan* as the mystical guardian of Merapi at that time. In the previous 2006 eruption, the people of the upper slopes were already asked to evacuate immediately, including Kinahrejo hamlet (7 km from the summit), in which *Mbah Maridjan* stayed. But as *Mbah Maridjan* himself refused to evacuate, the people in general also refused to evacuate. At that time, *Mbah Maridjan*'s belief that Kinahrejo is safe was proved empirically and the eruption did not affect there. This reinforced trust in *Mbah Maridjan*.

During the 2010 crisis, *Mbah Maridjan* changed his attitude a little bit, suggesting people should move down as asked by the government, while he himself would remain in the village because of his responsibility as the guardian. However, his presence was interpreted that the hamlet is safe from the eruption. At that time, the vulnerable groups, such as the elderly, pregnant women and children, were already

evacuated, but the vast majority, including many elderly people, remained in the hamlet even though the volcano was in the highest status of ‘*awas*’ (beware). Finally, when Mt. Merapi first erupted explosively on Tuesday, 26 October 2010, at 18:00 PM when daylight was fading, they fled in panic. Unfortunately, 37 people died, including *Mbah* Maridjan. Many of them were the residents who were too late to flee, or young men who climbed back to evacuate other residents (Nazaruddin 2013).

The attitude of local people was also the same in the previous eruption of Merapi, as has been described in previous studies, such as Lavigne et al. (2008), Dove (2008) and Donovan (2010). These previous studies usually relate this resistant attitude to two main causes; people’s cultural beliefs which lead to the trust that their villages are safe, and their fear of abandoning their livestock. At moments of emergency, the local people would keep the livestock in their house, because they cannot bring their livestock to the camps. They are also worried of losing their cattle, because it would be a serious threat to their survival after the eruption. Hence, losing cattle is a more concrete and serious threat than the eruption itself (Lavigne et al. 2008: 285; Donovan 2010). This kind of rational-economic thinking was rarely covered by mass media. They just represent the local peoples’ responses who do not want to evacuate as strange and silly behavior, without a proper background description (Fauzanafi 2012).

It also confirms what Douglas and Wildavsky (1982: 221) have emphasized as ‘risk perception’, a sociocultural phenomenon affected by social values and organization that affect perception about what is considered dangerous and guide responses to a hazard. Thus, media have created discourse and narratives on the perception of the state, determined scientifically and objectively, as “real risk”, while “perceived risk” by the local people is irrational and even excluded (Oliver-Smith 1996).

### ***12.4.3 Evacuation Team Photographs: Representation of Capable Government Apparatuses***

In this theme, Kompas displayed more headline photos than Kedaulatan Rakyat. There are three parties often emphasized in this theme: the military agencies police and search and rescue (SAR) (Fig. 12.5). They are represented as having very important roles in emergency responses. In this sense, the media have excluded the work of other various groups of ‘un-uniformed’ volunteers. The media have also discoursed that volunteers have different characteristics with the survivor, such that volunteers are helpful and vice versa survivors are helpless. The media has ignored that many of volunteers are local people who also become survivors. These representations are the manifestation of the discursive formation that the state is powerful and the local people are powerless.

At first, it can be seen that there are only three groups of people carrying out evacuation and relief activities: the military, police, and SAR, discernible from their



20. KR, Friday, 12 Nov 2010



21. KR, Sunday, 14 Nov 2010



22. KR, Saturday, 20 Nov 2010



23. Kompas, Monday, 8 Nov 2010



24. Kompas, Wednesday, 10 Nov 2010



25. Kompas, Friday, 3 Dec 2010



26. Kompas, Monday, 6 Dec 2010

Fig. 12.5 Evacuation team photographs

uniform. Sometimes, in the photo captions, they are named as “evacuation team”, “SAR team” or “volunteer”. Apparently, the journalist is too lazy to write a number of institutions involved in the work of evacuation (Nazaruddin 2010b; Hermanto 2011). In their sloth, they only mention institutions that are considered important or already popular, while other institutions simply referred to as “volunteers”.

There are two important issues here. First, the very prominent representation of these parties in the headline is very instrumental in the handling of the Mt. Merapi eruption in 2010. Unfortunately, there is no proper representation of the work of other volunteers, who are usually without uniforms. Likewise, in the captured photo, they only mentioned as ‘volunteers’ or ‘another volunteer’, which ultimately obscures who they are and their roles. In contrast to specific mention, such as ‘Special Forces (*Kopassus*)’, ‘*Yon Armed*’, or ‘Yogyakarta SAR team’, this will definitely highlight the role of these institutions. Thus, there is marginalization of the role of volunteers in non-military, police or SAR. Strictly speaking, there is an excessive exclusion of various groups of volunteers.

The exclusion also occurred concerning the job description of volunteers outside the exposed area of ash clouds. It seems that the work of volunteers is only to evacuate the people, the dead bodies of victims or to clean up the debris. In fact, during the 2010 eruption, the work of volunteers was very complex. Most of their locations are even not in ruined areas, but in the evacuation camps where the survivors were still alive and needed help.

In addition, there is also a problem of the dichotomy between volunteer and survivor. Volunteers are not survivors, and vice versa. On one side, the volunteers are powerful and helpful with a variety of activities that they do to help the survivors. On the other hand, survivors are described helpless, only waiting for the help from volunteers. The media ignore that many of the volunteers are local people who have become survivors. They live in evacuation camps, but they are not only waiting for help. Instead, they are actively involved as volunteers, managing and distributing aid to camps, managing public kitchens, organizing recreational activities and more (Nazaruddin 2010b). Some experts have recommended that media coverage of disasters should provide not only a narrative on sorrow and devastation, but also on stories of survivorship and bravery, which are very rarely published (Walters and Hornig 1993; Worawongs et al. 2007).

Disasters generally reveal certain fundamental behaviors of people, especially toward material resources, such as altruism, self interest, private property, competition, reciprocity or trust. Disasters also create high tension between the moral order of the society and individual rational choices (Oliver-Smith 1996: 311). Thus, the ‘people help people’ phenomena, as well as the active survivors engaging in relief activities during the 2010 crisis, are evidence of strong altruism and societal moral order. Unexpectedly, the media prefer to frame helpless, lazy and individualistic images of local people.



#### ***12.4.4 Evacuation Center Photographs: Representation of Powerless People and the Government's Inadequate Shelter and Aid Management***

There are six photographs representing survivors, in which the figures of children and the elderly become the main signifier and are usually portrayed in sitting and lying positions (Fig. 12.6). It represents certain knowledge that survivors are unable to cope with the eruption, are lazy and helpless and waiting for external aid. No photos depict survivors doing certain activities. This kind of image denies the fact that at the moment of emergency, while staying at the camps, the survivors are involved in various rescue and relief activities. It shows the media's tendency for dramatization and sensational disaster coverage, for the sake of commodification and to fulfill their commercial interest. The images also representative of the failure of government to provide adequate emergency camps, as well as to effectively distribute disaster aid. We can conclude that the representation is rooted in the discursive formation of weak people, as well as weak government.

##### **12.4.4.1 The Powerless Survivor**

In these six photos (Fig. 12.6), the figures of children are pictured in all photos, except the photo 29 and 30. Likewise, there is always a grandmother figure in the photographs, except photo 28, 29 and 30. Children are represented as survivors of the eruption, but unlike adults, they can enjoy the evacuation condition. Similarly, old people are portrayed as powerless and resigned, but still smiling. In general, sitting and lying positions represent abandonment, helplessness, or even laziness.

They just sit and lie down, do not do anything, just resigned to wait for aid. No photos depict them doing certain activities. In fact, during the emergency period of the 2010 eruption, hundreds of local people who become survivors, while still grieving, were involved in rescue and relief activities either individually or in groups, such as preparing food, distributing aid etc. (Nazaruddin 2010b; Habibi 2011; Christia 2012). Moreover, some people continued to work while they were staying in the emergency camps (Christia 2012). In the previous 2006 eruption, the local people did many activities during their stay in emergency camps. Donovan (2010) and Lavigne et al. (2008) identified three types of behavior: some people, mainly women, children and the elderly, stayed in the camps; while some others, mainly 20–50 years old males and females, stayed in the camp at night and went back during the day to the villages to feed their cattle; and the others, exclusively male, stayed in the village all day and night to keep the cattle. At the moment of the 2010 eruption, similar phenomena took place (Christia 2012).

The figures of grandmothers, women or children were featured in almost all evacuation or survivor themed photos and were framed as the focus of the photo. Why a grandmother, woman or child? The answer is commodification. Images of children and grandmothers who slept huddled in shelters, grandmothers who ride



27. KR, Tuesday, 26 Oct 2010



28. KR, Wednesday, 10 Nov 2010



29. KR, Thursday, 18 Nov 2010



30. KR, Sunday, 31 Oct 2010



31. Kompas, Tuesday, 26 Oct 2010



32. Kompas, Sunday, 7 Nov 2010

Fig. 12.6 Survivor photographs

the truck during the evacuation process, crying women with dust-covered faces, are a very effective framing to generate compassion, sympathy or empathy from audiences.

Thus, compassion will bring solidarity and will further increase the amount of aid. Media, through their images and stories of victims, survivors or relief efforts, have the best capability to build public compassion that would encourage fund-raising for disasters (Bennett and Kottasz 2000). Olsen et al. (2003) emphasize that the presence of the media along with their dramatic narratives was instrumental for

the smooth disaster relief. Thus, the media play an important role in increasing disaster relief. Admittedly, the role is very important in the post-disaster emergency conditions, when the assistance of various stakeholders is really needed. The media take on that role by creating grief and sadness stories, often with certain dramatization.

However, the dramatization is closely related to the dual role of media during the disasters. Masduki (2007) states that the Indonesian media have a dual role when covering disaster, i.e. the primary journalistic role to broadcast disaster news and the charity role to collect and distribute disaster relief as secondary. Both of these roles are not necessarily congruent, and sometimes even contradict each other. The charity role has raised the common understanding of media quality during the disaster which are measured by the amount of collected and distributed aid. The media who have widely collected and distributed disaster aid would be great media. This secondary role eventually impacts the primary journalistic function. The emergence of dramatization in disaster news could be seen as one of the results of the domination of the charity role. In addition, the charity role has trapped the media to deal with the issue of disaster relief accountability.

The media tendency to dramatization and sensation in disaster coverage has long been criticized. Media images and stories of disaster have focused on the survivors' shock and helplessness (Liebes and Blondheim 2002; Walters and Hornig 1993). Brayne (2007) said that the early emergency period would usually be signified by dramatic rumors, such as the hyperbolic number of victims, social chaos etc. Ardalan et al. (2008) said that media tendency towards dramatic stories of disasters is motivated to "pump up ratings" and to be critical of governments. Such criticism has also come from Indonesian scholars, such as Arif (2010), Yusuf (2006), Masduki (2007), Nazaruddin (2007), Lukmanto (2007) and Nazaruddin and Habibi (2012).

Philo (2002) stated that such dramatic stories would generate incomplete understanding of the disaster. In the absence of explanation, the audience would fill in the gaps with traditional myths related to disasters, such as the lazy and helpless survivors. Moreover, Matei and Ball-Rokeach (2005) have also put forward those other consequences that media coverage on traumatic events would have a permanent and long-term effect.

#### **12.4.4.2 Inadequate Shelter and Aid Management**

These photos in this part represent the limitations and inadequacies displacement camp conditions. They are presented to show the slum conditions in camps inhabited by grandmothers and children. Thus, these pictures represent the failure of governments to provide adequate emergency camps for its citizens.

Representation of support deficiency is somewhat contradictory if we relate it to photo 28 which displays mounting piles of used clothing that were used as children's playground.

This is an indication of excessive used clothing assistance, no longer needed by the survivors, while other photographs feature a discourse of the lack of support to

the camp. At a glance, it shows a contradictory discourse, but all photos actually frame the weakness of disaster relief distribution. Logically, used clothing assistance may accumulate in certain camps, which are usually the central camps widely covered by the media. In the photo 28, excessive used clothing aid accumulated in the Maguwoharjo survivor camp, which is the central and biggest camp in Sleman district having the highest number of survivors, as well as the camp most frequently covered by the media. Sadly, the need for decent clothing in other camps had not been fulfilled. This photo was published on November 10, 2010, just a few days after the big eruption of Mt. Merapi. On this date, the survivors are still scattered at various points, in school, in the village hall, in campus, in the houses and so on, without any assistance. Also, at this time, many survivor shelters had not been handled properly, even for basic needs such as food and drink. Many of those shelters were even helped by the initiative of local residents surrounding the camps. So it is clear that on 10 November 2010, at the time of the photo was published, many other shelters still need clothes (Nazaruddin 2010a).

The images are better understood through comprehensive consideration of the emergency condition during the 2010 eruption, which lasted from late October until November. During the crisis, the hazard-prone area was extended from 10 to 15, and finally to 20 km from the summit (Surono et al. 2012). The official contingency and evacuation maps and plans were only prepared by the government for 10 km evacuation zone. So, when the evacuation zone expanded to 15 km, then again to 20 km, the government could no longer overcome the emergency conditions; their crisis plans were inadequate to anticipate such a big eruption, since the number of people who had to be evacuated was much higher than the prediction. The emergency camps were not prepared, even their locations were not specified. Actually, some scholars had warned that the official emergency map of Merapi only takes into account small to medium eruptions, and underestimates the potential for a large eruption and its impact (Hadisantono et al. 2002; Thouret and Lavigne 2005).

The huge explosive eruption on 5 November 2010 happened only several hours after the evacuation zone was extended to 20 km. Thousands of people were not ready to evacuate, since they were already in the emergency camps located more than 10 km, but still within 20 km from the summit. The condition was so dramatic since that they fled in panic at night. At that moment, neither residents nor the government knew where they had to go. Some of them ended up at a school building, university campuses, village hall, *Masjid* or church, while some others who had relatives around Yogyakarta province went to their relatives. Feeling comfortable with the family was the main reason for staying in relatives' houses (Christia 2012).

At that moment, the local authorities of Sleman district decided Maguwoharjo football stadium to be the main camp, which could accommodate around 20,000 survivors. However, due to limited space at the stadium, many people remained in smaller camps managed by local communities or local institutions, or relative-based camps. There were others improvised and emergency camps. Then, what happened was that 'people helped people', whereby the residents from non-affected areas and many civil society groups became the saviors through various ways, such as collectively supplying meal packets, providing their houses as emergency camps,

setting up and managing the camps and the aids, opening emergency public kitchens, doing free medical care etc. (Nazaruddin and Habibi 2012).

At a glance, the representation of government failure in providing adequate camps and distributing disaster aids is the break to the discursive formation of the 'great government and weak people'. But, it could be better understood as 'an interpretive repertoire' or mini-discourse that tends to be quite specific to a particular social institution (Potter 1996), of the discursive formation of the great government. This interpretive repertoire likely belongs to the mass media, as it was common for the Indonesian mass media in disaster coverage to criticize the government in term of camp condition and aid distribution. Thus, governments are still great, but have a weakness in providing adequate camps and distributing aid. Rose (2007: 164), has said "Discursive formations have structures but that does not necessarily imply that they are logical or coherent".

#### ***12.4.5 Damages Photographs: Representation of Houses as Most Fundamental Assets to the People***

As well as the theme of eruption, ruin-themed pictures, which show damage due to ash clouds, appear frequently in the two daily newspapers. *Kedaulatan Rakyat* published six photos, while there were two photos in *Kompas*. Some objects often appeared in this theme, namely houses, cars or motorcycles, uprooted trees, and people looking at the debris or looking for remnants in the ruins (Fig. 12.7). The images represent two types of knowledge: (1) the eruption has claimed the most fundamental assets of thousands of local people, (2) local people exhibiting 'eccentric' attitudes i.e. refusing evacuation. These representations are again rooted in the discursive formation that Merapi is great and powerful, and that people are weak.

These ruin-themed photos predominantly show former residential areas hit by ash clouds. All the objects in the photos, apart from the people searching for goods, are covered by thick volcanic ash.

First, the dust that covered all the objects in the photo is a sign that the damage was caused by ash clouds. The thick dust is also a sign of the proximity of the pictured area to the peak of the volcano, as well as a sign that the photos were taken shortly after the eruption.

Second, the settlements and houses destroyed by the ash cloud represent that the eruption has claimed the most fundamental thing of the local people, their homes. Third, the environment including trees and cattle destroyed and covered by ash, also represent that the fundamental asset for survival after the crisis has been claimed by the eruption. Not just one, two or three houses were destroyed; the eruption had even devastated residential complexes consisting of tens or even hundreds of houses. Thus, the eruption has claimed the essential assets of hundreds, even thousands of families who live on the slopes. Oliver-Smith (1996: 304) said that a disaster "tends to be a totalizing event or process, affecting eventually most aspects of the commu-



33. KR, Thursday, 28 Oct 2010



34. KR, Saturday, 6 Nov 2010



35. KR, Tuesday, 9 Nov 2010



36. KR, Tuesday, 11 Nov 2010



37. KR, Friday, 26 Nov 2010



38. KR, Tuesday, 23 Nov 2010



39. Kompas, Thursday, 28 Oct 2010



40. Kompas, Tuesday, 9 Nov 2010

Fig. 12.7 Damages photographs

nity life". Related to these ruin-themed photos, which are frequently displayed, Wenger and Friedman (1986) a long time ago reminded that images or news of chaotic conditions and the total destruction of disasters may be useful to affect public attention, but the media tends to over-emphasize destruction and devastation.

Photo 33 was published by *Kedaulatan Rakyat*, while photo 39 was published by *Kompas*, but both shoot the same location, with a similar angle. The photographer captured Kinahrejo hamlet, Cangkringan, Sleman, focusing on the ruins in front of the mosque and the house that was still standing. Readers who are familiar with this location will know that the house in front of the mosque is the house of *Mbah Maridjan*, caretaker (*juru kunci*) of Mt. Merapi who died in the first eruption on 26 October 2010. A couple of days during the emergency period of the 2010 eruption, this was a favorite story reported by almost all Indonesian media, of the death of *Mbah Maridjan*. Actually, there were many victims besides *Mbah Maridjan*, but the media only focused on a single story. It confirms Scanlon and Alldred's (1982) opinion, that the media remain focused on a single story event.

Another question arises, what is exactly represented by this photo? The mosque and the house of *Mbah Maridjan* are synecdochal signs of Kinahrejo hamlet, part of Kinahrejo standing in for the whole. Displaying the icon, in its ruined condition, the photo represents that the entire hamlet of Kinahrejo was destroyed by the eruption. This photograph also develops a discourse that *Mbah Maridjan*, previously considered as the most discerning person who understood the activity and the will of Mt. Merapi with supernatural abilities, could not escape from the ash clouds. This photo delegitimizes the attitude of some Kinahrejo residents who shared this 'eccentric' attitude. They refused to be evacuated by the government because they followed *Mbah Maridjan's* decision to stay in his house. This photo implicitly states that such an attitude was a big mistake and resulted in the loss of life, including *Mbah Maridjan's* own and that of other residents.

The third theme is the picture of car or motorcycle debris. During the emergency condition when Mt. Merapi's activity was increasing, cars, motorcycles and trucks became the main vehicles of evacuation. The ruins of a motorcycle or a car boiled by ash clouds can be a sign that the owners were still in their houses when the eruption occurred. They did not have time to save themselves, and finally died as victims. Furthermore, it also serves to underline their 'eccentric' attitude.

## 12.5 Conclusion

This study has discussed five themes of headline photographs, namely: eruption, evacuation processes, evacuation team, evacuation center, damages from the eruption.

This study concludes that the media discourses on the eruption of Mt. Merapi are rooted in modern scientific discursive formation of Mt. Merapi and its eruptions, which is mainly sponsored by the state. The discursive formation promotes some truth claims which are based on some binary-opposition understandings or dualistic

views. First, binary opposition between the sacred and the profane, in which Mt. Merapi is represented as a signifier of God, as a powerful-sacred subject, while people are represented as the weak-profane object. While the eruption is represented as a horror phenomenon which has claimed the most fundamental assets of local people. During the eruption period, people become merely powerless objects who could not cope with the disaster as acted by the subject. Second, the dualistic view between state and people (citizen) that is the state is powerful and people are powerless. The great state is justified through some discourses, namely take and implement strategies and to be always ready to help the citizens. On the contrary, local people are delegitimized through some ways, namely believing in traditional myths about Mt. Merapi and its eruption, performing 'eccentric' attitudes such as refusing evacuation, showing individualistic attitudes and acting as lazy and helpless survivors, simply waiting for aid.

The media should take the role as the public sphere for the dialogue between policymakers who rely on modern mitigation plans and local people who believe in the spirituality of their environment. Media should practice disaster sensitive journalism and always relate themselves to disaster management in general in each stage. Jurriens (2014) has empirically found that the 'sensitive understanding' was practiced by many alternative media in Indonesia during the disaster crisis and drove them to a positive contribution towards disaster relief and community resilience. Ethical disaster journalism should be more utilised in order to implement sensitive disaster journalism, namely public interest alignment, accuracy, voice of the voiceless, commitment to recovery, control and advocacy.

This study is an important contribution to formulate public policies related to disaster and natural hazard in a holistic form. By revealing the media discourse on disaster, this research would give an important contribution to understand the variety of disaster understandings believed by different groups, how certain perspectives on disaster are more powerful than others, and how Indonesian society in general view and interpret disaster and natural hazard. The understanding is indeed very important in formulating and developing early warning systems, mitigation strategies, emergency plans, as well as post-disaster recovery actions that holistically take into account cultural, social, economic and environmental capitals within the effected societies.

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## Chapter 13

# The Role and Capacity of Disabled People's Organisations (DPOs) as Policy Advocates for Disability Inclusive DRR in Indonesia

Michelle Villeneuve, Alex Robinson, Pradytia Putri Pertiwi, Sarina Kilham, and Gwynnyth Llewellyn

**Abstract** This chapter describes Disaster Risk Reduction (DRR) capacity building activities with disabled people's organizations (DPOs) in four hazard risk provinces in Indonesia. Established as part of an Australian Aid supported development research initiative, the project was implemented in the last years of the Hyogo Framework for Action by the Centre for Disability Research and Policy, University of Sydney and Arbeiter-Samariter-Bund Deutschland e.V, Indonesia and Philippines Office. As in other regions, participation in DRR by Indonesian DPOs was highly limited under the HFA. With the Sendai Framework for DRR (SFDRR) now recognizing persons with disabilities as key stakeholders, there is a need to broaden knowledge on the role of DPOs in DRR. While the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) refers to situations of risk, the

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related article has received little attention from DPOs due to multiple competing priorities. Similarly, DRR actors have rarely engaged with the disability sector. The SFDRR calls for greater collaboration between these two groups. This chapter outlines core features of the capacity building initiative and the impact of the programme on equipping Indonesian DPOs to engage within DRR. We describe how capacity building initiatives contributed to increased collaboration between disability and DRR actors, providing a practical model for supporting DPOs as policy advocates in other regions and countries. Disability-inclusive DRR recognizes the importance of collaboration to reduce and prevent risk. As the chapter illustrates, the resources to achieve this are far closer at hand than the DRR community previously thought.

**Keywords** Disaster risk reduction • Disabled People’s Organizations (DPOs) • Inclusion • Capacity • Community development • Policy • Advocacy • Yogyakarta • Central Java • West Java

## 13.1 Introduction

“Persons with disabilities and their organizations are critical in the assessment of disaster risk and in designing and implementing plans tailored to specific requirements, taking into consideration, *inter alia*, the principles of universal design”(UNISDR, para. v.36.iii, 2015)

Over a billion people worldwide are persons with disabilities (WHO and World Bank 2011). Over 650 million persons with disabilities live in Southeast Asia and the Pacific (UNESCAP 2012). In Indonesia, as elsewhere, persons with disabilities remain a hidden population within communities, practice and policy. Furthermore, negative stigma leads to persons with disabilities being regarded as objects of charity, by both communities and government, rather than as citizens in their own right.

The United Nations Convention on the Rights of Persons with Disability (UNCRPD) establishes disability as a human rights issue. Including persons with disabilities in disaster risk reduction (DRR), in line with UNCRPD Article 11 on ‘situations of risk and humanitarian emergencies’, is an important step towards making these rights real (UN 2006). Duties of, and ways forward for, DRR actors are elaborated in Goal 7 of the Incheon Strategy to “Make the Right Real” for Persons with Disabilities in Asia and the Pacific, which commits to “Ensure disability-inclusive disaster risk reduction and management” (UNESCAP 2012, p. 30).

Persons with disabilities are at higher risk of injury or morbidity than the general population in disasters. Following the Great East Japan Earthquake, 2011 the mortality rate for persons with disabilities was up to four times higher than for the general population (UNESCAP 2012). Persons with disabilities experience barriers to accessing early warnings and lifesaving information and procedures. Assuming persons with disabilities are able to access such information, they may not be able to

act on this information in times of emergency; such as, being able to independently evacuate (Robinson and Kani 2014).

Quality data on disability and disasters is limited. The first global survey (online) concerning disability and disasters was conducted by the United Nations Office for Disaster Risk Reduction (UNISDR) in 2013. Responses indicate that consultation with persons with disabilities in DRR is not the norm. Importantly, only 20% of respondents with disabilities reported being able to evacuate effectively in an emergency. The ability to evacuate safely rises to 38% if appropriate information is available (UNISDR 2013). A lack of consultation with and participation by, persons with disabilities in DRR contributes to exclusion during disaster response and curtails recovery. Inaccessible early warning systems, emergency shelters and services create barriers that further increase the risk of persons with disabilities. While these examples are illustrative, more research is needed to better guide evidence-informed policy and programming.

A disability-inclusive approach to DRR recognizes that relevant DRR solutions should come from persons with disabilities themselves. Participation in DRR, such as in the work described in this chapter, may be mediated by disabled people's organizations (DPOs) as the representative organizations of persons with disabilities. Creating space and opportunities for persons with disabilities to contribute to DRR is essential in reducing the overall risk profiles of communities. This requires decision makers, DRR actors, DPOs and community members to better acknowledge the respective contributions of one and all.

Disability-inclusive DRR (DiDRR) also demands a change in perceptions. The concept of vulnerability is ingrained within DRR; however, when considering disability the concept of vulnerability can reinforce perceptions of need and charity. Such thinking runs counter to the understanding that persons with disabilities can, and should, actively contribute to DRR. Wisner et al. (2004) propose that a shift from thinking about "vulnerable people" to thinking about "vulnerable situations" is required. The risk deriving from vulnerable situations is part-and-parcel of the daily lives of many persons with disabilities. The intricate daily negotiations required to manage societal attitudes and barriers equip persons with disabilities with the skills to manage risk and to contribute resilience building. Such thinking better reflects the whole-of-society approach to DRR now emphasized within the SFDRR. This thinking is informed by reports on the instrumental role of DPOs during post-disaster response and recovery including: forming voluntary support networks, identifying disabled victims, and participating in recovery assessment (Alexander et al. 2012; Kett et al. 2005; Rooney and White 2007).

Despite its shortage, the grey literature shows evidence of empowerment of people with disabilities in disaster risk management initiatives in developing countries. Programmes have been either directly managed by international non-governmental organizations (NGOs) or developed by disability-focused organizations/aid agencies working with local DPOs. Among others, members of the Asia-Pacific Disability Inclusive Disaster Risk Reduction Network (DiDRRN) have been vital players in advocating the inclusion of disability in all stages of DRR. DiDRRN provides examples of good practices for inclusive disaster risk reduction efforts especially in

the Asia and Pacific region. These initiatives have focused on improving the preparedness of people with disabilities and their families or carers at the community level, through capacity building and regular drills (CBM 2013; Handicap International 2014). Moreover, they used strategies that established DRR champions from DPOs or individuals with disabilities to train and facilitate other disabled persons, thereby advocating the inclusion of disability in disaster planning and programming at the local and national level (Centre for Disability and Development 2011; Centre for Disability Research and Policy (CDRP) 2015; CBM 2013; Handicap International 2014). The capacity building program reported in this chapter builds on the emerging research and practice knowledge to share a specific methodology for developing capacity of DPOs to engage with local communities and government stakeholders as partners in DRR in Indonesia.

## 13.2 Disasters and Disability in Indonesia

Indonesia's hazard risk is well known. Historically, from 1900 to 2016, major hazard events in Indonesia have been dominated by volcanic activity and earthquakes. For the same period, earthquakes and floods accounted for the majority of affected persons. Between 2000 and 2016, ten major disaster events in Indonesia had a combined estimated death toll of 176,564 people with millions affected (CRED 2016). Due to a lack of data, the impact of these events on persons with disabilities is unknown.

Official disability figures for Indonesia stand at around two to three percent of the total population. Indonesia's National Statistics Agency places the percentage of persons with disabilities at 2.45% (BPS 2012). However, categorizations and methods of data collection vary across ministries. This raises concerns over the reliability of available disability data. This situation is not uncommon globally with official figures often standing in stark contrast to World Health Organization and World Bank (2011) calculations of 15–20% of a country's population (WHO and World Bank 2011).

## 13.3 Policy Context

The programme described in this chapter was implemented from 2013 to 2015 during the final 2 years of the Hyogo Framework for Action (HFA) for DRR (2005–2015). As such, the programme sought to engage in consultations towards the successor to the HFA; the Sendai Framework for Disaster Risk Reduction (SFDRR). The government of Indonesia was an active contributor to SFDRR consultations at both regional and international levels. While the HFA was an important catalyst for generating political commitment to DRR, there was little attention to disability. In contrast, disability-inclusion is now firmly established within the SFDRR.



International progress under the HFA, and the subsequent shift towards the SFDRR, was mirrored by the Indonesian policy context.

Indonesia took significant steps towards implementing the HFA. In 2007, Indonesia passed Disaster Management Law No.24 (BNPB 2007). This law formed the basis for the establishment of the National Disaster Management Agency (*Badan Nasional Penanggulangan Bencana*, BNPB). The law also instructed the establishment of sub-national Disaster Management Agencies (*Badan Penanggulangan Bencana Daerah*, BPBD). The establishment of BPBD at provincial and district levels has accelerated in recent years. However, capacities of individual BPBD offices remain mixed.

BPBD offices directly involved in the programme benefited, in general, from earlier establishment and, relatively, stronger capacities. These were Bantul, Yogyakarta; Klaten, Central Java; and Ciamis, West Java. The selection of working areas for the programme included consideration of both hazard risk (all high) and the potential of BPBD to adopt disability-inclusive practices. The exception to this was the Mentawai Islands, West Sumatra, which, partly due to remoteness was considered to have low governance capacities in general. The hazard profile of the Mentawai makes the islands highly vulnerability during natural hazard emergencies. As such, the Mentawai acted as a point of reference and comparison within the overall development research programme.

Against a policy backdrop of growing awareness of the need for greater disability-inclusion within SFDRR consultations, in 2014 BNPB passed a national regulation on the Protection and Participation of Persons with Disabilities in Disaster Management (BNPB 2014). BNPB, through its training and education centre, also drafted a training curriculum on disability and DRR in 2014. This curriculum was significant as the process included, for the first time, consultation with DPOs. While this curriculum takes a disability-specific rather than disability-inclusive approach, it is an important step forward towards the implementation of policy.

### 13.4 Programme Purpose

In line with growing awareness of the need for disability-inclusion in DRR at national and international levels, *Arbeiter-Samariter-Bund Deutschland e.V* Indonesia and Philippines Office (ASB) and the Centre for Disability Research and Policy, University of Sydney (CDRP) designed the disability inclusive DRR (DiDRR) programme with the following objectives:

1. To better understand, and contribute to the evidence base on disability and disasters.
2. To develop the capacities of DPOs to better contribute to DRR policy and practice.

This work was funded by an Australian Aid (now DFAT) grant under the Australian Development Research Awards Scheme. The programme was implemented between

2013 and 2015. A key programme strategy was to provide opportunities for the self-representation of Indonesian DPOs to advocate for DiDRR in SFDRR consultations. This advocacy was facilitated by ASB as a founding partner of the Disability-inclusive DRR Network (DiDRRN, [www.didrrn.net](http://www.didrrn.net)). The chapter focuses on the capacity building component of the overall development research programme.

Capacity building targeted DPO representatives from the 4 programme working areas (total 59 DPO members). DPO representatives were brought together with government officials and community volunteers in a series of capacity building activities over a 22 month period.

The chapter proceeds by introducing a conceptual model for framing the capacity building design and methods. Key characteristics of capacity building components are then outlined. This is followed by a discussion of programme impacts at different stakeholder levels. Illustrative examples are provided to add context and highlight key points to the reader.

## 13.5 Method

The Community Development Continuum Model (Jackson et al. 1989) was used to guide the development of capacity building work packages within the programme. The Community Development Continuum Model is based on an advocacy model, and philosophical framework, which nurtures and encourages active engagement with community stakeholders. The aim of the model is to facilitate linkages between individuals, groups, and organizations with shared interests to more equitably distribute social and economic power (Jackson et al. 1989). As such, the model provides a stepwise methodological approach for guiding, and linking, individual and social change through increasing informed participation in decision making. Table 13.1 below describes the sequence of implementing the five capacity building work packages and alignment with this model.

Four features were central to the design of the capacity building components. These were: (1) experiential learning; (2) embedded monitoring and evaluation; (3) ensuring accessibility and (4) inter-sectoral collaboration. Each characteristic is outlined in turn below to describe how the program was implemented, monitored, and evaluated. Text box examples are offered as illustrations of how core features were implemented.

### 13.5.1 *Experiential Learning*

Experiential learning formed the basis of capacity building activities. The aim was to develop both soft and core skills for DPO members in particular. Soft skill development included building confidence, motivation and personal interaction. Core skills related to DRR concepts, disability data collection and data-driven advocacy.

**Table 13.1** Sequence of capacity building work packages and alignment with the community development continuum model

Community development continuum model (Jackson et al. 1989)	Sequence of capacity building work packages
<b>Developmental casework</b>	N/A
Develops the capacity of individuals to make decisions and advocate for their own needs	
<b>Mutual support</b>	<b>Work package 1</b>
Focuses on strengthening the relationships with family, friends, and neighbors; Forming new supports for self-help and mutual aid	<b>Aim:</b> to raise awareness on the potential contribution that each stakeholder could provide. Communication and working relationships among DPOs and with the local disaster management agencies was established at this point <b>Timeframe:</b> August 2013 to August 2014 <b>Process:</b> The work package brought together DPOs and local disaster management agency officials within a working area to learn about DRR and identify current practices and gaps towards local level DiDRR implementation
<b>Issue identification and campaigns</b>	<b>Work package 2</b>
Deals with issues that move beyond the personal to a political or community level	<b>Aim:</b> to identify issues requiring direct advocacy by DPOs to develop the inclusion of disability in DRR policy frameworks <b>Timeframe:</b> August 2013 to August 2014 <b>Process:</b> the work package provided information on current legislation on DRR at local, national and international levels and raised awareness about how disability is not acknowledged in the current legislation. At this stage, selected DPOs were also invited to join the post-HFA consultations at regional and international levels to raise issues on disability inclusion and contribute towards ensuring acknowledgement of disability in outcome documents
<b>Participation and control of services</b>	<b>Work package 3, 4</b>
People in the community attempt to exercise greater control by joining groups or forming new organizations	<b>Aim:</b> to bring together DPOs from all working areas to band together and learn from each other's contexts <b>Timeframe:</b> August 2014 to February 2015 <b>Process:</b> since the lack of available data on disability and disaster affects disaster planning and implementation efforts, this work package emphasized the development of skills needed to conduct research and gather information from persons with disabilities. DPOs partnered with village volunteers in each community to engage in field research which encouraged working relationships and facilitated the inclusion of persons with disabilities in gathering data to inform decision making for DiDRR
<b>Social movement</b>	<b>Work package 5</b>

(continued)

**Table 13.1** (continued)

Community development continuum model (Jackson et al. 1989)	Sequence of capacity building work packages
By engaging in social movement, participants seek some fundamental change in decisions that affect their lives and the way those decisions are made	<p><b>Aim:</b> to produce data-driven tools to enable DPOs to engage in local, provincial, national and international level advocacy. This work package taught BPOs to interpret data collected from WP 3 and 4, select relevant information, and use this information for DiDRR advocacy</p>
	<p><b>Timeframe:</b> April 2015 to May 2015</p>
	<p><b>Process:</b> DPOs by nature are advocacy organizations. However, in practice advocacy actions are not necessarily based on relevant data or information</p>
	<p>At this stage, DPOs engaged with the project team to develop infographics and videos and contributed to newsletters as a foundation for communicating findings with the government DRR sector</p>
	<p>Evidence shows results of the advocacy works including initiatives from the BNPB on establishing a group of DPO disaster response volunteers and three new DPO-led DRR projects</p>

Source: Jackson et al. (1989)

Within the five work packages delivered, a range of training delivery methods was utilized. These included a combination of in-class activities and field practice. This approach sought to allow participants to apply learning via direct experience of application in real-world contexts. As such, a multi-method and holistic approach to experiential learning was adopted in order to promote learning via experience, perception, cognition and behavior (Kolb 1984).

Box 13.1 offers an example of how DPO members engaged in data-driven advocacy to influence policy as a key part of experiential learning in work packages 3 and 4.

### **Box 13.1 Data-Driven Advocacy to influence policy**

DPO members developed data-driven advocacy strategies as part of work packages 3 and 4. DPOs applied data collected to raise awareness and advocate for the inclusion of disability in DRR. Programme advocacy tools included reports, infographics, video and newsletters.

DPOs used data in consultations at local, national, and international levels. For example, DPOs shared information in consultations at the 4th Session of the Global Platform DRR, Geneva; International Day for Disaster Reduction (IDDR), 2013, Indonesia and New York; 6th Asian Ministerial Conference on DRR (AMCDRR), Bangkok and the 3rd World Conference on DRR (WCDRR), Sendai. At the local level disaster management officials acknowledged the important contribution of DPOs to data collection in working areas.

**Box 13.2 Learning Simulation for Safety Procedures**

Safety information and procedures for responding to natural hazard emergencies are not often accessible to persons with disabilities. This is particularly the case for persons with visual and hearing impairments.

Information was delivered by a combination of audio and visual methods. Practice simulations allowed participants to experience and practice correct procedures. For example, in an earthquake scenario, participants simulated 'drop, cover and hold.' Adjustments were made for participants using wheelchairs to enable them to focus on the 'cover' component without significant deviation from the overall safety procedure. Participants reported simulation practices as the most memorable learning

Box 13.2 provides an illustrative example of a simulated learning exercise that actively engaged participants in learning through the experience of implementing correct safety procedures during natural hazard emergencies. In these activities, participants with a range of impairments learned together to modify safety procedures to accommodate people with a range of disabilities.

### ***13.5.2 Embedded Monitoring and Evaluation***

Effective monitoring and evaluation assisted in ensuring capacity building components achieved their aims. Quantitative and qualitative data were collected from participants before, during and after each work package. Kirkpatrick's (1975) model for training evaluation was used to guide monitoring and evaluation. Kirkpatrick (1975) divides evaluation into four components

- Reaction: How well the trainees liked a particular training.
- Learning: What principles, facts, and techniques were understood and absorbed by the trainees.
- Behavior: Extent of behavior and capability improvement and implementation/application.
- Results: The effects on the business or environment resulting from the trainee's performance.

Box 13.3 illustrates how learning portfolios were used to capture participants' prior knowledge and reflections on each work packages. These portfolios provided the project team with information about the impact of the capacity building program on learning outcomes of each work package. Portfolios also served the purpose of ensuring responsiveness of subsequent work packages to participant-identified learning needs.

### Box 13.3 Using Learning Portfolios to Monitor Progress

In the delivery of work packages a participant learning portfolio was used. The portfolio captured participants' prior knowledge and reflections on each work package. Portfolios assisted monitoring of individual progress. In the portfolio, participants had the opportunity to ask questions, identify concerns and share personal feelings that they felt difficult to express in a larger group. Individual portfolios proved helpful in guiding and adapting trainings and identifying individual needs that were then responded to.

The application of Kirkpatrick's model and the methods used to monitor and evaluate the capacity building program are presented in Fig. 13.1 below. The instrumental role of learning portfolios in monitoring and evaluation is also elaborated below and described in the figure.

### 13.5.3 Ensuring Accessibility

Accessibility is fundamental to full participation and inclusion in this capacity building initiative. Accessibility not only applied to ensuring equitable and meaningful participation of persons with disabilities. The inclusion of village volunteers and local government representatives meant mixed ability participants in terms of both DRR and disability knowledge. Ensuring access to learning required

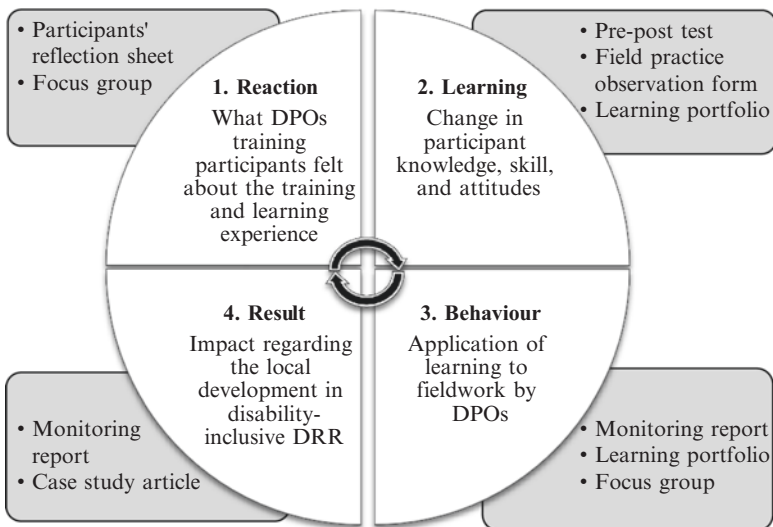
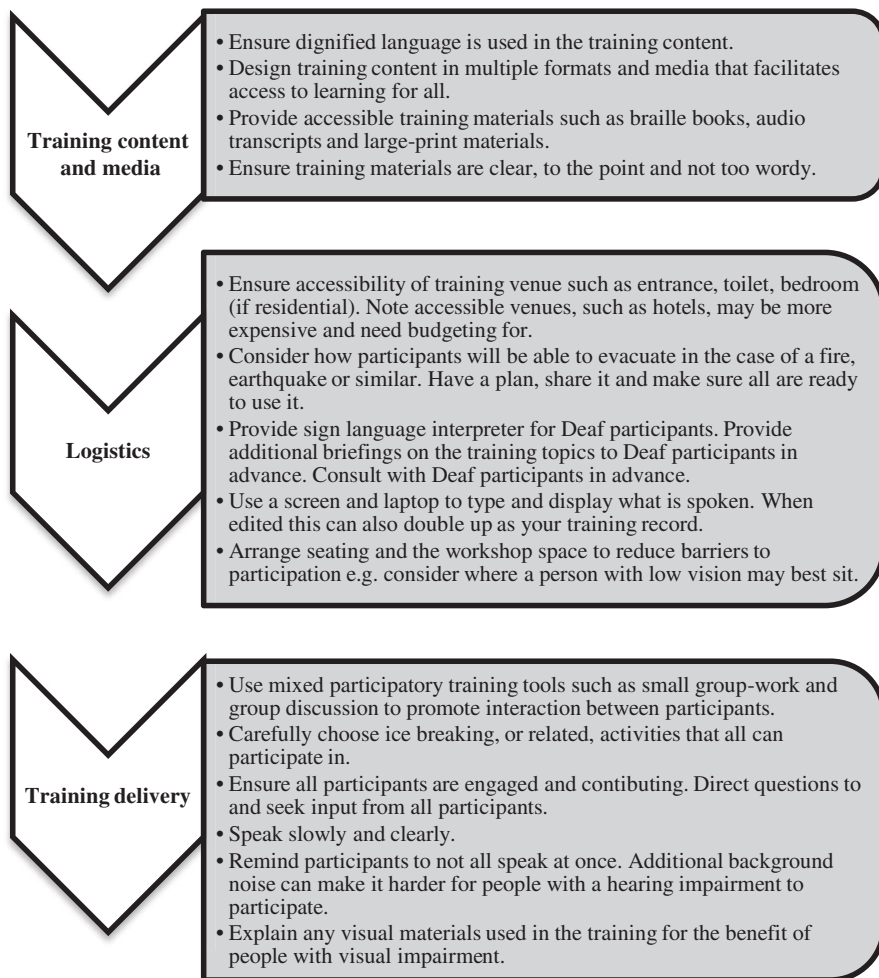


Fig. 13.1 Monitoring and evaluation within capacity building (Source: Kirkpatrick 1975)



**Fig. 13.2** Accessibility considerations for inclusive training program (Source: Authors)

consideration of both physical access (e.g. to training venue) and training content (i.e. to information to be shared). Figure 13.2 outlines three areas where we sought to remove barriers within work package delivery, including: (a) training content and media; (b) program logistics; and (c) delivery of the training program.

Deaf participants were provided with sign language interpretation as standard practice. However, other adjustments were required. This included simplifying some training content and additional use of visual media in delivery. Some Deaf participants from rural areas had not attended school and, therefore, had limited literacy and language skills. Additionally, some technical DRR terms had no corresponding sign in either preferred national or local sign languages. As such, prior

**Box 13.4 Accommodating Diversity**

Representatives of DPOs came together from across Indonesia to participate in work package 4. In this workshop, DPO participants partnered with village volunteers to learn how to administer the Disability Inclusive Disaster Resilience Tool developed within the research programme (Llewellyn et al. 2015). The tool was subsequently used by DPOs and village volunteers to gather information about experiences of disasters from persons with disabilities in communities in working areas.

During in-class practice, a blind woman administered the Braille version of the tool to a colleague. Across the room, a Deaf woman made recommendations for further adapting the tool for use in sign language. Some participants trialed the Indonesian language version whilst others preferred the Javanese language version. These women and men represented the incredible variety of languages and cultures in Indonesia. Further, they demonstrated the importance of adaptation and effectively anticipating, and responding to, individual needs.

consultation with Deaf participants concerning communication preferences was integral to the training process.

Box 13.4 illustrates the diversity of participants and how their needs were accommodated during implementation of the work packages.

**13.5.4 Inter-sectoral Collaboration**

While the focus of capacity building was to better enable DPOs to contribute to DRR, this necessitated a collaborative approach. Alongside DPOs, community members and DRR officials participated in capacity building work packages. During related data collection activities community volunteers were paired with DPOs. This proved to be an effective approach to fostering collaboration at the community level and improved both the quantity and quality of data collected.

Village volunteers, as insiders, were trusted within communities and, eased entry for DPOs from outside the villages. Initially, village volunteers found it difficult to interact with community members with disabilities. Interaction was aided by DPO colleagues. The partnerships created during collaborative class and field activities facilitated communication and built mutual trust and recognition of the value of each's contribution. Box 13.5 illustrates how DPO participants collaborated with village volunteers in the field.



**Box 13.5 DPO Collaboration with Village Volunteers**

DPOs and community volunteers were trained to use the Disability Inclusive Disaster Resilience Tool in community level data collection. Each team was given 10–14 days to practice gathering data and information, with supervision and support, within a village.

Initially, DPOs and community volunteers felt uncomfortable. Through interaction, regular assistance and discussion with ASB's field monitors each discovered the other's strength and support. DPOs facilitated interaction and communication between community volunteers and respondents with disabilities. Village volunteers helped and guided DPOs with mobility or visual impairment through geographically difficult survey areas. Village volunteers offered accommodation for DPOs who lived far from the village. DPOs had further opportunities to interact with community members with and without disabilities. Respondents with disabilities, and their families, came to see DPO members as role models.

Outside of the survey, DPOs provided motivation and encouragement as well as information on referral services to community members with disabilities. In Klaten, 8 survey respondents were referred to a mechanics training programme from the local social affairs department. In another area, DPOs providing remedial massage therapy were visited by villagers without disabilities for treatment. Another DPO member was invited to speak in Muslim meetings (*pengajian*) after community members discovered the individual's knowledge of Islamic teachings. Through these exchanges and partnerships, DPOs gained respect, stigma was overcome and these new relationships have proved lasting.

The participation of government was also central to the programme and particularly at the local level. Although both DRR and disability are crosscutting issues, responsibility for DRR is often still considered to be the sole responsibility of BPBD and disability the concern of the social affairs department. As such, it was essential that opportunities were created for both agencies to better engage with each other and with DPOs. Box 13.6 describes how DPOs and village volunteers interacted with government officials to share data on disability to inform DRR planning.

**Box 13.6 DPO Collaboration with Government Stakeholders**

Selection of communities in which to administer the field survey was made in consultation with BPBD officials. An initial consultation was held in sub-district government offices. BPBD and social affairs department officials attended alongside DPO and village representatives. All stakeholders were supportive and welcomed more available and accurate data. Attendees noted the importance of identifying households with persons with disabilities in order to prioritize evacuation and assistance in emergencies.

Final survey results were reported back to government. This included additional officials from education, health, community empowerment, and local planning agencies. Officials expressed concern over the low levels of participation of persons with disabilities in all aspects of life identified in the survey. Discussions led to the formulation of recommendations on how to use the data to inform planning and implementation particularly in terms of DRR. DPOs and community volunteers readily offered to partner with government to realize these plans.

None of these three stakeholder groups had any significant prior experience of working together. The structure of the capacity building work packages created space for engagement and brought stakeholders together towards collaborative planning and decision-making. This building of mutual awareness and working relations led to positive impacts through greater openness of all collaborators toward more disability-inclusive DRR. These are discussed in the following section.

## 13.6 Discussion of Findings

This chapter provides the reader with insight into four key features of the program design to illustrate how we applied the Community Development Continuum Model to the design, implementation, and evaluation of this capacity building program and the impact on supporting DPOs as policy advocates for DRR in Indonesia. For a full report on the capacity building program and associated tools, the reader is directed to the Centre for Disability Research and Policy (CDRP [2015](#))

There were some limitations in carrying out this research and development of the capacity building DRR programme. First, regarding people with disabilities as capable participants is new in DRR activities in Indonesia. Consequently time and resources need to be allocated to preparatory meetings with all stakeholders. Attitudes of stigma and discrimination towards people with disability remain widespread in Indonesian society. This, we found, also includes some DPOs where the confidence to participate with government officials may not yet be present.

Second, many people with disabilities in Indonesia only attend junior school education or do not attend school at all, so it is incumbent on project teams to provide easily understandable materials and present in different formats including opportunities for repetition and revision. In this programme these learning opportunities were more intensive than we originally anticipated. Third, the programme specifically identified four distinct and geographically distant working areas in which to carry out the programme. This provided the opportunity to work with several DPOs in geographical areas affected to varying extents by diverse natural hazards. This was of great benefit to examine the implementation of the programme in diverse settings yet, again, was time and resource intensive requiring project team travel. Lastly, although ASB was already known to some DPOs, BPBD and to local community and government officials, the project team being available at multiple points for information sessions and discussions during the delivery of the capacity building programme was essential to its success. Providing opportunities for multiple engagements between all stakeholders is an essential requirement in capacity building programmes which bring together personnel from the community who may be quite unfamiliar or unknown to each other.

We now turn to a discussion of program impacts in the following three areas. First, the programme raised awareness on disability and DRR among DPOs, community volunteers and disaster management officials. Second, the programme fostered inclusion of persons with disabilities in DRR planning and programming. Third, DPOs took on roles to lead community-based DRR initiatives on behalf of their constituents.

### ***13.6.1 Raised Awareness on Disability and DRR***

The capacity building program succeeded in bringing together DPOs, local government and community volunteers to points of shared concern and understanding. During the programme, local officials became aware of limitations in their DRR practice through not engaging with persons with disabilities. Importantly, officials and persons with disabilities were provided with space to build relations and develop understandings through the process of collective problem solving. This led to increasing recognition that persons with disabilities were not a burden to government, but in fact a resource that government could draw upon.

Well, sometimes I feel ashamed. Because since the 2006 earthquake that shook Bantul, there hasn't been any significant programme concerning persons with disabilities. How do we care for persons with disabilities when a similar disaster occurs? We haven't really thought about it. We are now motivated to think thoroughly on this matter. [...] some persons with disabilities reported that they have been trained and are ready to volunteer in our organization [BPBD]. Their readiness took me by surprise. We will explore this matter further regarding which aspect [cluster of volunteers] they can fit into. Mr. Dwi Daryanto, Head of BPBD, Bantul.

This growing awareness that persons with disabilities can contribute to government programming is important. Low capacities of BPBD, as mentioned earlier, relate to resource constraints that hinder the implementation of national policy. This recognition and broadening of available human resources for BPBD is an essential step towards Indonesia delivering on positive policy commitments to disability-inclusion under the SFDRR (BNPB 2012).

As with government officials, community volunteers had little, if any, prior interaction with persons with disabilities. Perceptions, again, were found to change quickly. Findings support the view facilitating opportunities for interaction and dialogue between DPOs and community is critical to developing capacity for a whole of community approach to DRR (CBM 2013).

I would like to promote the rights of persons with disabilities to be treated with dignity just like other people without discrimination. I also wish that persons with disabilities, especially children, have access to education. In my village, it is sad to see how they [persons with disabilities] only spend their day at home without any constructive activities. I want to share findings from the research and use it to advocate on behalf of persons with disabilities. For example, to raise awareness on disability, so people will not make fun of persons with disabilities in the future. I am grateful that as a data collector, I am contributing to make this change. Ms. Siti Aam, community volunteer, Ciamis.

The process of experiential learning also facilitated DPO members to better realize their own capacities. Successful collaborations and acknowledgment of individual contributions reinforced feelings of self-dignity and worth. DPO members expressed a change in their own mind set from being ‘incapable’ to being ‘able’.

I was very nervous when I started the survey. After it was finished, I was surprised that I could do it. I am so proud of myself. Mr. Fitra, DPO member, Ciamis.

### ***13.6.2 Inclusion of Persons with Disabilities in DRR Planning and Programming***

Capacity building contributed towards increased disability-inclusion at a number of levels driven by the different stakeholders involved. Working relationships established between community volunteers and persons with disabilities led to community volunteers raising disability issues in annual village planning discussions. Community volunteer inputs were not limited to DRR, but also addressed other critical areas including access to health and education for community members with disabilities.

In Ciamis, West Java, BPBD formally inaugurated the district’s multi-stakeholder DRR forum in February 2014. Two DPO representatives were appointed as coordinators for the empowerment of vulnerable groups. This was the first time that persons with disabilities had been included in a DRR forum in Indonesia. In Klaten, Central Java, BPBD allocated a budget to train 100 persons with disabilities on preparedness in 2015. This was the first disability related initiative undertaken by

the agency. Klaten BPBD went on to initiate accessibility improvements in evacuation shelters serving the volcano Mount Merapi. This included the building of ramps and accessible toilets at shelters in consultation with DPOs and has since received praise as a model example from BNPB.

DPOs themselves shared information gained within their organizations. DPO participants noted the importance of their colleagues being more aware of, and prepared for, natural hazard emergencies. Knowledge was shared internally by DPOs in Ciamis, Bantul and Klaten districts through their existing channels, forums and organization meetings. One DPO in Ciamis also took the initiative to share preparedness procedures with local early childhood education centers. At the national level, increasing trust between DPOs and BNPB led to DPO consultations on the curriculum development mentioned earlier. Further, following a sit-down at the 6th Asian Ministerial Conference on DRR in 2014 with the then Head of BNPB and DPOs participating in this programme, momentum was gained to finalize the previously mentioned national regulation on disasters and disability. The case illustration below demonstrates the important role of people with disability as a resource for their community in DRR initiatives (Box 13.7).

#### **Box 13.7 Case Illustration: Persons with Disabilities as Resource Persons in DRR**

Mr. Suparman (38 years) acquired a disability in the 2006 Yogyakarta earthquake. Falling debris damaged his spinal cord as he tried to run from his home. He now uses a wheelchair and following his injury withdrew himself from community activities for a number of years. In 2014, Mr. Suparman participated in a basic DRR training. He was generally silent and unwilling to participate. In most meetings he was reluctant to come inside the meeting room preferring to listen from outside.

ASB discussed with him what could be done to make him more comfortable. Over time, he became confident to join with the other community members and increasingly participate. This led to Mr. Suparman becoming part of the survey team. During the survey Mr. Suparman had to meet new people and became more accustomed to interacting with persons with and without disabilities. Initially, Mr. Suparman was not very confident; however, his confidence improved when assisted by one of the village volunteers.

*'I was able to meet many people with different characteristics. I feel that I can do things that I thought I was never capable of doing.'*

Mr. Suparman's own experience made him acutely aware of the need to involve persons with disabilities in DRR. He is now active in his village disaster management team and is also a member of the village DRR forum. Mr. Suparman is now also regularly invited by local NGOs to speak about inclusive DRR.

### 13.6.3 DPOs as Leaders in DRR Initiatives

After closure of the capacity building programme, three DPOs from Klaten and Bantul districts and Padang in West Sumatra took the initiative to apply what they had learned. Each of these three DPOs applied for and secured funding from the Disability Rights Fund (DRF) to implement DiDRR projects. This was the first time that DRF had received any proposals from DPOs to implement DRR initiatives under Article 11 of the UNCRPD (personal communication, 2015). The DPO project funded included improving data on disability in relation to disasters; advocacy for inclusion of disability in local DRR planning and budgeting; and preparedness training for households with a family member with disabilities.

These three initiatives, driven by DPOs, represent a new era for DRR in Indonesia. They mark the beginning of a shift from persons with disabilities as recipients of humanitarian aid to persons with disabilities actively reducing and preventing risk in the communities in which they live. This final case illustrates the potential of the Community Development Continuum Model (Jackson et al. 1989) to support the design of capacity building programs that aim to have an impact full participation in and control of services that have a fundamental impact on disability inclusion (Box 13.8).

#### **Box 13.8 Case Illustration: Contribution of DPOs to Disability Inclusion in DRR**

*Paguyuban Penyandang Cacat Klaten* (PPCK), a participating DPO, was active throughout the capacity building. During the capacity building components, PPCK built new relations with Klaten BPBD. PPCK were active in the BPBD funded training of 100 persons with disabilities in volcanic eruption and earthquake preparedness.

BPBD also invited PPCK to provide training to first responders on disability etiquette and techniques for evacuating persons with disabilities in the event of a volcanic eruption. This led to PPCK being invited to join the local first responders' forum. PPCK was then invited by BNPB to join the 2015 national celebration of International Day for Disaster Reduction. Inspired by the participation of DPOs, BNPB held training for 95 DPO representatives from across Java leading to all participants being officially recognised as national disaster volunteers.

PPCK went on to receive Disability Rights Fund (DRF) funding for continuing work on DRR. This is the first time PPCK has secured institutional donor funding. In the past, PPCK had been reliant on donations from the local social affairs department to cover operational costs. The building of trusted working relations between BPBD and PPCK has also led to BPBD directing further funding to PPCK. PPCK are now forming alliances within other districts around the volcano Mount Merapi and have bigger ideas for the future.

### 13.6.4 *Implications*

Participatory, people-centered and inclusive principles are among those guiding implementation of disability inclusion in DRR in Indonesia (BNPB 2012). Consequently, this program offers a model for Indonesia and other countries on implementing disability-inclusive approaches to program design and development consistent with contemporary social and rights-based understandings about disability (Thohari 2013).

The potential for people with disability to contribute as equal partners has only recently been introduced into the discourse on disability and disaster (e.g. Stough and Kelman 2015; Abbot and Porter 2013; Wisner 2002; Priestley and Hemingway 2006; Twigg et al. 2011; Alexander et al. 2012; Lockwood and Tardi 2014). To date, information reported has been (a) limited to the experience of people with disability as the recipient of disaster risk reduction programmes and (b) reported from the perspective of development agencies. The findings of this capacity building initiative demonstrates active engagement of DPOs in building partnerships and links for disability-inclusive DRR and recognizes the role of people with disability and their representative organisations as agents of change. Consequently, this program contributes effective strategies for the full inclusion of people with disability and their support organisations in DRR.

This Indonesia program demonstrates the key principles outlined in The Australian Development for All 2015–2020 strategy – building community resilience through disability-inclusive DRR (DFAT 2015). This program design, monitoring, and evaluation approach offers a model for developing capacity building for disability-inclusive DRR that can be implemented in other regions and countries. It contributes to the budding research on disability-inclusion in DRR and has the potential to contribute more broadly to discussions on disability inclusion in development.

The capacity building program presented in this chapter provides knowledge and information for implementing the Incheon Strategy (2012): “Make the Right Real” for Persons with Disabilities in Asia and the Pacific. Goal 7 focuses specifically on disability-inclusive DRR and management which currently have the lowest data records (UNESCAP 2014). This program offered four specific program features and discussed the impact of this capacity building initiative on developing DPOs as policy advocates in DRR. This initiative provides the direction needed to realize the SFDRR, particularly with respect to the inclusion of people with disability in all DRR efforts through meaningful participation and the leadership of people with disability.

This capacity building initiative in Indonesia informed the design of a disability-inclusive DRR initiative in New South Wales (NSW), Australia. This new community development program recognizes the central role and contributions of people with disabilities, their family, carers, and support organisations working in partnership with emergency managers in natural disaster emergency preparedness. Similar to

the Indonesian project, community-based knowledge workshops will be used to develop the collaborative actions needed to influence a whole of community approach to DRR and impact service planning, governance, and policy (Llewellyn et al. 2014).

## 13.7 Conclusion

The capacity building components, and subsequent impacts, described in this chapter hold promise for DiDRR in Indonesia and further afield. At the start of the programme, and during the final years of the HFA, disability was only an emerging concern in DRR. The impacts of disasters, such as the Great East Japan Earthquake, continued to illustrate only too well the dangers of not ensuring persons with disabilities are fully accounted for within DRR. However, inclusion in DRR is not only about the individuals affected. DiDRR is about maximizing potential and utilizing all available resources to better address challenges of common concern to all in society.

Such changes in perceptions among officials, community members and DPO members themselves were evident throughout the delivery of the capacity building. Following guided facilitation through Jackson et al.'s (1989) model, awareness was raised, issues of common concern identified, informed decision making increased and advocacy for mutually beneficial change initiated. More importantly still, stakeholders at all levels were inspired to take action. Individual transformation in knowledge and skill development contributed to changes in institutional behavior to improve the environment and society in which individuals live. The Community Development Continuum Model (Jackson et al. 1989) offered an important structural framework for designing the capacity building programme to support disability-inclusive DRR as a community development strategy.

Ultimately, these changes stemmed from creating and sustaining collaborative learning opportunities. This afforded DPO participants the opportunity to experience their roles as advocates over the duration of the programme. Time and opportunity to interact with others contributed to the development of mutual rapport. As stakeholders learned from each other they came to appreciate their combined contributions to DRR. Stakeholders used their collective talents to achieve common aims.

The SFDRR stresses the need for a people-centered approach, the importance of a better understanding of risk and the importance of collaboration to reduce and prevent risk. These values are also fundamental to disability-inclusive DRR. As the chapter illustrates, the resources to achieve this are far closer at hand than the DRR community previously thought. Creating opportunities to promote and further the contributions of persons with disabilities within DRR is, in short, of benefit to all in Indonesia and globally.



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# Chapter 14

## The Role of the Panglima Laot Customary Institution in the 2004 Indian Ocean Tsunami Recovery in Aceh

Michael Boyland, Agus Nugroho, and Frank Thomalla

**Abstract** This chapter presents an examination of the role of the Panglima Laot (translation: sea commander) customary institution in the recovery of fisheries communities in Aceh following the 2004 Indian Ocean tsunami, as well as the roles and relationships of other actors from the perspective of the Panglima Laot local leaders and institution. The roles of the Rehabilitation and Reconstruction Agency (BRR) of Aceh-Nias, the local government and international and local non-governmental organizations (NGO) are also analyzed in order to understand the broader recovery process, the interactions between these different stakeholders, and the types of loss and damage systems relevant to coastal fishing communities affected by the tsunami.

Based on a review of the academic literature, an analysis of documents published by humanitarian and government organizations engaged in Aceh's recovery and key informant interviews with representatives of Panglima Laot, local government agencies and international and local humanitarian organizations, our findings show that the Panglima Laot leaders and institution were instrumental in the recovery of Aceh's coastal fishing communities. Importance lies in the trust people have in the institution and its community leaders; their role as mediators between communities, government and NGOs, and their leadership in implementing, monitoring and evaluating livelihood recovery programmes that address community needs. External agencies recognized these capacities and some provided financial and technical support to strengthen the institution further.

In conclusion, we argue that the case of the Panglima Laot, positioned within the context of wide-scale disaster recovery interventions, offers lessons for actors engaged in localized post-disaster operations that aim to build resilience. Lessons in particular are around the importance of leadership, community engagement and people-centered recovery approaches.

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**Keywords** Indian Ocean Tsunami 2004 • Panglima Laot • Disaster recovery • Build back better • Loss and damage • Resilience

## 14.1 Introduction

This chapter presents a case study examination of the roles and relationships of key disaster recovery actors in the province of Aceh, Indonesia following the 2004 Indian Ocean tsunami. Specifically, its objective is to better understand the roles and relationships of the Panglima Laot (translation: sea commander), a customary fisheries institution in Aceh consisting of close to 200 coastal community leaders and coordinating bodies at district and provincial levels, during the post-tsunami recovery of coastal fisheries communities. The over-arching objective and dominant narrative of the 2004 Indian Ocean tsunami, led by the United Nations (UN) and other international agencies, was to “build back better” and to build resilience in the affected communities to future major disasters. However, large-scale, multi-actor, disaster recoveries may be too top-down and prescriptive, while the role and importance of pre-existing grassroots, community-based actors in shaping post-disaster interventions and mechanisms may be under-estimated, and is certainly under-researched. This study aims to contribute to the understanding of bottom-up approaches during major disaster recoveries by retrospectively studying aspects of the tsunami recovery in coastal communities of Aceh from the perspective of the Panglima Laot following the formal conclusion of the disaster recovery phase.

The research questions of this study are:

- (a) What were the roles and effects of the Panglima Laot in post-tsunami loss and damage systems?
- (b) What were the roles and effects of other recovery actors in post-tsunami loss and damage systems, particularly in relation to the Panglima Laot?
- (c) What might have contributed to the successes and failures of the post-tsunami loss and damage systems, and the tsunami recovery?

The tsunami recovery phase spanned several years and involved interventions and initiatives from dozens of international, national and local actors. This chapter refers to these interventions collectively as loss and damage systems. Here, a loss and damage system is defined as a formal or informal system that helps people and communities cope with and recover from the impacts of disasters that are either irreversible (loss) or can be replaced (damage). Loss and damage from climate change is a keenly debated issue seen within the 2015 Paris Agreement (UNFCCC 2015) yet it is not well-defined (Surminski and Lopez 2015). The term loss and damage (system) as defined for use in this chapter is seen as a form of risk management and reduction following disasters (Boyd et al. 2016). Drawing on the Boyd et al. (2016) typologies of loss and damage, the relevance of climate change here is for emphasis on incorporating climate risk and resilience into more holistic, proactive risk management strategies which include mechanisms to improve the efficiency and effectiveness of recovery processes.

### 14.1.1 *The 2004 Indian Ocean Tsunami*

On the 26th of December 2004, a magnitude 9.1 earthquake struck off the coast of Sumatra, Indonesia, causing a series of devastating tidal tsunami waves to rapidly radiate out across the Indian Ocean from the epicenter of the earthquake. Overall, the disaster killed approximately 228,000 people across 14 countries (Cosgrave 2007). Indonesia suffered the greatest human and economic losses of all of these countries.

Post-tsunami impact assessments estimated the total loss and damage at approximately US \$10 billion, with Indonesia, and specifically *Nanggroe Aceh Darussalam* (NAD, hereafter “Aceh”) on the island of Sumatra, suffering almost 50 % of this economic loss and damage (approximately US \$4.5 billion) (BRR 2005; World Bank 2005a). This sum equated to 140,000 destroyed houses and 80 % of Aceh’s provincial gross domestic product (GDP) at that time (BRR and World Bank 2005; Telford and Cosgrave 2006). The coastal fishing industry was the worst affected sector; ports and harbours were destroyed, along with fleets of boats, and an estimated 15 to 20 % of the 10,000 fishermen of Aceh Province were killed (CONSRN 2005a; World Bank 2005b; Garces et al. 2006; Stobutzki and Hall 2006; Telford and Cosgrave 2006). The loss and damage of boats across the province amounted to approximately 50 % of motorized and 30 % of sail boats (FAO 2007). In terms of financial damage, around 80 % of all fishing equipment was lost or severely damaged (Janssen 2005). The impact on the capacity for fishing was at least as highly significant as the financial cost (FAO 2007). Related infrastructure, such as drying facilities, landing sites, piers, fish aggregating devices, meeting halls and fuel stations were also acutely impacted (ibid).

The post-tsunami response and recovery in coastal Aceh has been complex, owing not only to the extensive impacts of the disaster, but also to the political context of the region. Thirty years of conflict, in addition to inequitable trends of economic development prior to the tsunami, made Aceh one of the poorest provinces in Indonesia (Fan 2013). The conflict was officially brought to an end in 2005, with a peace agreement signed by both the Indonesian government and leaders of the Free Aceh Movement, as a means to enable the rebuilding of the region. The Rehabilitation and Reconstruction Agency’s (BRR) short-term rehabilitation initiatives largely concentrated on replacing fishery assets such as boats (BRR 2005); but arguments have been made that short-term interventions such as these do not sufficiently address social vulnerabilities (e.g. Ingram et al. 2006). Existing studies conducted in fishing communities in Aceh highlight the major long-term issues related to socio-economic conditions, such as rising fuel and declining fish prices, rather than catch rates (FAO 2007). Furthermore, falling catch rates are actually attributed to pre-existing trends of overfishing, resource misuse and ecosystem degradation, and not to the environmental impact of the tsunami. In theory disaster recoveries present new opportunities for reducing the vulnerability and building the resilience of affected populations (Birkmann et al. 2010), but in practice it is not necessarily as straightforward as setting a goal such as “build back better” and expecting recovery efforts and loss and damage systems to build widespread resilience (Fan 2013).

### 14.1.2 *The Panglima Laot*

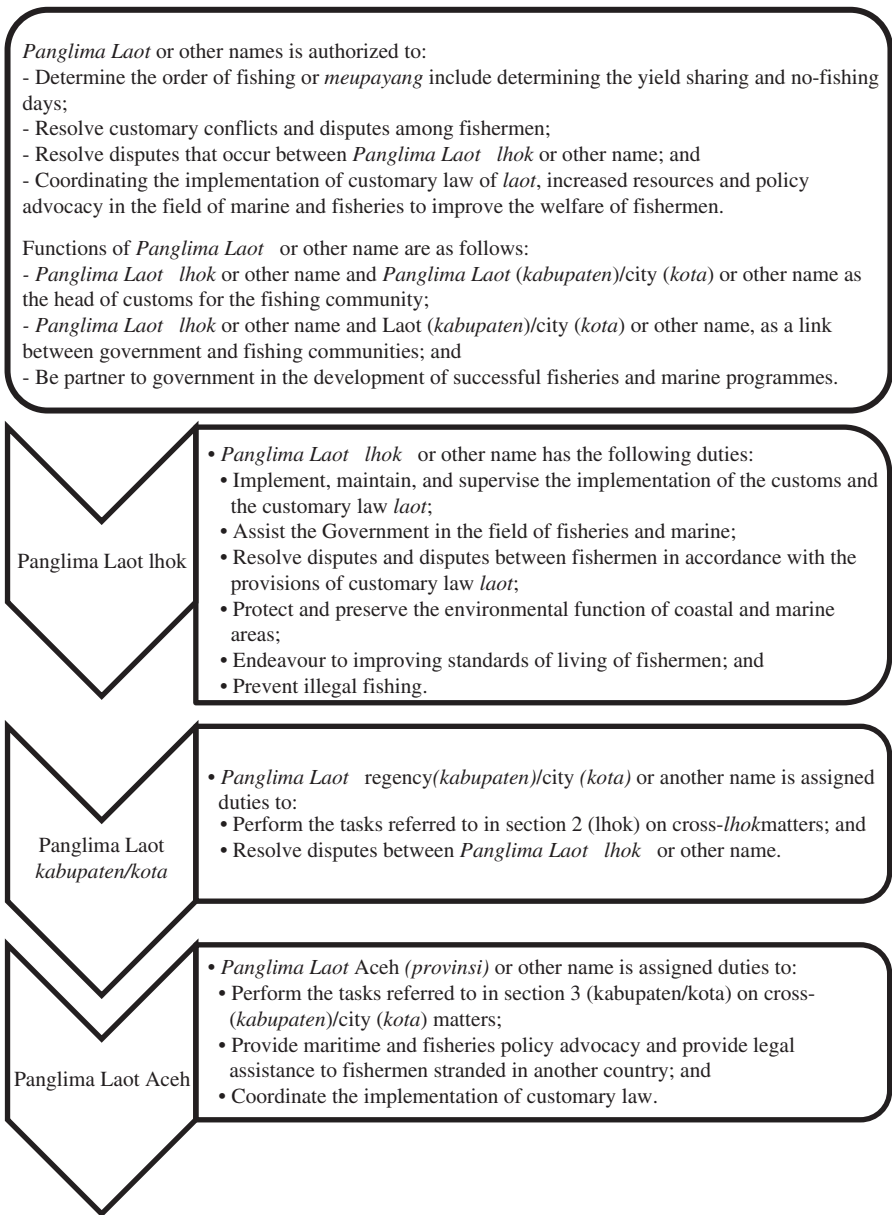
Each of the three primary ecosystems of Aceh: forest (*uteun*), agricultural land (*blang*) and the sea (*laot*), has its own traditional customary (*adat*) institution with an elected leader, a set of customary laws and rules, defined borders, autonomic power and a traditional judicial court system (*pengadilan adat*) (Nurasa et al. 1993). The Panglima Laot refers to both the traditional customary institution for the marine ecosystem and its elected leaders for the fisheries communities of Aceh. The presence of the Panglima Laot institution in Aceh is believed to stretch back to the seventeenth century (ibid). Shaped by key milestones, the existence, duties and even recognition of the Panglima Laot have evolved significantly over the past four centuries (ibid).

The specific roles of the Panglima Laot in Aceh are to: regulate fishing practices, mediate and settle disputes among fishermen; implement the customary laws related to fishing; act as a mediator between fishermen and actors such as government or non-government organizations; and, advocate for policy that will enhance Aceh's fisheries resource base and the all-round environmental, social, and economic prosperity of the fishing communities (Chaliluddin et al. 2015). In 2008, Acehnese *Qanun* (law) (No. 9/2008) on the preservation of customary law, and on customary law institutions (*Qanun* No. 10/2008), formally recognized the function and importance of the Panglima Laot for those communities and households that rely on fishing for their livelihoods (UNDP Indonesia 2008). According to M. Adil Abdullah, Secretary General of the Panglima Laot:

As the customary repository of leadership for Aceh's fishing community, as the key liaison between the government and the community, and as a partner in the sustainable development of the region's marine and fisheries sector, the Panglima Laot plays a very important and strategic role in the province, and can serve as an example for traditional fishing communities elsewhere, of community-based natural resource management. (Adli Abdullah 2009, p.1)

As of 2016, there are a total of 168 Panglima Laot *lhok* (bay), or "bay leaders", operating in every coastal village in Aceh and on other small islands within the province (Panglima Laot 2016). Across the province, Panglima Laot *lhok* leaders are present in 73 villages in 18 of the 23 regencies (*kabupaten*) and cities (*Kota*) (18 regencies and five autonomous cities) that constitute Aceh (ibid). Since 2000, institutional bodies at the district and provincial levels have coordinated the elected Panglima Laot *lhok*; mirroring the governmental hierarchical system, as shown in Fig. 14.1.

The exact working relationship of the Panglima Laot and the Aceh government is not clear. However the change in structure was claimed as a positive move to enhance and formalize relationships between the customary institution and government agencies such as the fisheries department. The change was also to build the capacity of the Panglima Laot through technical support and to better position the provincial Panglima Laot to advocate for the rights and interests of fisherfolk (Janssen 2005). However, some opposition was expressed as it was felt the traditional local level functions should be kept separate from a provincial political system dislocated from the national government and hampered by civil conflict (ibid).



**Fig. 14.1** Organisational structure, and authority, duties and functions, of the *Panglima Laot*

Members of the Panglima Laot institution may have preferred to retain decision-making power and not have to concern themselves with reporting to political bodies. As the Panglima Laot is an institution with seemingly growing ties to formal political structures, the roles and relationships of the two actors in the post-tsunami context is an area of interest. This chapter analyses these roles and relationships.

The importance of a bottom-up participatory approach to community-based disaster risk management has been highlighted by previous research (e.g. Garces et al. 2006). As a recognized institution imbedded in local livelihood practices, the Panglima Laot is a relevant agent to study in the context of responding to a major disaster. Furthermore, the high disaster vulnerability of poor coastal communities in Aceh intensifies the need for a greater understanding of the interventions that occurred following the tsunami, and how they have helped shape local vulnerability and resilience in the long-term. The operation and structure of the Panglima Laot was undoubtedly impacted by the tsunami, having lost almost a third of all leaders (Wilson and Linkie 2012); but the ability of the institution to provide temporally and spatially extensive community support, during the response and recovery phases, remains unevaluated. Quickly replacing lost local leaders, through elections, was an important step in giving the institution the capacity to respond to local needs and demonstrates the resilience of the institution.

Now, just over 10 years on from the disaster, research interest in the long-term recovery has renewed (e.g. Shaw 2015). Given that some commentators regard the tsunami recovery in Aceh as unfinished (e.g. Fan 2013), an analysis of the loss and damage system that operated at the local level is warranted. The Panglima Laot is an institution that had strong local significance long before the tsunami, and is therefore likely to have made important contributions during the disaster recovery. The effectiveness of these responses to cope with the devastating losses and damage, as well as “build back better” or build resilience to future events, in the most affected region, deserves investigation. Their focus and experience as predominantly a resource management network, for example, is likely to have shaped the interventions facilitated by the Panglima Laot in post-tsunami Aceh. This chapter investigates the contribution of the Panglima Laot to the recovery in Aceh, as well as its positioning within the wider post-tsunami loss and damage system, through the relationships with other recovery actors.

## 14.2 Methodology

The objective of the study presented in this chapter is to better understand the roles and relationships of the Panglima Laot during the post-tsunami recovery of coastal fisheries communities in Aceh. The research questions are:

- (a) What were the roles and effects of the Panglima Laot in post-tsunami loss and damage systems?
- (b) What were the roles and effects of other recovery actors in post-tsunami loss and damage systems, particularly in relation to the Panglima Laot?



- (c) What might have contributed to the successes and failures of the post-tsunami loss and damage systems, and the tsunami recovery?

The first stage of the methodology involved a detailed literature review of a number of key topics: disaster recovery, the 2004 Indian Ocean tsunami disaster event and recovery approaches, and the Panglima Laot. The literature reviewed includes peer-reviewed journal publications and grey literature such as donor agency and non-governmental organizations' (NGO) reports, policy frameworks and documents, and relevant statistical guidebooks. This review of the most relevant literature helped inform the primary data collection process. For instance, analysis of secondary data enabled identification of the most severely affected Acehese districts in terms of the fisheries sector (FAO 2007). As the two most devastated districts in this regard, Banda Aceh and Aceh Besar were selected as areas in which to investigate the roles and relationships of the Panglima Laot lhok leaders.

The second stage was primary data collection through key informant interviews (KII). For KII only a select few personnel from identified stakeholder groups are interviewed in order to obtain detailed, in-depth responses from a series of open and semi-structured interview questions. This study's interviews were audio recorded and transcribed, after the consent of each participant. Interviews were not coded using software. The structure and chronology of the data gathering process also allowed new and emerging themes raised by one interviewee (e.g. local government official), to be explored with subsequent participants (e.g. Panglima Laot).

A total of 12 KII were conducted across Banda Aceh and Aceh Besar districts, with interviewees belonging to several key stakeholder groups: local NGO, local business/SME owner, research/academia, district head, Aceh Disaster Management Agency (*Badan Penanggulangan Bencana Aceh* – BPBD) official, the acting Provincial Panglima Laot Secretariat and four Panglima Laot lhok from two districts whom were active during the tsunami recovery. Leaders described their general role in the fishery community, their personal and institutional role in the tsunami recovery, the types of interactions and relationships with other actors during the recovery, and their perception of the success of recovery interventions concerning whether or not communities were 'built back better'.

### 14.3 The Roles and Effects of the Panglima Laot

The Panglima Laot in Aceh, rooted in local social networks, played an important role in the rehabilitation of tsunami-ravaged communities. (Kumar 2010, p. 12)

The Panglima Laot lhok had various roles in different loss and damage systems that constituted the recovery among fisheries communities. Several of these built on their pre-existing roles and capacities, such as conflict mediator, whereas others, particularly related to the implementation of international agency humanitarian and development programmes, were quite novel to the Panglima Laot lhok.

Acting Panglima Laot from the time of the tsunami and recovery were asked to discuss the role of the institution in the post-tsunami loss and damage system of the

fisheries communities, and how they partnered with other recovery actors. The interviewees were consistent in their responses, stating that the Panglima Laot were leaders whom acted to represent the fisheries communities and communicate their requested needs to external agents such as donors, INGOs, the BRR and other government agencies. Answers to the question “what was your role in the recovery?” included “to direct the assistance based on identified needs of the fishermen” and “communication with the government and to find assistance”. Panglima Laot lhok went through the provincial Panglima Laot as part of this process. The primary recovery requirement of the communities that the Panglima Laot represent was regarding restoration of their livelihoods, and the Panglima Laot were helped to ensure that livelihood recovery assistance allowed the fisherfolk to return to “normal” as quickly as possible, by talking to both fishermen and actors offering assistance to match up demand and supply.

At the provincial level the Panglima Laot also had some funds directed to them by international donors and the BRR to implement recovery programmes as lead agencies, and in partnership with local NGOs. As the BRR coordinated the multi-donor trust fund, money delivered directly to the Panglima Laot at the institutional level was under the control of the provincial Panglima Laot, who distributed funds down to district and bay community levels accordingly. However, the provincial interviewee said that the institutional mostly did not manage aid but rather “just monitored its usage and the implementation at community level”. Implementing “cash for work” schemes for response and fisheries livelihood recovery (i.e. boat-building, making fishing gear, rebuilding fisheries infrastructure) were regularly named by interviewees as a function of the Panglima Laot.

Other functions mentioned by the local leaders were settling disputes among fishermen, offering occasional emotional and social support for surviving fisherfolk, or “overcoming the trauma” as one leader put it, facilitating human resources and financial capacity building training for different levels of the Panglima Laot, as well as training on effective engagement with NGOs with support from the Kehati Foundation. In line with their pre-existing role of advocating for policy that will enhance Aceh’s fisheries resource base and the all-round environmental, social, and economic prosperity of the fishing communities, at the institutional level the Panglima Laot sought recovery interventions that restored the coastal ecosystem, for example mangrove restoration and tree planting.

In addition to establishing and implementing recovery programmes, there were also cases of the Panglima being engaged in end-of-project activities, i.e. local-level monitoring and evaluation. They helped identify shortcomings in projects and the means to address them in future activities. Specifically, respondents spoke of the large portfolio of trainings that local NGOs, government officials and community-members were given to develop a variety of skills, but which initially lacked follow-up and evaluation of learning outcomes. As a result, more effective training programmes were designed and coordinated to prevent overlap and repetition, and which placed more emphasis on monitoring how the training outcomes were utilized in day-to-day practices.

Responses given regarding the institution’s role in the tsunami recovery were corroborated by the Provincial Panglima Laot representative, who also said it had

been important to them and the success of the recovery to “build relationships with potential donors”, particularly as all international development actors were new to Aceh on account of the previous civil conflict.

In the wake of the tsunami, the Panglima Laot attracted a lot of attention from external agencies that saw them as important sources of information, and potential service providers (Janssen 2005). For instance, as quoted in an ADB (2005, p. 10) grant assistance proposal for the sustainable livelihood development of Acehese coastal communities:

The credibility of Panglima Laot in rendering services to fisher communities will be crucial in social mobilization activities and in determining transparent and open mechanisms for the delivery of project benefits.

In summary, the Panglima Laot provided leadership and social support to the recovering fisheries communities; offering living allowances, consultation channels to government and non-government interventions, and guiding community members in working with NGOs.

Certain roles, such as acting as a facilitator and intermediary between fisherfolk and external agents, and advocating for the rights of fisherfolk. For instance, in 1999/2000, they had been instrumental in successfully campaigning for the local government and NGOs to support Acehese fisherfolk in tackling illegal fishing by foreign trawlers that was blighting the natural resources and threatening local livelihood security (Janssen 2005).

The Panglima Laot conducted assessments of the number and status of boats being repaired or replaced throughout the province (Janssen 2005). The assessments revealed the distribution of boats was uneven; for instance, a district that accounted for 40 % of boat losses in Aceh, received 75 % of new or repaired boats (ibid). Their role in such data collection processes was invaluable for monitoring the effectiveness of interventions, particularly by comparing social conditions with pre-tsunami times (FAO 2007). Because prior to the disaster, conflict-affected Aceh province had been largely closed to outsiders, such as donors and NGOs; any effective impact and outcome monitoring and evaluation therefore, was dependent on surviving community members, customary leaders, and local government officials for baseline data.

The Panglima Laot was often called upon by external actors, INGOs and NGOs to provide context, networks and access to those fishery communities most in need of assistance. However, the challenges of conducting loss and damage, needs, and recovery assessments in the wake of such a devastating event, should not be overlooked. The sheer number of (overlapping and repetitive) assessments also made the process sub-optimal, and the limited capacity of local actors on the ground often meant surveys were incomplete, data analysis was difficult, and lessons were not easily learned (ibid).

In their capacity as mediators, the Panglima Laot reported to donors, NGOs and other agencies (e.g. BRR) that the vessels being provided to affected fisherfolk were not always appropriate in terms of design, size, quality, and provision of supplementary fishing gear. Further, as has been noted in the literature (e.g. Schulze 2005; Telford and Cosgrave 2006), there were early incidences of boats and fishing gear

being given to villagers who had no experience or interest in fishing, and so where possible, the Panglima Laot stepped in and sought to guide more effective distribution of livelihood resources (Utomo 2010).

The tsunami recovery, particularly the reconstruction, caused some conflicts to arise between resource management and industry stakeholders, and also among local fisherfolk (FAO 2007). This is where the Panglima Laot exists to perform one of their key duties: conflict resolution, but in the context of aid distribution and livelihood support.

The longstanding role of the Panglima Laot in Aceh to oversee the management of coastal and marine resources at the local level for the sustainability of fishing communities' livelihoods meant that as the tsunami response and recovery phases got underway, they found themselves in great demand for their skills and local knowledge. For many years before the tsunami, they had been functioning as a bridging agent between fishing communities and the Acehese governments. In the post-tsunami context, that role became vital as outsiders, including government agencies and NGOs, entered into coastal Aceh with the mission of "building back better."

Traditionally, coastal land (defined as the point from where the wave breaks to the point where annual vegetation does not grow) in Aceh, is under the customary marine laws (*adat laot*) that the Panglima Laot enforces. As such, the fishermen and their Panglima Laot must agree upon any coastal land-use changes that may impact their local community. This practice came under severe pressure in the wake of the tsunami, as hundreds of external actors entered Aceh to assist the affected communities in rehabilitation, reconstruction and recovery.

The establishment of Panglima Laot bodies at district and provincial levels, just 4 years before the disaster, can be viewed as a double-edged sword. On the one hand, it gave affected fisherfolk formal channels to decision-making processes, such as under the BRR; but on the other hand, it added to the hierarchy and possibly quieted the voices of Panglima Laot lhok and recovering coastal communities that may otherwise have had more direct access to decision-makers if the provincial and district Panglima Laot had not been formed. As it played out, NGOs and other actors largely focused on dialogue with the provincial Panglima Laot, on the assumption it would be an accurate and effective central representative of the entire Panglima Laot network throughout Aceh (Janssen 2005).

#### **14.4 The Roles and Effects of Key Recovery Actors, and Relationships with the Panglima Laot**

Various national and international actors were involved in the recovery efforts in Aceh. This section describes and discusses the roles of key actors, how they collaborated with the Panglima Laot on certain loss and damage systems, or recovery initiatives, and the overall relationship between the different actors and Panglima Laot.

#### 14.4.1 *Rehabilitation and Reconstruction Agency (BRR) of Aceh-Nias*

When the tsunami struck Aceh, the National Coordinating Board for Disaster Management (BAKORNAS) was the government agency responsible for coordinating any disaster relief and response efforts (Telford and Cosgrave 2006). However, when the true scale of devastation became apparent, it was clear that the existing disaster response mechanism would be insufficient to mount an effective and efficient recovery (Fan 2013). As a result, in March 2005 President Yudhoyono created a ministerial-level agency, *Badan Rehabilitasi dan Rekonstruksi* (BRR), to coordinate the rehabilitation and reconstruction effort across the provinces of Aceh and Nias. BRR was given a 4-year mandate to produce policies and plans, responsibly and transparently disburse the huge multi-donor trust fund, and coordinate the expanse of ministries, institutions, INGOs and NGOs implementing response and recovery programmes (Janssen 2005). The explicit mission of the BRR was to “build back better,” using the disaster and disaster recovery efforts as an opportunity to address underlying social causes of vulnerability, such as poverty and inequality, transform political relationships, end a 30-year civil conflict in Aceh, and set the province on a path towards sustainable development (Fan 2013). In an interview with a representative of the Aceh Provincial Disaster Management Agency (*Badan Penanggulangan Bencana Aceh – BPBA*), the interviewee indicated that the BRR worked with the BPBA to monitor and evaluate livelihood recovery activities and programmes being implemented, and actively sought to ensure community participation and ownership was a guiding principle for identifying needs, finding solutions, and all decision-making processes.

The BRR established various divisions and subdivisions to focus on specific sectors’ recoveries. The Fisheries Subdivision existed under the Natural Resources and Livelihoods Division, and convened a steering group, which included representation of the Provincial Department of Fisheries, relevant donor agencies, technical advisors from ADB and FAO, and the provincial Panglima Laot (Janssen 2005). The effectiveness of the Fisheries subdivision of BRR, including the role of the steering group, in building back better resilient fisheries livelihoods has not been analyzed. However, the inclusion of the Panglima Laot, albeit just the provincial body, is a promising sign that recovery decision-making processes were inclusive, and participatory of Panglima Laot lhok and affected fisherfolk.

Furthermore, there are indications that the establishment of the BRR, which was not fully operational until more than 6 months after the disaster, improved the degree of local stakeholder and community engagement for the rehabilitation and recovery phases, following reports of the Panglima Laot lhok being bypassed by external aid agencies during the initial relief phase (ibid). The exact implications of the 6-month delay in operationalizing an effective coordinating body, i.e. the BRR, for the long-term recovery, are not well understood; but it could be hypothesized that at the very least it had a knock-on timing effect for when the transition from response to rehabilitation, reconstructing and “building back better” could be made.

### 14.4.2 *Local Governments*

The local governments in Aceh were themselves severely impacted in terms of infrastructure, loss of civil servants, and overall capacity to assist communities in the recovery. In the coastal districts of Aceh, all administration facilities were destroyed, and a temporary office space had to be set up at the municipality offices. As such, the local authorities, particularly the coastal districts, required external support in much the same way the fisherfolk did, and benefitted from multiple disaster recovery and capacity building programmes themselves. As a recovery actor, therefore, the role of the local governments was relatively minor in comparison to the BRR and international actors.

District governments were called upon by the BRR, INGOs and other agencies to provide both loss and damage data as part of post-disaster impacts and needs assessments, and disaggregated demographic and socio-economic data to inform their recovery interventions in fisheries communities. In Meuraxa district, Banda Aceh, the government largely supported the BRR in coordination of activities at the community level, but also delivered programmes such as the revolving fund for fisheries communities, which had a value of approximately 270 million Rp, or 28,000 USD (based on exchange rate of \$1.00 = Rp 9,490, as of 31 July 2005). District heads (*camat*) also demonstrated an acute awareness of the Panglima Laot, and the important functions they had following the tsunami. When asked for their perspective on the role of the Panglima Laot during the recovery, one interviewee stated:

They had a very important role as the link between the government's development assistance, and the communities. A key aspect of this role is that they helped identify the needs of the fisheries communities.

### 14.4.3 *International and Local NGOs*

Hundreds of NGOs, both national and international, were involved in the tsunami response and recovery phases; with the number of registered INGOs in Banda Aceh peaking in June 2005 (175), just months after the disaster, suggesting more emphasis and resources were placed on the response phase over the recovery phase, as numbers declined when the efforts transitioned from response to recovery (Telford and Cosgrave 2006). The common participatory approach in fisheries communities involved engaging with local NGOs, community leaders, and the Panglima Laot, to represent the needs and views of affected households (ADB 2005; Janssen 2005). In terms of the fisheries sector more broadly: Oxfam, UNDP, Mercy Corps, JICA, USAID, FAO, UNOCHA, and others, implemented numerous livelihood rehabilitation and recovery programmes. A common component of these programmes has been called, "cash for work" initiatives. Generally, funds were directed from INGOs to local NGOs, and also the Panglima Laot, to be used to pay fisherfolk and other coastal community members to carry out clean ups and housing and boat reconstruction activities. This was seen as a way of giving affected people an immediate

source of income, as it may take several months to restore boats and other fisheries infrastructure, not to mention the psychological impact the tsunami had on fisherfolk who did not wish to return to the seas for some time after the disaster.

A study of the first 12 months of the response and rehabilitation in fishing communities (Janssen 2005) in Aceh, raised concerns around the long-term implications of cash for work schemes. After a series of such schemes throughout 2005 for clearing debris – often funded by USAID and UNDP, and endorsed by the Panglima Laot – a regularly voiced complaint was that people demanded cash for participating in every activity, meeting or consultation. Janssen (2005) suggests this attitude might only last temporarily, but this study found this issue was still at play in Aceh, and was raised by both local government officials and the Panglima Laot during interviews. This offers an important lesson for disaster recovery strategies; traditional practices and values of community service and togetherness should be harnessed and not undermined by widespread, prolonged cash for work programmes.

In post-disaster contexts, external agents should not be blind to the wider socio-cultural context and embedded values and practices, and not reduce local customary institutions to service providers (*ibid*). Rather, recovery programmes seeking to embed resilient development throughout affected communities should actively seek opportunities to strengthen the capacity of local institutions, whilst not overlooking their traditional roles and responsibilities. After all, as the long history of the Panglima Laot shows, these enduring institutions are highly resilient themselves, and much can, and should be learned from them.

## **14.5 Recovery Successes and Failures: Has Aceh Been Built Back Better?**

One of the key direct influences of the Panglima Laot for effective recovery activities was the established trust and leadership ability they possess and were able to draw upon in the context of the recovery. As a deep-rooted community-based customary institution, the Panglima Laot are thought of locally as experienced in taking leadership and driving initiatives forward, particularly when engaging with external agents such as government ministries and INGOs on behalf of fisherfolk. Being able to work with an already established local institution with an active network across Acehese coastal communities, was perceived by incoming external actors to be very important to ensuring the recovery programmes were demand-driven and suitable to the local cultural and livelihood contexts. A commonly stated successful approach by interviewees was if the recovery activity or programme addressed the real needs of the fisheries communities and involved the local Panglima Laot leaders; “some of them go through Panglima Laot to give assistance; some of them go direct to community. Usually for those going through Panglima Laot the distribution is better and it corresponded well with the actual need on the field.” In general, this approach was unsurprisingly deemed successful by Panglima Laot *lhok* because having being elected they feel trusted by the community to represent them and their

needs. Leaders felt it useful that they had some pre-tsunami experience of negotiating and advocating with external agents.

According to Panglima Laot interviewees, some of the more successful recovery programmes that donors and INGOs consulted them on, included a strong DRR component; i.e. “focused on the future”. In addition to rehabilitation and livelihood recovery activities, the Panglima Laot perceived the need for taking advantage of this opportunity to implement DRR activities not directly resulting from the tsunami. For instance, some fisherfolk who had not fully returned to fishing were involved in planting wind-protective trees, mangrove rehabilitation for erosion and risk reduction, dredging of the delta, and others. Of course, engaging the Panglima Laot was a key strategy of actors to assess coastal risks and social vulnerabilities that extended beyond the loss and damage caused by the tsunami, due to their inherent knowledge of the local livelihood, culture, political and natural environment contexts.

More general to the overall tsunami recovery in coastal Aceh, successes of “build back better” were made possible by the technical and financial resources poured into Aceh, during the months and years following the tsunami. Furthermore, the level of worldwide assistance would certainly not have happened without the national government allowing INGOs to work in Aceh, and the signing of the peace agreement in August 2005, ending 30 years of civil conflict. Although the vast number of actors created some well-documented problems, it also meant recovering communities benefited from a wealth of programmes that targeted a range of sectors. Institutions such as local NGOs and the Panglima Laot were there to ensure those community members had a say in the design of such recovery programmes. Respondents from the Panglima Laot stakeholder group felt strongly that where actors bypassed them and went straight to the community level and implemented projects without consultation, interventions were less successful in helping fisherfolk recover to pre-tsunami conditions and far less able to “build back better” and enhance long-term resilience.

Although there were many notable successes of the tsunami recovery, and the work of the Panglima Laot and other actors, the recovery efforts and certain loss and damage systems were not without their faults, challenges and long-term negative consequences. The return to pre-tsunami catch levels after just a 1 year dip has been positively attributed to the action of donors and NGOs, but as the long-term trend suggests, the huge numbers of new boats (numbering more than lost or damaged boats), and increase in fishing gear efficiency, has potentially further exacerbated the fisheries resource sustainability issues that existed before the disaster, as predicted by FAO (2007). The fact that the fisheries production levels have not fallen, as was recommended by some, is not just down to INGOs; the 2008–2011.

Aceh Recovery Framework (ARF) of the Government of Aceh (2008) recommended a scaling up of fisheries as a key poverty reduction strategy. It states growth of fisheries: “*at once meets socio-economic objectives for livelihoods restoration and poverty reduction, as well as holding the promise of stimulating trade, industry and economic growth*” (Government of Aceh 2008; p. 60), without mention for the ongoing unsustainable resource use and ecosystem degradation facing the fisheries sector in Aceh, or how risk reduction measures will be built in to promote resilient, sustain-



able development. In fact, when interviewed for this study, the Provincial Panglima Laot representative described worsening coastal environmental conditions, which was impacting upon fisherfolk who now have to fish much further away from the coastline than they used to, costing them more in the way of fuel and time resources.

As raised by local government, NGO and Panglima Laot interviewees, a key limiting factor for the recovery phase following the tsunami was an aspect of the approach taken during the response phase. As mentioned previously, “cash for work” initiatives were common in affected areas, and funded by various donors and agencies. According to the Panglima Laot Aceh Strategic Planning 2005–2015 document (Panglima Laot 2005), numerous cash for work for community clean-up programmes were implemented throughout 2005 by UNDP and USAID. Although this strategy was designed to provide fisherfolk – who were unable to fish due to boat loss and damage – with an immediate source of income, different respondents, all of whom are Acehnese residents, regularly talked of the long-term impact of this approach on the communities and the province more broadly. One interviewee elaborated:

Cash for work has negatively changed the mindset of people. Before the tsunami, existed *gotong royong* – or mutual cooperation, a principle of community togetherness that often saw people helping one another voluntary. Now, people will not do additional work for the benefit of the community without money or compensation.

This altered mindset created by the relief, rehabilitation and reconstruction programmes, may have restricted the subsequent recovery phase in achieving the principles of “build back better”.

Despite the signing of the peace agreement ending conflict in Aceh being an overwhelmingly positive step for the tsunami recovery and the development of the province, as discussed above, the 30 years of war itself had major implications for social development and vulnerability. As put by one respondent: “*the conflict is as big an influence on the success of the recovery as the recovery process itself*”. If the recovery was to “build back better”, or enhance resilience, it would have to go some way towards addressing underlying causes of vulnerability attributable to the conflict, and this proved to be a major challenge. Aceh still faces issues of poverty, malnutrition, social inequality, lack of education, weak governance and economic instability.

Other factors given as responses during interviews included examples of inappropriate livelihood recovery assistance given, such as unsuitable fishing boats and equipment, and the conducting of dozens of livelihood trainings or capacity building workshops, which were often ineffective, repetitive and uncoordinated. One interviewee spoke of attending over 50 trainings offered by a range of actors, where cash for attendance was regularly given, and contributed to the erosion of *gotong royong* across coastal communities.

To synthesize the key insights of this research discussed above, Table 14.1 presents findings against stated FAO (2007) recommendations for the recovery of the fisheries communities in Aceh.

Central to “build back better”, is the tackling of root causes of vulnerability. In the case of Aceh’s recovery, a widely heralded success was the transformation of political relationships, and the ending of a 30-year civil conflict. Whilst the conflict resolution certainly aided the response and recovery efforts throughout, questions

**Table 14.1** Key findings of this research compared with FAO (2007) recommendations for the recovery of fisheries communities

FAO (2007) recommendations for the recovery of fisheries communities	Key findings
Focus on addressing key long-term issues present prior to the disaster (i.e. resource depletion, ecosystem degradation, poverty and social inequality)	In the case of the Indonesian government, the recovery and “build back better” was used to transform political relations, through the ending of the conflict, that were at the root of social and economic vulnerability in Aceh (Fan 2013). However for actors on the ground, including the Panglima Laot, tackling vulnerability was not a major focus of activities proclaimed to be “building back better,” and major challenges remain in the province; including poverty, malnutrition, and marine ecosystem degradation
Ensure building resilience to future disasters is part of strategies and programmes	A key proposition for the recovery was that preparedness for and resilience against, future disasters must be enhanced. In terms of structural and institutional resilience, successes are apparent, and many respondents felt confident that if the same tsunami were to occur again today, they are better prepared and educated, and would suffer reduced losses as a result of resilient housing, infrastructure, and evacuation shelters and routes constructed during the recovery
Consider livelihood diversification options	As discussed, fishing remains a major source of livelihood in coastal Aceh communities, but some limited evidence was found of livelihood diversification activities, and particularly more women becoming business owners, and providing a secondary household income, thus enhancing economic resilience of fisheries communities
Address new socio-economic challenges arising since the disaster (i.e. increased fishing capacity, increasing fuel prices, changes to fishing grounds, illegal fishing practices, and conflicts with other recovery programmes targeting different sectors and communities)	Panglima Laot, as a customary institution and leaders, are trusted to regulate fishing practices and prevent any illegal practices, and this is now formally recognised in law. In addition, they acted to represent fisherfolk and their communities in dialogues with actors, implementing a variety of recovery programmes, to seek some cohesion and addressing stated community needs. Their role as mediators helped to limit the number of conflicts between actors and programmes operating within the same communities
Build the capacity of fisheries institutions, both customary and formal, particularly for the enforcement of regulations and management of socio-economic challenges that are arising post-tsunami (see No. 4)	Panglima Laot, both the institution and sea commanders, felt certain capacity benefits of working with external agencies. For example, with financial and technical support from USAID and the Kehati Foundation, the Panglima Laot Aceh Strategic Planning 2005–2015 document was published (Panglima Laot 2005). This strategy sets goals and targets, details a post-tsunami model for strengthening the institution, and documents the <i>Hukom Adat Laot</i> (customary laws of the sea) in English and Bahasa Indonesia. Further, in 2008 the Panglima Laot achieved formal recognition of its institutional roles and functions in Aceh through <i>Qanun</i> Aceh No. 10 (Acehnese law)

(continued)

**Table 14.1** (continued)

FAO (2007) recommendations for the recovery of fisheries communities	Key findings
Interventions and mechanisms should be as flexible as possible in order to be able to adapt to lessons learned through regular monitoring and evaluation of impacts and outcomes	According to the findings presented here, cases exist of the Panglima Laot supporting agencies in monitoring and evaluating the impacts and outcomes of recovery programmes, and they sought to make recommendations for improvement where possible, particularly concerning livelihood recovery activities

Source: Authors

are still being asked of whether enough was done to address the social and economic vulnerability in the province, which has the conflict at its core (Fan 2013). Today, Aceh still has major challenges ahead, in terms of poverty, social inequality, malnutrition, natural resource depletion and economic instability (Thorburn and Rochelle 2014). For the consideration of lessons for recovery and resilience building, perhaps a more important question to ask is: whether, despite the opportunities that disasters can present (Birkmann et al. 2010), the post-disaster phase is the right time to look to address entrenched issues driving social and economic vulnerability (Fan 2013). Perhaps the role of a disaster recovery is to capitalize on ways to build resilience that are directly linked to humanitarian actions, before turning attentions to the root causes of vulnerabilities that led to the disaster.

## 14.6 Conclusions

After the tsunami, the marine customary law and Panglima Laot have become stronger. (Adrianto et al. 2009)

This chapter has presented a study of the roles and relationships of key disaster recovery actors in Aceh, Indonesia following the 2004 Indian Ocean tsunami. Specifically with the objective to better understand the roles and relationships of the Panglima Laot, during the post-tsunami recovery of coastal fisheries communities. For generations, the role of the Panglima Laot institution and its leaders has been to oversee the management of coastal and marine resources for the sustainability of fishing communities' livelihoods in Aceh. As an important customary (*adat*) institution at provincial, sub-provincial, and village levels in Aceh, it was transformed into a key actor for mediation between communities and the myriad of external actors engaged in post-tsunami recovery efforts that sought to "build back better". It has been found that the Panglima Laot was an important recovery actor, from the perspectives of both the communities and external recovery actors, i.e. national government agencies and international NGOs. The institution's main role was to act as a mediator, or bridge, between affected coastal communities, and those national and international organizations offering assistance, particularly in order to ensure that livelihood

activities could return to normal as quickly as possible. Of particular interest is the fact that fisherfolk were primarily looking for ways to restore pre-tsunami conditions as quickly as possible, whereas recovery programme implementers were seeking to “build back better” – a blanket term used in many different contexts as a means to reduce risk and build resilience. This raises questions around what “better” should look like, for whom, and how things should be better. Disaster recovery narratives, such as “build back better”, tend to be constructed and defined by groups of powerful stakeholders to help articulate problems and solutions, but can leave behind the views and desires of local actors and affected communities.

In terms of the role of the Panglima Laot in building resilience amongst fisheries communities, it appears to have been largely influenced by donors and implementing agencies. Whilst a main conclusion of this study is that the explicit involvement of the Panglima Laot – a trusted customary institution by donors and NGOs in their recovery programme design and implementation – was certainly an overwhelmingly positive move, the actual function within a wider recovery effort requires closer attention. Adopting participatory approaches for the restoration and recovery of livelihoods is likely to enhance project impacts and outcomes, but as found through this research the manner in which the approach is implemented can also have negative implications. Specifically, in this case, “cash for work” schemes, including for community clean-up, reconstruction, and attendance at meetings and trainings, have eroded the social value of *gotong royong* (mutual cooperation) in coastal Acehese communities. Such unintended consequences of disaster recoveries are highly likely to affect the long-term resilience of at-risk people such as members of the fisheries communities along the exposed coastline of Aceh. The Panglima Laot will continue to have an important role in ensuring effective DRR practices in this historic part of Indonesia.

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# Chapter 15

## The Role of Faith-Based Organizations (FBOs) as Risk Communicators: Case Study of Bandung, West Java

Farah Mulyasari and Rajib Shaw

**Abstract** Disaster risk communication is a fundamental part of disaster management. Knowing who the senders and receivers of risk information are, what constitutes necessary risk information, and how to appropriately convey risk information to trigger actions towards risk reduction, still remains challenging for risk information processes. The aim of this study is to identify the role of Faith-Based Organizations (FBOs) in Bandung, Indonesia as risk communicators through FBOs SIERA framework. A set of indicators in social, economic and institutional resilience activities (SIERA), with a scope of 45 activities covering three different disaster periods (before, during and after disaster), was developed to define the delivery process of risk information by FBOs through their activities at wards.

The data was collected through a questionnaire survey method using the SIERA approach. FBOs' leaders at wards were surveyed concerning their perceptions on these 45 scopes of SIERA, ongoing activities, as well as their risk information sources and dissemination processes.

The relationship between the variables such as periods of disaster, types of activities, and attributing factors in finding variations of risk communication activity for communities was analyzed quantitatively. FBOs disseminate information about disaster risks during prayer sessions and are attentive at sending out emergency warnings and communicating these through instruments in mosques such as loudspeakers that can be heard by thousands of people in neighborhoods. By having these instruments, FBOs are enabling the establishment of an early warning mechanism with local government. Above exemplary results confirm that FBOs are active agents of change within communities at wards and fulfill the role of risk com-

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municators through their religious activities in disaster risk reduction and disaster management as part of bigger action in building community resilience.

**Keywords** Religion • Risk communication • SIERA • Disaster management • Resilience • Bandung

## 15.1 Introduction

In a disaster situation, decision-making process is crucial and has large implications for individuals, communities and society at large. Patterson et al. (2010) mentioned different types of decisions people have to make in disaster situation. These are the swift execution and efficient accountability, which were conditioned by their perceptions of risk and their vulnerability and how these factors influenced their ability to make and carry out decisions. Other scholars, such as Aldunate et al. (2005) postulated that the quality of the decision-making improves if the right people interact about the right tasks at the right time and with the right information. Most of the decisions are the products of complex interaction between individuals, their communities, their surroundings and the natural environment itself (Patterson et al. 2010).

This chapter focuses on the role of Faith-Based Organizations (FBOs), which may play in the continuum of disaster preparedness, response and recovery. The research questions adopted are:

1. What are the perceptions of the leaders of FBOs about the role of mosques in DRR?
2. Can FBOs (mosques organizations within communities) play imminent role in mitigating and DRR?
3. What are the available mechanisms and operational stages of FBOs that made them as potential informants and risk communicators to communities?

The aim of the study is to identify role of FBOs in DRR, such as risk communicators to communities. This is done through extracting and taping the perceptions of the leaders of FBOs at community level on the role of FBOs (mosques) in DRR within communities as well as analyzing the FBOs as potential informants within informal risk communication networks.

FBOs are not just only Civil Society Organizations (CSOs). FBOs have much more to offer through networking and building linkages, information management, prayer support and psychosocial healing in difficult times such as disasters. One of many community resources to respond to disasters is mosques' organizations. As stipulated in Disaster Management Law No.24 Year 2007 about community participation, a mosque's role in disaster situation is one way to fulfill and express the right of community in DRR. Therefore the study would like to highlight the distinctive roles and functions of FBOs in responding disasters and to address the uniqueness of FBOs (mosques) that can contribute in DRR within communities. The chapter attempts to address the gap and identify the role of FBOs in DRR by commences



with the reviews of literature on the role of FBOs in Disaster, including the role of mosques as part of FBOs. Then a framework in scoping the activities of FBOs (mosques) before-during and after a disaster within the social, institutional, and economic dimensions are utilized to analyze its potential role as risk communicators. The findings are discussed and implications of FBOs' role in DRR and risk communication in building resilience are concluded.

## 15.2 Review of Literature on Role of FBOs in Disaster

The section will shed a light on the role of FBOs in disaster and how mosques, as part of FBOs can contribute in DRR activities. FBOs provide strong social networks within communities as well as economic perspective to the community. Being the center of community activities, FBOs can enhance the economic resilience of the community.

Furthermore, underpinning the contribution of mosques in DRR, many mosques adequately withstood the destruction and damages due to stronger construction while other buildings and houses collapsed. Mosques provide large open spaces and sanitation that could accommodate vulnerable communities seeking temporary shelter and transformed into centers of aid coordination and distribution. While during and post-disaster, mosques provide spiritual and psychological composure for communities in finding peace and solace.

### 15.2.1 Role of FBOs in Disaster

It explores, where the decision to act of FBOs fit in the concept of DRR & risk communication framework. Different of people and individuals react differently to certain issues in disaster; as such Aldunate et al. (2005) suggested that advancing the quality and decision making improves, if the right people interact about the right tasks at the right time and with the right information. Most of the decisions, according to Patterson et al. (2010) are the products of complex interaction between individuals, their communities, their surroundings, and the natural environment itself.

For example, the majority of evacuees of Hurricane Katrina stated that although they had previously experienced a significant hurricane before, they still felt that they lacked the appropriate information to make a decision to evacuation when local officials issued a mandatory evacuation order (Patterson et al. 2010). This finding revealed that their perception of risk might have been correlated with the information conveyed as well as trust in authorities. Additionally, the 2006 landslide in *Jember* in East Java Province, Indonesia, most people evacuated to the nearest mosques and *Pesantren* (Islamic Boarding School). The community considered the religious leaders in FBOs more as their trustee. This implies that there is a factor, which influences their decision, in particular perceived risk by an individual or com-

munity that has been thought to be a major component of decision making and community network.

FBOs stress much on the importance of social networks. FBOs could provide risk communication platform (interaction, inter-active, face to face; and when they meet up, they talk and discuss about risk information). Moreover, FBOs could also provide economic perspective to the community. Being the center of community activities, FBOs can enhance the economic resilience of the community. FBOs also encourage other community member to be more actively engaged in disaster preparedness activities and not only during and after a disaster. For example, the case of FBOs in Bandung City highlights how they have taken the role as one of risk communicators group in the continuation of disaster management cycle (before, during, and after a disaster/ disaster preparedness, response, and recovery). This chapter put as well a, notion on how the FBOs of Bandung, aside from being risk communicators in the context of DRR, build the community capacity and socio-economic resilience.

Appleseed (2006) mentioned that many community and FBOs have consistently been on the ground early and remained in the forefront of the recovery effort, along with larger volunteer or humanitarian organization, such as Red Cross. The case of Hurricane Katrina showed the magnitude of social networks during and after disaster aftermath that community organizations and community-based networks took part in disaster preparedness and recovery (Patterson et al. 2010). Specific to community-based networks, it is observed that local faith-based, volunteer, non-governmental organizations are pointed out to be flexible and adaptive in the work of recovery after a disaster. Furthermore, de Tocqueville (2000, 2001) viewed those citizens, who act together in community, using institutions of civil society like churches, voluntary associations, and the press; are able to take immediate action to address the issues that occurring to them. Instead of waiting the authority to solve the issues, they rather join together in addressing those by themselves. They do not neglect self-interest: rather it is moderated by a regard for the common good de Tocqueville (2000, 2001).

There are two characterization of community elaborated by de Tocqueville (2001, 2002). One is that the community as an aggregation of individual persons, population, which may be discussed in small geographical units labeled neighborhoods. And the second notion describes the community as an autonomous actor, with its own interests, preferences, resources, and capabilities. Moreover Tocqueville (2001) pointed out the example of American civil society, corporate actors such as churches, clubs, associations, town meetings, political parties, and other similar organizations are equal capable as feudal society. Tocqueville (2001) also argued that community organizations are more effective than agents of a government. Community organizations are more flexible, adaptive, rapid, thorough, and consistent, not only because they have local knowledge, but also because they have an interest in a common good, of which a government (central/local) and self-interested individual petitioners are incapable.

This definition is substantial for developing strategies for recovery and preparedness considering it illuminates the relationship between organizations, individuals, and government. Thus, community organizations such as FBOs can bring the gov-

ernment and communities (individuals) closer, and bridging the gap on disaster preparedness, response, and recovery.

### 15.2.2 Mosques as FBOs (During Normal and Disaster Situations)

In Indonesia, the mosque as part of FBOs has historically been a focal point where political, social, and religious activities are blended together. A mosque is classified as being a communal mosque if the mosque has more than 40 members (quantified in Friday’s praying session for men). Mosques allow Muslims to perform their personal, social and cultural responsibilities, and provide a scope to perform their solidarity duties to society (IRI et al. 2011). Figure 15.1 illustrates the tactical roles of communal mosque in disaster.

Those roles are such as:

- Provision and arrangement of accommodation and place to sleep for evacuation purposes (as men and women are separate according to Islam religion), including food consumption, sanitation and personal hygiene

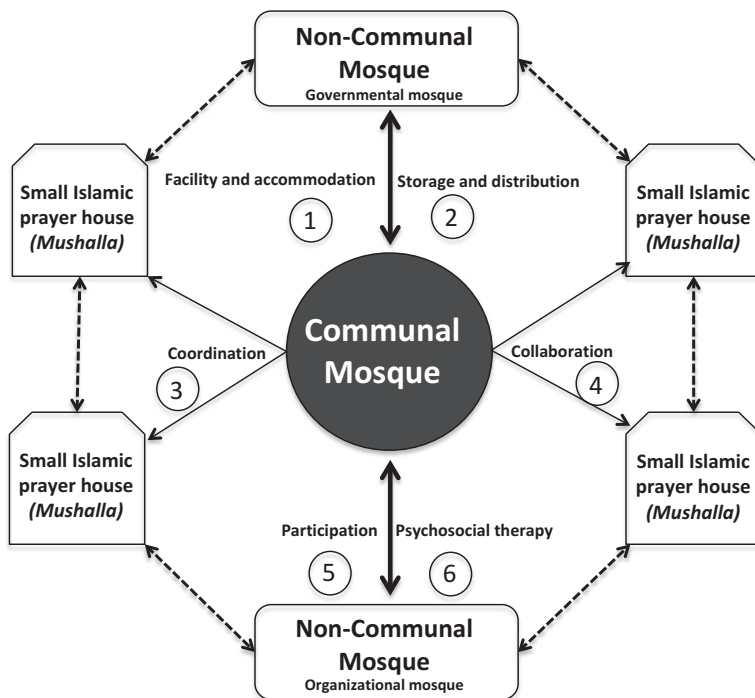


Fig. 15.1 The communal mosque and its role in disaster (Adapted from IRI et al. 2011)

- Storage and aids distribution
- Coordination of aids involving the council and members from all group of ages and areas
- Collaboration with authorities, experts, and disaster management practitioner
- Mobilization of FBO members' participation in physical and non-physical aids
- Psychosocial therapy/support for communities through praying sessions and religious lessons

During disasters mosques play an important role in collecting *sadaqat* (charity in the form of money and goods), organizing the community or as a place of refugee. The communal mosque collaborates with government in directly distributing aids to the needed ones, without involving directly the local leaders. It has the fully right and mandated by the government to implement those six tactical steps in optimizing the role of mosque in disaster. In disaster situation, mosques inhibit the social-religious leadership roles as part of mosque's mechanism framework.

According to the data in Islamic Relief Indonesia (IRI) report, as Indonesia with the highest Muslim population in the world, it is the world's largest in the terms of the number of mosques (630,000) and mushalla (500,000 small Islamic prayer houses). Learning from major disasters in Indonesia in the past 5 years, mosques have been playing important roles, especially during an emergency phase, such the case of Masjid Banda Aceh after the 2004 tsunami. With stronger construction, many mosques adequately withstood the destruction and damages, while other buildings and houses collapsed. Thus mosques have been provisionally accommodating vulnerable communities seeking temporary shelter and transformed into centers of aid coordination and distribution. Additionally, during the disaster, people also tend to turn to mosques to find spiritual and psychological composure, adding to its already eminent position in the community affected by disasters.

The selection of the mosque as an alternative, informal center for disaster issues has strategic considerations since the mosque has been considered as a house of God, which is safe for anyone. Moreover, the mosque is usually accessible and is located inside the residential areas, thus it provides a sense of security and safety. Although the role of the mosque in disaster situations is evident, there has been no proper study yet to explore fully the potential of mosque, especially in DRR, risk communication and disaster resilience (Mulyasari and Shaw 2013).

Mosque was also valued to monitor people's welfare (Department of Religious Affairs 2009). According to *KH. Miftah Farid*, leader of MUI (Indonesian Muslim Council) of West Java Province a mosque's function is not only for praying to Allah, but also for social, economic, and cultural activities (*Pikiran Rakyat* 2008, in IRI et al. 2011). Moreover, a survey result of *Republika* Research and Development in 2009 (IRI et al. 2011) gave similar view about the role of a mosque as the Department aforementioned.

Moreover, related to FBOs in Indonesia, a recent report by IRI, the UN Office for the Coordination of Humanitarian Affairs (OCHA) and *Nahdlatul Ulama (NU)*, a traditional Islam organization in Indonesia, is the first to research the potential role in a disaster for the country's 600,000 mosques (IRIN 2011). The report is impor-

tant in revitalizing and empowering the mosques, especially after disaster losses in some areas. It focused on case studies of six mosques in two provinces of Java recently affected by a disaster. The mosques have been used in many of Indonesia's disasters, large and small, from the 2004 tsunami in *Aceh* to the 2009 earthquake in *Padang*, West Sumatera. Ignacio Leon- Garcia, head of OCHA in Indonesia mentioned that the mosque is the key element in DRR and key element to save lives. They are not only providing the material and spiritually aids, also mosques' building, physically offers the evacuation centers for the community.

In addition, mosques in DRR function as well as the storage of supplies, coordination of a relief effort, distribution of supplies, and a place for therapy and long-term healing. Mosques in Indonesia, including in Bandung are divided into several categories. Previously mentioned, aside from *mushalla* and communal mosque, there are governmental mosque, and organizational mosque (IRI et al. 2011). The above roles of mosque in disaster are being optimized and work for communal mosque only.

### 15.2.3 The SIERA Framework

To underline why socio-economic and institutional resilience are utilized as an approach for this study; it considers the ideas and model developed by Cutter et al. (2008). They explained that there are social characteristics, which influenced both vulnerability and resilience, such as (socio-economic status, education, and insurance, for example). Moreover, DRR strategies need to be associated with the social and livelihood framework, as opined by Twigg (2004). Thus, it emphasizes on socio-economic aspect. In terms of institutional resilience, human communities are the social and institutional components of the city. They include the formal and informal, stable and ad hoc human associations that operate in an urban area: schools, neighborhoods, agencies, organizations, enterprises, task forces, etc. In summary, the communities act as the brain of the city, directing its activities, responding to its needs, and learning from its experience. During a disaster, the community networks must be able to survive and function under extreme and unique conditions. If they break down, decision making falters and response drags. This implies that social and institutional networks exhibit varying degrees of organization, identity, and cohesion.

By propelling socio-economic and institutional resilience activities of the DKMs (*Dewan Keluarga Masjid* or mosque family councils), it is asserted that risk communication process will take place between the DKMs and communities. Additionally, McEntire (2001) emphasized that a holistic approach is needed to the disaster problem and what is needed is an approach that addresses all agents and all actors, and all phases (before, during, and after disaster) pertaining to disaster vulnerability.

Therefore, a Social Institutional and Economic Resilience Activities (SIERA) framework is developed in scoping DRR and risk communication actions of FBOs,

which aims to analyze the role of FBOs as potential informants within informal risk communication networks. Table 15.1 shows the common FBOs SIERA, drawing from the aforementioned roles of the communal mosque in disaster situation.

### 15.3 Methodology

The data were gathered through questionnaire survey. The leaders of mosques at wards were asked their perceptions on the role of FBOs in DRR. It utilized SIERA questionnaire to find out the urgency level of FBOs perceptions of DRR actions in social institutional and economic dimensions and their prioritization. Their priority is important in finding which types of activities need to be endorsed for risk communication. These will address the role of FBOs in DRR from the leaders' perspective as well as pointing out whether FBOs (mosques) can play important role in DRR and risk communication. Following, those FBOs' leaders were asked on their risk communication sources and mechanisms preferences, to answer on the availability mechanisms and operational stages of FBOs that enable them to become risk communicators and potential informants to communities.

#### 15.3.1 Data Collection and Analysis

The perceptions of the FBOs, represented by the leaders of DKMs at ward level are therefore collected to analyze the role of FBOs in perceiving the disaster risk and their role in DRR by implementing their activities in their community. This can eventually enhance the community resilience.

The FBOs was analyzed quantitatively and qualitatively. The quantitative approach is used in measuring the SIERA perceptions of DKM leaders of mosques in Bandung City.

A two-stage random sampling was conducted for data collection. Firstly, it should represent one FBO per ward and secondly, mosques that were selected have to be located within a large-size community. Thus, 151 wards equals to 151 FBOs samples were collected. Qualitatively, the results are manifested in the form of informal and un-structured interviews with the DKM leaders. It is used to capture the insights into shaping the risk communication process through the proposed FBOs SIERA (see Table 15.1). To acquire their perceptions, a FBOs SIERA questionnaire was utilized. Firstly, their perceptions on the proposed SIERA based on immediate, or sometimes, or postponed are captured, followed by the prioritization of their undertaken SIERA in their respective wards.

Secondly, these DKM leaders were asked about theirs and their members' disaster and risk knowledge, disaster risk information source, media to convey the risk information, and partnership. Once the data are collected through surveys, it investigates FBOs as local potentials in DRR and the enhancement of community resil-

**Table 15.1** Faith-based organizations' SIERA

Dimension	Primary indicator	FBOs' scope of DRR in SIERA		
		Before disaster	During disaster	After disaster
Social	Population	List most vulnerable households	Collection of used clothes and goods for donation	Coordination with other CBSOs (WWAs/Women Welfare Associations and YUs/Youth Unions) in collecting data of affected people
	Health	Organization of health information sessions	Link the affected community for medical treatment	Clean the debris waste after floods and/or waste after fires
	Education and awareness	Disaster awareness campaign after praying sessions	Emergency and early warnings	Link institutions for enhanced disaster awareness campaign materials for the community
	Social capital	Discussion disaster issues among leaders	Community mobilization in hosting evacuation place	Organize and engage community in cultural events
	Community preparedness	Assign roles and responsibility in the event of disaster with leaders	Community mobilization in supporting evacuation process for vulnerable groups	Mobilization, organization the community for large aids distribution
Institutional	Mainstreaming	Inform community about disaster management plan after praying sessions	Confirm local government in disaster management utilization	Engage community to participate in disaster management plan review
	Crisis management	Community mobilization in volunteering trainings and first aid	Mobilization of men in neighborhood watching	Coordination, gather, and communication data of vulnerable groups to authority
	Knowledge dissemination and management	Dissemination of printed safety materials after praying sessions	Collaboration with community leaders in early warning	Enhance disaster awareness materials
	Institutional collaboration	Networking	Collaboration with other stakeholders in taking care refugees	Engage disaster experts for community forums/ meetings
	Good governance	Participation in early warning system development	Gather information of disaster loss for authority	Engage community leaders in the development of rehabilitation and reconstruction process plan

(continued)

**Table 15.1** (continued)

Dimension	Primary indicator	FBOs' scope of DRR in SIERA		
		Before disaster	During disaster	After disaster
Economic	Income	Facilitation the community's in business network	N.A	Invite and involve outside experts in providing community's skills in setting-up home industries
	Employment	Invite business sector for training	N.A	Facilitation business sector in building community capacity in generating income
	Household assets	Inform in securing household assets in case of a disaster	Inventory of non-and destroyed household assets	Mobilization the community in restoring and cleaning the household assets
	Finance and savings	Link households to religious-based institution	Support local government in financial aids distribution	Cooperative unit campaign
	Budget and subsidy	Sensitization of budget allocation	Fundraising during/after praying sessions and distribution	Link local government in rehabilitation of mosques, community halls, and schools

Mulyasari (2014)

ience through their local risk communication approaches that are inhibited in their activities within the three domains of the FBOs SIERA (See Table 15.1 previously).

### ***15.3.2 Case Study of Bandung City, Indonesia: Mosques as Part of FBOs***

Bandung City has been investigated and measured for its Climate-related Disaster Resilience Index (in terms of Physical, Social, Economic, Institutional, and Natural dimensions). Because of that, various Civil Society Organizations (CSOs), including FBOs were scrutinized, whether they can contribute in DRR, communicating disaster risks, and enhance the resilience in the social, institutional, and economic perspectives. Bandung City has 2,282 mosque family councils, widely spread in 30 sub-districts and 151 wards (Bandung City Statistical Agency 2015). These mosque family councils, known as DKM (*Dewan Keluarga Masjid*) are under the Religion Department of Bandung City. DKMs are informal FBOs, self-empowered (depends heavily on charity and funds from the community), with limited and irregularly budget/incentive from the local government. In DKM Bandung, the mosques also being as education centers for adults as well children in learning the religion deeper.



Every afternoon and evening after the school and office hours, children and adults are coming to the mosques and get together to discuss about religious and social issues. Men head the DKMs and mosques, when Islam told the Muslims that men are meant to be leaders in favor of women. However, this leadership's rank is not diminishing the role of women; women play also major role in DKMs, particularly for women's Muslim issues. Thus, the DKMs accommodate the needs of many age's section population. Consequently, if such mosque, which is common and widely distributed in Bandung, has the mechanism in disaster management in place; presumably mosque has conducted certain level of DRR as part of disaster management. Thus risk communication process needs to be explored in optimizing the role of mosque in disaster. The section below describes the approach of exploring the role of Bandung's FBOs in risk communication.

## 15.4 Results and Findings

The results and findings on exploring the role of FBOs in DRR (Sect. 15.1) and risk communication (Sect. 15.2). Firstly, their perceptions were collected and analyzed, as well as in terms of the urgency and prioritization in implementing their resilience activities (45 scopes of SIERA). Secondly, FBOs risk communication interface is described by FBOs risk communication and mechanism and which media are their source of information and their best suitable media in conveying/communicating disaster risks to wider communities. Key findings showed that FBOs leaders perceived the 45 scopes of SIERA should be immediately put into action, however emphasizing more on disaster education actions. Furthermore, FBOs' main source of risk information is from conventional media such as television, radio, and newspaper and communicating further down that risk information to wider communities through their resilience activities.

### 15.4.1 FBOs' Perceptions

The findings of the FBOs' perceptions are described in Table 15.2. Those findings were obtained by asking the FBOs' leaders of the urgency in taking those 45 scopes of SIERA from Table 15.1 previously. This table shows the urgency of FBOs' highest perceptions of their DRR actions in SIERA.

The dimensions and indicators of SIERA (Social Institutional Economic Resilience Activities) are evolved from dimensions and indicators of Climate-related Disaster Resilience Index (Physical, Social, Economic, Institutional, and Natural) by Joerin and Shaw (2011). CSOs like FBOs can enhance the resilience from social, institutional, and economic perspectives.

In terms of social resilience, almost all social resilience activities are perceived immediate, except for education and awareness before the disaster (conducting

**Table 15.2** The urgency level of faith-based organizations' perceptions of disaster risk reduction actions in SIERA

Dimension	Primary indicator	Disaster time frame		
		Before	During	After
Social	Population	Immediate	Immediate	Immediate
	Health	Immediate	Immediate	Immediate
	Education and awareness	Sometimes	Immediate	Immediate
	Social capital	Immediate	Immediate	Immediate
	Community preparedness	Immediate	Immediate	Immediate
Institutional	Mainstreaming DRR and CCA	Immediate	Immediate	Immediate
	Effectiveness crisis management	Immediate	Immediate	Immediate
	Knowledge dissemination	Immediate	Immediate	Immediate
	Institutional collaboration	Immediate	Immediate	Immediate
	Good governance	Immediate	Immediate	Immediate
Economic	Income	Sometimes	NA	Immediate
	Employment	Sometimes	NA	Immediate
	Household and assets	Immediate	Sometimes	Immediate
	Finance and savings	Sometimes	Immediate	Sometimes
	Budget and subsidy	Immediate	Sometimes	Immediate

Mulyasari (2014)

awareness campaign after praying sessions) (Table 15.2). This shows that FBOs are not familiar with this activity, which it was endorsed by the responses that are given by the majority of the FBOs leaders at wards.

In terms of institutional resilience, all institutional resilience activities are perceived immediate. This might have shown that FBOs at wards have a clear organizational structure and might work during emergency such as disaster. Previously mentioned, FBOs have a clear distinct tactical role in social-religious leadership during disaster. The division of role for different mosque category enables the FBOs locate themselves in institutional issues in disaster situation. In addition, based on the conducted interview, 83.5% out of 1,307 respondents (FBOs' leaders) stated that a mosque should not only be a place of worship. The majority of the respondents (84.2%) also encourage that a mosque should be accounted for non-religious activities as well, such as the center of culture, economy, social, and education. Thus, the provision of risk communication platform with larger communities (local community, government, etc.) is wide open. Therefore, risk reduction actions in disaster take place, if there is high participation from the community. FBOs and its members can give support in the form of information to let the places of worship (mosque) and educational places (school, religious center) be used for emergency shelters. Mosque, which is a sacred place and a place of worship for Moslems, is then becomes public, providing an opportunity for outside party to enter it. Behavior and appreciation among inter-faith is seen natural in the mosque's social mechanism during disaster.

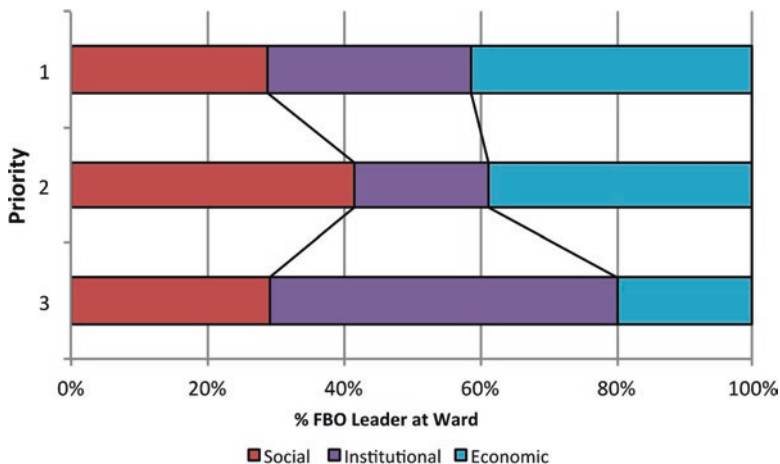


Fig. 15.2 Prioritization of SIERA by FBO leaders at wards

In terms of economic resilience, the urgency of activities in income, employment, household and assets, finance and savings, and budget and subsidy are varied one to another. Although in general FBOs are not focusing on economic outlook, however FBOs’ leaders at wards have prioritized the economic resilience activities as the number one, following the social and institutional ones (Fig. 15.2). Despite that their urgency of economic activities (i.e. income, employment, household and assets, finance and savings, as well as budget and subsidy) is varied from ward to ward, however leaders are concern about their community members’ welfare and wellbeing. This highlights communities’ economic perspective as utmost important issue.

### 15.4.2 FBOs Risk Communication Source and Mechanism

Furthermore, Table 15.3 illustrates the overview of FBOs risk communication source and mechanism. FBOs prioritize the source of information according to the credibility and trustworthiness of the information that are provided by those sources.

FBOs rated television as their number one source of information as well as their number one credible and trustworthy information provider. This provides the entry point for media in taking role in the overall framework for risk communication of Bandung. The fact that people in Bandung have a television in each household does not reflect different economical status among community. This in turn, may support people in ensuring the risk communication flow from authorities to communities. The local government is being the second trusted source of information for FBOs in Bandung. It shows that FBOs not only inhibit a strong relationship with communities but with their wards or sub-district government. Additionally, FBOs SIERA stands out between conventional media (printed and electronic media). It emphasizes that conducting communities’ activities is the entry points of risk communication platform among larger communities.

**Table 15.3** Faith-based organizations’ risk communication source and mechanism

Faith-based organizations (FBOs)	Priority		
	1	2	3
Source of disaster risk information	Media (television, newspaper, radio)	Local government	FBOs SIERA (religious and community activities)
Risk communication mechanism	FBOs SIERA (religious and community activities)	Media (Radio, Television) Internet, Mobile phone, Short Message Service (SMS)	Printed Media (Newspaper, Leaflets, Posters, Banners, Notice boards in community house/mosque/ward office

### 15.5 Conclusion: Implications of FBOs Role in DRR and Risk Communication

In conclusion, the chapter has shown that FBOs provide risk communication platform through their SIERA by direct interaction, face-to-face when they meet during religious activities in the mosque. Moreover, FBOs could provide economic perspective to the community. Being a center of community activities, FBOs can enhance the economic resilience of the surrounding neighborhood. Undoubtedly, FBOs are implementing wide varieties of SIERA. There are three main key words that construct key arguments and may explain the nexus of FBOs as risk communicators, keeping in mind the role of mosque in disaster situation.

The *first* keyword is resilience. There are various definitions given by many scholars. However, the understanding of resilience that is closest to FBOs is defined as a capacity of a system, community, or people who have potential exposure to danger, to reach or maintain an acceptable level of function and structure. Highlighting the understanding resilience from UNISDR (2009), it is to determine of how far that social system is capable to organize itself in order to improve its capacity to learn from previous disasters for better protection in the future, and to improve risk reduction actions. That definition refers to the strengthening of social system that is capable to dynamically adapt in preventing and handling disaster. Sociologically, resilience can be defined as a process of strengthening integration, latency, and communication, which exist in community (Parson 1997, p19–21 in IRI et al. 2011). In this definition, According to IRI et al. (2011), resilience is very different from the meaning as in resistant. The latter word is not dynamic, and it does not give an opportunity for an occurrence of a process to adopt “new things” from the previous social system.

Community is the *second* keyword in this regard about the FBOs as risk communicators. Community in FBOs means a group of individuals who gather based on the common interests and goals, and they have social bond. They are the creator and executor of emergency response in that social system. With the system in their unconsciousness, the members try to reach the common goal within their own ways. Similar to the definition of resilience, the community here in FBOs means a group

of individuals with its unique social system with operational strategies; they are susceptible to disasters, being living in disaster prone areas.

The *third* keyword is disaster management. This covers activities of before that includes DRR, during, and after the disaster. Muhtadi (2011) in IRI document (IRI et al. 2011) developed a chart of disaster management cycle, which explains Islamic perspective of disaster management that can be traced to *Al Qur'an* (Holy Book of Islam) and *Hadits* (guidance from the Prophet *Muhammad SAW*). There are 4 phases in which *Al Qur'an* defines sustainable disaster management. Those are the following: (1) prevention and mitigation; (2) awareness and preparedness; (3) emergency response; and (4) rehabilitation and reconstruction. In terms of prevention, *Surah Al A'raf* [7] verse 56–58 explains that human are not allowed to make damage on earth. This prohibition covers all areas including *Muamalah* aspects, such as intruding the source of living and other people's subsistence (Quran *Surah Al Qasas* [28]: 4). Based on the lesson learnt and best practices from the history of prophets, it is revealed that there were mitigation and awareness-preparedness as explained in *Surah Yusuf* [12]: 47–49. Efforts that were made by Prophet *Yusuf* were about saving his people and citizens from surrounding countries whenever there was a severe draught that lasted for 7 years. This was given as an example of mitigation. Furthermore, *Surah Al Maidah* [5]: 2 explain about helping each other in emergency situation, and Prophet *Muhammad SAW* conveyed a *Hadith* (*Hadits* narrated by Muslim), which states the importance of human to help each other. In terms of rehabilitation and reconstruction, *Surah Ar-ra'd* [13]: 11 explain that humans are given the capability to interact socially and coordinate programs or activities with multi-stakeholders in multi-sectors; hence disaster management can be done comprehensively. *Al Qur'an* also states that efforts of rehabilitation and reconstruction must obey three principles. First, is about increasing public awareness about the cause, evidences, and approach, to prevent repetition of risks. Secondly, it is about acknowledging traditional, local wisdom, (*Al-'Adah Muhakkamah*), culture and local indigenous; hence there would not be any friction in the society. And thirdly, is about cultivating patience, preventing despair, and the will to survive (*Al Qur'an Surah Yusuf* [12]: 87). Therefore, the disaster management above described in *Al Qur'an*, which is as well embedded in the SIERA approach, serves as the foundation for the FBOs and its members in manifesting and justifying their DRR and disaster management activities.

Drawing lessons from above, operational actions in disaster management cycle will succeed if the resilience mechanism in the community, for example, role of a mosque is functioned. The social mechanism of the mosque occurs, if the community has parallel worldview with the significance of disaster management in *Al Qur'an*. Through that common view, FBOs and its members are being able to relate, "What is the best thing to do" when the disaster strikes. As mentioned by Abdullah (2008 in IRI et al. 2011), disaster management and relief require speed and approaches based on the particular situation in the field, including operational mechanism that involves mosque. Above arguments give the rationale for a mosque to take part in risk reduction and risk communication that are part of larger disaster management concept. According to the IRI report (2011), it is not considered as

*Bid'ah* or forbidden. On the contrary, it revitalizes the initial role of mosque. Mosque, as mentioned before, is not only a place to do *Mahdhah* (worshipping). In the time of Prophet *Muhammad SAW*, a mosque had multi-functions, such as a *madrasah* (place of education), art show center, hospital, court for prisoners, and information center.

The findings of FBOs study and background information of mosques as part of FBOs provide immense evidences on the potentials and crucial roles of mosque within community in DRR and entry points for risk communication process in enhancing community resilience, especially in social and economic aspects. This has to be taken up, geared, and accommodated by the government as vehicle to communicate risks to wider public. FBOs activities in pre-during-after a disaster showed that FBOs in Bandung utilizing their pre-existing local networks and buildings, and their shared identity, social vision, religion narratives, and mosque leaders to mobilize, coordinate, and communicate risks to community. This approach builds upon on existing FBOs' coping mechanisms and assets that will harness social capital, and thus strengthen community resilience.

There are twofold roles of FBOs in risk communication. In the social resilience dimension for education and awareness, FBOs are disseminating information about disaster risks during praying session in printed format. They distributed leaflets from time to time during Fridays' Men's prayer session. Moreover, during disasters, in time of emergency, FBOs are being attentive for sending out emergency warnings and communicating these through mosque's instruments/tools such as loudspeakers that can be reached and heard by thousands of communities in neighborhoods. In the institutional resilience dimension for good governance, FBOs are establishing early warning system/mechanism with local government. Because they are equipped with loudspeakers that can be utilized for early warning, FBOs are advocating and engaging local authorities for agreed warning levels, countermeasures/anticipation actions and consequences.

Above twofold roles of FBOs in risk communication are contributing in building disaster resilience. Specifically in the Sendai Framework for DRR (UN 2015), on the role of stakeholders; civil society, volunteers, organized voluntary work organizations and community-based organizations to participate, in collaboration with public institutions may contribute to and support public awareness, a culture of prevention and education on disaster risk; and advocate for resilient communities and an inclusive and all-of-society disaster risk management that strengthen synergies across groups, as appropriate. On this point, FBOs activities and roles are thus complying in the process of building resilience.

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## Chapter 16

# The Role of a Women's Collective in Rebuilding Livelihoods After a Disaster: Case Study of Salam Village, Yogyakarta

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**Abstract** The May 2006 earthquake caused widespread damage and loss of life throughout the Yogyakarta Special Region. As international aid flowed into the region in the preceding months, numerous first-response, rehabilitation and longer-term recovery projects proliferated. Given the sheer number and scale of disasters that impact Indonesia annually, the disaster risk management community often has limited time and resources to evaluate the performance of responses and improve future practice. Drawing on a case study from Salam village, on the outskirts of Yogyakarta, this chapter seeks to contribute to the limited documentation of the successes and ongoing challenges of long-term livelihood recovery efforts following a large-scale disaster.

This study, undertaken in July 2015, uses a sustainable development lens to assess the performance of a Caritas-funded disaster recovery project in Salam village. This disaster recovery project aimed to assist affected women to rebuild their livelihoods and enhance their long-term financial resilience following the 2006 earthquake. Drawing on focus group discussions with a number of the women (n = 9) involved in the recovery project, it was perceived overall as high benefit and low risk; however, a number of weaknesses also emerged that have restricted the potential growth and long-term sustainability of the project. Comprehensive studies analyzing the performance of these recovery projects are often absent from disaster studies. This is an oversight given that we must learn from these interventions to: assure optimal performance; guarantee that donor assistance is deployed in ways that create the most value; and ensure that livelihoods are rebuilt and transformed so that their vulnerability is reduced.

**Keywords** Collective • Livelihoods • Sustainable development • Women • Yogyakarta

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## 16.1 Introduction

Indonesia is the fourth largest democratic country in the world with a rapidly increasing population of 255.9 million as of July 2015 (CIA World Fact Book 2016). Development is a key national concern with a growing population and persistent poverty levels (11.3% of the population is under national poverty lines; World Bank 2014). The ability for Indonesia to alleviate poverty and improve livelihoods is partly affected by its position in the Pacific Ring of Fire; a location that causes the country to endure more than 130 hazards including volcanic eruptions, tsunamis and earthquakes annually (Asian Development Bank 2010; UNDP 2010; Lavigne et al. 2008). This exposure to various different hazards, in conjunction with other factors, such as poverty, education, political instability, inequity and environmental degradation, contributes to people's underlying vulnerability to hazards (see Ribot 2014, 2009).

Over the past 12 years Indonesia has experienced a number of major hazards that have resulted in significant disasters, including the 2004 Indian Ocean tsunami in Aceh, the 2006 earthquake in Yogyakarta and the 2010 volcanic eruption of Mount Merapi (see Mulyasari and Shaw 2013; Hadi 2008). From the destruction and damage to community infrastructure, to the loss of critical livelihood assets, disasters affect the conditions necessary for future development (Gaillard and Texier 2010; Rodriguez-Oreggia et al. 2008). Disasters can also perpetuate a state of chronic poverty due to the exacerbation of economic stresses prior to, during and after a disaster (Ahrens and Rudolph 2006). They also result in thousands of fatalities, with many others left injured or homeless, highlighting the need for effective policy and program intervention (Abhas and Stanton-Geddes 2013).

There are numerous disaster risk-related policies and programs that have been implemented in Indonesia in response to the high exposure of communities to hazards. The 2004 Indian Ocean tsunami, for example, prompted the Indonesian Government to sanction the Law on Disaster Management, which redefined the national disaster risk reduction system (Abhas and Stanton-Geddes 2013). This legislative change facilitated a shift from disaster response to disaster risk reduction and disaster preparation (Ophiyandri 2011). Moreover, this law acknowledges that integration between various stakeholders is imperative for the successful implementation of disaster risk reduction plans (Shaw and Izumi 2014). Despite the necessity for these national-level laws, policies, support and financing for disaster risk reduction, it is also increasingly recognized that top-down approaches are not as effective as locally-grounded approaches (Shaw and Izumi 2014; Abhas and Stanton-Geddes 2013; Kusumasari and Alam 2012).

Looking at the local level, many initiatives targeted to reduce or manage disaster risk attempt to: bridge Indigenous knowledge with modern technologies; ensure the adoption of participatory, all-inclusive processes; and rebuild social structures alongside physical structures (see Abhas and Kusumasari and Alam 2012; Mercer et al. 2012; Ophiyandri 2011). According to Lassa et al. (2011), community-based programs are more effective as they promote the involvement of all local community

members and can be adapted to suit the values, beliefs and behaviors of that community. Gaillard and Mercer (2013) assert that a lack of public participation promotes failure across programs to manage disaster risk as attempted strategy implementations often become socially or culturally inappropriate. The importance of considering local, cultural values is highlighted by the continued residence of over 60% of Indonesia's population near 16 of the 130 active volcanoes, despite being aware of the associated dangers (Donovan 2010). This reflects the ability of local and cultural connections (in this case to volcanoes) to significantly influence risky decision-making and the actions individuals take, regardless of knowledge of risks and dangers. Indonesian Government agencies attempting to implement disaster risk management strategies devoid of an appreciation of local and cultural contexts will continue to endure complications (see Gaillard and Texier 2010).

## 16.2 Study Aim and Site

This chapter endeavors to summarize the results of a study on the performance of a livelihood recovery project in Salam village, located south of Yogyakarta. Salam village, located within the Gunung Kidul District, is made up of six smaller villages (known as sub-villages) within a 1,485.36 square kilometer area (Fig. 16.1) (Fujiwara et al. 2011). Gunung Kidul has the lowest income per capita of all districts within the Yogyakarta province, highlighting its heightened vulnerability and the associated need for projects to reduce and manage disaster risk (Hoen 2010).

The district's vulnerability to hazards is evident through the impacts of the May, 2006 earthquake which destroyed houses and community infrastructure including freshwater wells in Salam village (Lingkar Association 2010). In response, a livelihood recovery project was implemented in all six sub-villages (Baran, Gunung Manuk, Ngasemayu, Salam, Trosari and Waduk) of Salam village through funding from Caritas-Switzerland and management by a local non-governmental organization called Lingkar. This recovery project ran from September 2008 until January 2010 and focused on three core project deliverables: integrated dry land agriculture and farming system training including demonstration plots; clean water supply systems and water resource management; and food processing and the development of local resource-based home industries.

The focus of this chapter is on the latter component of this recovery project – that of food processing and home industries. To achieve this, women's collectives were established in all six sub-villages to become a platform by which to diversify livelihoods in the hope of reducing income vulnerability, increasing the value of pre-existing agricultural commodities, and enhancing people's resilience to respond to future hazards (Lingkar Association 2010). Livelihood diversification within this project involved the production and sale of cassava chips, and more recently banana chips. Prior to this project, the women helped on their husbands farms or collected grass for cattle. The production and sale of cassava chips as opposed to simpler forms of the cassava vegetable ensured an increased value of the cassava plant per



**Fig. 16.1** Location of Salam village (*blue circle*) within Gunung Kidul district (*in red*), Yogyakarta Province (Source: Google maps, 2016)

kilogram (Lingkar Association 2010). Although initially implemented in all six sub-villages of Salam village, the project remains (as of July 2015) operating in solely the sub-village of Gunung Manuk due to a multitude of reasons, such as project financial resource deficiencies. The fact that only one-sixth of the original project is still functioning (in Gunung Manuk sub-village) speaks volumes to the overall sustainability of the project, however, the aim of this study was to understand how and why it has been maintained in Gunung Manuk and learn lessons from this. We did attempt to speak with members of the five non-functional women's collectives in the other sub-villages but Lingkar no longer had contact with these women and as such it was not possible to contact them to participate in this study. This chapter therefore evaluates the performance of the remaining livelihood recovery project in Gunung Manuk.

### 16.3 Methods

To gain a better understanding of the Caritas-funded livelihood recovery project, qualitative data was collected in Salam village. Two focus group discussions were conducted over 2 days (7th and 9th July, 2015) with members of the women's

collective in Gunung Manuk sub-village. These focus groups were organised through Lingkar, who assisted the researchers gain entry to the sub-village. The main purpose of these discussions was to examine stakeholders' perspectives on the performance (using a sustainable development lens) of Lingkar's project in safeguarding and sustaining livelihoods. Focus groups were chosen by the researchers independently for this study. Gathering information in a group setting rather than individual interviews allows participants to reflect on the views and experiences of others, thereby potentially encouraging deeper discussions (Ritchie et al. 2014).

A total of nine women from the women's collective participated in the focus group discussions that were conducted by a large number of facilitators. The large number of facilitators was unavoidable given the nature of this study which was also a key learning exercise as part of a field course in Indonesia. The facilitators consisted of five students from the University of Queensland (UQ; all chapter co-authors) as well as three Universitas Gadjah Mada (UGM) students and a Lingkar representative. The UQ students were each allocated specific roles such as: explaining the overall purpose of the focus group discussions; running specific activities; note-taking and writing up results on large sheets of paper during activities; as well as providing a brief introduction and conclusion to each session. The UGM students and the Lingkar representative assisted with the activities and translation; an aspect that is acknowledged as a potential limitation due to the possibility of misunderstandings and miscommunications. With the consent of the participants involved, a digital recorder was also used to document discussions. According to Bryman (2012), focus group sessions work most efficiently when they are recorded and subsequently transcribed as note-taking alone cannot capture the dynamics of the group conversation and activities.

Prior to the first focus group discussion, data collection in the form of participatory observation was ascertained. This process involved a walk-through demonstration of the key stages in the cassava chip-making process as well as the opportunity for researchers to understand the stages through hands-on experience (from planting to cooking to packaging). This process aided the establishment of rapport and a comfortable atmosphere for subsequent focus group discussions. It further created a better understanding of the time and effort involved in the project which set the context for the focus groups.

Following the demonstration, questions and activities (as part of one big focus group discussion) commenced, which lasted for four hours in total (spread over 2 days) in the communal building. This is where the women undertake the majority of the cassava chip-making process. This arrangement ensured familiarity and created a relaxed setting that allowed the women to feel more comfortable in sharing their thoughts and opinions. Kitzinger (1995) argues that focus groups should always be conducted in a comfortable setting and preferably in a circle to establish the right atmosphere. Both of these tips were applied in this study: participants sat in a circle on the floor. During the focus groups, key questions were asked (which were developed by the researchers prior to fieldwork) to create a visual demonstration of the project and stimulate conversation on how the project has evolved over time.

Activities involved participants drawing a map of their village and indicating key locations such as cassava growing areas and the homes of the women involved in the project. Cost-benefit and risk-benefit exercises were also undertaken to derive the women's perceptions on the overall performance of the project and sense of reduced vulnerability. It is imperative to note that in the initial stages of the first focus group discussion, two authoritative male figures were present and observing discussions. This may have presented limitations to the depth of discussions and accuracy of collected data (Scheyvens et al. 2014). However, these men soon left the room and discussions appeared to flow more freely thereafter. A sustainability analysis activity was also a key activity undertaken in the focus group. This involved deducing perspectives on the overall successes and challenges of the project from a social, economic and environmental standpoint. A sheet of paper for strengths and a separate paper for weaknesses were used for noting key aspects of discussions. On each piece of paper, three columns were drawn to organize the key points under the three pillars of sustainable development. This was a time-intensive activity as it involved asking detailed questions on the advantages and disadvantages of the project, which led to questions about how it has progressed over time and how it could be improved. The results of this sustainability analysis activity form the basis for this chapter, and in particular the section to follow.

## **16.4 Evaluating Project Outcomes Through a Sustainable Development Lens**

Drawing from the perspectives of members of the women's collective, this section explores the overall performance of the project, as well as specific successes and challenges using a sustainable development (social, economic and environmental) lens. The women's collective unanimously indicated the high benefit of the project, due to a multitude of social and economic gains that surpass associated costs. Overall, the project was considered positive in this one sub-village, particularly due to the perceived resilience of the cassava plants against local fluctuations in environmental conditions which helps to ensure reasonably reliable yields. It is however important to note that this success is only relevant to this sub-village; the program has ceased in adjacent sub-villages likely due to a lack of participation and funding. This is comparable to a multitude of similar projects in developing countries that, as a result of resource and management pitfalls, endure slow progress or are terminated entirely (e.g. Salayo et al. 2012; Salkeld 2007). The following sections explore the social, economic and environmental dimensions of the project in Gunung Manuk sub-village.

### 16.4.1 *Social Dimension Successes: Education, Relationships and Pride*

A significant success of the project included the educational by-products – a broadened knowledge on processing and marketing strategies as well as practices. There are numerous advantages to this as enhanced knowledge increases productivity, income and gainful employment (e.g. Salkeld 2007). Ongoing education is often considered indispensable for project success as well as for maintaining agricultural productivity and income (see Zamroni and Yamao 2011). Although instigation of the educational process can be attributed to Lingkar's provision of an initial training session, it is imperative to note that the planned schedule of workshops and consultation visits were not entirely fulfilled for this collective. This may have been a result of resource and organisational limitations as seen in similar projects (e.g. Salkeld 2007). This lack of training provision combined with the collective's determination for continued growth of the business fostered a culture of self-training through trial and error as well as adaptation which enabled the improvement of knowledge and activities surrounding marketing and food processing. This continued knowledge building, despite the lack of fulfillment in proposed continued assistance by field staff and consultation visits to improve knowledge and practices, highlights the self-motivation and determination of the women's collective to attain new knowledge and skills. Furthermore, this ability to self-educate has inspired confidence and respect within the collective; an indirect outcome that will foster further benefits of enhanced resilience and project success (e.g. Ferris et al. 2010).

Another key success of the project includes its capacity to encourage and enhance relationships amongst the women within the community. This success has occurred as a result of the collective's organisational structure that encompasses a system of communally owned and managed land. The communal land tenure provides a platform for interaction which creates friendships and familial relationships that subsequently enhances solidarity (Diaswati and Barnes 2015; Kusumasari and Alam 2012). The sustainability of land tenure systems such as these, however, have been frequently contested with issues such as the 'tragedy of the commons' which highlights how the interaction of self-maximizing individuals and shared natural resources will result in overexploitation (McCay and Acheson 1987; Hardin 1968). As McCay and Acheson (1987) highlight however, contextual factors can invalidate underlying assumptions of this notion. The individualistic bias and assumption that self-maximizing individuals are unrestricted by social norms may, for example, be undermined by *gotong royong*; a Javanese social organization founded on cooperation, reciprocal assistance that involves community collaboration to achieve common goals (Diaswati and Barnes 2015; Bowen 1986). *Gotong royong* and its associated social norms stem from a village-scale logic that outlines the necessity of cooperation for fostering development and stability, and can apply to a multitude of contexts such as politics, village maintenance of infrastructure or post-disaster recovery (Diaswati and Barnes 2015; McCay and Acheson 1987). As a disaster generates an atmosphere of collectively shared risk, disruption and loss, the communal culture of

*gotong royong* habitually emerges in local recovery processes. Within Gunung Manuk's recovery and adaptation, *gotong royong*'s structure and its associated norms that ensure cooperation and care for others may have offset any individualistic or self-maximizing characteristics that encourage the overexploitation of communal property (McCay and Acheson 1987). Moreover, the individualistic bias of the tragedy of the commons notion is also undermined by the nature of the project as a business for the collective whereby all women cooperate to produce the product and thereby share the revenue. This successfully implemented communal structure also supports the recovery process by enhancing project efficiency, sustainability and resilience through facilitating coordinated action, the spreading of risks and its potential role as a 'social bridge' to manage conflicts (Kapucu 2006; Martaamidjaja and Rikhana 1996). Moreover, the long-term viability and effectiveness of this risk reduction project is furthered by the capacity of group activities to foster greater commitment and willingness to fulfill key tasks and goals (McCay and Acheson 1987).

The collective also unanimously agreed that the project's accomplishments inspire pride and elevate morale; characteristics identified by the collective as imperative for driving long-term sustainability of the project. This ability of pride and morale to drive projects has also been observed in similar livelihood diversification projects in South Sulawesi and the Philippines, where pride associated with achievements perpetuate participation and project continuity (see Zamroni and Yamao 2011; Pollnac and Pomeroy 2005). An elevation of pride is also present through the revival of a former culture in cassava consumption. This is a unique project outcome due to the common trend of fading cultural practices as markets expand. This cultural revival may be considered an important success to government bodies in particular as it fulfils cultural preservation objectives in the National Middle-Term Development Plan (2010–2014). Moreover, the project's aforementioned use of *gotong royong* also contributes to the continued salience of Indonesian traditions.

#### ***16.4.2 Economic Dimension Successes: Infrastructure and Income***

The clustered arrangement of requisite infrastructure in Salam village has significantly enhanced the project's economic success by improving efficiency. The close proximity of necessary infrastructure has facilitated an efficient lifecycle by enhancing ease of access between homes and the processing location which promotes limited travel time and reduces time spent on arduous tasks (Schwarze and Zeller 2005). This situation improves project efficiency and productivity by providing a social space that complements the women's other responsibilities. Working women habitually acquire greater workloads than working men as traditional social structures designate additional domestic duties to women (Loh and Dahesihisari 2013). Clustered infrastructure and its ability to promote accessibility enables women to

balance these competing aspects and allocate adequate time and resources towards improving efficiency and productivity of the project. This ability of infrastructure proximity to enrich efficiency and productivity is also indispensable for elevating income and enhancing resilience to shocks.

As an attribute that is highly valued by Lingkar and the women's collective, performance of the project in the context of income is notable. The collective perceived this aspect as a success with the level of income typically being high and the hierarchical structure of revenue distribution considered reasonable. Income is particularly enhanced by the high quality of cassava in the area which ensures reduced revenue loss and consistent sales. Maintenance of this high cassava quality and its influence on income is indispensable for positive income growth and reduced vulnerability to future disaster threats (Viverita et al. 2014; Lingkar Association 2010). A disadvantage however is that income, due to the seasonal nature of agricultural occupations, is inconsistent, thereby reducing resilience and security during lower-income periods (e.g. Salayo et al. 2012). However, this is somewhat countered as the collective further developed their occupational multiplicity (in livestock, banana chips as well as selling grass) in the event cassava production stalls. This practice ensures income continuity and financial resilience through its ability to spread risks against agricultural production or market failures (FAO 2013). The development of further income alternatives outside project activities and goals highlights how this project has successfully empowered the collective to self-help and independently implements strategies for resilience.

### ***16.4.3 Environmental Dimension Successes: Limited Waste and Transport***

Due to the nature of agricultural occupations and the fundamental role of the environment for productivity, income and sustaining livelihoods, environmental performance merits significant importance (Turner et al. 2003). This is supported by a host of reports and plans – the Sendai Framework for Disaster Risk Reduction 2015–2030 (UNISDR 2015) and the National Middle-Term Development Plan (BAPPENAS 2010) – that highlight the important contribution of ecosystem management in disaster risk reduction. The project in Salam village demonstrated two key successes and no notable challenges in this area, highlighting its alignment with these policy documents that recognize the importance of environmental management. Dependency on cassava as the central component of the project has limited waste as unused parts of the final product (such as the leaves) can be used for compost or integrated into home-made recipes for cakes, soups and alcohol. Furthermore, any cassava plants categorized as poor quality are utilized for compost or fed to livestock which further supports the limited waste output. This diversion of organic waste can, through the reduction of waste quantities, assist in extending landfill life and reducing associated air and water emissions (e.g. Seng et al. 2013). Using waste



for natural compost products as an alternative to chemical fertilizers also reduces greenhouse gas emissions and enhances soil quality by avoiding drastic changes in soil composition (e.g. Bedada et al. 2014). This maintenance of surrounding environmental health also contributes to productivity, thereby supporting the financial wellbeing of farmers (e.g. Schwarze and Zeller 2005). The collective's financial outcome is furthered by the benefits associated with avoiding disposal costs and the need to purchase fertilizers, feed as well as ingredients for home-made recipes (Hoornweg et al. 2000).

An additional environmental success is manifested in transportation as walking is key to maintaining this business. Transport between key infrastructures is predominantly undertaken by foot as a result of the aforementioned clustered infrastructure arrangement which thereby minimizes greenhouse gas contribution. Concomitant financial advantages through decreased transportation costs and health benefits through physical activity and limited air pollution also ensue (e.g. Woodcock et al. 2009). This aspect of the project can be considered a success due to its minimal carbon footprint and contribution to a healthier lifestyle.

#### ***16.4.4 Ongoing Challenges: Health, Gender Equality, Equipment, Demand and Competition***

Although Gunung Manuk's livelihood project encompasses numerous successes across the three sustainability pillars, several challenges prevail and inhibit project growth and sustainability. Despite a healthier lifestyle being promoted through increased amounts of physical exercise, direct health risks from the cassava preparation process counteract these benefits to become a major ongoing challenge. These risks include smoke inhalation and burns which are exacerbated by the habitual use of economical cooking products such as wood rather than gas. Furthermore, as a result of poor disposal technology, plastic wrapping was consistently burned during the cooking process which, through the release of toxic emissions, intensifies risks of asthma, rashes and headaches (e.g. Forbid et al. 2011). The World Health Organization (2008) illustrates a causal relationship between structural determinants of health such as income and intermediary determinants such as workplace conditions. The purchase of riskier fuel products such as wood, for example, reflects the 'material circumstances' category of intermediary determinants; an aspect that involves poor consumption potential (as a result of low income) and the subsequent investment into poorer quality assets that create health-compromising conditions (WHO 2008; Solar and Irwin 2010). These health-related issues can impede project success by interrupting work productivity, leading to reduced income flows and potential impacts on domestic violence, malnutrition, among others, and as such should be prioritized for improvements in future initiatives.

An additional challenge that reflects the social domain involves the wider society's traditional norms and values surrounding gender equality and roles. In relation

to the aforementioned successes surrounding the enhancement of relationships, positive support from husbands was particularly emphasized as a valued aspect of the project by the women's collective. As similarly observed in livelihood diversification projects on Nias (Indonesia), this prerequisite for male validation may be attributed to the women's employment of male-dominated responsibilities such as asset management and decision-making throughout the cassava production process (Salkeld 2007). Although the husbands of Gunung Manuk women supported these novel responsibilities, the traditionally less powerful status of women within the community may not have evolved as the independence of women remains somewhat restricted. This was observed in the initial presence of men during focus group discussions with the collective. These gendered cultural narrations impose predicaments for women's professional development and may therefore be a key hindrance to maximizing project growth and promoting resilience. This challenge associated with gender equality also emerges in the context of transport as the women in Gunung Manuk lack access to and ownership of motorized vehicles. This can hinder the growth of this female-driven project as the collective's access to infrastructures that require longer travel distances, such as larger markets, are affected. In response to the challenges presented by gender inequalities, numerous policy documents such as the National Middle-Term Development Plan (BAPPENAS 2010) and the National Disaster Management Plan (BNPB 2010) have integrated gender considerations and promoted women's roles in disaster risk projects.

Ongoing challenges reflecting the economic pillar of sustainability also emerged. Although project productivity and efficiency are promoted by the aforementioned infrastructure arrangement, efficiency is conversely hindered by the use of poor-quality, labor intensive equipment. As observed in analogous projects, ownership of and access to adequate resources are a pre-condition for enhanced productivity and economic mobility (see Zamroni and Yamao 2011). Therefore, reliance on inefficient and poor-quality equipment hinders productivity and perpetuates the inability to realize potential commercialization (e.g. Martin et al. 2013). This then impedes the collective's ability to increase income levels and develop financial resilience against shocks. Similar observations have been made in diversification projects in South Sulawesi where a need for appropriate technology to improve the quality of products and subsequently increase market value was identified (Zamroni and Yamao 2011). These efficiency hindrances are most likely attributable to a lack of resources and funding which supports the frequently emphasized need for improved budget and resource management practices in disaster risk reduction, as well as disaster response and recovery (see BNPB 2014, 2012).

Project success is also significantly dependent on market demand (Salayo et al. 2012), an aspect that was perceived as high and growing. In order to reach demand and thereby promote project growth, the collective introduced varying packaging sizes (extra small, small and large) with accompanying varied prices. These marketing initiatives to meet demands however are ineffective due to the product's lack of enticing packaging. Local shops remain indisposed to selling products with plain packaging while also defining costly and challenging requirements such as a specified plastic thickness. These requirements and the associated inability of the collective

to meet them are a key hindrance to the project's growth while also affecting aspects such as income and productivity.

In relation to demand, competition also significantly affects project success. Although competition has been observed in some cases to aid pro-poor development, the unfair competition in the packaged food context of Salam village has hindered economic growth of the project and collective. As larger, wealthier businesses are able to afford appealing packaging that better meet the aforementioned shop requirements, these businesses also acquire enhanced abilities to market products and elevate sale prospects. This competitive advantage that wealthier businesses possess over smaller enterprises is also reflected in analogous projects such as in the Philippines where small-scale fish farmers were displaced by corporations who were more able to afford higher quality feeds and deal with market fluctuations (Salayo et al. 2012). A rich-poor dichotomy in the context of competition therefore emerges and reflects a system of advantage favoring financially affluent stakeholders. This lack of fair competition may consequently be a key hindrance to the growth of this smaller project.

## 16.5 Conclusion

In recent years, communities across Indonesia have endured several natural hazards and as a consequence livelihoods and ecosystems that support these livelihoods have been severely impacted. As climate-related hazards elevate in frequency and intensity, policies and programs aimed at assisting and reducing the risk of communities have become increasingly necessary for sustaining livelihoods. Although the number of projects aimed at increasing resilience and forging sustainable livelihoods has increased, the performance of these projects in fulfilling objectives often remains unevaluated. This study therefore intends to contribute to this limited documentation on the performance of disaster risk reduction projects, and can be provided to donors and relevant agencies in the hope of assisting in the improvement of future projects and practices. The findings of this project for instance have been provided to the implementing agency in the hope of improving project design, implementation and evaluation in the future.

This chapter has drawn on an evaluation of a livelihood recovery project in Salam village (specifically in Gunung Manuk sub-village) following the devastating May 2006 earthquake throughout the Yogyakarta Special Region. The recovery project was implemented by Lingkar, whose efforts focused on income diversification of women through the establishment of women's collectives. Focus group discussions were undertaken with several women from the collective to elucidate the successes and shortcomings of the project using a sustainable development lens. As a result of the numerous successes, the project was perceived as positive overall by the women. One of the most positive social aspects of the project involved the enhanced levels of self-esteem and confidence as a result of the ability to self-educate and the associated benefits that marketing and processing knowledge had for productivity and

income. The project's capacity to encourage and enhance relationships between the women and their families as well as elevate pride, morale and cultural revival were also deemed successes. From an economic perspective, the project was successful in its high efficiency and ability to produce income. This high level of income was particularly important for fulfilling the primary objective of the project; to increase the reliability and level of income in order to enhance financial resilience. The overall environmental performance of the project was also perceived as successful with low levels of waste and greenhouse gas emissions as well as the use of natural fertilizers for improved soil health.

Although the project has been financially successful thus far, many limitations to the expansion of the project were identified. These include the need for: improved working conditions to reduce workers' exposure to health hazards along with reducing environmental pollution; more efficient processing equipment; and improved packaging to better meet demands and remain competitive in the market. These aspects are associated with an overarching challenge surrounding budgetary and resource management limitations; an issue emphasized by the National Disaster Management Authority (see BNPB 2014, 2012). Gender inequality and the associated cultural behaviors and norms also emerged as a major challenge that presented complexities for project growth and sustainability, with several aspects such as transport being affected.

There is value in doing project evaluations: successes can be identified and maintained; shortcomings can also be identified and ameliorated; lessons and learning can be disseminated to stakeholders, donors and practitioners to make actionable changes and inform future practice. As this study has shown, this project evaluation has demonstrated a number of successes as well as challenges, which together highlight a host of lessons for the successful implementation and operation of future livelihood recovery activities following disaster events.

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# Chapter 17

## Science Communication for Disaster Risk Reduction: Role of LIPI Through the COMPRESS Program

Irina Rafliana

**Abstract** Effective science communication is essential for addressing the call that science needs to be more responsive to the needs of society. However, there are still gaps in understanding the role of science in reducing disaster risks and also strengthening the capacity of those at risk. Over the past decades, it is generally agreed that the physical and natural sciences predominated in disaster research and frameworks of disaster risk reduction interventions. The Indonesian Institute of Science (LIPI) is amongst the pioneering national research institutions that conduct natural and social studies in Indonesia. In the early 1990s, LIPI's studies predominantly emerged from geo-hazard disciplines, with several attempts to communicate science to the public. Only after the 2004 Indian Ocean tsunami did scientists from social and natural science backgrounds come together to understand and agree that the loss of lives during disasters was not down to a lack of knowledge, rather a weak role of science and science communication. It was realized that commonly adopted technical approaches in reducing risks were deemed ineffective and insufficient to bring social changes.

This chapter aims to contribute social perspectives of disaster risk reduction, by analyzing the role of the LIPI Community Preparedness Program (COMPRESS) on science communication for tsunami risk reduction, from 2004 to 2014. This chapter uses the approach and analysis of agriculture extension workers in conducting communication for rural innovations. It shares 10 years of LIPI's experience in reaching out to the public through creative learning processes, such as learning-by doing and experimental approaches. It also shares the key highlights of communicating science, as well as instrumental challenges in sustaining science communication in Indonesia.

**Keywords** Science communication • Disaster preparedness • COMPRESS • LIPI

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## 17.1 Introduction

Indonesia is well known for being prone to disasters, including earthquakes and tsunamis. The Indian Ocean Tsunami in 2004 was the third largest ever registered on a seismograph (Global Assessment Report UNISDR 2015) and marked by tremendous loss of lives, assets and livelihoods. The 2004 Indian Ocean tsunami is not the first, nor the last such event and scientists are expecting more great earthquakes and tsunamis nearly on par with the 2004 Indian Ocean event in the next couple of decades in the Sumatera region alone (Sieh 2006). Sieh (2006) argued that scientific research and educating people at risk are valuable and practical steps that could save hundreds and thousands of lives in coastal cities and offshore.

This chapter begins with a historical account of catastrophic events in Indonesia, some of which even resulted in the loss of civilizations (Arif 2013). The chapter will then discuss the brief history of science in Indonesia. The historical disaster events are important to revisit briefly, in order to understand the need for science in reducing risks in an Indonesian context. The history of science is important to look at as well, as it gives us a better understanding on the backdrop of how science was traditionally operated, and how sciences ought to be used in reducing risks. During the colonial era for example, the sciences were used as tools to gain power and legitimacy, and similarly during the post-colonial era through the government's science rationalizations in the New Order era. The science rationalization during the Suharto era used as narrow a space for critical debate as possible to drive and support its development policies. As a core feature, communications are made through rhetorical statements to instill legitimacy, where people must be 'made to understand'. Democracy was perceived as disruptive and unnecessary. Science, as Goss (2014) would put, is featured as serving the bureaucracy. Such history cannot be avoided when trying to understand the fabric of science in Indonesia today.

Through social perspectives we can have a better understanding on why sciences are demanded to perform much more than its traditional operations. To reduce risks, science needs to be extended, reaching out to society using different methodologies and applicable 'languages' so that society can be better informed. The dim presence of social perspectives and social studies in disaster risk reduction and science communication in Indonesia is believed to have contributed to the current gaps in understanding the role of science in reducing risks. Globally, the Global Assessment Report on Disaster Risk Reduction (UNISDR 2015) identified the divorce between discourse and practice that further challenges the implementation of DRR in development priorities and investments, including investments in science and research. The author would argue that the absence of critical discourse in the past history of science in Indonesia has contributed to that divorce. Therefore, the author chooses to utilize social perspectives in the discussion and analysis as part of the methodology. In particular, the author utilizes the concept of agricultural extension workers (Leeuwis 2004) from sociological viewpoints, and also several definitions of science communication from the literature. The author then briefly discusses the power relations of science for disaster preparedness application. The chapter aims to share

lessons during a particular time from the past decade on how a national scientific institution struggled to find contemporary ways to communicate science to reduce risks: contrary to its traditional operations, and developed unprecedentedly after the 2004 Indian Ocean event. The chapter shares a comprehensive history of the COMPRESS Program within LIPI. In the discussion, the author will show how COMPRESS, including its researchers and volunteers.

## 17.2 Literature Review

This section will briefly visit a historical account of disasters and the evolution of science in Indonesia. The historical narrative aims to outline some shortcomings of role of science in reducing risks prior to 2004, and the reasons for such severe losses. This section will also briefly discuss two perspectives of science communication, namely the canonical model and interactive model. Taking these perspectives into context, the author discusses the critical points in practicing science communication, adapting communication for agricultural extension and also the relations of knowledge and power in the science of risk reduction.

### 17.2.1 *Disasters and Science in Indonesia: A Brief History*

Disasters have been part of society in the Indonesian archipelago for thousands of years. Studies have shown how civilizations changed due to ancient disasters in Indonesia, particularly tsunamis and earthquakes. Kingdoms such as Barus and old and new Singkil in Aceh were lost in the twelfth century, leaving evidence of an ancient tsunami catastrophe. Archeological evidence of the once great Barus maritime kingdom was buried one meter below the surface (Arif 2013). Later, many European scholars attempted to understand this force of nature, or at least record most of the important natural events in Indonesian history. For example, Georg Everhard Rumphius documented the Ambon tsunami of February 17, 1674. He described the disaster in great detail, in spite of the loss of his wife and daughter during the catastrophe (Baas and Veldkamp 2013). Nevertheless, despite the detail of documentation, disaster studies were not part of the scientific traditions during the colonial era. The colonization interventions, including the development of modern science in Indonesia, were mainly geared towards economic interests in spices and rich biodiversity; factors that drew Rumphius to Indonesia in the first place (Baas and Veldkamp 2013; Arif 2013).

For many local communities, most knowledge of disaster events was locally recorded through oral traditions, wrapped up in many forms of local folklore, myths and legends that do not necessarily suggest what to do in the future to reduce any potential similar events. Disasters were perceived in many different ways, even as harbingers of fortune or prosperity. For example, an elder in Ternate Island was

interviewed on the Gamalama eruptions that killed at least 141 villagers in 1775. To him, eruptions were troublesome; nevertheless, on the upside it brought fertile land and prosperity through high quality cloves and other plant commodities, without the need for fertilizers (Arif 2013). Another example comes from Mentawai, where the traditional and transcendental beliefs of Arat Sabulungan suggested that earthquakes bring natural prosperities such as the growth of mushrooms and fruits (Ralfiana 2015). There are, however, several ancient literatures written before the eighteenth century such as *Babad* in Sangkala, that suggest natural phenomena such as tsunamis and earthquakes severely altered society in Jawa (Arif 2013).

The history of (modern) science in Indonesia was written about, among others, by Andrew Goss, in his book titled 'The Floracrats: State-Sponsored Science and the Failure of Enlightenment in Indonesia' (2011). His in-depth analysis attempted to pin down the role of science in Indonesia from the colonial era to the New Order, moreover on the birth of the Indonesian Institute of Sciences or LIPI (*Lembaga Ilmu Pengetahuan Indonesia*). Historically, modern sciences were introduced by the so-called Enlightenment Apostles who were enthusiastic in exploring the nature of the colonies, including Indonesia. These 'apostles' were common workers of the Dutch administrations with no professional achievements back in Europe, but re-established themselves as intellectuals in the colonies. These intellectuals were confident that their knowledge could create appropriate and favorable political settings, a roadmap towards a civil society (Goss 2014, p. 23). They were mainly botanists who later on trained Indonesian technicians. The technicians further established themselves as scientists, and continued the established tradition; mainly serving the ruling government's bureaucracy. These botanical scientists from the early 'enlightenment era' to the contemporary era are referred by Goss as 'Floracrats'.

During the post-colonial era, particularly the rise of the New Order, modern science advanced and was used for political and development purposes but also propelled social changes. Daniel Dhakidae, in his book 'Scientists and Power in the New Order', observed how Suharto's regime campaigned for science rationalization in society in late 1960s and early 1970s due to the increasing role of universities and research institutions under the New Order regime. Nevertheless, universities and research institutions operating within the New Order regime had been propelled to serve the nation's development programs, but at a certain point, the government made decisions based on research that was pre-ordered by the government itself. Dhakidae referred this science-government relationship as 'incestual' (Dhakidae 2003). There were not many Indonesian scientists from the pre-independence era up to Soeharto (New Order) regime, who worked on disaster documentation, despite the numerous disaster events that occurred in the past. Hence, not many disaster risk management initiatives were undertaken during this time, since disasters were not perceived as disruptive factors towards the government's development agenda, although there were scientific institutions assigned to conduct geological and volcanology surveys to produce hazard and disaster knowledge. The rise of science rationalization, however, was nowhere near enough to allow society to improve its understanding of, and prepare for future disasters. On the other hand, traditional

knowledge embedded within communities, with its varied interpretations and perceptions of disasters, was only vaguely putting forward messages of preparedness to future threats.

In modern times, a devastating tsunami occurred in the Indian Ocean on 26 December 2004. The earthquake itself released even more energy than all earthquakes that occurred in the past 10 years combined (Arif 2013). Many of the communities in Aceh as well as Nias were accustomed to earthquakes, but not the tsunami that followed, which caught almost all by surprise. Even the Mentawai people grew to accept that earthquakes could generate tsunamis, as once told by visiting scientists to their villages few months before.

A documentary effort on the 2014 Indian Ocean tsunami was made by Tanaka Shigeyoshi, Takahashi Makoto and Ifran Zikri, in a book titled, '*Orang-orang yang Bertahan dari Tsunami*' or 'People Who Survived the Tsunami' (Shigeyoshi et al. 2011). The authors interviewed survivors in Banda Aceh and Aceh Besar, two of the districts severely affected by the earthquake and tsunami wave. None of the survivors being interviewed had known that a tsunami would occur after the earthquake happened. During the severe ground shaking, most communities prayed to God while dropping their body to the ground, since it was almost impossible to stand still. Afterwards, many still had the time to check their homes and talk to neighbors. In fact, there were tsunami events in Aceh in the past, around two generations before, in 1907. The tsunami phenomena were called *Ie Beunah* or huge wave. More accurately, on Simelue Island in Aceh, the characteristics of the earthquake followed by a huge and destructive sea wave, which meant one should run to higher ground, was understood in one word: *Smong* or *Kmong*. A study conducted by Yogaswara and Yulianto (2006) suggested that the knowledge about the deadly wave phenomena differed from one place to another in Aceh, even within Simeulue Island. The youngest generation, (elementary-school age) when interviewed in 2006, suggested that they did not know what *Smong* was. Neither *Ie Beunah* or *Smong*, or *Kmong* were picked up as potentially life-saving knowledge during the 26 December 2004 event in both districts studied by Takahashi, Tanaka and Irfan.

In the first weeks after the tsunami event, the national media exposed the general public with hysterical scenes of devastation. Footage of naked bodies, cars swept away by debris and black, mud-like water and survivors howling in remorse, were repeatedly displayed on television. Dramatization became the winning norm in disseminating information through the media, in combination with updating the public on situations in the affected area. The intentions of the dramatization were not necessarily for humanitarian purposes. Crying newscasters in the affected fields were purposeful, made to collect donations from viewers through the media's bank accounts (Arif 2010). Members of the public of all ages signed up to volunteer in various ways and forms. Communities in villages in Jawa, Kalimantan and Sulawesi had humbly collected their used clothes and foods to be sent to Aceh and Nias. University students lined up in traffic junctions, bringing boxes to collect charity money from drivers. The collected money was used for sending out logistics, or travel costs for students to enroll as volunteer workers. The full attention was on the response and relief phase of the disas-

ter. The tsunami wave had in turn attracted waves of goodwill. The altruism raised through the dramatization and romanticism of disasters somewhat made up for the absence of science and knowledge in saving lives, despite the long history of disasters Indonesia has experienced and will continue to do so in the future.

Asides footage of the devastation, the media also paid attention to the science behind the event. They paid attention to the lack of community knowledge on tsunamis and what to do about it. Yet, rather than posing apologetic gestures for not being present during the pre-disaster phase, scientists took their roles to a different level. Hazard knowledge became a tool and resource for domination, only shortly after the Indian Ocean Tsunami in 2004. Luckily, many then start to question the role of science in educating people at risk (Arif 2013). A number of scientists had attracted media attention as earthquake and tsunami experts. For several years afterwards, for example, Dr. Natawidjaja was very popular among communities including local government, lay people and schoolteachers in Padang, West Sumatera. Scientists began to intensively expose the public with articles, interviews and narratives on the future threat of tsunamis that could be equally as devastating as in Aceh and Nias. As a result, the media and communities became attracted to disaster science and tsunami scientists like never before. The catastrophe generated an unprecedented community response towards scientific rationales of disasters, years and decades after the science rationalization during Suharto's regime.

### ***17.2.2 Perspectives in Science Communication***

After discussing the backdrop of disasters in Indonesia, as well as a brief history of the science, it is important to ask the questions of 'what' and 'how'. What can scientific communities do to improve the quality of communities at risk and to be better prepared? If there were means and ways, how would it be possible to implement, taking into considerations the complex history of science and disasters in Indonesia? Science communication offers a remedy.

This section looks at several literature references to be utilized in understanding how science should and could be communicated to help reduce risks and save lives. Science communication emerged out of the need to increase public understanding of science. Throughout time, the approaches were canonical, as scientists produced their own knowledge and disseminated the findings to educate or even entertain the public, or moreover, socially legitimize the pursuits of science itself (Nielsen et al. 2007). Nielsen further explained, that the canonical model tended to fail due to its inability to adequately guide the relationship between scientists and the public.

Alternatively, a reflexive model of science communication encourages more public participation, with scientists more involved in public dialogue. The first type or model uses 'dissemination of scientific methods and results', while the later is

rather an exchange of knowledge and competencies with society, that allows public debate' (Nielsen et al. 2007).

### ***17.2.3 Reinventing Innovation and Science Communication***

The author qualitatively uses the concepts of innovation, assessed and reinvented by Cees Leeuwis (2004). Cees Leeuwis discussed the changing role of agricultural extension workers through innovations that is quite easy to mirror with the COMPRESS Program in LIPI through science communication. Both identified themselves as doing extension work. As problems and challenges arise, they require the need to extend services and communicate unconventionally.

Leeuwis utilizes the definition of extension workers as a professional activity, which is paid or rewarded by agencies external to the communities. Extension work is:

...a series of embedded communicative interventions that are meant, among others, to develop, and/or induce innovations which supposedly help to resolve (usually multi-actor) problematic situation. (Leeuwis, p. 27)

Hence, extension worker does not apply exclusively to agricultural issues, but can be applied to other contexts, including reducing risks to disasters. On the other hand, science communication itself is challenged to put a clear and concise definition due to the different perspectives used. Conventional or canonical perspectives may use science communication as a tool to raise awareness. Others might use it to propel science understanding, using approaches and methods that are process-based. Burns et al. (2003) defined science communication from a contemporary perspective, that is:

...the use of appropriate skills, media, activities, and dialogue to produce personal responses on awareness, enjoyment, interest, opinion and understanding of sciences. (Burns et al. 2003, p. 191)

In this definition, Burns allow a more dialectic relation, and do not limit the notion to scientist-public linear relations only. Burns also appreciates the fact that it is not easy to recognize and assess due to its long-term or personal nature. The contemporary definition of science communication fits best with the extension approach, in which the science communication worker seeks to aspire debate and dialogue, stimulate discussions and encourage participations.

In this chapter, the reinvention of extension will be briefly explained. Later, the COMPRESS Program will be explained using Leeuwis's perspective of extension as intervention, in which the author refers to science communication in the reflexive discussion following this section.

Methodologically, the challenges met by farmers in agricultural issues and communities at risk of tsunamis are similar. In this chapter it is particularly helpful to understand that science communication goes beyond the conventional corporate communication approach, or what Nielsen would refer as to canonical communica-

**Table 17.1** Alternative communication strategies

Issues	Science communications strategies
Dealing with collective issues	As a changing concept, extension workers would need to put greater emphasis on collective processes and understanding different perspectives. It also relates with diverging interests, conflicts and negotiations
Co-designing, rather than disseminating innovation	Understanding the issues addressed are socially complex, and that a tailor-made approach in designing innovation processes is instrumental
Managing complexity, conflict and unpredictability	Earlier, extension and development-oriented organizations looked at change and innovation as something that needed to be planned ahead, assuming that people and development in society can be steered. Nevertheless, the social dynamic do not always 'behave' in expected ways, thus challenging fixed objectives, activities and budget allocation. 'Unplannable' phenomena are similarly important. In managing complexities, the following might take a major role; such as accidental discoveries, coincidences, informal networking, creativity, enthusiasm and 'personal chemistry'
Becoming a learning organization	The survival of organizations depends on whether or not they can adapt to changing circumstances, thus becoming a learning organization. Learning from mistakes and problems shows how organizations allow space for critical thinking
Being brokers in an era of participation	Being dependent on donors and funding resources, workers often find themselves in a broker position: they need to prove that they can do a good job, while on the other hand communities have completely different priorities and expectations. The workers are also challenged with the 'participatory paradox', where communities are expected to be capable, knowledgeable and active, but on the other hand the assumptions of the intervention are based on the premise that 'communities can't do it for themselves, hence need interventions'
Changing professional identities	The role or identities used by the extension workers may shift towards different forms, including communication specialists or not even considering themselves as extension workers due to the change of professional identity and the organizational environment (extension workers can be public relation officers, process facilitators, organization development assistants, tied together with the common purpose to work with the deliberate use of communication to stimulate changes)

tion. As a literature reference, the following are several characteristics of extension works for the agrarian issue, which had conceptually evolved from a canonical approach towards a more complex approach, and will later be reflected in the case of 'extension workers' in communicating risks. The author deliberately picks several points below to illustrate the development and challenges in science communication for DRR (Table 17.1).

### ***17.2.4 Science Communication in Relations with Knowledge and Power***

If science communication were one of the paths to take to reduce risks, what challenges would lay ahead, considering the complex backdrop of science and disasters? What would make science communication efforts sustained or demolished? Anthony Giddens has refined Weber's definition of 'power', which previously had a negative association of capacity to reach one's will, despite having to oppose others. Giddens suggested that actors or agents also have the power and capacity to transform and get certain things accomplished, as they also have the power to dominate (Giddens 1976, in Leewis 2003). Agencies are heavily relying on certain circumstances to construct and make use of their power, both to transform and to dominate. The combination of constraining and enabling circumstances as well as properties are referred by Leewis as 'social structure'. Despite the long-standing debate on the concept of 'structure', this reference is helpful to analyze COMPRESS's role within LIPI, and COMPRESS's interactions with communities at risk from a social structure and agency perspective.

Access to knowledge and the availability of knowledge itself can enhance, or on the other hand limit, actors to construct or engage in a transformational process. In this sense, knowledge serves as source of agency. To conduct science communication, knowledge becomes the main ingredient of the interaction, therefore, access and availability of knowledge is instrumental. Similarly, for communities at risk, access to knowledge will empower communities to deal with uncertainty and risks.

Structural properties such as political stability, institutional functions, as well as material configurations (technology used, geo-physical layout, available infrastructures) are the constraining and enabling factors to allow knowledge to be applied as structure. Continued drawing on knowledge can result in relatively persistent structural properties, which enable (or otherwise constrain) human agency. Science and Technology Studies refer to structural properties as technological regime; a coherent set of technologies, rules and institutions in the context of which people are operating at a given time (Kemp et al., in Leewis 2003). In practice, both knowledge as agency and knowledge as structure are intertwining. The reciprocal relations can help explain the trajectory of COMPRESS in a given time (2005–2014) related to the work of science communication.

## **17.3 Method**

This study is done through literature review of materials related to development of science and science communication in Indonesia, along with the author's own professional experiences working on various science communication projects in LIPI.



## 17.4 Examining the Role of COMPRESS LIPI: Translating Science to the Public

The early official formation of LIPI by the Government of Indonesia was in 1956, under the name of the Indonesian Science Assembly (MIPI or *Majelis Ilmu Pengetahuan Indonesia*). MIPI was dismantled and changed into The Indonesian Institute of Sciences or LIPI (*Lembaga Ilmu Pengetahuan Indonesia*) in 1967. In its establishment, LIPI aimed to become a world-class scientific institution, with emphasis on the research, development and utilization of science to increase the country's competitive advantages. LIPI's missions cover scientific inventions to increase economic competitiveness, conservation and sustainable use of natural resources. It also aims to increase the quality of Indonesian human resources through scientific activities. Disaster sciences are extremely relevant to the vision and mission. Nevertheless, the vision and mission is not explicit enough to embed science and knowledge production on disaster risk reduction within the institution. In the contemporary era, i.e. the 1990s to today, the development of disaster science was beset with inconsistent investments, and relies quite heavily on external funding and support.

LIPI's disaster research is mainly concerned with natural hazards. Part of LIPI's earliest studies on geological dynamics and natural hazards, particularly tectonic plates, has been undertaken since 1963 when the research institution was still named after the National Institute for Geology and Mining. Studies on earth plate deformations and the Sumatera trench continued when the institution changed to become LIPI. In the early 1990s researchers focused specifically on natural hazards.

For example, for Dr. Danny Hilman Natawidjaja to intensively study the Sunda Megathrust, external support was required. Luckily, his study was supported by the California Institute of Technology. Communities in Saibi Samukop village in Mentawai benefitted from the presence of Dr. Natawidjaja's group of paleoseismologists and geology scientists in early 2000. The group was under the leadership of Professor Kerry Sieh (Caltech/California Technology University) who started their research on the Sumatran Subduction Megathrust in 1994 (Rafflesia 2015). In 2002, the group advanced the research by installing Global Positioning Systems (GPS) to continuously monitor the movement of the earth's crust beneath Mentawai, including installing an instrument in Saibi Samukop village. During the GPS installations, these scientists introduced modern knowledge on tsunamis and earthquakes (Rafflesia 2015). The team did not come to Mentawai only to conduct research on the Sunda Megathrust. Some preparedness messages were also conveyed on what to do during an earthquake or tsunami, through discussions and village meetings as well as poster dissemination. This was perhaps one of the earliest attempts of LIPI to translate science to communities at risk (Rafflesia 2015). Some tsunami disaster education activities in schools were also conducted by Professor Sieh and his team, although very limited. Posters were produced and disseminated to villages to convey the message of "Our Island is Sinking" (Rafflesia 2015). The message was chosen to illustrate the island's submerging phenomena and was suggested as an

indicator of potentially locked energy, that is released through strong earthquakes and possibly generates tsunamis in the region<sup>1</sup> (Raffiana 2015).

The Government's national priority program had not yet inserted disaster risk reduction perspectives, so the initiatives made by a small group of natural scientists relied quite heavily on external sources, in this case, from Caltech. The small effort of conducting the conventional or canonical model of science communication to communities at risk generated feedback from communities, who were mostly confused with the concept of a sinking island. The different language and perspectives of scientists and lay people created a contradictory message, moreover a resistance towards modern knowledge (Raffiana 2015).

Several years after the early initiatives of community preparedness in Mentawai by the LIPI-Caltech team, a group of researchers and marine education practitioners were also caught up with the romanticism, questioning how could a research institution such as LIPI provide aid to ease the devastation in Aceh and Nias? In a small office room in LIPI's COREMAP (Coral Reefs Rehabilitation and Management Program) office just a couple of days after the tsunami event, this team of people gathered to sort out a matrix of knowledge on coastal dynamics and tsunami disasters. The matrix was discussed and further developed into a teacher or facilitator's guide about tsunamis that volunteers could use in the affected area. It was filled with options of games and trauma healing activities, infused lessons on earth dynamics with religious guidance from Qur'an verses, and were carefully tailored for different ages. The book was quickly printed and LIPI held the first science communication training workshop for volunteers in January 2005 on how to use the book, collaborating with government, non-governmental organizations and commercially-sponsored non-profit organizations. Such altruism marked the fetal formation of COMPRESS (Community Preparedness) Program. This chapter continues with a discussion of the role of science communication facilitated by the COMPRESS program.

From 2005 to 2006, despite the devastating impacts of the tsunami disasters, this did not necessarily trigger immediate funding from the government of Indonesia for related institutions to directly invest in science communication for reducing risks. The following disaster events in 2006 in Pangandaran due to tsunamis, and in Jogjakarta for earthquakes, had increased the involvement of researchers and volunteers to follow up with science-based preparedness activities for teachers, children and communities. These preparedness activities were also combined with trauma healing approaches. Similar altruism in 2004, the 2006 earthquake in Yogyakarta and the tsunami in Pangandaran had predominantly motivated the movement initiated by LIPI. Informally, LIPI opened wide opportunities for university students to take part as volunteers in the science translation work. It was due to the hesitance to support university students with their 'charity box' approach at traffic red lights, because students indeed had much more intellectual capacities to offer.

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<sup>1</sup>Through an interview with Bambang Suwargadi, team member LIPI-Caltech/EOS who was engaged in the research as well as delivering socializations in earthquake and tsunami in Saibi Samukop from 2002.

LIPI's researchers (social scientists, geologists) and public education practitioners under the COREMAP program conducted a 1-week training in 2006, inviting volunteers from various universities by word-of-mouth. The training was not funded by LIPI and the researchers as well as practitioners had to provide the resources needed. Around 15 volunteers participated, some were still students and a few were recent graduates. These volunteers were trained and able to be involved actively in developing methods, tools and approaches for public education activities, with inputs from various disciplines related to disasters. The early approaches of science communication were still somewhat canonical. But the engagement of fresh graduates and university students allowed more interactive approaches and out-of-the-box creativities, as well as a more bottom-up approach. Afterwards, the LIPI team approached several research centers including Research Center for Oceanography, Research Center for Population and Research Center for Geotechnology to support in transporting the volunteers to Jogjakarta and Pangandaran, where children and communities were severely impacted by earthquakes and tsunamis. The program was called 'Children Science Support' (CSS). The LIPI team and the volunteers expanded networks with NGOs, INGOs and local government to enable the identification of communities, and also support for logistics including housing for the team in the affected areas (Fig. 17.1).

Within the first 2 years, the small team developed a particular program called COMPRESS LIPI or Community Preparedness Program. Supports were made through the Ministry of Research and Technology, UN agencies (UNESCO) and also other related NGOs such as the International Federation of the Red Cross that saw the benefit of collaborating with scientific institutions in developing preparedness inter-



**Fig. 17.1** The COMPRESS team

**Fig. 17.2** COMPRESS mascot with tag line: *Indonesia Rawan Bencana, Mari Kita Siaga*



ventions. Through UNESCO and with support from UNISDR, LIPI had the opportunity to develop the first national preparedness assessment framework that studied five critical parameters sensitive to an Indonesian context in increasing the level of preparedness. These include: Knowledge and Attitude, Policy Statement, Emergency Planning, Warning System and Resources Mobilization. Based on these critical parameters at schools, communities and local government, COMPRESS came up with methods to increase the level of preparedness through science communication and public education, with mascot and tag line of 'Indonesia Rawan Bencana, Mari Kita Siaga' (Indonesia is Prone to Disasters, Let's Be Prepared!) (Fig. 17.2).

Over the next 2 years, from 2007 to 2008, LIPI was allowed to develop comprehensive science-based preparedness activities with full funding from the Government of Indonesia. This was also in line with the establishment of the Decree Letter of the Coordinating Ministry of Social Welfare No. 23/KEP/MENKO/KESRA/IX/2006. The decree aimed at establishing the National Team for Indonesian Tsunami Warning System Development. Within this decree letter, LIPI is responsible for engaging in public awareness and preparedness, risk assessments and also to continue to conduct related research. With sufficient funding, COMPRESS LIPI were able to engage more than ten researchers from different disciplines and research centers, more than 25 volunteers from a variety of disciplinary backgrounds and have a presence in more than seven districts and cities prone to tsunamis. In addition, the team developed their skills in facilitating annual tsunami drills. The program produced preparedness knowledge quite productively through preparedness assessment software, guidebooks, comic books, animation, songs, flipcharts, posters, educational games, TV PSAs (public services advertisements) and numerous knowledge products.

It also developed methodologies and approaches for training students by students or peer groups (CSS or Children Science Support), motivational training for youth groups (TOM or Training for Motivators), and School-based Preparedness Models

(SSB or *Sekolah Siaga Bencana*), using the preparedness assessment tools. The SSB model was adapted by many education organizations working in DRR in Indonesia. It was also possible for LIPI to conduct preliminary studies on paleotsunamis, liquefactions for hazard assessment and social vulnerability assessments, as a foundation for each and every site or districts designated for public education interventions. The researchers returned with the preliminary results, and further engaged and worked more intensively with the COMPRESS personnel to discuss tailor-made activities based on the assessed level of preparedness, historical tsunami studies and related vulnerability profiles. Afterwards, education activities were designed specifically for all different districts. The public interventions comprised training for school children, teachers, and high school peer groups as motivators, community leaders and local government officials. Local government also requested for in-kind commitments and coordination for the so-called 'Full Menu' activities in the district. The intervention in each district can take up to 2 or even 3 weeks. In the final days of the intervention and training, preparedness 'tests' were conducted in the form of a full-blown integrated tsunami drill, with schools, communities and up to local authorities. Right after each drill, a 'hot-wash' debriefing and evaluation takes place. The entire drills were documented using video and photos. On the last day of the intervention, COMPRESS LIPI worked together with local NGOs, community leaders and artists/musicians to put up a "Local Community Preparedness Exhibition" in public areas. This medium allows more access for wider communities in the district who were not engaged with the education interventions and drills. Audiences were able to interact with scientists and public education practitioners, with the local NGOs, local government and other stakeholders in risk reduction efforts, including receiving basic skills on first aid and evacuation. The documentation of the drill a day before was also displayed in the exhibition event.

Communities can participate in various activities and self-evaluate themselves on their participation during the tsunami drill. The exhibition was packaged in a term popularized by COMPRESS, 'info-edu-tainment' on DRR, with a series of art performances including music, dance, drama and talent shows. Local media were always engaged in the overall processes. In such a comprehensive intervention in each district, at least 2000 community members, school children and local authorities are exposed to the preparedness activities, or 14,000 communities in total to count the least.

More are exposed through the National Exhibitions held annually, which from 2005 to 2008, comprised at least 3000–5000 communities, including school children. The National Exhibition on Disaster Preparedness was designed to present science in a more fun and entertaining way, through puppet shows, music, drama performances, traditional shows, dance and poetry. The concept was designed earlier in 2005 by *RuangRupa*, a contemporary arts organization well known as international curators for art exhibitions. The scale of the exhibition is larger than the local exhibitions in districts, and takes place at the city's landmarks. The entire exhibition is tied under several main topics, that allow a more merged and integrated presentation of more than 20 organizations outside LIPI, including government offices, NGOs, INGOs and the private sector. All organizations have equal publication space to reflect the importance of collaboration and networking, and that in

times of disasters; everyone is equal. Visitors were accommodated with 'Special Classes' that allowed closer interactions with scientists, first responders, disaster education practitioners, professionals and national musicians and artists. Consecutively, the exhibition was held in the National Museum in Jakarta (2005), Discovery Mall in Bali (2006), Taman Budaya or Cultural Park Padang (2007) and Taman Pintar or Smart Park Yogyakarta (2008). Such exhibitions required extremely strong collaboration and networking with as many organizations as possible.

Preparedness interventions by other organizations addressing the Sumatran Megathrust intensified from 2005 onwards. NGOs started to approach scientists as demand for training and education increased. Research and studies were now aimed at improving preparedness and policies on reducing risks (Sieh 2006; McCloskey et al. 2007). Geo-scientists suggest a 30 min lead-time for mainland Sumatera to anticipate the first tsunami wave after a strong earthquake. This 30 min window would be expected to allow sufficient time for evacuation. For Mentawai, there was no such time window or anything clearer than 'somewhat less for the off-shore islands'. Although COMPRESS LIPI were active in tsunami prone districts in Jawa and east Indonesia (West Papua, Ternate, Cilacap, Banten, Maumere), the main attention of national and international organizations conducting preparedness interventions was on saving Padang, as it is inhabited by more than two million people within the zone modeled to be inundated by tsunami waves. NGOs and local government in West Sumatera diligently followed scientific suggestions and produced as well as disseminated the approximate same message on what to do during an earthquake and noticing seawater receding afterwards. Scientists also consistently warned of the very high possibility of future tsunamis in Mentawai and West Sumatera (Sieh 2006; McCloskey et al. 2007, Puailiggoubat bulletin edition 263, 2013). Words such as frighteningly were favored to emphasize the anticipated rupture similar to that in 1797, and 'near future' to relate geological time and space with a social sense of time, space and urgency. Although, they also pointed out that: 'near future' does not necessarily mean in weeks or months but between tomorrow and the next 50 years, but not likely to be delayed much beyond that (See Sieh 2006). In this sense, as Douglas (1990) noted, risk had been deployed to induce fear through the legitimacy of science. Through such a science legacy, scientists' publications may be considered as effective in constructing tsunami risk perceptions. These publications can either be accessed directly by communities or forwarded/translated/reinterpreted by organizations and NGOs (Rafiana 2015).

The following earthquake and tsunami events in Nias and Bengkulu (2007) as well as the Padang (2009) earthquake, had accumulated communities' psychological tensions and at the same time attracted NGOs to intervene with preparedness skills and trainings. Surfaid, Mercicorp, ASB and Ready-UsAID were among the NGOs intervening in Mentawai, as scientific communities warned of the 'The Next Big Thing'. Interventions took place mainly with communities and schools, with several programs in disaster risk reduction and disaster management engaging the rather passively motivated local government. Intervention actors and agencies positioned themselves as outside of the community, although the 'participatory' approach was used to address the need for more bottom-up community engagements. Disaster risk

reduction activists have good confidence that ‘communities’ will participate, as it depends on the approach and methods used to communicate or engage ‘them’. There was hardly any resistance posed against preparedness interventions. Unfortunately, on October 25th 2010, a tsunami-earthquake occurred in the south islands of Mentawai, sending deadly waves through the slow-swaying ground shake, in less than 10 min. Some villagers who survived shared that they had followed the suggestions by NGOs (referred to scientists), to run only when the ground shaking is strong and difficult to stand up, and the water recedes. This event had proved otherwise and tragically, more than 500 people lost their lives (Yulianto et al. 2011a, b).

The 2009 Padang earthquake occurred shortly after the presidential election and appointment. When appointed, surprisingly, Disaster Management was not in the cabinet’s priority although in the first round of administration, although the cabinet had extremely challenging tasks to deal with the 2004 tsunami catastrophe (Aji et al. 2014). Due to the 2009 event a few months after the President took the office of administration, a particular phrase on ‘Disaster Management’ was attached to one of the national priorities, environmental management, and thus became Environmental and Disaster Management (Priority 9) of the Indonesian Mid Term Development Planning under the administration of the newly re-elected President, Susilo Bambang Yudhoyono. This priority program is supervised under BAPPENAS (*Badan Perencanaan Pembangunan Nasional*, or State Ministry for National Development Planning).

The funding for LIPI to continue its public education and science communication work was also discontinued in 2009–2010. It was not clear why, but the expiration of the Ministry’s decree letter and weak political drives may be one of the reasons for avoidance in extending the investment. At this time, many also were confident that the role of public education should be placed in a structural position within BNPB, which has the specific function of preparedness and mitigation, and that LIPI as a scientific institution is not an implementing agency to conduct preparedness activities on a continuous basis. COMPRESS LIPI therefore, had to survive without sufficient funding. The number of volunteers involved in 2009–2010 was cut down from more than 25 to 4 persons, but with secured monthly incentives to maintain several activities. The role of LIPI at the national level was sustained, as LIPI was engaged in the development of National Tsunami Risk Assessment Guideline, SSB Model (*Sekolah Siaga Bencana* or School-Based Preparedness) development in Aceh and Maumere with support from UNESCO, and other critical roles in DRR (Rafiliana 2011). Nevertheless, the inclusion of ‘Disaster Management’ in one of the National Priority Programs under BAPPENAS had allowed LIPI to secure funding from 2011 to 2013 and continue its preparedness activities.

Right after the Mentawai 25 October 2010 disaster, the President of the Republic of Indonesia called the leading agencies related to disasters to pay serious attention to developing communities’ capacities for self-evacuation. Flash appeals were made to strengthen role of the Armed Forces to collaborate with local government and communities. LIPI was positioned to play an active role in facilitating this appeal. Two years afterwards, or shortly after the Indonesian Tsunami Warning System was inaugurated (2011), another event occurred that trigger the warning. On April 11, 2012 an outer-rise earthquake event over 8.5 in magnitude occurred that was tsunamigenic. Again, the President of the Republic of Indonesia called for a funding

appeal, named the Tsunami Master Plan, on top of the routine budget for disaster management. By that time, the Ministry’s decree letter that bounded different ministries and agencies to collaborate and strengthen the Indonesian Tsunami Warning System had already expired. The leading institutions for the Indonesian Tsunami Warning System were left to BNPB (*Badan Nasional Penanggulangan Bencana*, or National Disaster Management Agency) and BMKG (*Badan Meteorologi, Klimatologi dan Geofisika*, or the Meteorology, Climatology and Geophysics Agency), and lacked a clear regulatory basis for other agencies to support and dedicate co-funding to sustain capacities for tsunami risk reduction.

During the times when there was no financial support for COMPRESS LIPI from the national budget, collaborations continued, for example, with UNESCO and the Australian Indonesian Facility for Disaster Risk Reduction (AIFDR)-AusAID. Through UNESCO’s support LIPI conducted an experimental approach of school-based preparedness in Maumere, Flores and Aceh. Moreover, UNESCO and LIPI collaborated with Syiah Kuala University in Aceh through the Tsunami and Disaster Mitigation Research Center (TDMRC) and developed capacity building training for university students and volunteers, that later formed the Aceh unit of COMPRESS, named as TDMRC-KOMPAS. UNESCO also engaged LIPI as the focal institution with which to develop disaster education materials for adaptation at the regional level, collaboratively with the Philippines, Thailand and Timor Leste. Many of COMPRESS’s education products were adapted to Timor Leste, Thailand and Philippines language and contexts, such as the Children Science Support Flip Chart, School-based Preparedness Guidebook (Fig. 17.3), etc.



Fig. 17.3 National media guidebook for tsunami warning dissemination



With AIFDR support, LIPI conducted an assessment in Mentawai to observe the effectiveness of preparedness intervention in saving lives. As mentioned in the previous section, communities and scientists were caught by surprise by the slow-swaying earthquake and loss of lives due to adhering to preparedness messages intended for the Indian Ocean tsunami in 2004. The study allowed greater understanding of the different reactions of communities exposed to tsunamis in 2010, and how interventions pre-disaster succeeded in saving lives, or on the other hand, resulted in more loss of life due to misleading educational messages. AIFDR continued its support to conduct a more comprehensive intervention in Mentawai based on the above study, and for LIPI to work more on risk communication. The funding schemes allowed LIPI to have wider space for 'experimental processes' in rethinking interventions. It was possible for LIPI to have a preliminary design such as developing a warning chain mechanism and evacuation planning, based on the study in 2010, and later revamp the design when there were more social political dynamics occurring at the local level, including the risk assessment developed by the local government of Mentawai together with BIG (*Badan Informasi Geospasial*, or Geospatial Information Agency) in 2011, and later, more detailed data and hazard information provided by PVMBG/AIFDR-BNPB. LIPI changed the strategy from intervening local government with technical interventions, and instead took the time to work together intensively with line agencies at the district level, utilizing critical thinking approaches and analyzing avenues of programs and budgets that can be sensitized towards DRR, even without being explicit with the purpose. For example, the Tourism Agency can allocate programs to regulate stronger building structures for resorts and also encourage evacuation planning together with communities. In addition, the Agency for Local Development Planning can exercise their role in sensitizing DRR into other agencies' annual and 5 year planning at the local level. Afterwards, the experimental work was brought to a national workshop hosted by BAPPENAS at the end of 2011. The flexibility allowed more creativity and enthusiasm, since LIPI was not constrained by tangible deliverables and also could continue its activities across consecutive years with no administrative constraints. Such flexibility had inspired LIPI to evolve its role, and to develop a science communication laboratory, where experiments, passion for learning and applied research could directly link with policy improvements in reducing disaster risks. Through this process, and particularly under the leadership of Eko Yulianto, a paleo-tsunami expert from LIPI, COMPRESS LIPI were looking way ahead in working more creatively towards improving or sensitizing DRR into development planning where budget constraints were flagged as the main issue. This would need a stronger role of research institutions and universities to work on this playing field and provide innovations and creativity for other agencies to invest creatively in DRR in developing countries such as Indonesia.

## **17.5 Discussion: The COMPRESS LIPI Program as an Experimental Work in Science Communication**

Based on the background of COMPRESS provided earlier in the chapter, the author will now discuss how the program mirrors the approach explained by Leeuwis (1999). The program departed from the canonical perspective and later shifted to a more reflexive approach. The program will be explained through many aspects of science extensions, the unique characteristics that often did not match well with the structure and bureaucracy in LIPI as a research institution or government system in general.

There was a gradual shift from ‘popularizations’ and ‘public understanding of science’, towards ‘dialogue’, ‘engagements’, and ‘participation’, that was part of the reflective processes and critical thinking methods. COMPRESS itself was not built with a crystal clear vision from the very beginning of its establishment, rather, it evolved through experimental processes. It was due to pressing circumstances and funding constraints that COMPRESS gradually shifted towards more critical reflections in its intervention. COMPRESS was an answer for the insufficient communication, in which technical sciences and knowledge failed to provide for communities at tsunami risk. The COMPRESS program was initiated and strongly propelled by altruism and was initiated after the devastating yet severely dramatized Indian Ocean event, as well as the proceeding events of the Pangandaran tsunami and Jogjakarta earthquake.

### ***17.5.1 Dealing with Collective Issues***

During the early establishment of COMPRESS after the 2004 tsunami, the program was less complex. Approaches chosen were commonly teacher training, in forms of lecturing, questions and answers. This was done during the first teachers’ training in Banda Aceh, in April 2005, and was more or less canonical. The interactions of various disciplines had taken the initiative to a different level. Geoscientists were particularly concerned with the physical matters and phenomena, while social scientists were interested in understanding society’s interests and welfare. Both were united by a common aim, however, of reducing the loss of lives. In these times, collective issues mattered quite significantly. Conflicts arose due to different perspectives in understanding disasters, but conflict resolutions were valued more. Interventions become more complex when COMPRESS dealt with significant funding in 2007–2008, as the understanding of the organization’s dynamic was even more valued. Every year, usually in January, COMPRESS organized capacity building events for internal workers/volunteers and scientists. Such events were used to build a common perspective, strengthen team building and plan ahead for the upcoming activities, both programs and budgeting. This way, different agencies and actors within COMPRESS could understand other’s perspectives and interests.

Externally, when dealing with local government and communities, the program allocated half to 1 day at the very beginning of the intervention to discuss the cross-cutting interests of local stakeholders. This process is called 'external synchronization', and allows stakeholders to access information related to the program planning, and even the amount of resources LIPI was allocated for the intervention. Such synchronizations are important to build rapport and trust, and also overcome deficiencies by having contributions from local stakeholders as well. Contributions could be in form of transportations, joint secretariat or temporary offices, snacks and meals, and so on. Therefore, LIPI did not necessarily intervene as a dominant player or actor, because the in-kind contributions made by different agencies at each district allowed more equal share and ownership towards the program. Later on, when implementing trainings, workshops, drills, exhibitions and media exposures, everyone had their small share and roles. With no line agencies at the local level, LIPI has very few managerial options when intervening, and the best way to implement interventions was to collaborate closely with as many stakeholders as possible.

In a wider sense, COMPRESS realized that the preparedness exposures are limitless. It should attract children, students, teenagers, professional workers, the armed forces, villagers, government officials, and private sectors, as well as the general public. The targeted audience varied immensely. Hence, the use of language, icons/mascots, songs, games, simulations, role plays, tactical drills, three dimensional learning devices, books, newsletters and other creative approaches were imperative. COMPRESS was prepared to tailor different methods and approaches, with wide spaces for new ideas. COMPRESS also allowed reflection on the failures and defects, including negative feedback and responses from the users of COMPRESS educational tools if any, for further improvements and as part of a continuous learning process.

### ***17.5.2 Co-designing, Rather Than Disseminating Innovation***

The external synchronization as mentioned previously, to certain extent, allowed local stakeholders to co-design the 'full menu' interventions in districts, similar to the design and execution of national exhibitions, where volunteers (high school and university students, NGOs, local leaders) from the respective city were quite strongly engaged. The national exhibition in many ways allowed a co-designing process, which other events tend to avoid, such as deciding the theme of the exhibition, the flow and topics, strategies to engage as wide an audience as possible, etc. Co-designing also created potential conflicts and compromised planning or pre-defined interventions. COMPRESS was aware of it, and decided to go on with such an approach. As a result there were fewer individual perspectives dominating the intervention processes. Changes occurred, in some cases even quite drastically, as the approach became relatively accommodative towards local actors or agencies. For example, the volunteers in Bali consisted of university students, local leaders

and artists. These were strong characters and figures and given the pre-planned exhibition design, there were resistances that affected the organization of the exhibition. To overcome the conflict, volunteers from Bali were appointed and partnered with volunteers from COMPRESS as coordinators and co-coordinators of the exhibit corners, security managers, stage managers and performances. They had to find ways to collaborate and execute their ideas logistically, thus, strong communication skills and teamwork were practiced and became skills that were developed by all volunteers engaged in the exhibition. There were, however, risks of failure due to being accommodative with the design and implementation, but all of the National Exhibitions in four cities were highly successful. Moreover, the network maintained its strong friendships.

### ***17.5.3 Managing Complexity, Conflict and Unpredictability***

The growing ability to manage complexity, conflicts and unpredictability matured with time, particularly from 2009 onwards. In times where funding from the government of Indonesia diminished, complexities and unpredictability increased. Activities were developed with support from other organizations, ministries or UN organizations such as UNESCO, but it became difficult to plan ahead when financial issues were not resolved. Earlier, COMPRESS was able to conduct capacity building activities and plan-ahead workshops. The program was also able to execute the so-called 'full menu' for approximately 20 days in one district, for approximately seven districts, involving tens of scientists and volunteers. Later, such full-blown interventions were no longer possible.

Most of the volunteers resigned and went on to find better careers with more promising returns, resulting in a huge loss of workers. For COMPRESS, this had turned into the 'unplanned phenomena'. The program then demanded more creativity, and also budget cuts for sustaining the COMPRESS secretariat. Activities were focused on improving preparedness in more strategic manner. Science communication was discussed more seriously, and more references were taken on board to study this emerging field, as during times of sufficient funding and little time for reflection, such study was not possible.

Catastrophic events continued to occur. The Padang earthquake caused severe damages in September 2009 with more than 2000 deaths. In the following year, the Mentawai 2010 tsunami resulted in severe destructions as well as more than 500 deaths. COMPRESS LIPI took the opportunity from the catastrophe to study in depth the effectiveness of interventions in Mentawai, and secured funding from the Australian-Indonesian Facility for Disaster Reduction (AIFDR). The study paid critical attention to the construction of scientific knowledge taken from the 2004 tsunami event, which in turn might become the 'killer' of The Mentawai people. The 30 min lead time was impractical for the geological context of Mentawai and the scientists had never familiarized communities with the so-called 'tsunami earthquake'. More than before, the new knowledge and critical reflections ignited more

curiosity and passion within the remaining COMPRESS workers. Nature, and also the communities, proved to be 'unexpected', and this is an important premise when communicating science. A stronger understanding of the communities and also the physical matters became increasingly important. The support from AIFDR luckily allowed such changes in implementing the proposal from COMPRESS. COMPRESS on the other hand, had the luxury of experimenting with new ideas for Mentawai with sufficient support and funding. The diminishing support and funding from the national budget did not affect COMPRESS at any significant level, as the workers managed to passionately sustain their activities from external resources.

As Leewis (1999) recognized, it is common that structural adjustment policies, economic crises, or being unable to convince a donor/government of the value of the work resulted in the need for cost recovery strategies, and cooperation with different organizations. The structural adjustments within LIPI may have been the disabling factor or circumstances to continue the science communication work, but the trust and support from international organizations and/or donors was maintained, allowing COMPRESS to keep moving on from 2009 to 2011. On the other hand, such circumstances had matured COMPRESS, and forced a maneuver from communicating science, towards more critical approach of science in reducing risks. At this point, the circumstances had forced COMPRESS LIPI to figure out an important paradigm of DRR in its interventions: mainstreaming disaster risk reduction into development planning that goes in line with budget constraint circumstances. The challenges facing LIPI were similar to challenges faced by other agencies involved in disaster risk reduction and brought perspectives that creativity can overcome financial and organizational constraints in reducing risks, and that embedded programs should be valued since a stand-alone approach in disaster funding will not suffice. Such perspectives were almost absent, as BNPB was perceived by important stakeholders (including the House of Representatives/DPR RI) as the sole organization responsible in times of disasters (Aji et al. 2014).

#### ***17.5.4 Becoming a Learning Organization***

Evaluation and documentation are two key parts of COMPRESS's activities towards becoming a learning organization. It was part of COMPRESS's tradition to conduct 'hot wash' debriefs or evaluations for every activity, as well as a more complex evaluation at the end of the year. Rapid or instant debriefs allow a fresher reflection of processes, methodologies and outputs. End-year evaluations allow, on the other hand, allow more reflective and in-depth evaluation of the entire intervention, which helps in figuring out what to design and what to avoid in the consecutive years. Topics discussed during the end-year evaluation were work performances, coordination performances and substantial issues related to preparedness interventions. Volunteers shared their plans on whether or not they would continue working for COMPRESS in the coming year.

Documentation in the form of books, lessons learnt and photo or video compilations were part of the tradition. Interventions in Mentawai, Maumere and Aceh were captured in a testimonial book that helped others to understand the planning and implementation of science communication and interventions, often inserted with ‘behind-the-scene’ information. The more COMPRESS matured, the more self-critical the narratives in the documents became, which facilitated a continuously growing and learning organization. Some of the books were discussed through workshops, usually with the support of the Indonesian Disaster Education Consortium. The Consortium, comprising more than 40 organization members working on disaster education, had always appreciated lessons collected and shared by COMPRESS. Moreover, many lessons were adapted for further disaster education interventions by these different organizations. To maintain its visibility and network, COMPRESS LIPI was also actively engaged in the Consortium, and acted as one of the presidium for one term (2009–2012).

Many also understood COMPRESS as a ‘school’ for learning. Learning approaches influenced the ways issues were being discussed, how programs developed, activities were planned, evaluations conducted, and how popular disaster risk reduction sciences were written up in various forms of publications. This became one of the strongest values of COMPRESS and it demanded its program to take time and discuss the topics and programs, whether through workshop processes or discussions with invited experts, including LIPI’s researchers. Other disaster education practitioners outside LIPI often attended the discussions. At the end of 2011, COMPRESS developed its attempt to formalize the ‘school’ mechanisms and approach, through development of a Lecture Series on Science Communication, including its syllabi of learning and identified lecturers and experts from Indonesia and around the world. The lecture series were conducted several times in 2012, with resource persons from Nanyang Technological University, Australian National University (Center for Public Awareness of Science), and many others. LIPI invited participants from LIPI’s public relations officials, and also organizations such as BMKG and PVMBG.

### ***17.5.5 Being Brokers in an Era of Participation***

COMPRESS grew dependent on funding sources, and in times of nil funding from LIPI, COMPRESS needed to understand how to accommodate the expectations of other funding sources whilst supporting proposals for preparedness activities. On some occasions, the demand for LIPI COMPRESS’s support came from other agencies, for example BMKG, UNESCO or local and international NGOs, to intervene in particular communities with disaster preparedness activities, including introducing risk communication. Such services were quite exceptional, not many organizations can provide science-based preparedness intervention services. Overall, the collaboration with different agencies and donors was encouraging, not putting COMPRESS too much as a ‘broker’, since these organizations did not significantly

demand particular expectations that needed to compromise the intervention planning and process. On the contrary, COMPRESS was trusted to expand their experiences, even through experimental approaches. To a certain degree, such an approach and on-site modifications of activities was necessary, but influenced the resource allocation as well. With strong communication and diligent coordination, such modifications were allowed, without too much compromise. An example of accommodating changes for experimental purposes is given by AIFDR through the intervention in Mentawai as explained earlier in this chapter. The vague role of a 'broker' helps significantly in accommodating participatory and process-based approaches. The intervention in Mentawai underwent a swift change, from delivering technical assistance on evacuation planning and warning dissemination, to technical assistance in mainstreaming disaster risk reduction into development programs and annual activity plans for almost all related agencies at district level, due to several reasons. One of the reasons for this change was that the COMPRESS team realized it would not be worth investing in technical assistance, when local government were kept dependent to external supports and funds, so much as COMPRESS were situated as well. The local government would need to rethink its strategy to ensure DRR initiatives were sustained and resources secured. The intervention took the same period of time as planned earlier, 2 weeks. Normally, for DRR mainstreaming workshops, it would not need be that long, but the COMPRESS team decided to go into rigorous discussion, assistance and analysis on the current government's midterm and annual plan, and derive creative ideas on how to sensitize DRR into each agencies' prioritized programs. The agencies included the Agency for Women Empowerment and Child Protection, Agency for Marine Affairs and Fisheries, Agency for Local Development Planning, Agency for Social Welfare, and several others. Although limited, each had funding allocations to improve the quality of the society in Mentawai. At the end of the intervention, all related agencies participating in the technical assistances came up with detailed programs that could already be sensitized with DRR through each respective activity in the coming year. As part of the COMPRESS tradition, the entire technical assistance process was documented in a detailed and informative report/book. Compromising the 'broker role' by funding sources had contributed to the encouragement of participation approach.

### ***17.5.6 Changing Professional Identities***

Eko Yulianto, one of the former coordinators of COMPRESS suggested that science communication works best through boundary-crossing actions, which goes beyond mono-disciplinary, mono-institution and practical/tangible deliveries. In practice, COMPRESS developed strong informal relationships with institutions and organizations related to disaster risk reduction, including with media persons and also artists and musicians, public relation officers and process facilitators. Identities such as researchers and public relation officers had blended into science communication

professionals to allow a deliberate use of communication for stimulating changes. Not only that, such boundary-crossing roles became significantly important to communicate and promote COMPRESS to potential funding sources, particularly when the program struggled to survive and needed support to sustain its initiatives.

In 2014, COMPRESS LIPI managed to conduct a reflective workshop on its role in DRR for nearly a decade. Several organizations and agencies were invited to share their review on the role of LIPI in communicating science. Jonathan A. Lassa was invited to provide his impression about COMPRESS in this reflective workshop and his brief writing was quite intriguing. Lassa had an adequate understanding about COMPRESS, and was invited several times to LIPI's COMPRESS activities, particularly to help construct critical debates on interdisciplinary interactions and science communication, as well as role of science in disaster risk reduction, which allowed him to observe COMPRESS from outside. Lassa's observation took the case of 2004 as the starting point of individual determinations to contribute to social transformations in Indonesia. The task was not easy. Lassa referred to how Indonesia's oldest research institution had traditionally divided science communicators and researchers as knowledge producers, both walked their own separate paths. By reading COMPRESS's latest publications, and also observing interventions in many areas of tsunami risk, COMPRESS had proven how transdisciplinary research could in fact become the solution for LIPI to solve the tensions between the demand to produce knowledge on the one hand, and on the other to take responsibility for encouraging social changes (Lassa 2014). Surprisingly, Lassa's observation of LIPI's intervention in Sikka, Maumere (East Nusa Tenggara) combined research and community drilling at almost the same time. The research models had gathered a complex interaction among different stakeholders, interdisciplinary collaboration, yet at the same time sparked transformative processes. Again, traditionally, lay people including scientists are traditionally unaware of the importance of such innovation. COMPRESS, with its unconventional approach, had given examples of how science communication can be utilized to communicate risks, as part of increasing social opportunities of the perceived risks. It will then be demanded, that COMPRESS elevate its role into a more steady structure, and more theoretically aware of interdisciplinary interactions and science communication. Such theory building needs to be more articulate, when entering global academic debates on disaster risk reduction, and championing transdisciplinarity in disaster preparedness, based on its exponential experiences in many areas and cases in Indonesia.

Yet, as much as COMPRESS would wish to have more theoretical roots in its maturing operation, the social structures were not so prepared. Eight to nine 9 years of experiences would naturally drive the need to sustain and enhance capacities. COMPRESS learnt through discussions with experts such as Jonathan Lassa (Nanyang Technological University), and Will Grant (Australian National University, Center for Public Awareness on Science), on how academically advanced science communication is today in developed countries. A particular approach was made in 2012 to top Indonesian universities to collaborate and develop higher education programs in science communication. The responses were not promising. Most of the communication programs offered in Indonesian universities are domi-



nantly for commerce purposes. There was skepticism on the demand and a clear career path for science communication workers in Indonesia. Or even worse, there was lack of understanding about the role of science communication, not to mention the importance of extending science to improve the quality of life. On the other hand, in most forums and discussions in LIPI where science is questioned for its effort to reach out to public, most scientists perceive that extending science is not a scientist's job.

The ability of science to influence policy and improve human quality of life and security lies in the ability to extend scientific knowledge with a deep understanding of the complex fabric of society, paired with a strong entanglement of lay-people's knowledge and perspectives, experiences and interests. Both sources of knowledge would require a reciprocal relationship. COMPRESS has yet to reach this point. To nurture such a reciprocal relationship, one needs to seriously invest and maintain capacities for science communication. Under current circumstances in LIPI or Indonesia in general, such awareness is severely lacking. Given the experiences from the role of science in disaster risk reduction alone, it is clear that science is not a powerful driver for directing policies towards risk reduction and national development. This somewhat reminded the author on the trajectory of science in Indonesia, and how Dakhidae and Goss stated earlier in this chapter, that the development of science is heavily entangled with politics. Science depends heavily on government funding, hence lost its independence and also demands from civil society for a stronger role for sciences. It would be immensely challenging to build a strong and steady capacity for science communication. It would be even more challenging to shift the role of science to becoming the driver of policies and social transformation. The easiest ways to implement scientific aims were to be what Goss termed 'government's floracrat', or in this case, disastrocrats.

### ***17.5.7 Altruism by Chance of Disasters: Not Enough?***

From an agency point of view, altruism is seen as a strong driver of the formation of COMPRESS, ignited with passion and curiosity. This was possible due to the involvement of young science communication workers or volunteers. The access to, and the availability of scientific knowledge, had fueled the organizations' deliverables, with very few 'competitors', and positively opened even more knowledge access to communities at risk. At the time, the volunteers involved were experiencing an increased capacity in communicating science from many different angles, be it for formal and informal education approaches, graphic designing, media documentation, game and material development, networking, advocacy skills, presentation and moderation skills, and many more. All are interconnected in its implementation. It became difficult to acknowledge the role of the 'volunteers' with humble wages, as their capacity gradually increased throughout time and first-hand experience of science communication and disaster preparedness. Opportunities grew outside COMPRESS, and the inability of LIPI to respond to such issues had

**Fig. 17.4** Significant events and the available funding sources

<b>Significant Events</b>		<b>Funding Sources</b>
2004	Indian Ocean tsunami	IFRC/PMI AUSAID
2006	Jogjakarta earthquake	UNESCO
	Pangandaran tsunami	RISTEK
2007	Bengkulu earthquake	APBN LIPI
2009	Padang earthquake	UNESCO
		RISTEK
2010	Mentawai tsunami	UNESCO
2011	Great East Japan tsunami	AIFDR/AUSAID
2012	Sumatera Outer-rise earthquake	APBN LIPI PN 9

opened options for the ‘volunteers’ to find more promising careers. It also became even more challenging to recruit new practitioners, as LIPI was faced with budget constraints and inefficiencies (Fig. 17.4).

From a structural point of view, the political agenda and settings had significant influence in the sustainability of COMPRESS. The birth of COMPRESS was not carefully and systematically designed by LIPI as an institution to understand the communities of whom science interacts with. Rather, COMPRESS was born by a strong sense of altruism and unprecedented initiative, rolled like a snowball during a certain time and space. Looking back to year 2004, the first general election was successfully held, marking the maturing state of Indonesia in its democracy. Very shortly after the new administration was appointed, the catastrophic Indian Ocean tsunami occurred. 2009 marked the second administration of Soesilo Bambang Yudhoyono as Indonesian President, the administration of whom had repeatedly left disaster risk reduction outside of its 11 (eleven) prioritized actions in the 5 years of Indonesian development planning. It was sufficient to conclude that the role of science in policy making, including ensuring DRR was embedded in development planning, was not quite strong, although the role of science in DRR had been under the spotlight after the 2004 Indian Ocean tsunami. Shortly after re-election in 2009, a major earthquake occurred in Padang, West Sumatera. Only after the major shock and damage did the government of Indonesia through BAPPENAS (National Development Planning Agency) insert ‘disaster management’ into its priority (Aji

et al. 2014). Despite the rough and unprecedented path of ensuring DRR in development plans, it had succeeded in forcing agencies including LIPI to translate the plans into budget and actions and sustain its DRR related studies and science communication activities, at least until 2013.

In 2014, the administrations changed in relation to the newly appointed President of the Republic of Indonesia, Joko Widodo, and his development priorities, which is named after *Nawa Cita* (Nine Goals). Disaster risk reduction was again not explicitly mentioned in any of the goals, thus inadequately arming scientific institutions such as LIPI to continue prioritizing disasters, particularly science communication, as the instrumental work that related significantly to development issues and investments. The prioritized actions of Joko Widodo's administration directed LIPI's priorities into seven main issues; (1) Biodiversity, Environment and Maritime, (2) Food Security, Agriculture and Husbandry, (3) Health and Pharmaceuticals, (4). Advanced Materials, (5) Energy and Transportation, (6) Technology, Information and Communication as well as Defense and Security, and (7) Social Dynamics, Humanity and Culture Innovation of Technology and Science Application. Besides from the major changes in the prioritized actions of the national development, there were major shifts in the tasks of the agents/structures involved in COMPRESS and there were insufficient efforts to improvise its goals adapting to the new development priorities. Although being internally advocated, that a solid structural framework that connects with LIPI's tradition and bureaucracy is needed to sustain such initiative, nothing has been done at the policy level within LIPI.

In such structural settings, it was quite difficult to justify the existence of COMPRESS in challenging phases where disaster risk reduction was not an explicit priority. Altruism or volunteerisms were reproduced as part of a social-cultural ingredient that formed COMPRESS. Yet, it does not necessarily mean that the altruism could propel its own unique power to overrule bureaucracy, as it requires continuous and systemic development of capacities in science communication. On the other hand, it seems true that science, including science communication, was not as solid as it potentially should be in driving the demands of policies, including ensuring disaster risk reduction is sustained in policies at different levels. The collective capacities and vast network, which LIPI had developed through its science communication interventions, would need more than altruism to sustain and contribute significantly to disaster risk reduction. Bureaucracy and structural issues such as internal policies, changes of agents/actors and the lack of national guidance and priorities impedes COMPRESS to sustain itself. The reciprocity of the agent and structure relationship issues within and surrounding COMPRESS LIPI was too challenging for the organization to sustain. At the end, in 2014 COMPRESS was unofficially dismissed.

Altruism was encapsulated in the culture of COMPRESS, maintained and embedded as workers were acknowledged as 'volunteers'. Paradoxically, demands for a better appreciation for these workers also grew, in line with the growing practical capacities in the field of science communication. Some 'volunteers' had the deliberation to choose other promising organizations for immediate future careers. It was evident that altruism, growing demands on professionalism and government bureaucracy, had faced difficult and challenging junctures. Nevertheless,

COMPRESS's thesis was proven to be true, that extending science to the public requires strong inter/trans disciplinary capacities, and needs to go beyond institutional boundaries. The more 'stand-alone' policies implied by the National Disaster Management Agency, the less science takes a role in DRR policies, the more difficult it would be for institutions such as LIPI to contribute in extending science to public.

COMPRESS succeeded in proving that a more dialogue-based approach, or participatory approach, is more favorable with much longer lasting impressions towards cognitive and behavioral change in reducing risks. Such an approach would need flexibilities in its management and funding, thus is extremely difficult if using the conventional government funding mechanism and deliverables. Such an approach is full of risks, uncertainties, tied with complexities and unpredictability, most of which conventional bureaucracy cannot afford. The demands for COMPRESS to continue their work resonate in many different organizations, such as BPPT, BMKG, BNPB and also non-government organizations such as UNESCO, YITBI, Plan International, and many others. Local governments that maintained informal communication until now among others were from Majene district, Mentawai district, Bantul district, and several others.

## 17.6 Conclusion

In practice, rather than treating science communication as a hyper-discipline in its short history or emergence, alternatively, science communication offers ample possibilities to bridge trans-disciplinary interactions. Workers in science communication therefore need to understand and master skills as 'boundary-crossers'.

Inter-disciplinary interactions, and role of being a 'boundary crosser' is challenging in an Indonesia context, since the bureaucracy of science influences the (in)-flexibility of such interactions. For example, scientists and officials' performance appraisal should put its attention on delivering high quality papers and international publications. On the other hand, public relations officers conventionally put more attention into corporate image building of the institutions.

Social sciences can contribute significantly towards the understanding and implementation of science communication strategies. It can explain why certain approaches fail or succeed, based on a complex understanding of the cultural, political, social and economic fabric of society. Moreover, it helps to understand the epistemic cultures of, and to 'read', the society of which a mutual dialogue on science and disaster risk reduction can be made. Science communication, at least for the time being, seems to persist in a non-economic value, that is not attracting money from those who are able to support with funds. It is unfortunate that currently universities hesitate to develop science communication programs, as science is not economically promising, not to mention science communication as a profession.

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**Part III**  
**Emerging Issues in DRR Research and**  
**Practice**

# Chapter 18

## Ecosystem-Based Disaster Risk Reduction in Indonesia: Unfolding Challenges and Opportunities

Annisa Triyanti, Yvonne Walz, Muhammad Aris Marfai, Fabrice Renaud, and Riyanti Djalante

**Abstract** The role of ecosystems has been recently acknowledged within the current global framework for environmental management, disaster risk reduction, climate change adaptation and also sustainable development. The approach of ecosystem-based disaster risk reduction (Eco-DRR) is promoted as a compatible with community inclusiveness and participation, as well as cost efficient, socially friendly and sustainable.

Notwithstanding its acknowledged strengths, Eco-DRR approaches face many challenges, including skepticism of its effectiveness towards different types and magnitudes of hazards and the complexity to govern such effort. In Indonesia, DRR approaches are strongly influenced by the spirit of community participation, especially after the 2004 tsunami in Aceh and the 2009 earthquake in Padang. We argue that the learning process is important to integrate structural and non-structural measures by incorporating community involvement in Indonesia, and that Eco-DRR

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should be promoted, particularly to identify possible opportunities to preserve ecosystems and reduce disaster risk.

The aims of this chapter are to explore the general concept of Eco-DRR, to review examples of Eco-DRR projects and to unfold the challenges and opportunities for Eco-DRR projects in Indonesia. Data is gathered through semi-structured literature reviews and content analysis of existing research related to Eco-DRR projects in Indonesia. Demak, a coastal area in Central Java Province and the Kuwaru coastal area in Yogyakarta Special Province are selected as case studies. The outcome of this chapter is a reflection on challenges and opportunities for further advancement of Eco-DRR to achieve disaster resilient and sustainable communities in Indonesia.

**Keywords** Ecosystem • Eco-DRR • Challenges • Opportunities • Indonesia

## 18.1 Introduction

Ecosystem-based disaster risk reduction (Eco-DRR) has been recognized globally as a sustainable approach to simultaneously reducing disaster risk and improving people's livelihoods and wellbeing (Sudmeier-Rieux et al. 2006; Sudmeier-Rieux and Ash 2009; Uy and Shaw 2012; Renaud et al. 2013a). There is growing evidence to support the significant role of various types of ecosystems in reducing disaster risk and providing natural barriers against disasters (Kathiresan and Rajendran 2005; Nel et al. 2014; Spalding et al. 2014a, b). Furthermore, ecosystem-based approaches have also been acknowledged in several important post 2015 development agendas, including the newly adopted Sendai Framework on Disaster Risk Reduction (UNISDR 2015), the Paris Agreement on Climate Change (COP21) (UNFCCC 2015) and the Sustainable Development Goals (SDGs) (UN 2015).

Rising frequencies of disaster events is a global phenomenon and one that continuously causes loss of human lives, livelihoods and capital. The Emergency Events Database (EM-DAT) from the Centre for Research on the Epidemiology of Disasters (CRED) and the United Nations International Strategy for Disaster Reduction (UNISDR) report on "The human cost of weather-related disasters 1995–2015" (CRED and UNISDR 2016) stated that there was an average of 335 weather-related disasters per year between 2005 and 2014. This represents an increase of 14% from 1995 to 2004 and almost twice the frequency of weather-related disasters recorded during 1985–1994. The figure of disaster loss, including earthquakes and tsunamis, is between US\$250 billion and US\$300 billion annually.

No disaster can any longer be considered natural. In the era of the Anthropocene, human activities have attributed to exacerbate exposure to natural hazards, vulnerability, and risk (Quarantelli 2005; Wisner et al. 2012; Blaikie et al. 2014). Levels of exposure increase with population growth, migration and the development

of productive assets and infrastructure (Marfai and Hizbaron 2011; Sakijege et al. 2014; Marfai et al. 2015). Vulnerability is mainly linked to global environmental change and the dynamics and complexity of socio-ecologic and socio-economic conditions of people and communities. Exposure and vulnerability are both influenced by poor land-use planning, poverty, urbanization and ecosystem degradation (IPCC 2012; Munang et al. 2013).

Our analysis of three existing international frameworks identified the lack of emphasis on the use of ecosystem value to reduce disaster risk. This is specifically the case for the linkage between socio-economic vulnerability of communities and the provision services and side benefits of ecosystems. As confirmation of this, the CRED and UNISDR (2016) report also suggests more efforts should be made to evaluate the real outcomes of DRR interventions on human lives and livelihoods. Furthermore, research on diverse case studies is required to scientifically prove the value of ecosystem services in order to reduce risk.

Renaud et al. (2013b) noted that generally, the implementation of Eco-DRR projects on the ground is hampered because of a lack of adequate policies. Eco-DRR is often executed through pilot projects and has yet to be mainstreamed as a national strategy (Marfai et al. 2008). Indonesia is considered one of the most disaster prone countries in the world (Alcántara-Ayala 2002; Dilley 2005; Garschagen et al. 2015; CRED and UNISDR 2016) and at the same time one of the richest in natural resources, biodiversity and ecosystems. It houses some of the largest tropical forests and the world's richest tropical marine ecosystems, including: coral reefs, mangroves and sea grass meadows within 3.6 million km<sup>2</sup> of territorial seas (Alongi et al. 2016). This provides huge scope for implementing Eco-DRR measures in Indonesia.

This chapter aims to:

1. Explore the general concept of Eco-DRR in terms of current progress and challenges in its adoption worldwide and also in Indonesia,
2. Review examples of Eco-DRR projects in Indonesia, and,
3. Present the challenges and opportunities reflected in the examples for future implementation and development of Eco-DRR.

The organization of the chapter is as follows. In Sect. 18.2, we discuss the general concept of Eco-DRR in relation to various global frameworks, including its benefits and limitations in the context of DRR. Section 18.3 comprehensively reviews the existing literature on Eco-DRR research in Indonesia. Section 18.4 presents the analyses of case studies on Eco-DRR application in Indonesia. Section 18.5 analyses and presents general challenges and opportunities for future applications of Eco-DRR and the final section presents our conclusion.

## 18.2 An Overview of Eco-DRR Approaches

This section is divided into two parts. The first part presents an analysis of the following global frameworks related to DRR: (1) HFA (UNISDR 2005), (2) SFDRR (UNISDR 2015), (3) SDGs, and (4) COP21. The second part presents the results of a literature review on the benefits and limitations of Eco-DRR approaches.

### 18.2.1 Global Frameworks

DRR has been gaining momentum by being acknowledged worldwide and is addressed through different global processes and agreements. The first international framework on DRR is the HFA (UNISDR 2005), which calls for DRR initiatives and emphasizes a system to assist disaster-prone developing countries with initiatives, technical assistance and capacity development. This has been superseded by the newly adopted SFDRR, which focuses on generating evidence-based and practical guidance for implementation in close collaboration with states through the mobilization of experts and reinforcing a culture of prevention among relevant stakeholders (UNISDR 2015). There are also several targets and goals of the newly adopted global SDGs, which indirectly address DRR. In addition, the COP21 addresses to some extent the interlinkages between DRR and climate change issues.

Table 18.1 shows a comparison between global frameworks relevant to ecosystem-based approaches. Our review details three ecosystem-related issues: the decline of ecosystems, the protection of socio-economical assets and ecosystems, and Eco-DRR, including the promotion of transboundary cooperation and inclusion in planning process and development strategies. A closer look at Table 18.1 shows the Sendai Framework as having the most comprehensive coverage of Eco-DRR approaches. In the HFA, the ecosystem perspective was mainly addressed under ‘Priority for Action 4’, which was dedicated to reducing the underlying risk factors. More specifically, the sustainable use and management of ecosystems, including better land-use planning and development activities to reduce risk and vulnerabilities, was encouraged. The follow-up framework, the SFDRR, more prominently mentions ecosystems as an element to be protected from natural and human-caused hazards over the next 15 years as well as an element to use for reducing components of risk. Furthermore, under the SDGs, Eco-DRR has not been mentioned specifically; meanwhile COP21 addressed ecosystems in the context of DRR and interlinks environmental issues with climate change adaptation.

**Table 18.1** Comparison between global frameworks relevant to ecosystem-based approaches, with ecosystems as elements of underlying risks

Ecosystem related issue	Criteria	HFA	Sendai framework	SDGs	COP21
Declining ecosystems	The unsustainable uses of natural resources and declining ecosystem		Paragraph 6		
Protecting socio-economical assets and ecosystem	Urgent and critical to anticipate, plan for and reduce disaster risk in order to more effectively protect socioeconomic assets and ecosystems		Paragraph 5	Goal 6 Target 6	Annex
	Protect and restore water-related ecosystems		Priority 1 understanding DR	Goal 14 Target 2	Article 7.2
	Sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts and strengthening resilience		Paragraph 24 (b)		Article 7.5
	Noting the importance of ensuring the integrity of all ecosystems and climate justice				
Ecosystem-based disaster risk reduction including promotion of transboundary cooperation and element of development	Encourage the sustainable use and management of ecosystems, including through better land-use planning and development activities to reduce risk and vulnerabilities	Paragraph 19 (a)	Priority 2: strengthening disaster risk (Global and regional levels)	Goal 15 Target 1	Article 8.4 (h)
	To promote transboundary cooperation to enable policy and planning for the implementation of ecosystem-based approaches with regard to shared resources to build resilience and reduce disaster risk		Governance to manage disaster risk	Goal 15 Target 9	Article 7.9 (c)

(continued)

**Table 18.1** (continued)

Ecosystem related issue	Criteria	HFA	Sendai framework	SDGs	COP21
	To promote the mainstreaming of disaster risk assessment, mapping and management into rural development planning and management of, inter alia, mountains, rivers, coastal flood plain areas, dry lands, wetlands and all other areas prone to droughts and flooding, including through the identification of areas that are safe for human settlement, and at the same time preserving ecosystem functions that help to reduce risks		Paragraph 28 (d)		
	Strengthening of baselines and periodically assess disaster risks, vulnerability, capacity, exposure, hazard characteristics and their possible sequential effects at the relevant social and spatial scale on ecosystems		Priority 3: Investing in disaster risk reduction for resilience (National and local levels)		
	To strengthen the sustainable use and management of ecosystems and implement integrated environmental and natural resource management approaches that incorporate disaster risk reduction		Paragraph 30 (g)		

(continued)

**Table 18.1** (continued)

Ecosystem related issue	Criteria	HFA	Sendai framework	SDGs	COP21
	Ensure conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and dry lands, in line with obligations under international agreements		Priority 3: investing in disaster risk reduction for resilience (National and Local levels)		
	Integrate ecosystems and biodiversity values into national and local planning, development processes and poverty reduction strategies		Paragraph 30 (n)		

Source: Authors

## 18.2.2 *Benefits and Limitations*

This section reviews the benefits and limitations of Eco-DRR. In general, proponents of this approach argue that Eco-DRR is cost effective, sustainable and socially and environmentally friendly. However, some limitations include the limited extent of protection and policy implementation.

### 18.2.2.1 **Benefits**

Over the last decade, Eco-DRR approaches have started to gain attention (Uy and Shaw 2012; Renaud et al. 2013a). A landmark step to endorsing Eco-DRR was the establishment of the Millennium Ecosystem Assessment (MEA 2005) as a platform to report the importance of ecosystems for human wellbeing. The Eco-DRR approach is alleged to buffer hazards, reduce the exposure of productive assets and reduce underlying socio-economic vulnerability (Estrella and Saalisma 2013). Developing countries are recently starting to implement Eco-DRR initiatives to promote sustainability in the context of DRR efforts. Implementation however, is only at the smaller local scales. Developed countries, specifically in Europe, undeniably dominate the efforts through larger projects such as living rivers in the UK (Karr and Chu 2000) or building with nature and room for the river in The Netherlands (Waterman 2010; Rijke et al. 2012). However, the fact is that developed countries experience bigger economic losses during disasters, but face relatively lower

incidences of disasters compared to developing countries (UNISDR 2005; CRED and UNISDR 2016). This brings more concern to extending and mainstreaming Eco-DRR considering the need to prioritize such initiatives to reduce disaster risk in developing countries. Furthermore, Eco-DRR possesses the following benefits:

### ***18.2.3 Cost Effective***

In terms of hazard protection, there is growing evidence that utilizing ecosystems is far more cost effective than installing ‘hard’ engineering structures. A study conducted on ecosystem-based coastal defense by reclaiming marshland in the UK found that after 25 years, the effort is economically more beneficial than building dikes (Turner et al. 2007). A similar study conducted in Fiji, used comprehensive cost benefit analyses to show that planting riparian buffers and afforesting upper catchments is a more cost effective approach to reduce flooding than hard infrastructure measures such as downstream river dredging (Daigneault et al. 2016). Cost effectiveness can also be perceived by the value it brings to community livelihoods through potential for income generation (Sudmeier-Rieux et al. 2006; Gupta and Nair 2012).

### ***18.2.4 Socially and Environmentally Friendly***

Eco-DRR approaches are promoted as socially friendly and encourage socio-ecological integration and interaction. Unlike hard engineering structures, where engineers and government authorities are mostly in charge, Eco-DRR approaches require the involvement of local communities and generate participation towards its implementation and management (Sudmeier-Rieux et al. 2006; ProAct Network 2008; Uy and Shaw 2012). In terms of its impact on the environment when developed properly, Eco-DRR brings fewer negative impacts when compared to hard engineering structures. For example, in the south western delta of The Netherlands, a conventional dam has created issues of tidal habitat loss (Temmerman et al. 2013).

### ***18.2.5 Sustainable***

The concept of ecological conservation is expanding. It realizes the value of conserving as well as utilizing ecosystems in an ecologically friendly manner to protect human civilization from natural hazards. The use of ecosystem services is believed to be more sustainable than conventional hard engineering approaches (Daigneault et al. 2016). There are several criteria that determine sustainability of Eco-DRR, including: (i) its cost effectiveness in terms of initiation and maintenance, and

(ii) fewer social and environmental side effects (Daigneault et al. 2016). These are also reinforced by livelihood improvement strategies embedded in Eco-DRR projects, which trigger community awareness and participation, which are to a large extent the key to success for sustainability (Renaud et al. 2013b p. 10).

### 18.2.5.1 Limitations

Eco-DRR approaches are not a panacea for all problems and also have limitations in terms of: (1) the limited extent of protection, and (2) weak policy and implementation.

## 18.2.6 *The Limited Extent of Protection*

By limited extent of protection it is meant that not all types and magnitudes of hazards, exposure and vulnerability can be completely reduced by ecosystem-based approaches alone. The successful and sustainable implementation of Eco-DRR measures strongly depends on the regional context, such as geographical conditions or the specificity and co-occurrence of natural hazards (Koch et al. 2009). For example, in the case of a tsunami, there are debates on the context in which mangroves can actually protect the area (Kathiresan and Rajendran 2005; Kerr et al. 2006). The extent of mangrove protection depends on many factors, including the magnitude of a tsunami, the location and distance from the epicenter and near shore bathymetry, which determines wave height at the coast (Kerr et al. 2006; Kerr and Baird 2007). To be effective and provide immediate protection in some context, a combination of hard and soft structures would be preferable, as ecosystems naturally take time to develop. Recent research elaborates on the benefit of such combination or ‘hybrid approach’. However, it is important to ensure that the design of hybrid approaches will not generate new or different risks in different locations (see Spalding et al. 2014a, b).

## 18.2.7 *Weak Policy and Implementation*

The World Bank’s newly published Wealth Accounting and the Valuation of Ecosystem Services (WAVES) technical report “Managing Coasts with Natural Solutions” (World Bank 2016), mentions the importance of policy implementation in protecting coastal areas in the context of using ecosystem services. There are four points of concern, including: (1) planning and land use decisions, including coastal zone management; (2) coastal defense infrastructure projects; (3) national risk and adaptation planning; (4) habitat restoration; and (5) post disaster recovery. However, in reality, there is still a lack of data on the benefits of ecosystem services and their



role in reducing disaster risk (Estrella and Saalisma 2013). Additionally, there is a gap between science and its use in evidence-based policy making (Renaud et al. 2013a p. 9) that has led to unclear and sometimes contradictory scientific information on the role of ecosystems for DRR (Estrella et al. 2013). This leads to the absence of decision-making tools to support the implementation of Eco-DRR efforts and to mainstream it into policies.

### 18.3 Eco-DRR Approaches in Indonesia

Having reviewed the current discussion on Eco-DRR, this section focuses on the application of the approach in Indonesia. To do this, we conduct a literature review and examine the extent to which the approach has been adopted and reported in the scientific literature. The literature reviewed shows that different types of ecosystems contribute to different risk reduction benefits. Coastal vegetation helps to mitigate coastal wave risks; natural forest and wetland ecosystems mitigate flood and drought risks whilst mountain forest ecosystems help to reduce the risk of landslides and volcanic activities. Moreover, there have been several programs that have implemented Eco-DRR measures in Indonesia and are described below.

First, the search terms used for the time period from the year 2000 until end of March 2016 were: “Eco-DRR”, “Indonesia” and “disaster”, whereas disaster was then respectively replaced by relevant hazards in Indonesia, namely: “tsunami”, “storm”, “sea-level-rise”, “earthquake”, “volcano”, “flood”, “drought”, “landslide” and “mud flow”. This search conspicuously showed that the terminology “Eco-DRR” is so far not taken up by the scientific literature, evidenced by only one result in Scopus when searching solely for “Eco-DRR” in both databases. Following this, the term “Eco-DRR” was replaced by “ecosystem”, which brought 151 results, however, only 35 papers provided relevant information with regard to Eco-DRR approaches in Indonesia. Most other scientific articles had a very general focus on ecosystem services and their role after a tsunami (Shaw 2008); sea level rise consequences on ecosystems (Marfai 2014); the consequences of agricultural land use change on biodiversity and ecosystem services – providing a hint to increasing flood frequency as a side effect (Rahajoe et al. 2014); and a methodological analysis on how to prioritize ecosystem services (Pattanayak and Kramer 2001). We therefore exclude these papers from the review section. A summary of this review is provided in Table 18.2.

Eco-DRR approaches in Indonesia are most prominent with regard to coastal hazards, specifically as a result of the 2004 Indian Ocean Tsunami. A review by Cochard et al. (2008) examined the impact of coastal vegetation (i.e. mangroves, beach forests, other dense forests), coral reefs and beds of sea grass to mitigate sea wave hazards and highlighted that all these ecosystems are to a certain extent effective in buffering the energy of normal waves, storm waves and tsunami waves for hazard mitigation in Aceh, Indonesia and Southern Thailand. A meta-analysis of Ferrario et al. (2014) showed that coral reefs can reduce wave energy by an average

**Table 18.2** Results of the structured literature review on eco-DRR approaches in Indonesia

Hazard category	Resulting number of papers	Papers with relevant Eco-DRR examples	References
Disaster (in general)	29	8	Laso Bayasa et al. (2011), Mukherjee et al. (2010), Randall et al. (2008), Sonak et al. (2008), Shaw (2008), Cochard et al. (2008), Check (2005) and Baird et al. (2005)
Ecosystem and tsunami and Indonesia	23	8	Laso Bayasa et al. (2011), Mukherjee et al. (2010), Randall et al. (2008), Sonak et al. (2008), Shaw (2008), Cochard et al. (2008), Check (2005) and Baird et al. (2005)
Ecosystem and storm and Indonesia	6	3	Miteva et al. (2015), Cochard et al. (2008) and Check (2005)
Ecosystem and sea-level-rise and Indonesia	4	1	Marfai (2014)
Ecosystem and earthquake and Indonesia	14	2	Sonak et al. (2008) and Shaw (2008)
Ecosystem and volcano and Indonesia	19	2	König et al. (2013) and Lavigne and Gunnell (2006)
Ecosystem and flood and Indonesia	20	8	Rahajoe et al. (2014), Vollmer et al. (2015, 2016), Lamond (2014), Laso Bayasa et al. (2011), Halim et al. (2007), Chew (2003) and Van Beukering et al. (2003)
Ecosystem and drought and Indonesia	31	3	Van Beukering et al. (2003), Pattanayak and Kramer (2001) and Lamond (2014)
Ecosystem and landslides and Indonesia	3	0	
Ecosystem and mud flow and Indonesia	2	0	

of 97%, and indicated that an estimated 41 million people are protected from waves with height below 10 m and originating from a distance larger than 50 km from the reefs along the coasts of Indonesia. With regard to the 2004 tsunami, damage assessments based on pre- and post- tsunami satellite images comprehensively documented that areas with more mangrove cover along the coastline suffered less damage (Check 2005) and if coastal vegetation was in front of settlements, casualties were reduced by an average of 5% (Laso Bayasa et al. 2011). However, in several parts of the Indonesian coastline, coastal vegetation and coral reefs provided no

protection and may even have increased the impact of the tsunami, e.g. due to intact and fragmented coral reefs, which led to accelerated water channels and flow debris (Cochard et al. 2008). The extent of protection by vegetation of coastal settlements from hazardous waves depends on many factors, such as the stand size, density, species composition, structure and homogeneity as well as the location of the settlement (Cochard et al. 2008; Laso Bayasa et al. 2011). If dense vegetation is located behind coastal settlements, the backwash may entrain debris that can cause structural damage and endanger human lives (Laso Bayasa et al. 2011). Nevertheless, more data are needed to further quantify the effects of these ecosystems on mitigation of coastal hazards.

Moreover, natural forest and wetland ecosystems play an important role in mitigating flood and drought risks in Indonesia (Chew 2003; Pattanayak and Kramer 2001). For instance, tropical forested watersheds have supported agrarian communities to mitigate droughts (Pattanayak and Kramer 2001). The flood mitigation capacity of approximately 2.5 million ha of Indonesian peat swamp forest was lost due to its conversion to oil palm estates, which strongly modified the hydrological values and functions of the original ecosystem with additional negative implications on soil erosion, flora and fauna (Chew 2003). Indonesian farmers have reported that the frequency of droughts and damaging floods in the context of degraded water catchments is increasing (Van Beukering et al. 2003). Mountain forest ecosystems in Indonesia act as buffer zones to reduce the risk of landslides and at the same time protect from lava or ash flows in regions with high volcanic activity (Lavigne and Gunnell 2006; König et al. 2013). These discussions show that the ecosystems mentioned above not only provide support in mitigating hazards if they are maintained and in a healthy state, but also simultaneously provide abiotic and biotic resources and multiple other ecosystem services.

In addition to the structured search in scientific databases, we complemented this review with a Google search to identify ongoing projects and unpublished research related to Eco-DRR measures in Indonesia. The most important program in this regard is called “Building with Nature”, which is represented by Ecoshape, a consortium of private parties, government organisations and research institutes (Ecoshape n.d). Within this program, a flagship project was started in 2011 in Demak district, Northern Java, which suffers from land subsidence and coastal erosion and where more than 30 million people face the risk of losing their houses, roads and valuable arable land (Tonneijck 2016). This project is based on a three-step approach with the overall objective to manage a safe, sustainable and resilient delta coastline. The first step aims at regaining land and restoring the fine sediment balance through soft engineering measures such as the construction of grids of permeable dams along with the rehabilitation of mangroves. Secondly, climate smart and productive land-use is promoted in the area, such as sustainable aquaculture, which can co-exist with a healthy mangrove forest and substantially enhance shrimp production and near shore fisheries. Thirdly, long-term maintenance of mangrove belts is secured through training and embedding the approach in policy and planning.

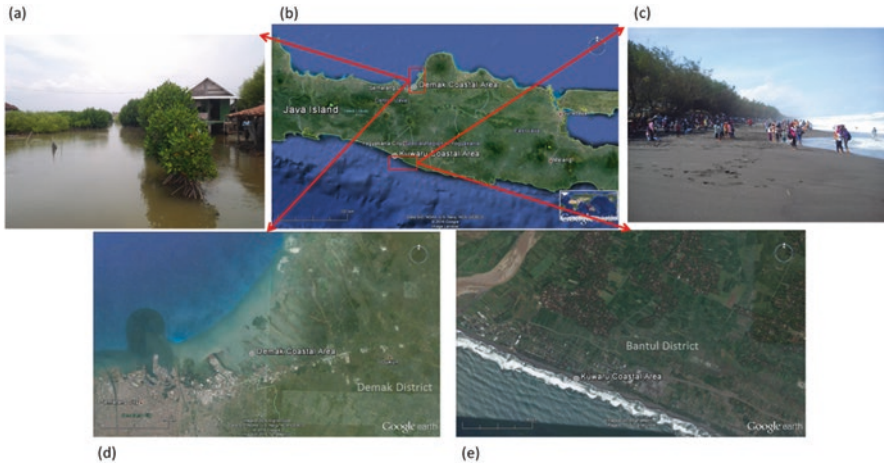
Another relevant program, although focusing more on rehabilitation and management of coral ecosystems rather than their utilization to reduce disaster risk, is the multi-donor Coral Reef Rehabilitation and Management Program (COREMAP [n.d.](#)), initiated by the government of Indonesia in 1998. Originally designed for 15 years, COREMAP was adjusted to changes in the political landscape and is spread over three phases: (1) the initiation phase (1998–2004), which highlighted the challenges facing coral reefs and the communities that depend upon them; (2) the decentralization and acceleration phase (2004–2009), in which the government of Indonesia initiated a participatory planning process with communities to establish protected marine reserves; and (3) the institutionalization phase (2010–2015). The overall aim of this program was to rehabilitate and protect coral reefs and raise public awareness of the values and services provided by healthy coral reefs.

The Mangrove Capital project – “capturing mangrove values in land use planning and production systems” was conceived by Wetlands International and partner organizations and implemented between 2012 and 2014 in Java, Indonesia. The main objectives were to analyze the ecological, socio-cultural and economic values of various management options of mangrove ecosystems and create a cost-benefit analysis for the case study site. Additionally, this project documented guidelines specifically designed for coastal managers and policy makers on how to manage mangroves with regard to coastal protection ([Spalding et al. 2014b](#)).

Besides these projects, it is worth mentioning several available practical documents that introduce and summarize Eco-DRR approaches, such as the step-by-step toolkit for practitioners by [Dudley et al. \(2015\)](#), which demonstrates how protected areas help in DRR and how to select the appropriate measures; or a training module on integrating DRR into coastal management specifically designed for Indonesia by [Sudibyakto et al. \(2004\)](#). A documentation of case studies representing Eco-DRR approaches including Indonesia can be found in [Renaud et al. \(2013b\)](#) and [Nehren et al. \(2014\)](#).

## 18.4 Case Studies in Indonesia

In this section, we exemplify the benefits and limitations of Eco-DRR as described in [Sect. 18.2](#) based on two case studies in Indonesia. In this regard, we analyze different drivers, challenges and opportunities of Eco-DRR, which will then be discussed in [Sect. 18.5](#). We chose two case studies in the coastal areas of Demak and Kuwaru ([Fig. 18.1](#)), which focus on the role of ecosystems in reducing the risk of coastal disaster, especially coastal erosion, wave hazards and coastal flooding ([Tonnejck et al. 2015](#); [Tonnejck 2016](#); [Triyanti 2013](#); [Dewi et al. 2016](#); [Santi 2015](#); [Foltny 2014](#)). These specific cases studies were not presented in the scientific literature, as described in [Sect. 18.3](#). However, we argue that the presentation of these case studies based on theses ([Triyanti 2013](#); [Dewi et al. 2016](#); [Santi 2015](#); [Foltny 2014](#)) will help us to demonstrate the application of Eco-DRR from a practical perspective. Furthermore, it will help us to juxtapose the different spatial attributes and



**Fig. 18.1** Location of Demak and Kuwaru Coastal Area (Source: (a) Triyanti (2013) (b) Google earth satellite image Landsat (2016); (c) Santi (2015); (d) Google earth satellite image data SIO NOAA, US NAVY, NGA, GEBCO, TerraMetrics (2016); (e) Google earth satellite image TerraMetrics, Digital Globe)

nature of risks in the application of Eco-DRR for reducing coastal disasters as well as its function to improve livelihoods of the local people in both areas and analyze the challenges and opportunities. The location of the two case studies can be found in Fig. 18.1.

#### 18.4.1 *Mangrove Coastal Protection Program, Demak, Central Java*

The Demak coastal area has been severely impacted by coastal erosion. The coast has retreated up to 100 m every year (Tonneijck 2016), damaging settlements, public infrastructure and livelihood space (Tonneijck et al. 2015). Several researchers mentioned that the most significant factor of erosion in Demak is the modified refraction of waves due to reclamation of the neighboring area (Semarang) for the development of ports and real estate's (Wahyudi et al. 2012; Marfai 2011). Furthermore, other research also mentioned sea level rise and intensity of waves as drivers of coastal erosion in Demak (Wahyudi et al. 2012). Land conversion from mangroves to fishponds is also assumed to be an important factor for coastal erosion and coastal inundation (Harwitasari and Van Ast 2011).

To overcome the erosion problem in Demak, the government has started initiatives to develop greenbelts along the northern Java coastal area by planting mangroves. Common mangrove species planted include *Avicennia marina*, *Avicennia lanata*, *Rhizophora mucronata* and *Rhizophora stylosa*. The mangrove planting project in Demak was initiated by the district level agricultural office (*Gerakan*

*Reklamasi Hutan dan Lahan – GERHAN*) in 2003–2004. It was followed by a project from Japan-based NGO, OISCA (Organization for Industrial, Spiritual & Cultural Advancement), focused in Bedono village from 2004 up to now as well as a mangrove planting initiation by local NGOs, government authorities, universities and private companies, such as PT Sido Muncul and PT Permodalan Nasional Madani (PNM) commonly under the company social responsibility programme.

Despite the success story of livelihood improvement through an increased level of fishery productivity and mangrove eco-tourism development, the conventional mangrove planting strategy could not reduce the coastal erosion rate. The coastal area of Demak still faces a big threat of coastal inundation and flooding (Triyanti 2013; Dewi et al. 2016). As a pilot project, the “Mangrove Capital” project was initiated by Wetlands International back in 2012 (see Sect. 18.3) with the major focus being to conduct research and collect knowledge in order to advance the management and restoration of mangrove forests for protecting the coastal area from disasters and for livelihood support. The Mangrove Capital project then led to the bigger project “Building with Nature Indonesia”, with the main theme of Securing Eroding Delta Coastlines (Tonneijck et al. 2015).

This project introduced the hybrid engineering approach by combining soft and hard approaches and has shown good progress through utilizing mangroves and local materials in order to increase sedimentation in eroding coastal areas. The media reported that the hybrid engineering structure constructed in 2013 increased the absolute sedimentation height up to 45 cm in an eroded area in Timbuloko Village, Demak (Suara Merdeka 2016).

Moreover, the aims of the projects are: (1) To restore 20 km of coastline through ‘Building with Nature’ with communities, local government and engineers; (2) to decrease coastal hazards, namely erosion, flooding and saline intrusion; (3) to enhance production from sustainable aquaculture; (4) to demarcate the protected mangrove zone in Demak district, and (5) to embed ‘Building with Nature’ in the master planning for sustainable coastal zone management and risk reduction in the Northern Java coastal area (Tonneijck 2016). Research done by Triyanti (2013) found that there are many local mangrove community organizations existing in the area. These organizations carried a form of social capital which is taking a significant role to support the coastal protection projects conducted by government, NGOs and private entities. The active involvement of mangrove groups in conservation programmes, which is promoting the spirit of local awareness and participation, became the key to success of implementation. The projects are showing positive progress, especially in terms of increasing the rate of success of mangrove plantation.

However, conflicts are occurring due to the unequal distribution of projects between different hamlets and villages, as well as the exclusion of benefits by local elites (Triyanti 2013). Therefore, the main challenges in Eco-DRR projects gleaned from this case study are segregation and disintegrated strategies between different stakeholders. Governments, especially at the regional and local level are facing difficulties coordinating a large number of projects conducted by different stakehold-

ers in the Demak coastal area and to ensure inclusiveness of benefits and also responsibilities of managing Eco-DRR projects.

#### ***18.4.2 Ecosystem Based Protection in Kuwaru Beach, Yogyakarta***

The Kuwaru coastal area is located in Poncosari Village, Srandakan Sub District, Bantul Regency, Yogyakarta Special Province. This case study was selected to show the implementation of Eco-DRR approaches in coastal areas in another region with different spatial attributes, natural conditions and genesis of the Eco-DRR initiative. Santi (2015) conducted a study to determine susceptibility to erosion and public participation in the project. She concluded that the entire coast of Kuwaru district has been highly susceptible to erosion since 1999 up until now; threatening settlement and livelihood spaces. Moreover, due to erosion, the coastal area of Kuwaru has been reduced from 192,624 m<sup>2</sup> in 1999 to 17,973 m<sup>2</sup> in 2014 (Santi 2015). The main driving factor is strong waves as a consequence of the coastal geomorphology in the southern part of Java. Due to its geographic location, Kuwaru, like many of the coastal areas in the southern part of Java Islands, is openly exposed to the Indian Ocean without any barriers such as small islands, which can normally reduce the strength of waves approaching the coast.

To protect the area from wave hazards, erosion and salt spray, local people together with the government and private companies plant coastal vegetation to function as a natural barrier. The first plantation programme happened in 2000 by the initiation of local university, followed by NGOs and private companies. Three types of plants can be found in Kuwaru: Casuarina trees (*Casuarina equisetifolia*), Pandan laut (*Pandanus odorifer*) and Railroad vine (*Ipomoea pes-caprae*). However, only Casuarina trees grow well in Kuwaru. Besides the protection value, the plantation project of coastal vegetation in Kuwaru also provides additional benefits in the form of tourism. Since 2010, many local tourists visited Kuwaru beach to enjoy the view of the Casuarina trees. The increasing number of tourists generates opportunities for local people to work in the tourism sector (Foltyn 2014).

In terms of livelihood conditions, local people in Kuwaru are mainly working as farmers and fishermen. Since the peak development of tourism in Kuwaru beach from 2010 to 2012, many people have started to work in the tourism sector (i.e. shops and restaurants). However, big waves in 2013 washed away the tourism area and their livelihood spaces, as well as lines of Casuarina trees that were planted since 2000. Consequently, people changed the source of their livelihood from tourism back to shrimp aquaculture, farming and fisheries. The conversion of local livelihoods from the coastal vegetation area to shrimp farming has harmful consequences for the ecosystem and the environment. The establishment of shrimp aquaculture requires a flat area. Thus, people will cut trees and build shrimp farms on former

sand dune areas, which further expose an unprotected coastal area to coastal erosion and wave hazards.

The result of this research suggests that solely planting *Casuarina* trees is not sufficient to protect the coastal area from erosion and big waves. To combat the erosion in the Kuwaru coastal area, plantations featuring a combination of shrubs and other species as well as a concept to trap sand and achieve sedimentation are needed. In terms of governance strategy, the research showed that governments tend to choose plantation strategies to avoid the cost of building wave breakers or other hard coastal structures. The research also suggests a better coordination between stakeholders in further programmes to protect the Kuwaru coastal area from erosion and big waves (Santi 2015).

## **18.5 Implications for Future Eco-DRR Measures**

This section elaborates the challenges and opportunities derived from the two case studies presented in Sect. 18.4. It provides a reflection on the challenges in implementing Eco-DRR measures, including natural-physical challenges, exclusion, inequality, livelihood issues and governance. Furthermore, several opportunities to overcome these challenges are proposed, including the room for combination, an integrated and embedded livelihood generating strategy and the need for institutionalizing interaction and coordination among stakeholders.

### **18.5.1 Challenges**

In reference to the case studies, there are three categories of challenges:

#### **18.5.1.1 Natural-Physical Challenges**

The magnitude of disaster risk varies from one place to another. The analysis of the two case studies suggests that there are several differences that need to be considered in the application of Eco-DRR approaches. The non-linearity of causes and driver of the hazard is important to consider. Demak, which is located in the northern part of the Java coastal area, is facing a greater threat of erosion due to development issues, including a disintegrated coastal management plan (i.e. reclamation) in the neighboring city of Semarang. Meanwhile in Kuwaru, which is located on the southern coast of Java, is specifically threatened by wave hazards due to the nature of its coastal geomorphology. Different strategies and combinations thereof should be agreed to tackle each unique case.



### **18.5.1.2 Exclusion, Inequality and Livelihood Issues**

The Demak coastal area has a more advanced development in terms of a local self-help group programme related to ecosystem conservation compared to Kuwaru. However, in Demak, there is also greater risk of conflicts due to exclusion and unequal distribution of benefits in certain projects. Meanwhile in Kuwaru, incorporating livelihoods into the Eco-DRR approach is becoming a key strategy to ensure people to conserve their ecosystem and environment. If this approach secures livelihoods, the community will automatically conserve the ecosystems. A comprehensive effort to increase awareness of local people towards the benefit of preserving ecosystems is needed in order to trigger bottom up initiatives and to achieve participation in a more meaningful way.

### **18.5.1.3 Governance**

The analysis of the two case studies highlights the challenges of governance aspects. The application of Eco-DRR projects in the Demak and Kuwaru coastal areas are mostly hampered by fact they are disintegrated programmes, which in the end do not benefit public interest. Stakeholders were not sufficiently involved to interact and synchronize existing or planned projects. Another challenge worth mentioning in decision making processes is the tendency of selecting Eco-DRR approaches as a strategy to merely reduce protection costs rather than realizing the most important idea is to conserve and protect ecosystems in order to achieve broader sustainability goals.

## ***18.5.2 Opportunities***

In reference to the case studies and defined challenges, the following opportunities are proposed to overcome these challenges:

### **18.5.2.1 Hybrid Approaches**

The coastal areas of Demak and Kuwaru are located in rural areas. Both case studies mentioned that Eco-DRR is the only solution, especially due to the lack of financial capacity of local governments to construct more expensive measures. However, due to the non-linearity of hazards, exposure and vulnerability, a combination of approaches can provide the solution, e.g. between different utilizations of ecosystems as well as soft and hard engineering infrastructure. Eco-DRR approaches provide room for links between the two, such as hybrid approaches that utilize mangroves and semi-concrete structures in Demak coastal area.

### **18.5.2.2 An Integrated and Embedded Livelihood Generating Strategy**

The key success of local people participating in the implementation of Eco-DRR approaches is through an integrated and embedded livelihood generating strategy. Local people will take responsibility to plant and conserve mangroves if they understand the benefits and improvements for livelihoods and security against coastal hazards. In Kuwaru beach, the plantation of *Casuarina* trees was conducted by local people and has granted them new livelihoods, which lead to an increased awareness among local people on the importance of coastal ecosystems and their ability to protect their land. In the Demak coastal area, mangroves have proven benefits towards people's livelihoods, both in terms of eco-tourism and the increasing productivity of fisheries.

### **18.5.2.3 Institutionalizing Interaction and Coordination Among Stakeholders**

After realizing the opportunities of combined and integrated livelihood strategies, the most important aspect to be considered in order to better govern Eco-DRR approaches is institutionalizing the interaction and coordination among stakeholders. Eco-DRR is by nature already promoting the involvement of various stakeholders. This will allow improvement, especially in terms of enriching the learning processes from the different experiences and capacities of various stakeholders.

## **18.6 Conclusion**

Given that Eco-DRR is a new approach at a global and local level, there is not much scientific literature available referring to this specific term, especially in the case of Indonesia. This review of Eco-DRR research and projects in Indonesia provides insights into challenges and opportunities that need to be considered in the future. We recommend that future research on Eco-DRR in Indonesia should explore and elaborate the opportunities to better synchronize science and the practical implementation of Eco-DRR approaches to achieve sustainable solutions. The context-specific reflection of potentials and limitations of Eco-DRR approaches and the flexibility to combine and adjust approaches is required to overcome the natural and physical challenges of hazard exposure.

An integrated implementation of Eco-DRR approaches embedded within good governance and livelihood generating strategies provides the basis for sustainable implementation of Eco-DRR approaches. Moreover, lessons learnt from the case studies on the implementation of Eco-DRR approaches in Indonesia include strengthening governing capacity, especially in terms of coordination and interaction among institutions and stakeholders, as this was the most crucial aspect to achieve an effective Eco-DRR implementation. At the global level, through differ-

ent global frameworks such as the SFDRR and the SDGs, the value and contribution of Eco-DRR approaches for DRR and sustainable livelihoods has been significantly acknowledged. However, the important question that remains is how to ensure sustainable and effective implementation at the national and local level considering specific challenges and opportunities in different countries.

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# Chapter 19

## Culture and Community Resilience to Flooding: Case Study of the Urban Coastal Community in Jakarta

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**Abstract** There is increasing recognition of the role of culture in influencing community resilience. When acknowledged as cultural aspects, behaviors, beliefs and social structure could shape risk perception and risk behavior. In the context of Indonesia, research on culture has been mainly explored within the context of earthquakes and volcanic eruptions, and rarely in the case of floods in coastal areas. This study aims to explore distinctive elements of culture that shape community resilience progressions from coping, self-organizing, recovering and learning to adapt to flood hazards.

We argue that unpacking and knowing how particular elements of culture influence the progression of resilience will lead to better understanding of how vulnerable communities build their resilience. Empirical data is collected through a survey of 170 households, semi-structured interviews with local leaders and group discussions in Muara Baru, North Jakarta.

This study finds that vulnerable communities can build resilience by optimizing their existing culture in daily life. First, household behaviors e.g. helping each other and offering mutual assistance, influences the ability to cope with disasters. Second, social structures e.g. task division amongst family members and the role of local leaders to manage relief programs, mainly determine ability to self-organize. Third, the recovery process is mainly shaped by networking within ethnic groups for social-economic support. Finally, the ability to learn to adapt is mainly influenced

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by strong beliefs which restrict people to learn from previous experiences and leaves them less prepared for future disasters. These findings are relevant for optimizing formal community resilience building programs.

**Keywords** Community • Resilience • Flood • Disaster • Culture • Coastal • Urban • Jakarta

## 19.1 Introduction

The coastal area of Jakarta is highly vulnerable to flooding due to its geographical and geomorphological characteristics (Yusuf and Fransisco 2009; Marfai and Hizbaron 2011; Firman et al. 2011; Ward et al. 2011; Budiyo et al. 2015), as well as rapid urbanization, which drives the growth of informal settlements and slums (Padawangi 2012). As an estuary of 13 rivers and two main canals, coastal Jakarta retains surface water during the rainy season as well as the influx water from upstream (Marfai et al. 2015). Moreover, relative sea level rise is exacerbated by land subsidence and leads to increased risk of tidal floods (ibid). This affects slums and informal settlements spread along the coast and surrounding industrial business areas (Padawangi and Douglas 2015). The low income population trade-off the risk by taking economic advantage of informal sector opportunities. Extensive studies about flooding in Jakarta show that low income groups who live in flood-prone zones, including coastal areas, are the most affected group during extreme disasters (see Ward et al. 2011; Padawangi 2012; Padawangi and Douglass 2015; van Voorst 2016).

Against this background, we pose questions such as: How can vulnerable people in coastal areas survive after exposure to extreme floods? How do they organize themselves and optimize their capacity to return to their normal activities? How do they recover following disasters beyond their social and economic assets? And, how do people learn to adapt to changes after severe floods? Based on studies of risk to natural hazards and disasters, scholars find that cultural factors mainly influence decisions to respond to hazards and disasters by creating certain perceptions of risk to hazards (Renn 2008; Wildavsky and Dake 1990). Thus, cultural factors such as beliefs, behaviors, values and attitudes influence how people behave and take actions to respond to hazard risk (See Cannon 2015; Schipper 2015; Birkmann et al. 2015; Dove 2008; Lavigne et al. 2008). Moreover, culture can explain why people become more vulnerable to disasters or survive under constant risk of hazards and disasters (Bankoff et al. 2015; Cannon 2015). Culture, such as beliefs and behaviors, influences the creation of meaning to people's lives and thus leads to preferences for livelihood and settlement patterns (Thomalla et al. 2015).

This paper aims to understand how communities build their resilience, particularly from the perspective of culture. We unpack the aspects of culture and progressive resilience to get a more detailed understanding of the process of resilience building. We utilize the concept of culture as people's practice or behaviors and day to day routine, shared by people through networking, relationships and kinship, in which attributes of social structure, beliefs and values are applied in



response to threat and hazards (Bankoff et al. 2015; Cannon 2015; Thomalla et al. 2015). Community resilience is understood as the ability to cope, self-organize, recover and learn to adapt to disasters (Cutter et al. 2008; Lebel et al. 2006).

To understand the linkage between culture and community resilience, we select Muara Baru Kampong in the North of Jakarta as a case study area. Muara Baru Kampong, located in coastal Jakarta, comprises large-scale slums and informal settlements (Kelurahan Penjarangan 2015) and is severely affected by extreme floods such as in 2007 and 2013. Empirical data collection is collected by implementing a combination of structured interviews with 170 households and semi-structured interviews with local leaders, in addition to focus group discussions (FGDs) with community members. We analyze the link between culture and community resilience by unpacking aspects of culture and components of community resilience. We also consider ethnicity as the background of a household to strengthen the understanding of the linkages.

This chapter is presented in five sections: (1) Section 19.1 describes the motivation to undertake this research and the research question, followed by the research objective. (2) Section 19.2 reviews community resilience concepts and the importance of considering culture to strengthen the understanding of community resilience to disasters. (3) Section 19.3 describes our method of empirical data collection and a description of the case study areas. (4) Section 19.4 presents the results and discussion that consists of a description of characteristics of respondents and an analysis of the relation between each aspect of culture with the progression of community resilience. (5) Lastly, in Sect. 19.5, we conclude our analysis and derive some recommendations for community resilience-building programs and further research.

## **19.2 Conceptual Framework: The Role of Culture in Community Resilience**

This section consists of three parts. First, we review the evolution of the concept of community resilience in the literature in order to understand current gaps in community resilience building studies. It presents the development of the concept of resilience from the focus on general factors, such as social, economic, environmental and institutional, to the need to focus on subjective factors, particularly cultural aspects in influencing community resilience building. Second, we review the role of culture in the study of risk and vulnerability to natural hazards. Third, we review an intermediary factor to link culture to resilience, namely ethnicity.

### ***19.2.1 Evolution of the Concept of Resilience to Disasters***

This sub-section presents the evolution of the concept of resilience to disasters, which departs from the fundamental concept grounded in Holling resilience theory and moves towards recent studies to assess community resilience. This study focuses

on the ability of communities to cope, self-organize, recover and learn to adapt to extreme floods in Jakarta.

From the field of ecology, Holling (1973) conceptualized “*the ability of systems to absorb changes of state variables, driving variables, and parameters, and still persist*” as resilience. Furthermore, the concept has grown broadly into the social and environmental domain. Timmerman (1981) linked resilience with vulnerability to hazards and noted that resilience can be seen as a certain response of a system to perturbation. Moreover, he highlighted that resilience is “the capacity to absorb and recover from occurrence of a hazardous event” and that it can be a part of strategy to reduce vulnerability.

Folke (2006) utilized the concept of resilience in a more integrated perspective to link social and ecological systems. Social ecological system scientists consider social process as such “social learning, knowledge, visioning and scenario building, leadership, agents and actors groups, social networks, institutional, adaptive capacity, transformability and adaptive governance” (ibid). This concept clearly gives us an understanding of how social and ecological systems interlink with each other. It is a challenge for further research to understand how they link together and interact across different scales and the role of adaptive capacity (Folke 2006). The interaction can be very dynamic and complex which potentially provides various results; either the system will return to its previous function or it can be ‘built back better’. As Birkmann (2013) stated, in contrast to vulnerability, resilience provides us knowledge of stressors and when a system has an opportunity for change and innovation.

Considering the social aspect of resilience leads us to community resilience. Communities face new challenges regarding the complexity and uncertainty of climate and natural hazard impacts (Adger et al. 2011; Djalante and Thomalla 2011). Therefore, the study of community resilience has increased over the last decade. Timmerman (1981) stated that a society or community can protect themselves from the uncertainties of disaster by enhancing their resilience. It becomes possible because communities have the power to adapt after a disturbance through the process of linking to a network of adaptive capacities (Norris et al. 2008). This means that there are internal capacities embedded in the community that can influence actions to respond to disasters beyond assets and people’s experiences (Adger et al. 2009; Bene et al. 2016). Lebel et al. (2006) stated the ability of society to maintain resilience resides in actors, social networks and institutions through self-organization and learning to adapt. Therefore, a system that experiences changes can still return to its existing structure and function (ibid). The ability to self-organize means that society can maintain and re-create its identity (ibid), whereas the ability to adapt and learn is related to how actors re-set their target to adjust to the changing context (ibid).

Re-setting the target can also be seen as a process of constructing resilience as stated by Kuhlicke (2010). There is a stage in which an actor will ‘make sense’ of their capacity to respond to a new stressor which might be different to a previous stressor (ibid). The consideration processes in many cases are influenced by beliefs and behaviors of the actors or community members. For instance, people in Padang with strong religious beliefs might find it difficult to consider an early warning system because they believe that if they run away, it means they have no faith to God,

hence the reason many people are ashamed to evacuate immediately (Birkmann et al. 2015). Similarly, communities that live at risk in the volcanic eruption zone in Central Java hold beliefs of living in harmony with the environment (Mountain) by conducting certain rituals and trusting local leaders that they will be safe from eruptions (Lavigne et al. 2008; Dove 2008). Thus, they create either positive or negative self-perception which means their perception of self-capacity can be higher or lower compared to the reality (Shaw et al. 2014). That will lead to the decision for action to respond to hazard and disaster risk and mechanisms for self-organization (ibid).

Self-organizing is an internal aspect of a system to return back to its existing structure and function. Lebel et al. (2006) defined self-organization as the ability to buffer the impact of a disaster without support from outside. This capacity is also related to coping with disasters. Birkmann (2013) stated that coping is an availability of resources and the ability to utilize those resources to deal with a disturbance. To utilize a resource, a community can organize social clubs, create community groups and engage with authorities (Shaw et al. 2014). Moreover, the availability of resources of an individual or household in a community will also influence people's capacity to recover following a disaster. Resources help people to return back to the previous structure and function (Holling 1973) and can be linked to physical aspects and infrastructure (Folke 2006).

The recovery process is related to time and efficiency. In the context of socio-ecological systems, Folke (2006) stated that the recovery process is related to the resistance to change. In other words, a system will take time to return to the previous condition following a disturbance (ibid). However, recovery is also influenced by the frequency and the scope of the disturbance (O'Neill 1999). Moreover, after several disturbances or disasters, a community might not only recover but also go beyond and learn how to adapt to the changes. The ability to learn and adapt means that the system can get better by pursuing certain objectives over time and taking the effort to respond to the next disturbance (Lebel et al. 2006). For instance, if the community can learn from their experiences in facing disasters, they will be able to improve preparedness in the wake of future potential disasters (Cutter et al. 2008).

### ***19.2.2 Aspects of Culture That Shape Progressive Community Resilience***

This sub-section presents how aspects of culture can influence each component of community resilience. The fundamental model of community resilience was introduced by Cutter et al. (2008). Termed the Disaster Resilience of Place (DROP) model, it provides candidate variables from six dimensions, namely ecological, social, economic, institutional, infrastructure and community competence (ibid). However, these indicators are only well applied at the regional level. For the local level, we need to focus on more subjective and cognitive determinants of resilience (Bene et al. 2016). Consequently, social capital has a strong positive influence on

community resilience, but at the individual and household level, knowledge, attitude to risk, culture and subjectivity are more dominant. Similarly, Berkes and Ross (2013) proposed people-place connections, values and beliefs, knowledge and learning, networks, collaborative governance, leadership and outlook, as factors that influence community resilience. These aspects too can be part of cultural factors in relation to hazard risk (See Bankoff et al. 2015; Thomalla et al. 2015).

The definition of culture in the context of disasters comes from a multi-disciplinary background including anthropology, sociology and geography (Bankoff et al. 2015). It is beyond the given set of social factors but rather focuses on the social arrangement and situation that exists in society (Bankoff et al. 2015). As culture is always dynamic, it can be represented by various aspects of society's living. The IPCC suggests that culture as *a complexity of elements that can relate to a way of life, behavior, taste, ethnic, values, beliefs, customs, ideas, institutions, art and intellectual achievement that affect, are produced, or are shared by a particular society* (IPCC 2012, 84).

According to their way of life, people make big decisions, for instance, to choose their livelihood and place of living. In relation to vulnerability to climate change, Cannon (2015) stated that "*culture involves an interactions between people and the environment, interaction between people and themselves, self-awareness and sense of place, and identity in relation self or individual consideration*". Those interactions are generated through beliefs, attitudes, values and behaviors (Cannon 2015).

Thomalla et al. (2015) created a typology of cultural aspects to define and implement culture in the context of hazard risk. It is based on literature reviews in the fields of geography, anthropology and sociology and divides culture into five aspects, namely: (1) behaviors/practices, (2) manifestation/products of culture, (3) beliefs, values and worldviews, (4) knowledge, and (5) social structure.

Thomalla et al. (2015) describe that the *first* aspect of culture, namely practices or behavior, can be represented by traditions, customs and norms, social behaviors, rituals and also livelihood. For instance, communities who live in volcanic eruption zones maintain their harmony with nature through conducting certain rituals to the spirit of Mount Merapi (Dove 2008) and benefit from the fertile land for farming (IFRC 2014; Lavigne et al. 2008). In the case of urban coastal zones, people choose to live in flood-prone areas because there are more options for low-skilled jobs, despite of having no access to formal housing. Thus, hazard risk is not the main concern for their daily life, but rather economic problems.

The *second* aspect of culture, manifestation, is described as arts and artifacts, rules and laws, tools and technology, communication and ideas (Thomalla et al. 2015). Rules and laws can be created based on community agreement. People who live in slums and informal areas have an informal system to support their survival strategy and implement flexible roles based on the local leaders. For our case study, we exclude manifestation due to the dynamic social condition caused by eviction and resettlement programs.

The *third* aspect, namely beliefs, values and worldviews, is represented by religion, spirituality, fatalism, attitudes and assumptions (Thomalla et al. 2015). For instance, a case study about early warning systems for earthquakes and tsunami in

Padang, Indonesia, shows that people respond less to early warning because of strong a religious system (Birkmann et al. 2015). That is, people feel ashamed to follow early warnings because it means they have less of a belief in God (ibid). However, people will follow religious leaders if given instruction for evacuation (Birkmann et al. 2015; Lavigne et al. 2008).

The *Fourth* aspect, namely knowledge, can be represented by indigenous, traditional, local and scientific knowledge and education (Thomalla et al. 2015). Lavigne et al. (2008) emphasize that local people often under estimate scientific knowledge and prefer to consider their experience and traditional knowledge when dealing with risk in the case of volcanic eruptions. This research excludes this aspect of culture due to lack of information and data about indigenous and traditional knowledge that still exists the daily life of community members.

The *fifth* aspect, social structure, is represented as social control and power, social networks, relationships, social organizations, agency, social capital and social belonging (Thomalla et al. 2015). Social structure as part of culture in this study goes beyond social capital. Bene et al. (2016) emphasize that to understand community resilience, it must go beyond social capital as quantifiable factors. Social structure in this research is represented by descriptions of how people interact and are interdependent on each other in response to hazards and disasters.

### ***19.2.3 Ethnicity: An Intermediary Attribute to Link Culture and Resilience***

Ethnicity is recognized as a representative of individual and group characteristic that sharing their certain cultural setting (Bolin 2007). Different ethnicity potentially gives different descriptions of practice, social structure and beliefs of community members and further influences their response to risk and disasters. Levine (1999) defined ethnicity as “*a method of classifying people according to their origins*”. It influences how people perceive the world (Brubaker et al. 2004) and construct identity and social interaction (Khan and Eriksen 1992).

The relationship among community members could be established by building ties based on ethnicity (Yinger 1985) and religion (Guarnacci (2016). Based on research 11 years after the Tsunami in Indonesia, Guarnacci (2016) finds that personal characteristics such as ethnicity, religion and gender influence the social support of community circles. For certain ethnic groups, attachment to place is strong including their economic activities that furthermore will influence the establishment of bonding among neighborhoods (ibid). Moreover, the role of religious and ethnic leaders, with their power to control communities, contributes to the community network (ibid).

Another type of relationship as part of cultures that present ethnicity as the background is also found in the context of economic relation of patron-client in fishing communities (Pauwelussen 2016). A study about patron-client ties among the

Buginese and Makasarese of South Sulawesi shows that the relation between patron and client is not only political but also economic (Pelras 2000). The patrons can give economic support for the client's household by lending money or providing other services. However, the client will fully serve the patron by providing their services and production to the patron fully (ibid). This relationship will be useful during disaster response and disaster recovery, especially for those who have limited capacity to respond to disasters. In the social learning context, patrons potentially act as a source of information and knowledge. As Reed et al. (2010) stated, the process of social learning can occur through interaction among networking members.

### 19.3 Methods for Empirical Data Collection

This section presents the case study description and empirical data collection. The case study area was selected through purposive sampling based on the consideration of geographic location in the coastal areas having slums and informal housing. Likewise, respondents were also selected through purposive sampling.

#### 19.3.1 Case Study of Muara Baru in North of Jakarta

The case study area is in Muara Baru Kampong, one of the flood-prone zones in the North of Jakarta and severely affected during floods in 2007 and 2013. It is located next to the coast and it has a dense slum and informal housing complex inhabited mainly by low-income migrants (Padawangi and Douglas 2015). The centre of the slum and informal housing is in the Pluit reservoir area, and has been occupied for more than four decades. Pluit reservoir is one of the projects of flood mitigation built by the government of Jakarta in 1960. However, in the 1990s, non-permanent houses gradually sprawled in its surroundings, causing a reduction of 20% in the reservoir's capacity to retain water (Sakai 2014). Moreover, land subsidence occurs in Muara Baru, particularly in Pantai Mutiara, a reclamation area in the North Jakarta. (Abidin et al. 2011). During 2006–2007, land subsidence reached 12 cm/per year and is the largest land subsidence in Jakarta (ibid). After flooding in January 2013 caused 200,000 people to be evacuated (BPBD Jakarta)<sup>1</sup>, the government of Jakarta started to rehabilitate the function of Pluit reservoir to retain surface water. This program forced hundreds of families to relocate to social housing and be evacuated from the Pluit reservoir area.

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<sup>1</sup> [http://bpbd.jakarta.go.id/assets/attachment/document/rekapitulasi\\_kejadian\\_banjir\\_tahun\\_2013.pdf](http://bpbd.jakarta.go.id/assets/attachment/document/rekapitulasi_kejadian_banjir_tahun_2013.pdf) accessed 19 October 2016.

### ***19.3.2 Empirical Data Collection***

In order to achieve the objective of this research in understanding how aspects of culture influence community resilience, we conducted structured and semi-structured interviews with selected household and local leaders, both formal and informal. In addition, we also conducted focus group discussions (FGD) among community members. Households are selected purposively in three different locations in Muara Baru Kampong to cover all different type of resettlements conditions after flood in 2013. The first location (bullet number 1) is located in Pluit reservoir and most of the inhabitants have to be evacuated and relocated, second location (bullet number 2) is next to the coast and about 500 meters to 1 kilometers from Pluit reservoir and the inhabitants are concern for the evacuation, and the third location (bullet number 3) is a social housing complex for the people who have to be relocated from the Pluit reservoir (See Fig. 19.1). The rational to choose of three different locations is rather to find the similarity and consistency of the culture aspect and community resilience building.

### ***19.3.3 Structured Interviews***

Structured interviews with 170 respondents aimed to get the household description on social, economic, and demographic aspects. The number of respondents was selected purposively to represent flood-affected households and different types of ethnicity. The number of respondents who live in social housing is fewer than two other locations due to their homogeneity.

Respondents were selected based on purposive sampling, in which respondents represent specific criteria (Teddlie and Yu 2007). Criteria for this research included having: (1) Experienced severe floods in 2007 and 2013, (2) experienced eviction and relocation, and (3) located next to the coast (sea dyke) and Pluit reservoir. Respondents lived in three different neighborhoods, namely RT 19, RT 20 and a social housing complex (see Fig. 19.1). During the household survey in 2015, informal houses in the sectional wet reservoir (Fig. 19.1, circle 2) were beginning to be evicted.

Until May 2015, around 50 % of 1449 informal houses have been relocated to social housing (Kelurahan Penjarangan 2015). The rest of those families have to find new places to live or go back to their place of origin. During the household survey, social housing in Muara Baru was only available for 1200 families. Therefore, only those who have citizen cards have access to social housing.



**Fig. 19.1** Map of case study areas (Note: for selected case study areas in Muara Baru: 1 = RT 19; 2 = RT 20; 3 = social housing. Source: Google Earth (own mark))

### ***19.3.4 Semi-structured Interviews***

Semi-structured interviews aim to get information from different backgrounds and knowledge (Barriball and While 1994). We conducted semi-structured interviews with local formal and informal leaders to get the information about the cultural factors that exist in the community and interaction among inhabitants. We also needed to find deeper information about the personal history and other information that is unavailable through structured interviews, such as the history of occupying the land in Pluit reservoir and social and ethnic conflict.

### ***19.3.5 Focus Group Discussions***

Focus group discussions (FGD) were conducted to understand the dynamic of interaction among community members. FGDs were conducted in RT 20 because this location is more stable compared to the two others in terms of the eviction process. The eviction is occurring in RT 19 and respondents in the social housing complex were rather homogenous. During the FGD, a researcher acts as a moderator and guides the participants by delivering some main questions and furthermore, the participants will interact with each other to discuss specific issues (Parker and Tritter 2006). Through the FGD, we can find new important information that still remains hidden during structured and semi-structured interviews (ibid). Detailed information about the method can be found in Table 19.1.



**Table 19.1** Summary of methods used in the study

Method	Location/number of respondents	Detail of sampling and questions	Data analysis
Semi-structured interviews: selected HH local informal leaders	RT 19	Selected households are based on length of their experiences of living in the prone area.	Data from the interviews is transcribed and analyzed by selecting and coding the information (Barriball and White 1994)
	RT 20	Main questions:	
	Social housing/3 local informal leaders (one in each location) 5 senior residents	History about disasters, history of their settlement, culture that exists in the community	
		Process of getting a place in informal housing, interaction and relation amongst community members	
Household survey	RT 19	Selected informal leaders recognized based on local community information during research. Main questions:	
		Role in community before, during and after disaster and during normal conditions	
	RT 20	Establishment of informal system and how to make it last for decades	
	Social housing/170 HHs	Respondents were selected with purposive random sampling by considering the house location, migrants and heterogeneity of economic activities. A number of respondents in social housing are lesser than others due to the homogeneity of their housing status and process to move. Structured questions are structured mainly into four parts, namely:	
		Family background, such as family size, place of origin, ethnicity and related livelihood	
		Perception of risk	
		Coping and adaptation strategies to respond to the two extreme floods in 2007 and 2013	
		Social capital including the social aspect of resilience that leads to information for self-organization, recovery after a disaster and learning to adapt	
	RT 20/	Main questions of FGDs:	
	Focus Group Discussions (FGDs)	Two groups each consist of 10 and 8	Local mapping of vulnerability and risk
		Collective actions to respond to risk of floods	
		The distribution of roles in the communities	

Source: Authors

### **19.3.6 Data Analysis**

Data from structured interviews is analyzed through descriptive statistics. Meanwhile, data from semi-structured interviews is analyzed through the stages of selecting, coding and categorizing information. Moreover, the result of the FGDs is processed through managing, sorting and interpreting the data (Rabiee 2004). Eventually we combine all of data and information through triangulation procedure. The finding from household's survey will be complemented by the findings from semi-structured interviews and focus group discussion.

## **19.4 Results and Discussion**

This section is presented in two main parts. First, we describe the ethnicity composition of our respondents based on household survey. Second, we analyze how each aspect of culture influence the ability to cope, self-organize, recover, and learn to adapt as the components of community resilience building.

### **19.4.1 Ethnic Background of Respondents**

This research considers ethnicity as one background of the respondents since ethnicity can serves as a context to understand self-identity and social interaction, and second, the unique characteristic of the case study area, Muara Baru Kampong, that consists of various ethnic backgrounds due to the flow of migrants from across Indonesia (Padawangi and Douglas 2015; Firman et al. 2011).

Based on household surveys, there are five dominant ethnicities in the case study area, namely Betawi, Sundanese, Javanese, Banten (respondents also mention ethnic Banten as Serang) and Buginese. Based on observation and semi-structured interviews with formal and informal leaders, we find that Banten and Bugis ethnicities are the two with the longest history in Muara Baru. They are recognized as the pioneers of building the informal housing in Muara Baru. In addition, Betawi is an original ethnicity or 'Jakarta asli' in Jakarta as mentioned by Castles (1967). However, it is a newly constructed ethnicity from the Dutch colonial era, which consists of various ethnic origins as such Javanese, Buginese, Sundanese, Malay, Balinese, Ambonese, Makassarese and others as such Europeans, Chinese and Arabs (Tjahjono 2003; Castles 1967). For this research, ethnic Betawi is those who are originally from Jakarta with ancestry during the Dutch colonial era. Sundanese is an ethnicity of West Java Province, while Javanese is an ethnicity mostly from central Java and Jogjakarta (Hatma 2011). Bantenese ethnicity is originally linked to the Banten Sultanate that was a Muslim Kingdom in the sixteenth and seventeenth century (van Bruinessen 1995) and located in Banten Province, which previously

was part of West Java. Buginese is an ethnicity from South Sulawesi (Pelras 2000), which also in this research includes ethnic Makassar. This research shows that the composition of respondents' ethnicity is nearly equally distributed. The ethnicity of the Javanese is the largest group, followed by the Buginese and Sundanese respectively (See Fig. 19.2 and Box 19.1).

### 19.4.2 Culture and Community Resilience

This section presents research analysis and findings on how culture shapes community resilience in the case study area. Overall, our research finds that each aspects of culture tends to influence different aspects of community resilience. Aspects of culture such as behavior or practice influences how a household and community cope, self-organize and recover following a disaster. The current prominent behaviors are mutual assistance (*gotong royong*), helping each other, and livelihood preference. *Gotong royong* is a traditional concept in Indonesia whereby people have developed a communal work system, people work together in the same time for certain purpose, for instance, to clean shared rivers and drainage channels around their settlements (Marfai et al. 2015). Through this culture, a household and community can absorb the changes caused by disasters. Relationships, networking and kinship among community members, originally established based on ethnic background, is important for supporting the self-organization, recovery and learning to adapt. Beliefs and values that shape risk perception influences how people learn to adapt. People currently are more concerned about the uncertainty of a place to live due to the eviction process. Thus, people tend to be less prepared to adapt for the uncertainty of future risk as they have other priorities. The following sub-sections are organized into four parts that each presents an analysis and finding of each aspect of cultural influence on each aspect of community resilience.

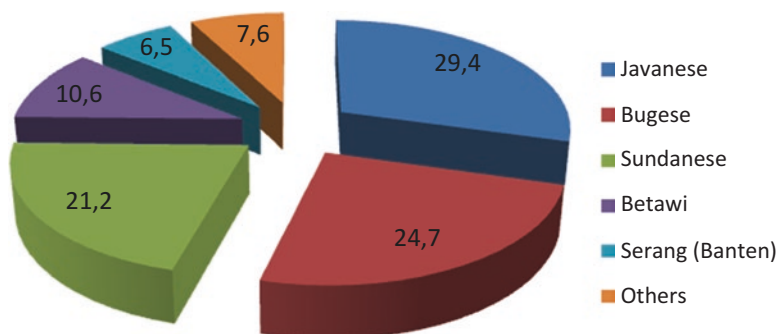


Fig. 19.2 Percentage distribution of respondents based on ethnicity

**Box 19.1: The history of informal housing and slum areas with the respected people who acted as pioneers living in Muara Baru**

In the 1970s, some people occupied the surrounding area of Pluit reservation as informal housing. The people who started building houses were from South Sulawesi Province (ethnic Bugisnese) and from Bantenese Province (ethnic Banten). People from Sulawesi arrived in Jakarta using traditional ships because they were fishermen. People acknowledged them as “seniors” and thus referred to them as respected people who could also act as informal local leaders. That means people will ask them for help and they could also become a connector to administrative processes in the government system. As initiators, they owned the land in large quantities. Not only did they build houses, they also utilized the land for planting sugarcane. Because they occupied large areas, later, they built more houses to be rented to other in-migrants. During that time, the informal housing was located next to the Pluit reservoir (surrounding reservoir). However, as the number of people arriving in this area was increasing, housing was also expanding fast. In the 1980s a new big fishing port in Muara Baru close to Pluit reservoir started to operate. Therefore, the houses were now growing into the reservoir area. The people started to build houses (categorized as non-permanent) on the water based on the wood pile *Based on semi structured interviews with local leaders.*

**19.4.3 Practices/Behaviors which Influence Coping with Floods**

This research finds that coping strategies mainly serve to reduce human and economic loss in time. The ability to cope with a disturbance is mainly determined by practices and behaviors that already exist in communities. We find two main practices or behaviors that help to understand how communities build their resilience.

First, coping is affected by the positive practice or behavior of helping each other and the spirit of working together or mutual assistance (*gotong royong*). During floods, people will save their family members, particularly children and elderly first, and then to move property to a safer place (FGD-01-PJR). During floods, each household will do this first for themselves and afterwards help others. People will help neighbors, particularly families with elderly or those without adults as well as women-headed households. For instance, they help to move heavy things to a safer place. In this case, people help without considering ethnic background. Moreover, people also try to protect their houses from flooding by installing sandbags in front of and around their houses (FGD-01, 02-PJR). People usually make sandbags themselves before floods. They collect sand from the small canal surrounding the informal settlement during the *gotong royong*, especially when cleaning the small canals in the neighborhood to prepare for the rainy season. They put all the sandbags along

the streets and over time they become dry and solid. People can then take them and put them in front of their houses in order to control the floodwater when it comes.

During floods, people who have a two-storey house prefer to stay at home even though the height of water can reach one meter or more. As long as they still can stay on the second floor, they feel safe to stay at home. However, family members especially the elderly and children will be evacuated to the shelter. Only adults will stay in the house. Based on the FGDs, we find that this was because they want to save their property and second, to save the house from being hit by boats that travel around the settlement to evacuate affected people. Knowing that neighbors are still in their house, others will keep supporting them by delivering food from the shelter or from charity organizations. Not only do people distribute food from the shelter, but they also share their own food when the water is still low and all people are still inside their houses. Based on their experiences of flooding, during the first and second day of the flood no aid usually reaches their place. Thus, they have to survive solely based on their own capacity. Therefore, sharing food with neighbors is one strategy and behavior that helps people to survive in the first and second day of the floods. This behavior is important for those whose house is far from the main road and thus might suffer a delay in being reached by relief. Based on these experiences, people in the case study area stated that they have the confidence to cope with disaster because they have a strong connection with one another.

This research also finds that other practices or behaviors of people to be able cope with floods are related to their livelihood activities. Respondents mention the economic benefit of living close to the fishing port. The port operates for 24 h and the busy time is at night when most of ships drop their fish and buyers come from all over the city. Respondents who have a night schedule of working need a place close by to live. Moreover, people who migrated from coastal area of their origin place feel comfortable in the familiar location of their current area and influence their perception to floods.

The main economic activities of respondents include working in the fishery sector, e.g. working as a crew aboard a fishing boat, traditional fishing, laboring at fishery firms, or as fish traders in the informal sector. Since their daily activities are close to the water, they ascribe a special meaning to water and are used to living in harmony with water (HH-01; 02; 03-PJR). People perceive floods merely as a change in the water condition. During FGD in RT 20, participants stated that high water is not something that makes them afraid, but in contrast, they felt they could deal with the situation. During floods, children enjoy playing around using small boats. One interview with respondents in RT 19 revealed that during floods they could throw rubbish directly to the water since the water moves fast. However, when the 2013 flood occurred, eventually people decided to go to the shelter after few days staying in their house, because the length of the inundation lasted around 2 weeks.

The benefits that they get make them less concerned about the severe experiences during floods, in particular the floods in 2007 and 2013, likewise for the decision to stay in their houses during floods. Protecting their property and avoiding damage to their house is seen as a better decision compared to going to the shelter. To conclude,

the practice and behaviors of the people in Muara Baru is represented through the characteristic of having strong empathy for each other and living in harmony with the water, which influences their ability to cope with floods. Hence, this also nurtures their confidence in the face of disasters.

#### ***19.4.4 Practice/Behaviors and Social Structures which Influence the Ability to Self-Organize***

In this research, the ability to self-organize means the ability to organize oneself after a disaster to be able to return to normal activities without outside intervention. This research finds that the ability to self-organize is influenced by two main aspects of culture. First, it is affected by the existing practice or behavior consisting of mutual assistance, division of tasks between women and men and the capacity to organize a small group for a relief program. Second, it is influenced by the social structure, particularly networking, kinship and relationships. Networking, kinship and relationships among neighbors is originally built according to certain ethnic groups. The ethnic Bugisnese are a group with strong economic networking and relationships. Most Bugisnese in our case study are members of an association of Bugisnese.

During severe floods in 2007 and 2013, major damage and loss created an unstable situation in communities where many houses were broken (ILL-01;02-PJR). The 2007 flood was caused by coastal flooding and compounded by the collapse of a sea dyke in front of the housing community. Since the sea level is higher than the settlement area, water from the sea inundates all housing behind the sea dyke. A discussion from FGDs in RT 20 reveals that after the water receded, people spontaneously repaired the dyke voluntarily because they have a positive sense of belonging of their neighborhood. During the new construction of sea dyke by the government of Jakarta, community members also worked together to support the process. Not only men, but women also got involved and joined the construction process and provided food for the workers. Moreover, local leaders mainly gave instructions but how they organized themselves was spontaneous.

The self-organizing ability in the community exists already, particularly the distribution of tasks between women and men, not only in response to flood events. In the case of a fire, men are responsible for extinguishing the fire while women provide and serve food to the affected families. In the case study area, we find that women tend to have an equal role compared to men. The equal status between women and men gives several benefits for responding to disasters. A study conducted by Liu and Mishna (2014) aimed to understand why women that were acknowledged as a vulnerable group could survive a severe earthquake in 1999 in Taiwan. They found that a positive task division between women and men plays a key role. Since women are often saved first during an earthquake together with children and the elderly, they have similar opportunities to carry out economic activities

to support families to return back to their normal condition. Our study shows that women also take responsibility for several organizational activities such as being appointed as local activists. There were two female respondents who were active in local community programs and helped to mobilize community members in community meetings. From the FGDs, we found that women also had ideas and the confidence to deliver the programs for community development. At the household level, decisions related to flood response also considered ideas from women.

The ability for people to manage themselves is evident from the relief distribution during the flood events. There were some local informal leaders that arranged the distribution of basic goods received from charity organizations and proved to be very useful due to the irregular structure of the informal settlement. Thus, despite the small size of the group handing out goods, more people could get aid. A religious leader in our case study also played a role in the distribution of aid. Each group finds aid resources from different sources such as charity organizations or individuals. An interview with an informal leader shows that he and others decided to manage the distribution by themselves by delivering basic needs door to door and preparing a sufficient number of packages. He stated that, when the number of people who needed aid exceeded that of aid availability, he reduced the amount of aid to be able to distribute to more families.

The other aspect of culture that supports self-organization following a disaster is kinship and networking. Under normal conditions, new migrants can get access for housing and a job through networking and kinship. In the case after the 2013 flood, networking and kinship were very helpful for all groups of people to organize themselves, as the government of Jakarta progressively implements evictions and only provides social housing for those who own a house in informal housing. Renters and inhabitants without Jakarta's identity cards cannot receive social housing. However, through strong networking and kinship ties, some renters can get access to social housing. There is a strong bond of trust between owners and renters. During the census conducted by local government to identify who should have the right for social housing, the renters are registered as owners of the house. Interviews with local leaders of Bugisnese ethnicity show that they try to give access for their renters, whom they refer to as relatives. One respondent stated that he could get seven social housing plots and only use one for him and his family. They manage it informally and only based on trust with each other.

#### ***19.4.5 Practice/Behaviors and Social Structures which Influence Recovery Processes***

The recovery process in this research is mainly observed through the renovation of houses and restarting economic activities after flood events. In this case, we find that the ownership status of housing as a non-cultural aspect leads to a decision to renovate the house. In this recovery process, there are two stages that we analyze to

understand community resilience. First, people's decisions to renovate their houses depends on the status of their housing, whether they own or rent it. Second, since it requires budgeting, they have to find financial support and for this purpose, the quality of networking, kinship and relationships strongly influences their ability to recover following a disaster.

Severe flooding in 2007 caused major damage to houses in RT 20 due to the high velocity of the water (HH-04, 05-PJR; FGD-02-PJR). Meanwhile, the flood in 2013 caused major damage because of the long period of inundation. Apart from damage to houses, both floods also impacted the properties of informal traders such as street vendors' wagons.

Our survey shows that more than 70% of respondents received major damage to their houses. Around 30% stated that their house received no damage but only the furniture. Moreover, only 35% of those surveyed who had a severely damaged house were able to renovate their house and around 65% stated that they only made small efforts to return the house back to its normal function. They were more concerned about the function of the house rather than its quality. For instance, repairing doors and walls are the first priorities when renovating a house. Those surveyed said they preferred to choose used-material with a low price or even free material from the neighborhood. The second option is to paint the wall, followed by elevating the floor including installing small embankments in front of the house. However, in our case study, renovating a house is perceived as a non-robust strategy in the face of future flood risk. Around 65% of those who renovated their house stated that since they live in a flood prone area and floods are getting worse, it was still likely they will be impacted the same as previous experiences. Hence, they prefer to carry out the most important options when renovating the house. In addition, for those who rent a house, the decision is most likely to depend on the owners since renovation is the responsibility of the owners. As a renter, they can decide whether to stay in that house or find another house. However, since the relationship between the owners and the renters is mostly based on a close network and kinship, they can often negotiate the renovation. In this case, the renters may renovate the house but the owners are obliged to give a month's free rent.

Besides the level of damage, the recovery process also depends on the availability of money. Since most respondents had no sustained monthly income or savings, they stated that there were several financial sources they could use instead. First, they could borrow money from relatives, families and neighbors. Interviews with respondents in RT 19 show that they preferred to utilize networking, likely related to ethnic background. One respondent stated that as a Javanese, she feels more comfortable to ask her Javanese relative to lend her money (HH-03-PJR). In contrast, FGD in RT 20 showed that ethnic background does not determine how people get access to money because all community members are closer to each other. Second, people can borrow money from a regular social gathering or *arisan*, which exists as a common system especially among women. Money is collected every week or month and someone from the group is chosen to receive the money. In an urgent situation a member of the *arisan* can have priority to get the money. People also strategically borrowing money after a disaster to fulfill the basic daily needs of



families and for starting new economic activities. Third, people can borrow money from moneylenders (*rentenir*) who give credit without formal administrative requirements and are flexible with the payment mechanism. Unfortunately, the interest rate is very high. The only reason people approach moneylenders is because they have no access to a formal financial institution themselves and usually only need a small amount of money. Borrowing money is becoming a more common practice in the community due to the instability of incomes and the cultural aversion towards saving money.

#### ***19.4.6 Beliefs and Values which Influence the Ability to Learn to Adapt***

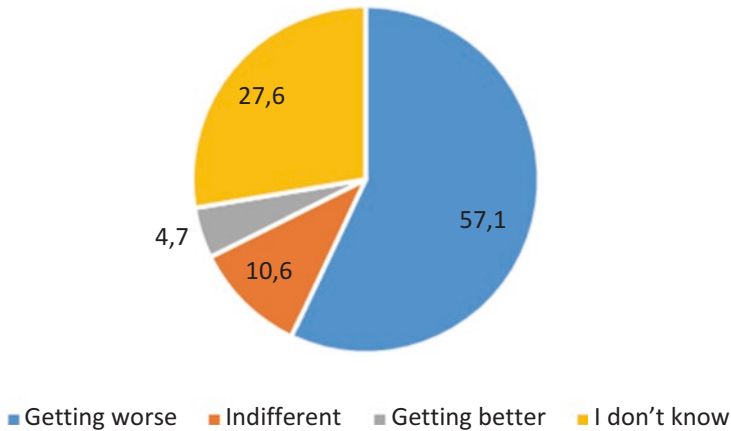
To understand the ability to learn to adapt, we start by describing the risk perception of the community members. Risk perception influences how people decide to take action for adaptation to future flood risk.

Respondents in the case study areas stated that flooding is not a major concern for their daily life since they are more considerate of the economic benefits of living where they do. However, the severe flooding in 2007 and 2013 influenced how people perceive future risk and how they should face the next flood. This study finds that people perceived flooding as getting worse and they are now more concerned about the uncertainty of the future caused by the eviction program implemented by the government. However, people still have strong beliefs that their future life is in God's hands, hence they learn to adapt only based on their previous experiences.

Figure 19.3 shows the percentage of respondents' perception of the trend of floods during the time they stay in Muara Baru which in average is for 30 years. Based on structured interviews with 170 respondents, recent floods were perceived as worse compared to 30 years ago both for river flooding and coastal flooding.

In general, people recognized that there are three types of floods, namely coastal flooding, river flooding and a combination of both. The combination of coastal and river flooding should occur every 5 years, but people stated that since 2012, the pattern has been changing and become more uncertain. This means that big floods could happen at any time. There are several factors that respondents mentioned as a potential cause for this (Fig. 19.4), such as: (1) temperature, (2) rainfall, (3) sea level rise, (4) storm surge, (5) wind from the sea, (6) water from upstream, (7) God's will, and (8) others.

The reason for flooding 'because of God's will', is interesting to be analyzed in relation to ethnic background, even though only 4% of respondents gave this choice. As described in the literature review and method section, the respondents come from several ethnic backgrounds and the acknowledged ones are Bantnese and Bugisnese. Both of those ethnicities have a strong Moslem religious background. Respondents' believe that "*God will give the best for them, sooner or later and in ways that they might not predict*". They only need to do their best and surrender to



**Fig. 19.3** Perception of the trend in flooding (%) (Source: Authors)

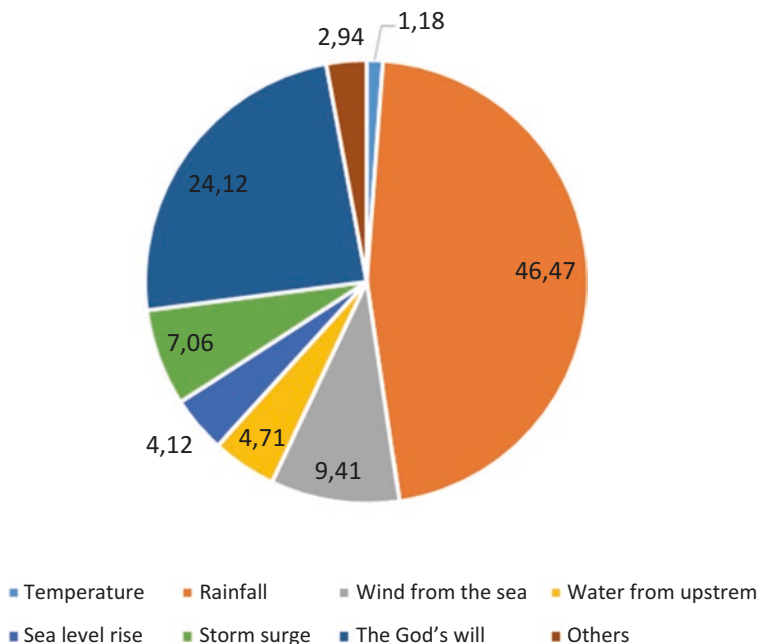
God. During FGD in RT 20 almost all participants raised the issue about the role of God in their life. They said that they are unable to avoid disasters if that is already God's plan. Moreover, they highlight disasters can occur anywhere.

Even though they believe that a disaster is caused by God's will, people try to do their best to prepare for future risk. Learning from previous experiences, they stated that flooding is becoming more uncertain and elevating the house is not only the best strategy to reduce the impact of flooding. However, interestingly, 60% of all respondents stated that they would renovate and elevate their house if they have sufficient budget for it. Forty percent of respondents mentioned that they would not directly reconstruct their house. Based on their experience, they are and will still be affected by floods even though they have elevated the floor of the house previously. Thus, they prefer to accept the situation and hope that in the future the disaster will be less.

Based on their experiences in responding to at least two severe floods, people stated that learning the strength of interaction, relationships and networking among community members is very useful to help them to survive during and after disasters (FGD-01; 02-PJR). Based on existing behaviors, they are not concerned about a new strategy to adapt to future risk but would rather focus on how to keep all those positive interactions sustained. This helps them to be more confident to face disaster.

*We can survive here because people here are very solid to face disaster together and we help each other... in 2013 flood, my husband was away from home and all people help me to safe all my properties... if we are not solid like this, we might be not survive... (Ibu LND, RT 20)*

However, when we ask about future risk and perception of their ability to face future disasters, respondents stated that they have less confidence compared to previous experiences. The survey shows that only about 46% of respondents stated that they believe they can face future risk and around 54% of them were still not sure.



**Fig. 19.4** Perception of the causes of flooding (%) (Source: Authors)

The semi-structured interviews show that respondents who are unsure about their ability to face the future are so because the current situation is different. For respondents in RT 19 and 20, they have more concern about where they are living due to the massive eviction program by the government of Jakarta. Eviction and resettlement in social housing has caused great changes to the neighborhood structure. Respondents who stay in social housing stated that they need to adapt to the new neighbors due to the random placement of resettlement.

Moreover, to adapt to future risk, this study finds that ethnic Bugisnese are more active in expanding their capacity by broadening and strengthening networking to other stakeholders. Respondents stated that due to uncertain conditions, they need more connection to government officers to obtain information about programs related to their neighborhood. Based on interviews with one informal leader in social housing, there were currently many new programs that impacted them significantly. Besides eviction and resettlement, they also have to get information about clean water provision and access for micro finance, particularly for people in the resettlement areas. Clean water provision is becoming the main problem for the communities in Muara Baru as they have to pay a high price for clean water. To conclude, learning to adapt to floods is mainly influenced by people's beliefs that God will protect them and their risk perception is shaped by their values of the

strength of networking, relationships and kinship. Moreover, having certain information will support them to take action in the face of future risk.

## 19.5 Conclusion and Recommendation

The utilization of culture as a factor to influence disaster risk reduction and adaptation has been broadly accepted (Thomalla et al. 2015). Cannon (2015) specifically highlights that culture has to be understood as a factor of the root causes of vulnerability. Therefore, cultural aspects can serve as an entry point for building resilience (Schipper 2015). By focusing on understanding how resilience is built by a vulnerable community, we unpack the aspects of culture to explain how each of them influences progressive community resilience. This study shows that three aspects of culture, such as practices/behaviors, beliefs and values and social structure, influence the ability of communities to cope, self-organize, recover and learn to adapt during and following disasters.

We find that the first component of community resilience, namely the ability to cope, is mainly shaped by the spirit of helping each other, mutual assistance and people's attachment to their livelihoods. These are existing practices or behaviors in the community and thus work effectively during disaster and help each other to reduce economic loss. People who work in the fisheries sector and have a strong relationship to water, have less concern about floods and rather accept extreme flooding as a changing condition of water. This leads some people to stay in their houses and support each other concerning the food supply.

The second component of community resilience, the ability to self-organize, is mainly shaped by two aspects of culture. First, the existing behaviors of community member as such mutual assistance, task division between women and men and the capacity to organize a small group for relief efforts, which are useful for managing the community. Through the power of local leaders, certain groups of people manage the aid to be distributed more equally to the community. Second, networking, kinship and relationship among neighbors, were developed originally from within their own ethnic groups. Different groups have their own ways to organize themselves. In terms of resettlement programs, relatives will help other based on trust to obtain social housing, especially for those who only have renter status.

The third component of community resilience is the ability to recover following a disaster and is mainly shaped by networking and kinship. Through existing networks and kinship ties, people can receive financial support for rebuilding after damage to their house and for fulfilling basic needs as a result of reduced income during floods. Each household recognizes to whom they should ask for financial access and mainly refer to lenders of a similar ethnic background.

The fourth aspect of community resilience is the ability to learn to adapt. It is mainly influenced by people's beliefs and previous experiences. People showed that they could survive after two severe floods in 2007 and 2013 and they can cope with disasters together with other community members and believe that God's will is a

reason they can survive. They stated that disasters could occur everywhere even though they would try to avoid that. Therefore, they are more concerned about the uncertainty of future eviction and not flooding. The only strategy they have is, if they possess sufficient budget, to build their house stronger and higher.

Based on the detailed relation among each aspect of culture and community resilience, this study helps to understand the local context of resilience. As Kuhlicke (2010) proposed about the myth of resilience, this study offers an explanation about how people as a community build their resilience through existing culture. As Norris et al. (2008) stated, communities have their own capacity to build resilience. This research proves that without external support, vulnerable communities can spontaneously build some resilience by utilizing existing behaviors, beliefs and values, as well as social structure. This can be used as an answer to the question about why vulnerable people can survive in flood-prone areas and experiences severe floods more than once.

These findings are useful to support the effort from stakeholders from both government and non-government organizations who deliver on intervention and empowerment programs to strengthen community resilience. Future activities should consider what aspects of culture are already established in the community and what is needed to strengthen it. Building resilience programs at the community level should consider in detail the local context in order to optimize the effectiveness of the program and avoid local conflict. Further research may be needed to understand people's resilience after their neighborhood system has changed due to resettlement and programs geared towards adaptation to future risk.

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# Chapter 20

## Religious Interpretations and Psychological Recovery from the Aceh 2004 Tsunami: The Promise of Heaven, Healing the Trauma

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**Abstract** This chapter discusses post-disaster mental health recovery and its relevance for disaster risk reduction. Specifically, it describes how to design post-disaster mental health programs that take into account the perspectives of the victims in both the design and implementation. Some theories state that religious beliefs and practices guide people's understanding of a problem toward finding solutions. The flexibility to adapt to local context is the key to successful and effective mental health programs. However, little is known about how Muslims themselves perceive disasters, death and loss because of disaster, and how they use their faith to recover. This understanding is relevant since some countries where the majority of the populations are Muslim, like Indonesia, are disaster-prone areas. Data is used from interviews with the beneficiaries that were conducted in December 2005. The interview data was analyzed using a thematic analysis. The themes appeared by identifying, analyzing and looking at patterns within the interview data.

The study finds five specific viewpoints that emerged, including: the disaster was preordained from God; there will be ease after the hardship; one must be grateful for what they still have; to pray to and remember God to find peace; and those who died are martyrs and were rewarded by God with heaven. These viewpoints are then explained through the lens of three prominent Muslim scholars and their texts that deal with Islamic perspectives to responding to calamities. These findings provide a basis for a proposal to develop and implement mental health programs that respect the perspectives of the victims in both counseling and discussions, are supported by

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religious figures, incorporate the use of prayers as a way of coping and healing, and integrate a mental health program with a livelihood program to help victims rebuild their lives.

**Keywords** Religious beliefs • Post-disaster • Mental health • Support program • Muslim community • Muslim perspective

## 20.1 Introduction

When disaster strikes, aid comes from various sources: other nations, philanthropic organizations, local and international NGO's, also professionals that come from a wide array of disciplines. They come from different places from all over the world with different social and cultural backgrounds and different beliefs toward religion. They bring their knowledge and prior experience in helping the affected communities. People from different social and cultural backgrounds might perceive an event entirely differently. As Tajfel (1969) explained, culture greatly affects the perception process. Marsella et al. (2008) argued that culture shapes the way people perceive and experience reality, and construct their realities. Their perspectives naturally guide their own practice and systems in giving the support in both reconstruction and recovery.

On the one hand you have the implementers; who have their own way of approaching disasters based on their own culture and the values adhered to in that culture. On the other hand, you have the beneficiaries who themselves also have their own way of approaching disasters. The victims themselves are not passive in responding to natural disasters. They also use the knowledge and skills they already have to deal with the situation as best they can (Pelupessy and Bretherton 2015). In this sense, Harris (2012) emphasized the importance of considering the cultural ideas of an affected population, who have their own particular societal and cultural attachments, to get a valid assessment of vulnerability. Failure to do so could cause misalignment between the support provided by aid groups, and that which is actually needed by the beneficiaries.

The importance of recognizing the existing knowledge and skills of the beneficiaries also needs to be put into consideration when giving mental health support. Pelupessy and Brethorn (2015) suggested when developing mental health support programs, relief agencies need to learn about local conditions and to be sensitive to local contexts and base the program on local capacities. It is vital that the intervention not put aside the identity and sense of worth of the beneficiaries, but is built on their strengths. The flexibility to adapt to a local context is the key to successful mental health programs, and therefore, programs that do not consider this will potentially lack effectiveness (ibid).

The aim of this chapter is to understand how the victims of the 2004 Aceh Tsunami made meaning of, and responded to the disaster, along with its coinciding death and loss. In particular, we approach the topic from the perspective of the mental health services that were offered to the survivors. Our study indicates that the

perspectives of survivors may be different from those of aid groups and support teams. We argue that, relief groups need to both understand and embrace the perspectives that are plausible for recovery in framing the support programs for maximum impact. Groups should assist while also respecting local beliefs and building programs based on the beneficiaries' capacities.

The objectives of this chapter are to review literature on victim responses to disaster; to present results of interviews on how Muslims in Aceh perceived the tsunami of 2004; how they used their faith as a resource to recover; and to use the works of three Muslim scholars to interpret the results. The main question we answer in this chapter is how the tsunami victims in Aceh interpreted and responded to the 2004 disaster. By looking at the case of Muslims in Aceh, an understanding of how people's religious beliefs should become a part of the knowledge and resources to recover and mitigate disaster is explained.

There is a limited body of work that really delves into the experiences of religious people, including Muslims in particular, who have experienced tragedy. We want to shed light on this, in order to inform service providers that both religion and culture should be considered more seriously. However, there is a possibility of human diversity in terms of the experience of tragedy and practice of Islam among the Acehnese. In general, Aceh is a very 'Islamic' place, but there will always be diversity in terms of beliefs and practices. One of the limitations of this chapter is that it only includes a handful of individuals, whose experiences cannot be generalized to the larger population. This understanding is important in developing and conducting mental health programs. Without the consideration of religion, beliefs, values and practices when planning mental health programs at a community level, the results could be biased, ineffective, and also not tailored to the people's needs. By harnessing the power of communities and creating culturally relevant solutions, barriers can be overcome to generate better results in the process of post-disaster recovery. The chapter is structured as follows: Sect. 20.2 describes the methods used to collect and analyze data. Section 20.3 introduces a literature review on the post-reconstruction process in Aceh from the point of view of mental health, and the role of religious interpretation of traumatic events on the ability to recover and mitigate the effects of disasters. Section 20.4 presents the findings of the study and links them with the works of three highly regarded Muslim scholars to support the existence of the themes we discovered in the field. Finally, Sect. 20.5 presents a summary of the key findings, and also discusses the implications for the findings on future programs on post-disaster mental health, specifically in Muslim societies.

## **20.2 Method**

### ***20.2.1 Data Collection***

This chapter is based on the observations and explanations of the beneficiaries' experiences a year after the tragedy. In December 2005, we interviewed seven survivors of the tsunami in Meulaboh, West Aceh. The participants' age ranged between

**Table 20.1** Profiles of study participants

Survivor/participant names	Gender	Age	Description/profile
1. Edi	Male	28	Edi lost his job and family members. His mother lost her home and a sister. He worked as driver at the time of the interview
2. Zakir	Male	21	Zakir lost both his mother and sister in the tsunami. He worked out of the city. His family lost all their possessions
3. Rosmiati	Female	40	Rosmiati lost her possessions and business. She used to have a small canteen before the tsunami. She worked as a cleaner at the time of the interview
4. Nurbasarah	Female	31	Nurbasarah rented house was swept away in the Tsunami. At the time of the tsunami, she was visiting her husband who was detained at the police station because of giving money to GAM (Free Aceh Movement)
5. Aswar	Male	19	He is a university student. His family lost their possessions. His university closed for months after tsunami
6. Auliya	Female	17	Her family lost their possessions. Her father lost his business
7. Arif	Male	20	His family lost their houses and other material possessions

17 and 40 years old. Two participants lost their family members, while the remaining subjects lost their houses and other material possessions. The following is a profile of the study participants is shown in Table 20.1.

The individual interviews were conducted in order to find out what programs were needed and relevant to the victims. The questions posed were designed to uncover how the victims viewed the disaster, how they made sense of the lives lost, and what helped them cope and recover from the aftermath (See Appendix A. Interview Protocol). It is important to note that the data cannot be generalized to the larger Acehnese or Muslim community, due to the size of the subject group studied.

### **20.2.2 Data Analysis**

The interview data was analyzed using thematic analysis. We observed the themes and concepts embedded within the data set. Thematic analysis is a method for identifying, analyzing, and reporting patterns or themes within data (Braun and Clarke 2006). The themes appeared by identifying and analyzing patterns within interview and across data. The themes reside in the data and emerge from the researchers identifying patterns and creating links as they understand them (Vinz et al. 1997).

Here, the researchers' judgment is vital in determining what the theme is (Braun and Clarke 2006). The themes explain what is important in the data in relation to the research question and they describe some level of patterned response or meaning (ibid).

There are different ways of approaching data in a thematic analysis. We approached the data in an inductive way in which the coding and themes are developed directly by the content of the data. We followed Braun and Clarke's (2006) steps of developing themes: first, we familiarized the data by reading and re-reading the data. Second, we did coding. We generated succinct labels that identified the important features in the data that might be relevant to answer the research question. After that we examined the codes and collated data to identify potential themes. When the patterns of potential themes emerged, we reviewed them to determine whether they presented a convincing story of the data and answered the research question. Then, we defined and named the themes, and finally, we wrote up the analytic narrative and the extracted data. The analytic phase seemed to be sequential, but it was not rigid. Since the dataset is not huge, we moved back and forth between different phases.

The analyzed interview results were then compared to the views of the three scholars. To better understand the teachings that influence the Acehese view of calamity, we refer to the scholarly works of three scholars who discuss these issues at length in their books, which rely on the source Islamic texts, the Quran and Hadith of the Prophet Muhammad, as their references. They were:

1. Aidh ibn Abdullah al-Qarni
2. Komaruddin Hidayat
3. Quraish Syihab.

The three scholars were chosen because their books on the issues of death and loss are a main reference for many Indonesians who suffer or experience traumatic experiences in their lives. The works of these three scholars are used to better understand the meanings offered by the survivors in their oral and written accounts of the tsunami of 2004. The proceeding discussion of the perspectives of the survivors is explained in light of the work presented in these authors' books.

Aidh ibn Abdullah al-Qarni is a Saudi Arabian scholar in Hadith and Islamic Theology who is also a poet. His views on death, loss, death and the afterlife were written in his popular book "*La Tahzan: Don't be Sad.*" This book was first published in 2001. This worldwide best-selling book has been translated to various languages including Bahasa Indonesia, Bahasa Malaysia, Urdu and English. In Indonesia, there are many versions of this book due to its wide popularity. As written on the cover of the book, the author explains that the book offers therapy for those who are weary, depressed, and in despair by using reflections from the Quran and Hadith.

The last two scholars are famous Indonesian scholars who have written many books on Islam. Both are ex-Rectors from the State Islamic University in Jakarta, Indonesia. They are also popular and have special TV programs on national TV in Indonesia.

We looked at Komarudin Hidayat's views by analyzing his book, "*Psikologi Kematian: Mengubah Ketakutan Menjadi Optimisme*" or "The Psychology of Death: Changing Fear into Optimism." This book attempts to interpret the meaning of death from the viewpoint of Islam and psychology. Komaruddin Hidayat's book is often used as a source of support during the ceremonies held by families conducting *tahlilan* or salvation prayers 40 days after someone's death. The book is often attached with the *Yasin* book (Yasin is one chapter in the Quran that talks about death), emphasizing the high esteem in which it is held by Acehnese Muslims.

We explored Quraish Syihab's view on these issues by looking at his book, "*Kematian adalah sebuah Nikmat: Sekelumit Pandangan Filosof, Agamawan, Ilmuwan dan Al-Qur'an*" or "Death is a Favor: A little view of Philosophers, Theologians, Scientists and Qur'an". This book explores various views on death.

### 20.3 Literature Review

This literature review serves to contextualize the analysis with existing literature. We put the analyzed data into context by presenting first, the literature review on the overview of the post-reconstruction processes in Aceh from the point of view of mental health, and second, the role of people's religious interpretation toward traumatic events and how they recover and mitigate the effects of disaster. This section helps establish a framework within which to present and analyze the findings.

#### 20.3.1 *Post Reconstruction Processes in Aceh: From the Point of View of Mental Health Experts*

We present literature on post reconstruction processes in Aceh from the point of view of mental health experts. Some scholars argue for the importance of cultural awareness and respect for religious beliefs of beneficiaries of mental health interventions. Previous research has shown, however, that some programs fail to acknowledge local communities' existing knowledge and resources. We begin with an overview of Aceh, its religion, culture and history, to put our findings into context. We then introduce some of the mental health programs conducted in Aceh following the tsunami and discuss the degree to which they met the needs of the people. Finally, we provide literature on the importance of acknowledging the community's culture and belief system in delivering mental health programs.

The tsunami in Aceh is one example of a plethora of aid groups coming from all over the world to help what were primarily Muslim communities, with the majority coming from different social, cultural and religious and non-religious perspectives. In response to the Aceh 2004 tsunami, at least 35 countries were involved in recovery and reconstruction (Afif 2014). These countries were acknowledged by the

Government of Aceh at the 10 year commemoration of the Aceh tsunami in 2014, more countries were involved than expected. Masyarafah and McKeon (2008) claimed that there were 463 organizations working in Aceh after the tsunami, 435 of them were NGOs, 27 donors, and one Indonesian government agency – the Rehabilitation and Reconstruction Bureau (BRR), which led and managed the work of the aid groups. Of the 435 NGOs, 75 % were international bodies (ibid). From the list of 35 countries above, more than half of those were from developed countries. These people came from different cultural backgrounds from the people they helped. The outsiders came with a high level of expertise but failed to consider the local context. Pelupessy and Brethorn (2015), who conducted a study on the impact of the psychosocial support programs conducted by the International aid groups 5 years after the tsunami, found that some programs failed to acknowledge the local communities' existing knowledge and resources in the recovery programs they had conducted. One such aspect was the Islamic religious beliefs of the Acehnese. Several examples bear this out, including giving measures and gifts to the victims that are considered offensive in Islam, or physical activities that involved non-related men and women coming into physical contact with one another (ibid). As a consequence, the program faced problems with engaging the communities (ibid). Only a small number of victims attended the individual and group counseling programs that were offered.

Aceh's population is comprised of more than 98 % Muslims and is the only province in Indonesia where Islamic Law is the official law of the land. Thus, for the Acehnese, Islam is considered the principal lens through which the world is understood. To the Acehnese, Islam is beyond what is conventionally attributed to as a religion, and reflects a way of life grounded in a well-developed philosophical and metaphysical worldview. It was expected that the reconstruction and recovery projects in Aceh considered the culture and the beliefs of the Acehnese. Some previous studies have shown that religion and wellbeing are related, and in a post-disaster situation, beneficiaries manage their feelings and the focus of coping in the context of religion is a way people attempt to maintain their wellbeing in the face of adversity (Beit-Hallahmi and Argyle 1997; Graham et al. 2001; Kennedy et al. 1998 as cited in Safdar et al. 2009). When people face destruction and loss, many of them turn to religion and look for support from the divine power or the religious community, but many post-disaster mental health support programs neglect the role of religion (Von Vocano and Schwarz 2014). Right after the disaster, survivors try to understand the situation. People continue to make sense of the disaster by assessing their situation then they make adjustments from their earlier interpretations. They use resources found within them and the communities. The survivor's cultural background and religious beliefs shape their interpretations towards the disaster and in finding the most suitable recovery approach.

Did the relief agencies put these as consideration? If the responses become like a pill, as prescribed by a doctor for a pre-existing disease without seeing the history of the patient neglected, then the mental health support program does not meet the needs of the people (Von Vocano and Schwarz 2014). What they considered important is not addressed in the program, what they think should not be done however, is

introduced in the program. The program becomes a waste. It is important to understand the beneficiaries, their needs and best ways to cope and heal with local and religious values, so then the program will be effective, efficient and meet the needs.

When aid is delivered to an affected community, it is important to acknowledge the community's culture and belief system. During and after a disaster, people attempt to make sense of the events and try to understand how the world works. Their religious beliefs and practices often guide them in the process of understanding a problem, relating the causality of the problem, and finding solutions to the problem (Pargament et al. 1988). The people's social and cultural backgrounds govern their interpretation of the event, its catastrophic effect and their hopes for the future. Gaillard et al. (2008) explained that people's behavior in the face of natural disasters is strongly influenced by the context of cultural, social, economic and political. This is in correspondence with Wisner (2004), who pointed out that people's behavior in the face of natural hazards is mostly dependent on the environment from which they originate. Their social, cultural, economic and political circumstances affect the way they behave.

Psychologists and trained paraprofessionals who deliver mental health programs need to have cultural awareness and respect and understand the religious beliefs of the people they aim to assist. Support services provided for victims should take into consideration the victims' interpretation of what has happened, is happening and will happen so that the support will match the needs of the people. The imperative of incorporating local knowledge and scientific knowledge in disaster reduction is increasingly recognized (Mitchell 2006). Mercer et al. (2010) presented a framework in which relevant indigenous and scientific knowledge could be integrated within disaster risk reduction. Local knowledge is a valuable resource which can facilitate disaster recovery in an efficient, participatory and sustainable way (Howell 2003). We must assess the knowledge carefully to ensure the proper implementation and effectiveness in dealing with disaster risk (Tibby et al. 2008). Such knowledge is a reservoir of available assets that can be used to prevent, mitigate, prepare for, cope with and adapt to disaster risks (Warner and Engel 2014). Scientific knowledge can no longer be seen as superior knowledge compares to local culture, or vice versa, these two fields of knowledge need to be gathered to provide continuous assessment and solutions for disaster risk (Gaillard and Mercer 2012).

### ***20.3.2 The Role of People's Religious Interpretation Toward a Traumatic Event on the Ability to Recover and Mitigate Disasters***

The interviews revealed that the survivors related the disaster with their faith. Faith also enabled them to recover and mitigate the disaster. Here, we explain how the people's religious interpretation toward the traumatic event became an important source of knowledge and a resource for the victims. Faith helped them to heal emotionally and to cope with the trauma that resulted. We also highlight the previous

work of Pelupessy and Bretherton (2015), who explored the need to consider religion in developing post-disaster mental health programs for religious communities, such as the Acehese.

Many disaster survivors look at religion to find meaning in tragic events. They derive meaning from religious cosmologies, where God, or “the Divine” becomes their outlet for or someone to talk with. However, conventional disaster and coping theories tend to obviate the role of religion (Von Vocano and Schwarz 2014).

When the 2004 tsunami occurred, many Acehese employed their belief and value system to cope and heal; they viewed their faith as a resource that gave them the strength to recover. Acehese people tend to view events through the lenses of religious teachings. According to the 2010 national census, almost 100 % of the population in Aceh is Muslims and very small minorities are Protestants, Catholics, and Buddhists (BPS 2010). The data shows almost a mono-religious composition in the Aceh population. For many Muslims, the Holy Qur’an is their reference book and the statements of the Prophet (Hadith), which are complementary to the Qur’an, are also a guide to follow (Mohsen Ghafory-Astiany 2009).

The people’s religious interpretation toward a traumatic event gives considerable impact to the way a community recovers and mitigates. The trauma due to disaster may make faithful individuals to question their beliefs or even lose faith, but in other times lead to people getting closer to their God (McGeehan 2012). So, it is important to understand how they see the event in assisting them to recover. In response to the Aceh tsunami, most aid was coming from Western groups and organizations. The beneficiaries and the aid groups had different ways of looking at the tragedy and different philosophies related to post-traumatic healing. Western definitions of trauma and the solutions to it are not the same as how the local communities see it. In contrast to mainstream Western cultural thought, Indonesians do not view trauma as an individual and problem-focused experience (Indradjaja and Zaumseil 2014).

Acehese people are well known for the courage and bravery. They are traditionally people of considerable pride as well. Several well-known female heroines from Aceh are for example Cut Nyak Din and Malahayati, who battled the Dutch colonialization. The Acehese resilience and strength are important factors that should be considered when administering psychological intervention (Pelupessy and Bretherton 2015)

Individual counseling is also not considered by the people as a less-useful program and people did not come to talk about their feelings with strangers (ibid). The people of Aceh have collective communities; the psychological intervention should not emphasize individualism (ibid). They share grief communally. The group praying and the speeches from a religious leader are their local knowledge of coping with sadness after hazardous events. Additionally, in conducting psychosocial support programs, teams should access and engage the religious leaders. In Aceh, *Tengku* are recognized and respected as religious leaders. *Tengku* can be accessed as the gatekeepers, enabling greater access to communities. Routinely there are religious communities gatherings held by *Tengku*, usually in the mosque. As such, *Tengku* could serve as conduits for creating an activity setting for a psychosocial support program.



The literature explains the need to consider the perspectives of the victims in order to develop a relevant and effective post-disaster mental health program. Their perspectives impact upon the way the people and community recover and mitigate disaster. It is explained by some previous studies that religion and wellbeing are related and in a post-disaster situation the context of religion becomes one way for people to attempt to maintain their wellbeing. The relief agencies need to consider this in response to disasters. This research uses the case of Aceh, which has a population that is almost mono-religious. For our study participants, Islam became the principal lens through which the disaster was understood. Previous research points to the need for relief agencies to consider the perspective of local communities. The mental health teams who deliver psychosocial support programs need to be aware and respectful of the religious beliefs of the people they are assisting. Confirming the literature review and the interview data, we see that these perspectives are important to consider when developing a program.

The next section includes an explanation of the research findings on the perspectives of the tsunami victims of the disaster. These perspectives would be valuable information for mental health program developers and implementers to understand how the victims, specifically Muslims in Aceh, see and respond to disaster. From there, well-suited programs that meet the needs of the people can be developed.

## **20.4 Research Findings: Survivors Perspectives and Scholars' Interpretations**

In presenting the findings, we begin by categorizing the results based on themes that emerged from the analysis of the data. We present a description of the beliefs and ways of coping based on interviews with the survivors. This is followed by an explication of these descriptions from the perspective of relevant Muslim scholars.

Five perspectives summarize how our participants perceived the disaster, loss and death, and healing. They are:

1. The believe that everything that happened has been preordained from God;
2. They did not see the disaster as a curse from God, but rather they see it as a reminder from God and believe that God will not give pressure more that they can bare and there will be ease after the hardship;
3. They remain optimistic and are still grateful with what they have even though they lost family members and possessions;
4. They find peace by remembering and praying to God; and
5. They accept the death of their loved ones as fate and they believe that those who died because of the tsunami are martyrs and they will be rewarded with heaven.

The following is an explanation of the five perspectives in detail. We first present the perspectives of the survivors, followed by the scholars' views to provide a

deeper understanding of the data obtained in 2005. The perspectives of the Muslim scholars are also explicated to help explain the interviewed beneficiaries' understanding of the events.

### ***20.4.1 Everything That Happened Was Preordained***

All the participants said that everything that happened in their lives had been preordained. They believe in fate. Belief in fate is one of the pillars of faith in Islam.

Participant 3 explained that she accepted the tragedy and was resigned to accept that this is the will of God. She lost her rented house and the furniture was also destroyed. She said,

This is God's willing, this is my fate. I accept it. This has been written in my book of fate (Participant 1)

Participant 1 also shared that his mother was sincere and accepted this fate even though she lost her sister and her house. He added that his mother was not angry with God. He had even become closer to God.

My mom said this is her fate. She cannot say no to her own fate. She said she surrenders her life to God, we should not be angry with God who gave her life. Get closer to God in your sorrow (Participant 1)

In parallel to the survivors' beliefs, 'Aidh ibn Abdullah al-Qarni explains that humans should not feel upset and sad because of illness or accidents, for God has determined everything and destiny has spoken. He adds that Man can strive and work in such a way, but the absolute right to determine, remains the property of God. He cites the Quran in chapter *Al-Hadid* or the Iron as the following:

No calamity befalls on the earth or in yourselves but is inscribed in the Book of Decrees (Al-Lauh Al-Mahfuz), before We bring it into existence. Verily, that is easy for Allah. (Al-Hadid/Iron: 22 cited from Muhammad Taqi'-ud-Din Al-Hilali and Muhammad Muhsin Khan 1988, p. 742)

Scholar Quraish Shihab also supports the idea that things happened in life have been preordained. He said that life and death is God's power. He cites the Ali-Imran or Family of Imran chapter in explaining that death is the law that will inevitably happen.

O Allah! Possessor of the kingdom, You give the kingdom to whom You will, and You take the kingdom from whom You will, and You endue with honor whom You will, and You humiliate whom You will. In Your Hand is the good. Verily, You are Able to do all things. You make the night to enter into the day, and You make the day to enter into the night (i.e. increase and decrease in the hours of the night and the day during winter and summer), You bring the living out of the dead, and You bring the dead out of the living. And You give wealth and sustenance to whom You will, without limit (measure or account). (Surah Ali-Imran/The Family of Imran: 26–27 cited from Muhammad Taqi'-ud-Din Al-Hilali and Muhammad Muhsin Khan 1988, p. 71)

What participant 1 and 3 discussed is that the tragedy of natural disasters is actually fate and needs to be accepted, which is explained by Quraish Shihab. He argues that the death and loss of property is the provision destiny. He understands that death may worry men, because they do not know when death comes, and they cannot run from death. Therefore, He suggests that we must always be ready and accept death. His opinion is as submitted by Allah in the Qur'an.

Verily, Allah! With Him (Alone) is the knowledge of the hour, He sends down the rain, and knows that which is in the wombs. No person knows what he will earn tomorrow, and no person knows in what land he will die. Verily, Allah is All-Knower, All-Aware (of things). (Surah Luqman: 34 cited from Muhammad Taqi'-ud-Din Al-Hilali and Muhammad Muhsin Khan 1988, p. 554)

Wheresoever you may be, death will overtake you even if you are in fortresses built up strong and high! (Surah An-Nisa: 78 cited from Muhammad Taqi'-ud-Din Al-Hilali and Muhammad Muhsin Khan 1988, p. 121)

Say (to them): "Verily, the death from which you flee will surely meet you, then you will be sent back to (Allah), the All-Knower of the unseen and the seen, and He will tell you what you used to do." (Surah Al-Jumu'ah/Friday: 78 cited from Muhammad Taqi'-ud-Din Al-Hilali and Muhammad Muhsin Khan 1988, p. 760)

#### ***20.4.2 God Will Not Give You More Than You Can Bare, There Is Ease After Hardship***

The second theme that emerged was related to the belief that God will only give pressure only to that people can bear, and there will always ease after hardship. Four of our study participants connected the peace of Aceh with the wisdom behind the quake and tsunami (participants 1, 4, 5 and 7). They believe there is always wisdom behind tragedy, there is ease after hardship, and that God only tests humans with actions that they can endure. They explained the tragedy would provide the people of Aceh with a lesson, to end the conflict.

Participant 1 shared a story about how his mother, who remained very positive, looked at the tragedy. He believes God tested them with this calamity,

This is the test from God, but he tested us only with acts that we can endure. This calamity is a warning from God to the people of Aceh to be better again, to reconcile. (Participant 1)

While participant 4 explained that there is wisdom of the earthquake and tsunami of 2004, which is peace in Aceh. Her husband was a school principal who was assigned to remote areas. Together with other teachers, her husband at the time was collecting money to be given to GAM. This deposit must be done by the teachers, if they wanted to survive. Her husband was detained because he was accused to be a supporter of GAM.

There are many lessons from these events, my husband was released from prison and is now a principal at a school in Calang. We are not afraid anymore of GAM. This was a warning from God, for many years we were in a depressed state, the conflict in Aceh made my husband work as a teacher full of terror (Participant 4)

Participant 5 stressed that the tsunami had created many lessons; Aceh is peaceful and now has open access for people to come and visit.

The memory of the tsunami, this tragedy has opened the doors of Aceh to the world, to the existence of Aceh. They came to rebuild Aceh and to expose the beauty of the nature of Aceh to the world. The memories of the tsunami, Aceh and Indonesia have united with the MOU to the presence of peace. The tsunami of Aceh created a lot of wisdom, which is huge, and bigger than the suffering of the people of Aceh. The Aceh tsunami has created change and progress in this region. Hopefully, we will not forget the day; December 26, 2004, which is now a major part of the history of Aceh. Behind the hardship, things will become easier, behind the sadness, there must be happiness. All of that, we feel it because we live in this world temporarily, and then do good deeds for the provision in the afterlife (Participant 5).

All participants argued that the tsunami brought a lot of good afterward, starting from peace in Aceh to rapid economic growth. The participant 7 said:

Day by day, month by month, now the island has experienced rapid change; from a devastated area hit by the disaster to now become a territory occupied by various carved buildings and a very orderly society. Also, from a conflict zone filled with bloodshed and uncertainty, it has now become a very peaceful area, especially since the signing of the Memorandum of Understanding in Helsinki, Finland, a peace agreement between the Indonesian government and the GAM (Free Aceh Movement). Now the island is a territory that cannot be underestimated again by the central government due to the rapid economic growth in Aceh. In the end, I was glad in my heart, Thank God, God is absolutely true; what you promised us occurred as indeed there is an easing after hardship (Inna Ma'al 'Usri Yusra) (Participant 7)

What these four participants conveyed are discussed by all three scholars. Quraish Shihab argues that humans are tested by God with distress, they cannot run from the difficulties, but God granted them the ability to overcome. Quraish elucidates that all the difficulties and sadness, which at first may seem so heavy to bear, yet sometime later would bring blessings and salvation for the victims. He gives example of how earthquakes, could be considered vices because it makes a lot of people suffer, but the quake also brings benefits to a lot of other people, not only because of the impact of the earthquake that actually fertilized the soil and also provided many other benefits thereafter.

Komaruddin Hidayat explains, Islam considers life as very meaningful and all of us will encounter trouble at some stage. He cites Quran Verse *Al-Balad* or the City, "*Verily, We have created man in toil.*" (Surah Al-Balad/The City: 4 cited from Muhammad Taqi'-ud-Din Al-Hilali and Muhammad Muhsin Khan 1988, p. 836). He highlights that nobody escapes from trouble, but trouble does not come without reward. He suggests the readers to be grateful for life in this world and make it as a means to get to the realms of eternity that there is no fear and pain, in afterlife.

'Aidh ibn Abdullah al-Qarni explains that God blesses those who have suffered, yet keep their patience and surrender to the provision of God. He wrote that if disaster happens, we should believe that it is part of the provisions that are supposed to happen, and each disaster will be a gift, every test becomes grace, and every event

into an award and reward. He prompts that we must surrender all things to fate, not to be oppressed by resentment, regret and misery. He cited the following Hadith:

Whoever Allah wants good for him, he puts them to test. He puts them through difficulties. Like a diamond or some metal that has to be burnt and then that which is bad from it is removed so that you have that which is the pure diamond or the pure gold or whatever. Put them to tests, trials and difficulties. (Hadith narrated by Bukhari and Muslim)

### ***20.4.3 Do Not Be Sad, Instead Be Grateful for What You Still Have***

This general theme of positive thinking also encouraged the survivors to be grateful for what they had, rather than mourn what they had lost. Indonesians have a phrase, “*Fortunately, I still have something, even though I lost a few things.*” This phrase is also expressed by participant 4 and 6.

Participant 4 remains grateful that the entire family survived even though the house and their stalls were all destroyed. She said

We lost a lot, but still my families are safe. (Participant 4)

Participant 6 related the incident with the blessing received by the people of Aceh after the incident. She is grateful for her family who were saved and how the people of Aceh are now able to live a more peaceful and prosperous life than ever before.

Indeed, Allah gives blessings to our family’s togetherness, so our family is still together until now. Then, which favors of your Lord will you deny? We need to understand and remember that “God will not give you more than you can bear”. And it is proven now, Aceh has improved and is improving even without the help of foreigners anymore. People can feel the peace between GAM and the (Government) of Indonesia as stipulated in the memorandum of reconciliation (signed) in Helsinki on August 15, 2005. The streets and houses are nicer and better than ever. Yes, there are many other positive impacts. This is evident by His words, after the grief, there will be an easing. I feel it, and I hope we all become closer to Him. (Participant 6)

‘Aidh ibn Abdullah al-Qarni explains in depth that we should not grieve over the provision of God. It is like the title of his book *Laa Tahzan* or Don’t Be Sad. He said excessive grieving is not helpful. He added that excessive grieving is forbidden as defined by the word of God, which reads:

So, do not become weak (against your enemy), nor be sad, and you will be superior (in victory) if you are indeed (true) believers. (Surah Ali-Imran/The Family of Imran: 139 cited from Muhammad Taqi’-ud-Din Al-Hilali and Muhammad Muhsin Khan 1988, p. 94)

Be not sad, surely Allah is with us. (Surah At-Taubah/The Repentance: 40 cited from Muhammad Taqi’-ud-Din Al-Hilali and Muhammad Muhsin Khan 1988, p. 94)

‘Aidh ibn Abdullah al-Qarni elaborates the reasons why people should not be too sad. He started his argument by saying that there is much suffering going on in

the world. He then questioned how many people have to be patient in accepting the ordeal? He reminded the readers that we are not the only people who have been affected and to realize that maybe someone else might actually have suffered worse than us. Undoubtedly, he wanted the readers to understand that we are more fortunate than they are. By realizing this, we will be thankful to Him for all that was given to us. Furthermore, he explained that sadness is actually like a fever that makes the body limp with helplessness. He argued sadness is not beneficial to the heart and suggested the best course of action was to accept willingly all the provisions of God and not be sad because you are in trouble. He believed that the difficulties will strengthen the heart, take away sin, and destroy the arrogant.

‘Aidh ibn Abdullah al-Qarni gives some reasons that we do not grieve when calamity strikes: first, there is always a way out after the trouble. Second, things are not preferred, it will give better benefits. And third, it is God who gives the benefits and prevents someone from danger. All that happens is the provision of God. He concludes these reasons from the book *At-Tanukhi* entitled, *Al-Faraj Ba’dasyi Syiddah*.

#### **20.4.4 Remember and Pray to God to Find Peace**

To enable the victims to find peace within them after the terrible experience they had endured, a common theme found by the researchers was that they looked to God and placed their faith in his plan. All participants said that they find peace by remembering God. They remember God by praying and reading the Quran.

Participant 4 said she feels the serenity of prayer, talking with God. She does not accuse God of creating the disaster, but she still sees God as a resting-place. She explained,

I sometimes remember these events. I’m sad, but I have to get up. Only God can I cry to, I pray when I’m sad. (Participant 4)

Participant 5 said, she also consoles herself by reading the Quran and prays whenever she remembers the events. She said,

If I’m sad, remembering the tsunami, I read the Quran and pray for reassurance. (Participant 5)

Participant 2, who lost his mother and sister, always prays when remembering them. He visited the mass graves. He also held a feast and give alms to orphans. It is common to have a feast and give alms to orphans when a family member dies in the Acehese community. During the feast they pray for the beloved ones who died. He said he finds peace by praying.

For the pilgrimage (visiting graves), I went to the mass graves in Beurugang and Ujong Karang. I wish those mass graves were renovated. In addition, for the sake of the memory of my mother, I also held a feast and give alms to orphans. We also lost our house. Now we live in a tent. If I’m sad to remember them, I would pray, that I stay calm. (Participant 2)

Scholar 'Aidh ibn Abdullah al-Qarni, said during hard times, we are obliged to pray and ask Him, in a state of ease and difficulty. He suggested that we spill all the problems to God. He explained the way is we kneel, be humble and beg for mercy to Him, and then it will undoubtedly be that help comes from Him. He cites the Quran:

And your Lord said: "Invoke Me, [i.e. believe in My Oneness (Islamic Monotheism) and ask Me for anything] I will respond to your (invocation). (Surah Ghafir or Al-Mu'min/The Forgiver or the Believer: 60 cited from Muhammad Taqi'-ud-Din Al-Hilali and Muhammad Muhsin Khan 1988, p. 638)

'Aid ibn Abdullah al-Qarni explains prayer is a proof of our obedience to God and it eliminates restless, upset and agitation. In his opinion, people who always remember God will always be happy and have a peaceful life. He wrote, the more we remember Allah, our mind will be more open, the heart will be peaceful, life will be happier, and our conscience will be peaceful and tranquil. He truly believes that God is always near when the servant prays to Him, always here when requested, and always grants the request.

'Aid ibn Abdullah al-Qarni repeats several times the importance to surrender all things to God, accepting what is destined, and having kind thoughts to Him. He added that when we are in trouble then we should submit to God, who becomes our helper. He gave an example, when the Prophet Abraham was thrown into the fire, he said "*wa Hasbunallah ni'mal wakil,*" then God made the hot fire become cold instantly. Likewise, when the Prophet Muhammad was in trouble, he also prayed the same (ibid).

Those (i.e. believers) unto whom the people (hypocrites) said, "Verily, the people (pagans) have gathered against you (a great army), therefore, fear them." But it (only) increased them in Faith, and they said: "Allah (alone) is Sufficient for us. And He is the Best Disposer of affairs (for us). So they returned with Grace and Bounty from Allah. No harm touched them; and they followed the good Pleasure of Allah. And Allah is the Owner of Great Bounty (Surah Al Imran/The Family of Imran: 173-174 cited from Muhammad Taqi'-ud-Din Al-Hilali and Muhammad Muhsin Khan 1988, p. 101)

#### **20.4.5 Died as a Martyr (Shahid) and the Promise of Heaven**

The third theme was about the believes that those who died from the tsunami died as martyrs, and hence god will put them in heaven. All the participants believe that their beloved ones, who died because of the tsunami, are currently resting in peace. They believe they have died as a martyr and that God will grant them a place in heaven. Participant 1 said that his mother believes her sister is in a better place now, in heaven, because she died as a martyr,

She was sincere that her sister died, she believes her sister was martyred and given the best place in God's paradise.

However he realized being sincere is not easy, but he must be willing for their deaths. They are already in God's heaven, because they died as a martyr or shahid.

Anytime I remember them I will pray. I know they are in better place now, because they died as martyrs.

The promise of heaven is explained by all the three scholars. ‘Aidh ibn Abdullah al-Qarni said we always have to see and believe that behind the disaster, there is a replacement and reward from Allah. He explained further what he meant by replacement and reward, God never took something away from us, except when He replaced it with something better. He explained the importance of being patient and remaining happy, we should not be too saddened by the plight, because all that determines it is God, he who has the final home, which means the afterlife. He cites the following verse from the Quran:

Salamun ‘Alaikum (peace be upon you) for you persevered in patience! Excellent indeed is the final home! (Surah Ar-Ra’d/Thunder: 24 cited from Muhammad Taqi’-ud-Din Al-Hilali and Muhammad Muhsin Khan 1988, p. 324)

Komaruddin Hidayat explains how Sufis view death as the gateway to step up to the garden of a new life, more beautiful, it is a walkway closer to the throne of God. So, death according to him is like a new beginning. He said that since it is believed that those who died because of a disaster died as a martyr, so the new beginning will be the happy life in heaven.

The word martyrdom is often defined as died in jihad or defending religion. Quraish Shihab argued martyrdom is not just death by fighting to defend the religion. He said the so-called martyr was because the cause of death is tragic by drowning, due to fire, childbirth and others, so they pitied and are expected to gain a testimony of the angels and good people. He cited the following Hadith:

Who do you reckon to be martyr (shaheed) among you?” They replied: “The one who is killed in the way of Allah.” He said: “In that case the martyrs among my people would be few!” They asked: “Messenger of Allah! Then who are the martyrs?” He said: “He who is killed in the way of Allah is a martyr; he who dies naturally in the Cause of Allah is a martyr; he who dies of plague is a martyr; he who dies of a stomach disease is a martyr; and he who is drowned is a martyr. (Hadith narrated by a Muslim).

In another Hadith, it also disclosed other criteria of martyrdom: to die by defending themselves, their families and possessions. These criteria are owned by the tsunami death toll.

Whoever is killed defending himself is a shaheed (martyr), whoever is killed defending his family is a shaheed, whoever is killed defending his property is a shaheed, [and whoever is killed defending his religion is a shaheed]. (Hadith narrated by Abu Dawud, Tirmidhi, and Nisa’i)

Indeed, those who are martyred will be placed in paradise along with other believers. Allah gives this promise in the Quran

And those who also obey Allah and the Messenger (Muhammad), then they will be in the company of those on whom Allah has bestowed His Grace, of the Prophets, the Siddiqun (those followers of the Prophets who were first and foremost to believe in them, like Abu Bakr As-Siddiq), the martyrs, and the righteous. And how excellent these companions are! (Surah An-Nisa/The Women: 69 cited from Muhammad Taqi’-ud-Din Al-Hilali and Muhammad Muhsin Khan 1988, p. 120)



## 20.5 Conclusion

In this chapter, we have shown through case study on how Muslims in Aceh perceived the tsunami disaster, and how their faith helped them recover. These findings will help those interested in relief work to be more aware of how affected communities respond to disaster. From our analysis, we identified **five** perspectives in making sense of and responding to the tsunami disaster.

**First**, program developers and implementers need to understand that the victims accept the event as their destiny, so they choose not forget it and use it to find healing. This is because they believe that what comes from God should be accepted. In counseling sessions, psychologists and paraprofessionals need to respect these perspectives. Their trauma and how they see the events might seem heartless, but is more faith-based.

**Second**, they are very positive in their outlook following the events, since they believe that there is always a lesson and wisdom behind a disaster. In talking about disaster, loss and death because of disaster, they, as many Indonesians, see that there is always fortune behind unfortunate events.

**Third**, the survived victims are also still grateful with what they still have and take ease on what they have lost. Helping the victims by rebuilding their lives, for example, through a mental health program that is integrated with a livelihood program could be an effective option.

**Fourth**, they cope with the psychological trauma by remembering and praying to God. Mental health teams that involve communities, community leaders and religious figures, which in the case of Aceh is *Tengku* in a mosque, will be more effective at engaging more people. Prayer is also considered as one of the ways to cope and heal. The religious figures can assist the victims to pray and find solitude.

**Lastly**, they accept the death of their loved ones as fate and they believe that those who died are martyrs who will be rewarded with heaven. This is also to show that to involve religious figures in mental health programs is plausible.

By integrating these findings into future program, the expected results of the future program would be it will engage more people from the communities to get engage in the program. The victims will use their previous knowledge and resources in recovering from the trauma, they will more familiar and comfortable to talk with the mental health psychologist and counselor because they know they understand them and their view are respected. The program will also meet the need of the victims because it is coming from their own view. The cultural insensitive approach could be avoided because the aid groups acknowledge the people's perspectives and way of life.

## Interview Protocol

1. Tell me about what you were doing when the earthquake and tsunami happened?
2. How do you view the disaster?
3. What did you lose as a result of the disaster?
4. How do you view these losses now?
5. What did you do to help you heal and cope? What do you feel made you stronger?
6. What (mental health) support do you believe you need or needed?
7. How do you see your life today (a year after the disaster)?
8. To whom do you prefer to talk to if you have a (mental health) problem?

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**Part IV**  
**Measuring Hazards, Risks and**  
**Community Resilience**

# Chapter 21

## Flood Risk in Polder Systems in Jakarta: Present and Future Analyses

Yus Budiyo, Muhammad Aris Marfai, Jeroen Aerts, Hans de Moel, and Philip J. Ward

**Abstract** Polder systems in Jakarta have been implemented since 1965, but their development has been hindered by social and political issues. Currently, the government of Jakarta has started to consider polder system as seen in the Spatial Plan 2030. This chapter assesses the benefits/costs of the polder system in Jakarta under current conditions and under future scenario of climate change, land use change, and subsidence.

We calculate the benefits of each polder using Damagescanner-Jakarta, which is a flood risk model developed in previous study. Cost estimates are based on the costs of 22 dike projects in Java. We use flood design standards at 2, 5, 10, 25, and 50 years, as set out in the Minister of Public Works.

The results show that benefit/cost ratios greater than 1 exist at 21 out of 66 polders reducing 25% of risk under current conditions, and at 31 out of 66 polders reducing 52% of risk under the future scenario (for a return period of 2 years). Much of this risk reduction could be achieved in just 3 polders, namely Kapuk Muara, Penjaringan Junction, and Kapuk Polgar, in which 50% of the current risk could be reduced. The study also shows that operating 12 polders could reduce risk by 81% in the future, and polders with very high net benefits are located away from the coastline. Sensitivity testing using lower (4%) and higher (10%) discount rates show the number of net benefiting polders reduces as the discount rate increases in a predictable trend.

**Keywords** Benefit Cost Analyses • Damagescanner • Flood Risk • Jakarta • Polder System

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## 21.1 Introduction

Since 2012, Jakarta has been operating a second major structural measure to overcome flooding, the Eastern Flood Canal (*Banjir Kanal Timur*). This canal complements the Western Flood Canal (*Banjir Kanal Barat*), which has been in operation since 1922 and has been revitalized over time. An overview of historical flood management practices in Jakarta can be found in Caljouw et al. (2005). The two canals act as a horseshoe that prevents floodwaters from entering the city, diverting major discharges from the upland to the west and to the east. The construction of the Western Flood Canal was initiated in 1917, as part of the Van Breen plan (Caljouw et al. 2005), which was revised in 1973 as part of the Master Plan for Drainage and Flood Control of Jakarta published by the Ministry of Public Works with the help of Netherlands Engineering Consultants (Nedeco). From 1975, the Western Flood Canal was heavily extended and was completed in 1983 with the completion of the Cengkareng drain (Gunawan 2010). The Eastern Flood Canal was also based on recommendations in the Master Plan for Drainage and Flood Control of Jakarta plan, which was detailed by Nippon Koei in 1997.

Now, the government of Jakarta is examining another structural measure to reduce flooding, namely improving and upgrading the city's polder system. The system was already proposed in the van Breen plan (Caljouw et al. 2005) that was prepared by the committee for Jakarta flood prevention (*Kopro Banjir*) in 1965 (Gunawan 2010). *Kopro banjir* was formed by the President's authority (*Kepres*) number 29/1965 (Diskominfomas DKI 2011). Polder implementation was started in the same year with the construction of Pluit retention lake, which was later recognized as Pluit polder. In 1972, the committee was changed into Greater Jakarta Flood Control Project (PBJR), resulting in two more polders, i.e. Sunter Timur and Marunda (Gunawan 2010). Ever since, the development has been hindered by river-bank squatting, solid waste disposal (Baker 2012) and lack of planning. Referring to Provincial Government Regulation number 1/2012 about Spatial Plan 2030 (Perda DKI Jakarta 1 2012), the government of Jakarta plans to intensify the use of polder systems to prevent floods. In the regulation, 43 existing polders are recognized and 23 new polders in Jakarta are planned.

Minister of Public Works Regulation 12/2014 (*Permen PU 12 2014*) states the flood return period of the draining design criteria for polders in different types of cities and for different catchment areas (see Table 21.1). For Jakarta, polders should have a design standard of between 2 and 25 years, depending on the polder size. The size of the polders in Jakarta ranges from 32 ha to 2954 ha. To contain excess water, a storage capacity is designed relative to the volume of the design rainfall and the time needed by the pumping system to discharge excess water away from the polder. As a revived policy, some polders already have the required retention capacity, while others do not.

Using the polder system plan of Jakarta 2030 (Perda DKI Jakarta 1 2012) and flood risk study, this chapter aims to provide a first-cut estimate of the potential

**Table 21.1** Flood return period of the drainage design criteria for different types of cities and catchment sizes

Type of city	Catchment area (ha)			
	<10	10–100	100–500	>500
Metropolitan city	2 year	2–5 year	5–10 year	10–25 year
Big city	2 year	2–5 year	2–5 year	5–20 year
Medium city	2 year	2–5 year	2–5 year	5–10 year
Small city	2 year	2 year	2 year	2 year

Source: Permen PU 12 (2014)

benefit and costs of each polder, both under current conditions, and under a scenario of future climate change, land subsidence, and land use change. This adds the widely available studies on polders generally focus on the individual function of polders as e.g. flood control, agriculture, recreation (e.g. Roth and Warner 2007; Klijn et al. 2010; Ritzema et al. 2011).

A large amount of scientific literature is available that examines technical aspects of polders and their functioning, including flood control, agriculture, and recreation (e.g. Roth and Warner 2007; Klijn et al. 2010; Ritzema et al. 2011). Several studies have assessed the potential reduction in flood stage or inundation extent or depth that can be achieved in polder or retention areas (e.g. Apel et al. 2004; Förster et al. 2005; Huang et al. 2007; Bouwer et al. 2009). However, few studies have specifically examined the risk reduction potential of polder systems. This is despite the fact that recent decades have seen a move towards a more risk-based approach towards flood management. In this sense, flood risk combines the probability of a flood event with its potential consequences. The concept of flood risk is usually operationalized as being a function of three elements: hazard, exposure, and vulnerability (e.g. Kron 2005; UNISDR 2011, 2013). Jonkman et al. (2004) and Bouwer et al. (2010) have assessed how flood risk may change in several polders in future scenarios of climate change, and Kind (2014) assessed the costs and benefits of a large number of polder systems in the Netherlands. However, studies on the risk reduction potential of polders and their costs elsewhere are sparse in the scientific literature. Budiyo et al. (2015) recently developed a flood risk assessment model for Jakarta, which allows for the assessment of flood risk, called Damagescanner-Jakarta, and used it to assess flood risk under current conditions and future scenarios of land use change, climate change, and subsidence Budiyo et al. (2016). However, the model has not been used to assess the potential impact of risk reducing measures on risk.

To address this, we use the polder system plan of Jakarta 2030 (Perda DKI Jakarta 1 2012) Damagescanner Jakarta to provide a first-cut estimate of the potential benefit and costs of each polder, both under current conditions, and under a scenario of future climate change, land subsidence, and land use change.

## 21.2 Methodology

In this study, we estimate the costs and benefits of upgrading the 43 existing polders and constructing the 23 planned polders mentioned in the Spatial Plan 2030. The benefits are estimated as expected annual damage (EAD) without the polder system, minus the EAD with the polder system. EAD is a common metric used in natural hazard risk assessment (e.g. Meyer et al. 2008), and can be interpreted as the average damage per year that one would expect over a very long period of time; its calculation is further described in section “Estimation of benefits”. EAD is calculated using the existing Damagescanner Jakarta flood risk model (Budiyo et al. 2015, 2016). The costs are estimated as the total construction and maintenance costs of the polder system. The benefit/cost ratio (B/C ratio) was assessed using the standard formula:

$$B / C = \frac{\sum_{t=1}^n \frac{B_t}{(1+i)^t}}{\sum_{t=1}^n \frac{C_t}{(1+i)^t}}$$

Where  $n$  is the number of years over which the project costs and benefits are evaluated,  $t$  are the costs and benefits for individual years,  $B$  is the sum of benefits in a given year ( $t$ ),  $C$  is the sum of costs in a given year ( $t$ ), and  $i$  is the discount rate expressed as a decimal. In this study, we used a time horizon ( $n$ ) of 100 years, and a discount rate ( $i$ ) of 0.07 (i.e. 7%), 0.04, and 0.10 (see section “Estimation of benefits”).

In this section, we describe the methods used to estimate these costs and benefits in more detail; an overview of the approach can be found in Fig. 21.1.

### 21.2.1 Estimation of Benefits

We estimated the annual benefits of the polder system as the EAD without the system, minus the EAD with the system. We assumed a project lifetime of 100 years, and a discount rate of 7% (Hallegatte 2014), and calculated the total benefits over this project lifetime. Note that in section “Uncertainty and sensitivity test” we also carry out a sensitivity analysis using discount rates of 4% and 10%. The lower rate was according to target inflation rate 2016–2017 in Ministry of Treasury Regulation (*Permenkeu* 93/PMK.011 2012), while the higher rate was according to the highest target of the Central Bank of Indonesia (Public Information Service 2013).

Damagescanner–Jakarta was developed by Budiyo et al. (2015, 2016) as a model in Python to calculate flood risk. Here, we provide a brief overview of the model; for details of the setup and model structure, we refer the reader to Budiyo et al. (2015) and Budiyo et al. (2016). In essence, Damagescanner–Jakarta is a



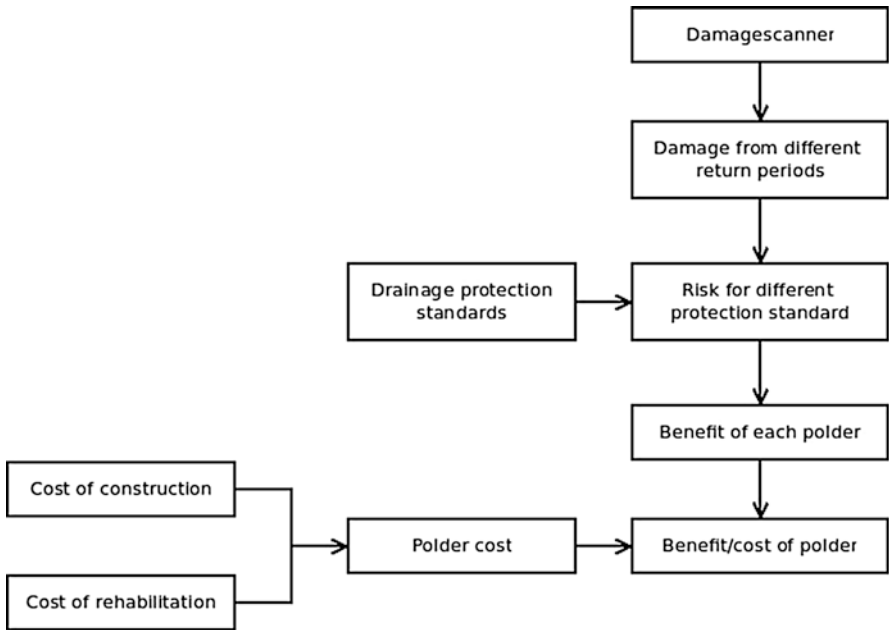
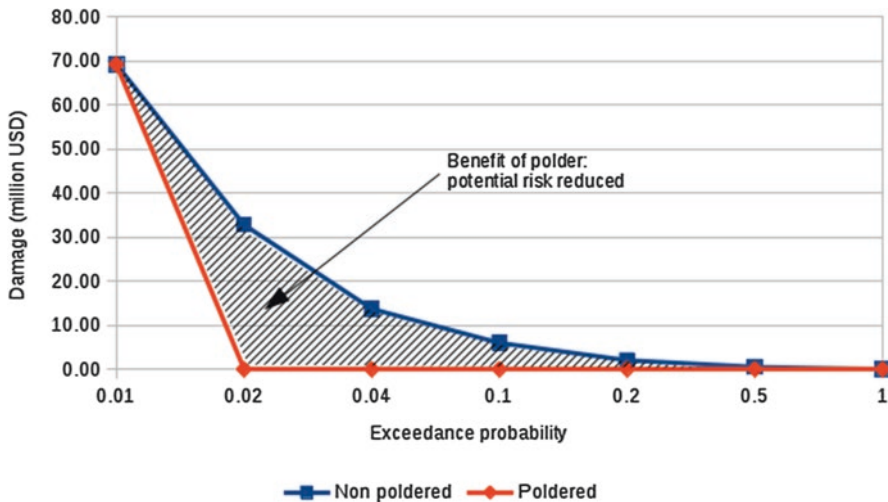


Fig. 21.1 The research framework of analysis (Source: Author’s design)

grid-based flood risk model, which runs at a horizontal resolution of 50 m × 50 m. It works by combining flood hazard maps and exposure maps (showing the land use in each cell and its associated maximum economic damage) with a depth–damage function to represent vulnerability. For each cell, Damagescanner-Jakarta identifies the inundation depth from the flood hazard map produced by the SOBEK Hydrology suite (Deltares 2014). Then, for this cell it identifies the land use class available from the office of city planning (DTR DKI 2007) and its associated maximum economic damage, which was derived by Budiyo et al. (2015) through expert interviews and workshops. The model includes a set of depth–damage functions per land use class, which show the proportion of the maximum damage that would occur for floods of different depths. As with the values of maximum economic damage, these were derived from expert interviews and workshops described in.

Budiyo et al. (2015). Damagescanner-Jakarta takes the depth–damage function for the land use class of the cell in question, and uses it to identify what proportion of the maximum damage would occur for the inundation depth in that cell. This procedure is used to simulate direct economic damage for floods of several return periods between 2 and 100 years. Then, the EAD is estimated as the area under the exceedance probability–loss (risk) curve, whereby the area is estimated using a trapezoidal approximation (e.g. Meyer et al. 2008); see visualization in Fig. 21.2.

For the current situation, we assume that the polder system does not provide protection against flooding. Hence, the damages simulated for floods of all return periods are used in the calculation of EAD. We then calculated the EAD that would



**Fig. 21.2** Theoretical example of the damages for different exceedance probabilities (1/return period) with and without a polder system showing benefit of polder designed at 50 years return period (Adopted from Mechler 2005)

occur if the polder system were implemented to provide protection against floods of different return periods, namely 2, 5, 10, 25, and 50 years; these are based on the return periods stated in the Permen PU 12/ 2014. This is carried out by assuming zero flood damage to occur for floods up to this return period (Fig. 21.2). This is first carried out for current climate conditions and based on the current land use map of Jakarta.

Next, we calculated the benefits that could be achieved under a scenario of climate change, land use change, and land subsidence. For this study, to demonstrate the use of the method, we use the median scenario amongst all scenario combinations described in Budiyo et al. (2016), which is USD 521 million per year. Future climate change in 2030 and 2050 was represented by taking changes in precipitation intensity. From downscaled output data of five global climate models (GCMs), namely GFDL-ESM2M, HadGEM2-ES, IPSL-CM5A-LR, MIROC-ESM-CHEM, and NorESM1-M (Hempel et al. 2013), forced by four Representative Concentration Pathways (RCPs), namely RCP2.6, RCP4.5, RCP6.0, and RCP8.5 (IPCC 2014). For sea-level rise, we used the likely range in global sea level rise projections of the IPCC's Fifth Assessment Report (AR5) (IPCC 2013, Table AII7.7) for 2010–2030 of 6 cm to 11 cm, and 14 cm to 24 cm for 2010–2050. For land use change, we used the official Jakarta Spatial Plan 2030 (Perda DKI Jakarta 1 2012), which is an idealized land use scenario for 2030.

Finally, a hypothetical scenario of land subsidence was developed, in which the current rate of subsidence (Abidin et al. 2011) continues at the same rate, and ultimately stops in the year 2025. This is based on an assumption that the government

will successfully implement the “100-0-100 sanitation policy” (*Direktorat Jenderal Cipta Karya 2014*), which means that the government will provide 100% of water supply needed by Jakarta by 2019 and consequently groundwater extraction and subsidence would cease, as also seen in Tokyo (Endo et al. 2001), Tokyo lowlands (Aichi 2008), and Bangkok (Phien-wej et al. 2006).

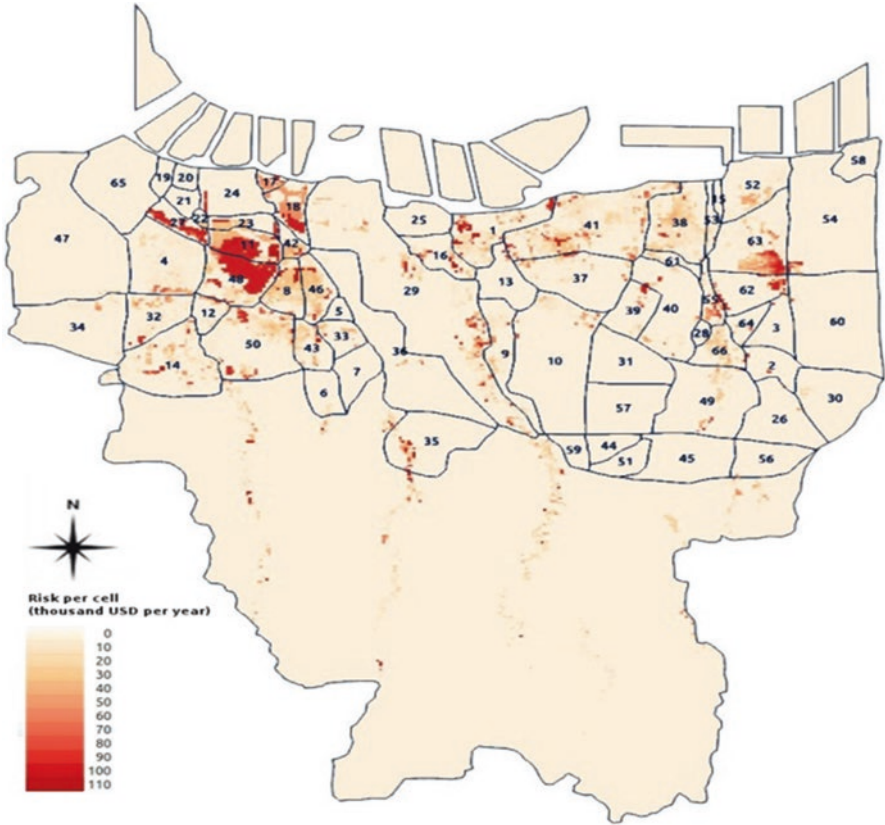
### 21.2.2 Estimation of Costs

The costs are estimated as the total construction and rehabilitation costs of 22 dike projects carried out in Java during the period 2007–2012 by the Ministry of Public Works (*Direktorat Bina Program 2012*). The cost of construction per meter is estimated at USD 554.26 while the cost of rehabilitation is estimated at USD 371.48. The minimum and maximum length of the dikes for these projects is 2000 m and 65,157 m respectively, with an average length of 7308 m. This is comparable to the dike lengths of 2431 m–34,229 m required for the polder systems in Jakarta. The maintenance costs per polder are assumed to be 1% of the construction costs per year, and begin in the year after dike construction. Note that the costs of each polder omit the price that could be shared by two adjacent polders, in order to make the costs comparable. We assumed the costs to be constant for different return periods of protection, since the dikes mostly follow street lines on top of older streets without the need for reworking the basis. The cost also neglects the need for retention lakes and pumping systems as suggested by e.g. Moerwanto et al. (2009) and Mechler (2005), which means that the results are subject to underestimation. As with the benefits, we assumed a project lifetime of 100 years, and a discount rate 7%, and calculated the total costs over this project lifetime. Again, note that in section “Uncertainty and sensitivity test” we also carry out a sensitivity analysis using discount rates of 4% and 10%.

## 21.3 Results

In this section, we describe results of our benefit/cost analysis for the 66 polders found in Jakarta Spatial Plan 2030. Section “Current situation” describes the results for the current situation, followed by results for the future scenario in section “Future situation”. To simplify the discussion, we use the term net benefiting polders to refer to polders with a B/C ratio greater than 1. Similarly, we use the term polders with very high net benefits to refer to polders with a B/C ratio greater than 20.

We also use the division of western polders and eastern polders using the Ciliwung Lama river as border. The Ciliwung Lama is the lower part of the main river of Jakarta and is contained in the Pluit polder. The Ciliwung is the biggest river system in Jakarta, extending from the mountains (*Puncak*) to the coast.



**Fig. 21.3** The 66 polders (43 existing and 23 new) overlaid on a map of simulated flood risk 2013 (Source: Author’s analysis) (For polder numbering refers to numbers in Tables 21.1 and 21.2)

At Manggarai, most of the water is diverted to the Western Flood Canal to avoid excess water from entering the city center. We take the border following PAM Jaya area service division (PAM Jaya 2012; PAM Jaya 2015) from 1997. The western area has long benefited from the Western Flood Canal while the eastern area has only benefited from the Eastern Flood Canal since 2010 (Adhi Ksp. 2010).

In Fig. 21.3, we show the current distribution of flood risk, before the construction/upgrading of the polder system. Here, flood risk is expressed in terms of expected annual damage, as calculated using Damagescanner-Jakarta. In Fig. 21.3, we also show the location of the polders that make up the polder system in the plan discussed in this chapter.

### ***21.3.1 Current Situation: Kapuk Muara and Penjaringan Junction Give the Highest Net Benefits***

Table 21.2 shows the B/C ratios that could be achieved by increasing the design standards for the existing polders, under current climate and land use conditions. Zero benefits in a cell means that our model simulates no risk. From the table, we see that 13 of the 43 polders could give immediate net benefits even if they were designed for a relatively frequent 2 year return period flood. Nine of them are situated in the west, while the other four are in the east. Fifteen polders could provide net benefits at the higher design return periods of 5, 10, 25 and 50 years. The table also shows that two polders, Kapuk Muara (Kapuk I, II, III) and Penjaringan Junction, give very high net benefits with B/C ratios of 23 and 49 respectively.

For planned polders, Table 21.3 shows that 8 out of 23 polders give immediate net benefits even for a design return period of 2 years. All of the polders are situated on the east. Four polders give net benefits for higher return period design standards (5, 10, 25, and 50 years). Among the nine net benefiting polders at a design standard of 2 years, Kapuk Polgar has a very high B/C ratio of 29, while the maximum B/C ratio among the other 8 polders is 3.9. The most inland planned polder is Kayu Putih, situated in the east (17 km from coast).

For planned polders, Table 21.3 shows that 8 out of 23 polders give immediate net benefits even for a design return period of 2 years. All of the polders are situated on the east. Four polders give net benefits for higher return period design standards (5, 10, 25, and 50 years). Among the nine net benefiting polders at a design standard of 2 years, Kapuk Polgar has a very high B/C ratio of 29, while the maximum B/C ratio among the other 8 polders is 3.9. The most inland planned polder is Kayu Putih, situated in the east (17 km from coast).

In Fig. 21.4, we show the distribution of the B/C ratios, assuming a design return period of 25 years, which relates to the highest standards for a Metropolitan City, as stated in the Permen PU 12/ 2014. See also Fig. 21.6 for the increase between present situation and future scenario for twelve polders with high net benefits.

### ***21.3.2 Future Situation: Kapuk Poglar and Nine Others Give High Net Benefits***

When designing structural flood defense measures, investments are made for a long time horizon. Therefore, we also assessed the B/C ratios for the different polders using a future scenario including climate and land use change. As described in the methods section, the results shown here refer to the median scenario of all scenario combinations used to assess changes in precipitation intensity, sea level, land use, and subsidence. This scenario results in expected annual damage of USD 493 million, when the polder system is not taken into account.

**Table 21.2** Benefit/cost ratio of existing polders in Jakarta on current risk

No	Polder name	Size (ha)	Perimeter (km)	Design return period (year)				
				2	5	10	25	50
1	Ancol Pademangan	557	12	1	2	2	3	3
2	Cakung Timur Selatan	278	8	1	2	2	3	3
3	Cakung Timur Utara	290	9	0	0	0	1	1
4	Cengkareng	791	11	4	9	11	13	14
5	Grogol	82	4	0	0	0	0	0
6	Hankam Slipi	247	7	0	0	0	0	0
7	Jati Pulo	304	8	0	0	0	0	0
8	Jelambar Barat (Wijaya Kusuma II)	286	8	1	2	3	6	7
9	Johar Baru	468	15	0	0	0	0	0
10	K. Item Serdang	1530	18	1	3	3	4	4
11	Kapuk Muara (Kapuk I, II, III)	329	8	49	114	144	160	167
12	Kedoya Green Garden	165	5	3	7	10	12	13
13	Kemayoran	377	10	0	1	1	1	1
14	Kembangan	896	12	1	3	5	6	7
15	Komplek Dewa Ruci	53	5	0	0	0	0	0
16	Marina	302	8	1	3	4	6	6
17	Muara Angke	70	4	0	0	0	0	1
18	Muara Karang	290	9	0	2	3	6	7
19	Pantai Indah Kapuk	36	2	7	16	20	23	24
20	Pantai Indah Kapuk	95	4	0	0	0	0	0
21	Pantai Indah Kapuk	107	5	0	0	0	0	0
22	Pantai Indah Kapuk	128	5	0	1	2	2	2
23	Pantai Indah Kapuk	172	7	3	10	14	16	18
24	Pantai Indah Kapuk	491	9	1	2	2	3	3
25	Pasar Ikan	313	7	0	0	0	0	0
26	Penggilingan	601	11	0	0	0	0	0
27	Penjaringan Junction	202	7	23	55	71	81	86
28	Perum Walikota (Don Bosco)	58	3	2	3	4	4	4
29	Pluit	2954	34	0	1	2	2	3
30	Pulo Gebang	701	11	0	0	1	1	1
31	Pulo Mas	589	10	0	0	0	0	0
32	Rawa Buaya	443	9	8	18	23	27	29
33	Rawa Kepa	203	6	0	2	2	3	4
34	Semanan	946	13	4	10	13	15	16
35	Setiabudi Barat	754	11	0	2	3	3	4
36	Siantar Melati	1365	25	0	0	0	0	0
37	Sunter Selatan	773	11	0	1	2	2	2
38	Sunter Timur I (Kodamar) atas	800	14	0	1	1	1	2
39	Sunter Timur I (Kodamar) bawah	335	7	1	3	4	6	6
40	Sunter Timur III (Rawa Badak)	650	11	0	1	1	1	2
41	Sunter Utara	1324	18	1	2	3	4	4
42	Teluk Gong	108	5	0	1	1	1	2
43	Tomang Barat	253	7	1	2	2	3	4

Source: Author's analysis

**Table 21.3** Benefit/cost ratio of planned polders on current risk

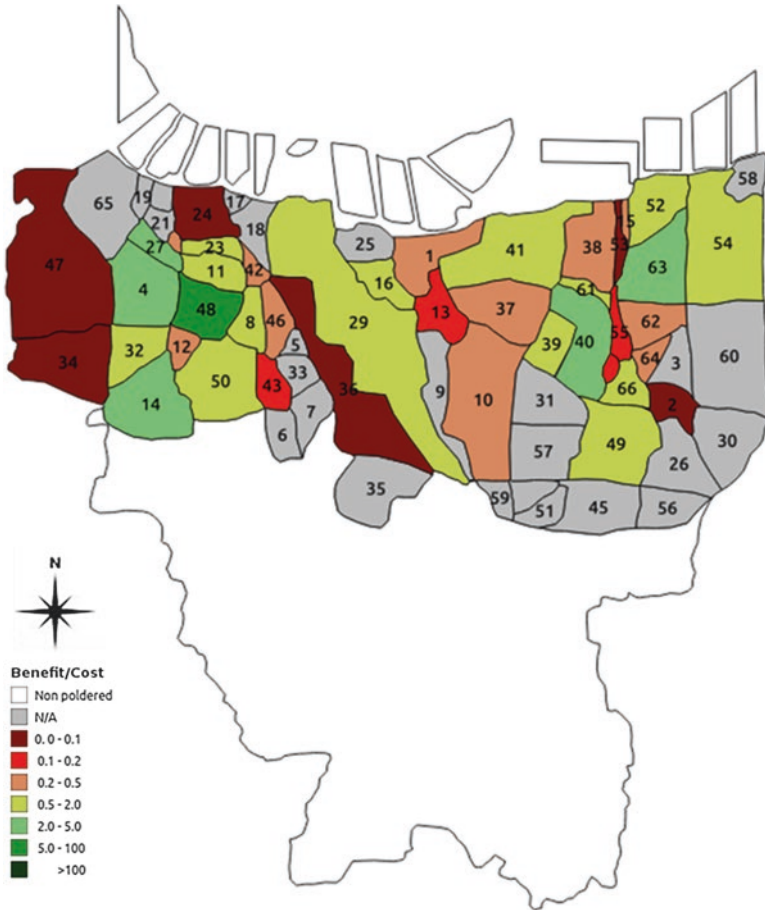
No	Polder name	Size (ha)	Perimeter (km)	Designed return period (year)				
				2	5	10	25	50
44	Cipinang	181	6	0	0	0	0	0
45	Duren Sawit	671	13	0	0	0	0	0
46	Jelambar Timur	284	8	0	0	2	4	5
47	Kalideres	2230	23	0	1	1	1	1
48	Kapuk Polgar	527	10	29	66	84	94	98
49	Kayu Putih	980	14	1	3	4	4	4
50	Kedoya Taman Ratu	942	12	1	3	5	6	6
51	Klender	211	6	0	0	0	0	0
52	Komplek Dewa Kembar	529	10	1	3	4	4	5
53	Kramat Jaya	109	8	0	1	1	1	1
54	Marunda besar	1555	18	0	0	1	1	1
55	Marunda kecil	241	7	0	0	0	0	0
56	Pegangsaan Dua	159	7	4	8	10	12	13
57	Pondok Kopi	381	8	0	0	0	0	0
58	Pulo Gadung	628	10	0	0	0	0	0
59	Rawa Bunga	151	6	0	0	0	0	0
60	Rorotan	1405	16	0	0	0	1	1
61	Sunter Timur I B	101	6	0	0	0	0	0
62	Sunter Timur II KBN	398	9	2	6	8	10	11
63	Sunter Timur II Kebantenan	784	12	1	2	3	4	4
64	Sunter Timur II Petukangan	156	6	1	3	4	4	4
65	Tanjungan	928	12	0	0	0	0	0
66	Warung Jengkol Vespa	262	8	2	5	6	7	8

Source: Author's analysis

The resulting B/C ratios for existing polders are shown in Table 21.4. The results show that 19 out of 43 polders could provide net benefits at a 2-year return period design standard; 11 of these polders are situated in the west, while the other eight are in the east. Seven more polders could provide net benefits for higher return period design standards.

Table 21.5 shows the B/C ratios using the future scenario, for planned polders. From the table, 13 out of 23 polders could provide net benefits for all return period design standards; only two of the polders are on the west. The increase of net benefiting planned polders using the future scenario compared to the current situation shows the importance of considering future changes when considering the polder system. Figure 21.5 shows the distribution of B/C ratios for future scenario.

Combining data on the net benefiting polders available in Table 21.2 to Table 21.5, we produce Fig. 21.6, which shows the number of polders with a B/C ratio greater than one for the different return period design standards. Looking at the steepness, existing polders are more sensitive to the selection of return periods than planned polders for both current situation and the future.



**Fig. 21.4** Distribution of benefit/cost for present situation (The grey area (“N/A”) relates to polders where no risk is simulate using Damagescanner-Jakarta) (Source: Author’s analysis)

We assessed the B/C ratios under the current and future scenarios for the 12 polders with the highest net benefits; these results are shown in Fig. 21.6. The total risk reduction that could be achieved through the implementation of these polders is very large, both under current conditions (USD 104 million per year) and future conditions (USD 400 million per year). Again, the figure also shows the importance of considering the future conditions when planning for such structural measures with a long lifetime, since the overall benefits of the projects are much higher when the potential future changes are included (Fig. 21.7).



**Table 21.4** Benefit/cost ratio of existing polders for the future scenario of climate change, sea level rise, land use change, and land subsidence

No	Polder name	Design return period (year)				
		2	5	10	25	50
1	Ancol Pademangan	35	53	60	63	64
2	Cakung Timur Selatan	0	0	1	1	1
3	Cakung Timur Utara	0	0	0	0	0
4	Cengkareng	11	18	21	22	23
5	Grogol	0	0	0	0	0
6	Hankam Slipi	0	0	0	0	0
7	Jati Pulo	0	0	0	0	0
8	Jelambar Barat (Wijaya Kusuma II)	7	12	14	15	15
9	Johar Baru	0	0	0	0	0
10	K. Item Serdang	0	1	1	1	2
11	Kapuk Muara (Kapuk I, II, III)	44	67	77	81	83
12	Kedoya Green Garden	1	1	1	2	2
13	Kemayoran	1	1	1	1	2
14	Kembangan	6	12	15	17	18
15	Komplek Dewa Ruci	6	9	10	11	11
16	Marina	9	14	17	18	19
17	Muara Angke	31	47	54	57	58
18	Muara Karang	24	36	41	43	44
19	Pantai Indah Kapuk	12	18	20	21	22
20	Pantai Indah Kapuk	0	0	0	0	0
21	Pantai Indah Kapuk	0	0	0	0	0
22	Pantai Indah Kapuk	0	0	0	0	0
23	Pantai Indah Kapuk	10	16	18	20	20
24	Pantai Indah Kapuk	0	0	0	0	0
25	Pasar Ikan	0	0	0	0	0
26	Penggilingan	0	0	0	0	0
27	Penjaringan Junction	78	120	137	146	149
28	Perum Walikota (Don Bosco)	0	0	1	1	1
29	Pluit	1	2	2	3	3
30	Pulo Gebang	0	0	0	0	0
31	Pulo Mas	0	0	0	0	0
32	Rawa Buaya	2	4	5	6	7
33	Rawa Kepa	0	0	0	0	0
34	Semanan	0	0	0	0	1
35	Setiabudi Barat	0	0	0	1	1
36	Siantar Melati	0	0	0	0	0
37	Sunter Selatan	7	11	13	14	14
38	Sunter Timur I (Kodamar) atas	5	10	12	13	14
39	Sunter Timur I (Kodamar) bawah	3	5	6	6	6
40	Sunter Timur III (Rawa Badak)	85	127	145	153	157
41	Sunter Utara	54	81	92	98	100
42	Teluk Gong	4	6	7	7	8
43	Tomang Barat	1	1	2	2	3

Source: Author's analysis

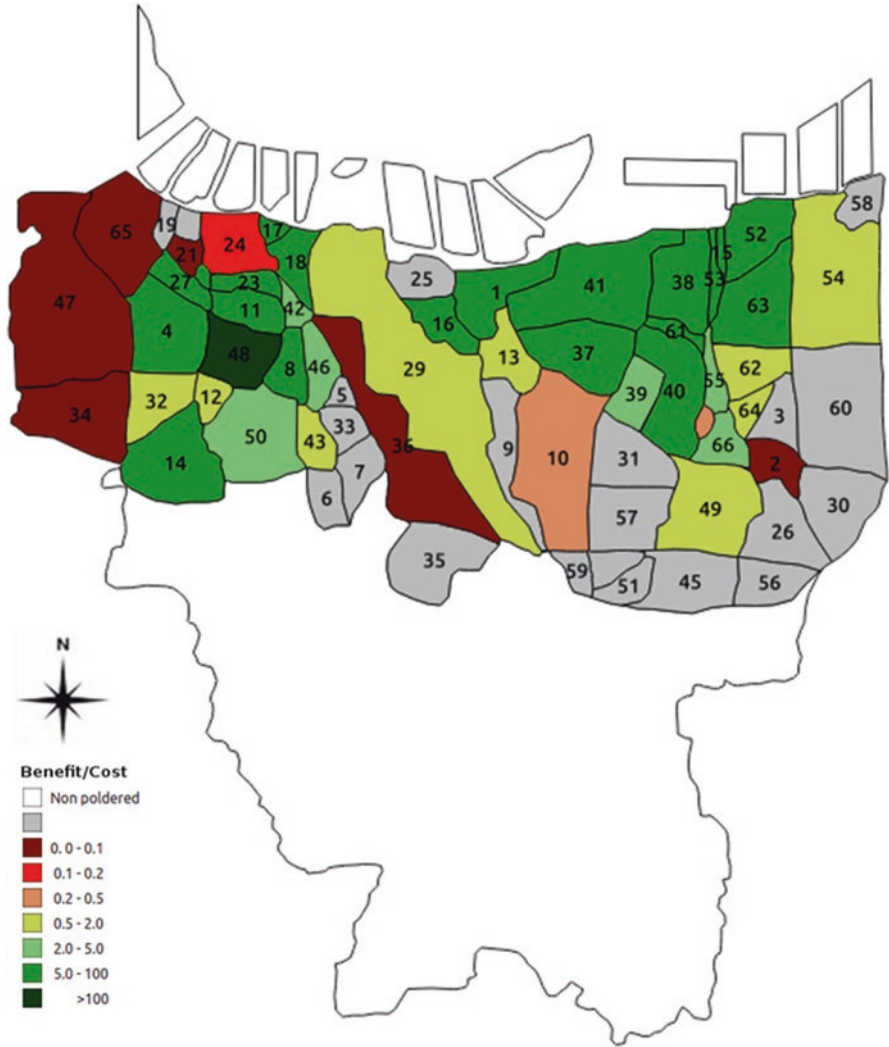
**Table 21.5** Benefit/cost ratio of planned polders for future scenario resulting from median of three scenarios i.e. climate change, sea level rise and land subsidence

No	Polder name	Design return period (year)				
		2	5	10	25	50
44	Cipinang	0	0	0	0	0
45	Duren Sawit	0	0	0	0	0
46	Jelambar Timur	2	3	4	4	4
47	Kalideres	0	0	0	0	0
48	Kapuk Poglar	91	139	158	168	172
49	Kayu Putih	1	3	4	4	5
50	Kedoya Taman Ratu	2	4	5	5	6
51	Klender	0	0	0	0	0
52	Komplek Dewa Kembar	31	47	54	57	58
53	Kramat Jaya	5	8	9	9	9
54	Marunda besar	1	2	2	3	3
55	Marunda kecil	0	0	0	0	0
56	Pegangsaan Dua	1	2	3	3	3
57	Pondok Kopi	0	0	0	0	0
58	Pulo Gadung	0	0	0	0	0
59	Rawa Bunga	0	0	0	0	0
60	Rorotan	0	0	0	0	0
61	Sunter Timur I B	11	17	20	21	21
62	Sunter Timur II KBN	1	2	2	3	3
63	Sunter Timur II Kebantenan	17	28	33	36	38
64	Sunter Timur II Petukangan Timur	1	2	2	2	3
65	Tanjungan	0	0	0	0	0
66	Warung Jengkol Vespa	2	4	5	6	6

Source: Author's analysis

## 21.4 Discussion

Overall, we show that the implementation of the polder system could greatly reduce flood risk compared to the current situation. In the current situation, even if polders were designed for a 2 year return period flood, they could reduce risk by 25% (from a current risk of USD 186 per year without polders, to 139 per year with polders). The potential reduction of future risk is even greater. Again, if polders were designed for a 2 year return period flood, they could reduce risk in 2030 by 52% (from a current risk of USD 521 per year without polders, to 261 per year with polders). Of course, we show that benefits are not achieved for all polders, and so our benefit-cost results are also useful for highlighting those polders where the benefits are expected to outweigh the costs. In the following sections, we first discuss the polders in which these potential net benefits are particularly high. We then discuss policy implications of the polder system, before discussing the uncertainty and sensitivity tests carried out for this study, and potential future research directions.



**Fig. 21.5** Distribution of benefit/cost for future scenario (The grey area (“N/A”) relates to polders where no risk is simulate using Damagescanner-Jakarta) (Source: Author’s analysis)

**21.4.1 Polders with Very High Net Benefits Are Located Away from the Coastline**

From Fig. 21.4, we can see that the polders with very high net benefits for the current situation are located away from the coastline. This is similar to the situation in the Netherlands (Klijn et al. 2010), but with a different rationale. In the Netherlands, the lower benefit of further compartmentalization in coastal polders was due to the prior existence of many ancient and secondary embankments including road and railroad verges.

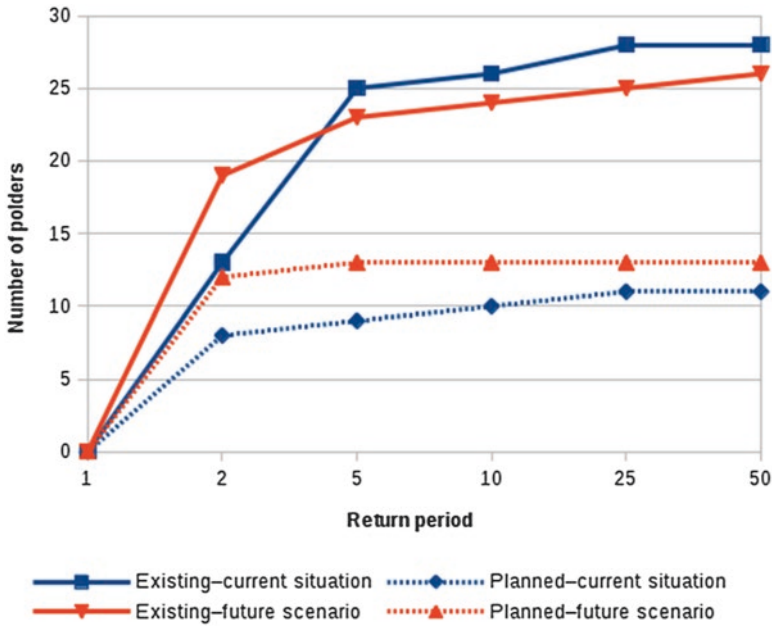


Fig. 21.6 Plot of the number of net benefiting polders for each return period design standard (Source: Author’s analysis)

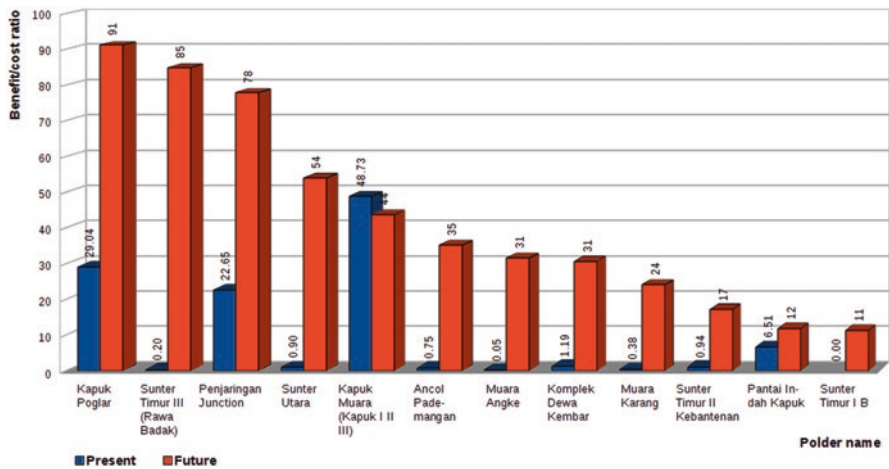


Fig. 21.7 Bar chart showing the B/C ratios for the 12 polders with the highest net benefits for current situation and future scenario (Source: Author’s analysis)

It is also important to note that the high number of polders with very high net benefits in this study may be related to an underestimation of costs. As stated previously, we do not include operational costs and costs of pumping stations, which can add significantly to the overall costs (Spackova and Straub 2015). Here, we provide first cut estimates that reveal that the plan may be beneficial for a large number of polders, but for those polders more detailed studies would be required to assess the costs more accurately, and also to assess the potential co-benefits (e.g. using the storage lakes for recreation and so forth). For this first study, it was difficult to include the costs of pumping in a way that would allow comparison of the results between polders, because the techniques used can vary widely. For example, Tanjungan pumping station uses screw pumps with lower maintenance while Pluit pumping station uses axial pumps that require more energy and capital investment. Also the Tanjungan polder depends on a long shore type of retention pond that diverts flood water slower (and tends to give more risk) compared to the state of the art Pluit Lake together with the solid waste filtration system and the recreational park. Similar variations also exist in Ancol station, which is moderately active compare to Tanjungan and Pluit. In addition to that, morphology of inland and near shore polders will make large differences in costs between polders, which should be examined in detailed studies of each polder.

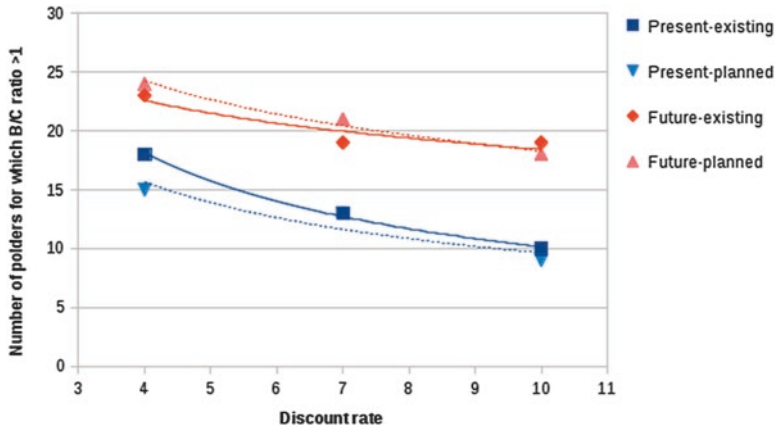
#### ***21.4.2 Policy Implications of Polder Systems in Jakarta***

Our results show that the implementation and management of just 3 polders, namely Kapuk Muara (Kapuk I, II, III), Kapuk Poglar, and Penjaringan Junction (see Tables 21.2 and 21.3), could have a huge impact on reducing overall risk. These could reduce risk by USD 92 million per year under the current situation, or USD 153 million per year under the future scenario (50% of current risk). The three decrease 31% of risk under the future scenario. Total investment of the three is USD 10.25 million, or 3.2% of total cost for all 66 polders.

Our results suggest that building and maintaining the 12 polders shown in Fig. 21.6, to a return period design standard of 50 years (see last column of Tables 21.2, 21.3, 21.4 and 21.5), could reduce the current risk by USD 104 million per year (i.e. 56% of current risk), or by USD 400 million per year under the future scenario (i.e. 81% of future risk). These examples show how risk based benefit-cost analysis can help to identify and prioritize polder construction.

#### ***21.4.3 Uncertainty and Sensitivity Test***

As mentioned previously, this study is intended to provide first cut estimates of the costs and benefits of the proposed polder system. This allows us to identify polders where the potential net benefits are the highest, which could be prioritized. However, the study is subject to large uncertainties. Especially, the costs considered here do



**Fig. 21.8** Sensitivity test using inflation rate 4%, 7%, and 10% showing number of polders that give immediate benefit at return period 2 years (Source: Author's analysis)

not include the costs for the pumping stations and retention lakes, which could add up to a significant part of project costs. Therefore, for polders with a B/C ratio that only exceeds 1 by a relatively small amount, caution must be exercised. For all polders, if one were to want to move towards implementation, much more detailed studies of both the costs, benefits, and hydraulics systems would be required at the local scale. Nevertheless, the results are useful for opening a dialogue between planners and decision-makers on the potential of the proposed polder system to reduce risk.

We tested the sensitivity of the BCA to the choice of discount rate, by also carrying out the analyses using lower (4%) and higher (10%) discount rates, and examining the number of polders for which the resulting B/C ratio  $> 1$ . The results are shown in Fig. 21.8, including a power fit between the discount rates of 4%, 7%, and 10%. As expected, the number of net benefiting polders reduces as the discount rate increases, since most of the costs are incurred early on whilst the benefits accrue over the lifetime of the polder. Nevertheless, even at the higher discount rate, a large number of polders show a B/C ratio  $> 1$ , indicating that these polders are relatively insensitive to the discount rate used.

#### 21.4.4 Future Research Needs

This study provides a first cut analysis of the costs and benefits of the described polder system. In future work, it will be important to use more detailed local information to assess the costs and benefits of the polder systems more accurately, especially for those polders that have shown potentially high net benefits in this chapter. In this regard, learning from existing polders that show cases of good practice would

be useful; a case in point is Pluit polder. Such future studies would need to include detailed data on aspects such as the dike line, the underlying soil type, retention lake capacity and placement, and costs of the pumping system. Moreover, the co-benefits of the polders should be examined, such as potential uses of the retention lakes for recreation and ecosystem services.

This chapter estimates the potential benefits based on hydraulic modeling of fluvial flooding. However, floods in the polders can also be caused by local precipitation, as seen in the flood of 19 February 2015 (Kadarsah et al. 2015). These extreme rainfall events may become more frequent or extreme in the future. It would be beneficial to also develop a flood hazard model based on scenarios of current and future pluvial flooding within a polder, which could increase the potential benefits of the polder system.

The results presented here for the future scenario are based on the median scenario of a large number of future scenarios of climate change, land use change, and subsidence, carried out by Budiyo et al. (2016). In future studies, it would be useful to examine the B/C ratios under all of the scenarios, in order to give a more complete picture of how the B/C ratios develop under each of the different scenarios.

Finally, this study does not examine the institutional and/or governance issues related to the potential implementation of polders in Jakarta; future research on this aspect is also essential.

## 21.5 Conclusions

We have demonstrated the use of a risk-based benefit-cost analysis for assessing potential effectiveness of the polder system described in Permen PU 12/ 2014 in Jakarta. The study provides first cut estimates of the benefits and costs involved, although costs of the pumping stations and retention lakes are not included in the analysis. Nevertheless, the results are useful for identifying polders where the potential benefits are the highest, and for prioritizing those polders. The results showed that implementing three polders could reduce current flood risk by 50%, namely Kapuk Muara (Kapuk I, II, III), Penjaringan Junction, and Kapuk Poglar. If we account for a future scenario of climate change, land use change, and land subsidence, the future risk could be reduced from USD 493 million per year to USD 340 million per year. Under this future scenario, nine additional polders could also provide net benefits, namely Sunter Timur III (Rawa Badak), Sunter Utara, Ancol Pademangan, Muara Angke, Komplek Dewa Kembar, Muara Karang, Sunter II Kebantenan, Pantai Indah Kapuk (19) and Sunter Timur IB. The 12 polders could decrease 81% of future flood risk, with the benefits far outweighing the costs.

Based on the findings, it appears that the highest immediate benefits could be obtained from developing the first group of polders. In the longer run, developing the other polders showing high net benefits could further reduce the risks from fluvial flooding in Jakarta.

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# Chapter 22

## Forest and Land Fires Hazard Level

### Modeling: Case study of Kapuas, Central Kalimantan

**Achmad Siddik Thoha, Bambang Hero Saharjo, Rizaldi Boer, and Muhammad Ardiansyah**

**Abstract** Forest and land fires occur almost every year in Indonesia and their impacts are detrimental to human life and the environment. The major causes of forest and land fires thus need to be determined and spatial pattern of the fire activity needs to be developed. The assessment of hazard levels can help policy makers to develop strategy and actions for managing fire risks and to develop spatial plans that can decrease the fire risk or evaluate the impacts of land use change on fire risk.

The objectives of this research are to analyze the variables that affected the level of forest land and fire hazard, to develop a spatial model of forest and land fire hazard and to determine the distribution of forest and land fires in the Kapuas District of Central Kalimantan. Forest and land fires in the Kapuas District of Central Kalimantan Province receive ongoing attention from local, national and international communities.

Composite Mapping Analysis was used to develop spatial model of forest and land fires hazard index. Six variables were used in determining the hazard of forest and land fires in Kapuas i.e., land cover, distance from river, distance from road, and distance from village centre, peat depth, and land system. The findings showed that fire hazard index could be developed by using three variables:

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peat depth, land cover and distance from road. The hotspot density could well be explained using the three variables with a coefficient of determination ( $R^2$ ) of about 73.8%. The highest peat depth class had a weight of 72.9% in determining the forest fire possibility through hotspot density. High hazard areas were mostly distributed in deep peat areas, found under land cover class of secondary swamp forest and shrub swamp and in close proximity to the road. This study provided suggestions to the Kapuas District stakeholders to enhance intentions to improve land productivity, to protect peatland conservation areas and to manage water in peatland. The study concludes on the importance of developing time-series forest and land fire hazard maps and to include socio-economic variables in the model.

**Keywords** Forest and land fires • Hazard level • Composite mapping analysis • Peatland • Kalimantan

## 22.1 Introduction

Forest and land fires occur almost every year in Indonesia and their impacts are detrimental to human life and the environment. During the 1997/1998 when El Nino hit Indonesia, forest fire emissions have contributed an equivalent of 13–40% of the global carbon emissions (Page et al. 2002). Social and economic activities were disrupted by haze generated from forest and land fires (Harrison et al. 2009, Langner and Siegert 2009) as have been shown in research by Tacconiet et al. (2007), that the 1997/1998 forest and land fires have caused haze across the country, causing millions of people to be stricken with respiratory infections and other illnesses, as well as economic losses of trillions rupiahs. In 2015, forest and land fires burned about 2.6 million hectares of land and forest areas and had caused great losses in the social and economic sectors (BNPB 2015) of about IDR 221 trillion (Kompas.com 2015).

In Kapuas District of Central Kalimantan Province, there are hundreds of thousands hectares of peatland which are located in the former Peatland Development Projects (PLG) or was widely known PLG. PLG supported the opening of massive peatland including swamp forests with deep peat through the construction of thousands of kilometers of canals that has resulted in the drying out of the peatland ecosystem. The drainage process has turned the area into a fire-prone area and a massive carbon emitter (Hoojier et al. 2008). According to Cochrane (2003), carbon emissions resulted from fires in peatland, are particularly high.

Forest and land fires in Kapuas District are currently receiving attention among local, national or international communities. As reported by WIIP (2007), KFCP (2009) and MoF (2011), the 2002, 2007, 2009 and 2011 fires occurred in PLG have disrupted the people activities and have damaged the peatland ecosystem. Jaya et al.

(2008) mention that Kapuas District is one area in Central Kalimantan with very high (extreme) fire risk.

An important strategic effort for managing forest and land fires is prevention. Prevention, fire suppression and post-fire action are aspects that support the success of forest and land fires management. One attempt in fire prevention is through an early warning system, which is a term commonly used in disaster risk management. According to UNISDR (2009), an early warning system is a series of capacity required to produce and disseminate meaningful warning information in time, to allow individuals, communities and organizations that are being threatened by the danger, to prepare and take appropriate actions, and within a reasonable time to reduce the possibility of damage or loss.

The four key elements in an early warning system are understanding risk knowledge; monitoring, analyzing and forecasting hazards; communicating or distributing alert and warning messages; and the local capacity to respond to the received warning (UNISDR 2009). Hazard fire mapping becomes an important part of the Fire Early Warning System (FEWS) because it could provide data and information regarding the risks, plan monitoring and forecasting hazards, hence could minimize the danger of forest fire.

Based on the Government Regulation Number 45 of 2004 on Forest Protection Act 16 one of the forest and land fire prevention program is the creation of forest and land fire hazard map. The map contains important information on the extent and magnitude of the regions based on the level of hazard. Fire hazard map is also a tool to monitor the area condition and community activities within the vulnerable areas. The hazard map is very important to allow much more precise management of forest and land fires. In addition, it could also be used as an instrument to predict the key factors causing the fire.

The level of forest and land fires hazard can be determined through modeling the relationship between forest and land fires, with the influencing factors. Since most of these factors are spatially referenced, thus the model could be approached and developed in a geographic information system. Soewarso (2003) who develops a prediction model of peatland fire prevention in South Sumatra, has found that the distance from the river to the farms plays a significant role in determining the hazard level of peatland fires, while Jaya et al. (2008) have found that human activities related factors such as roads, rivers and settlements are the dominant factors in determining the fire hazard level.

Identification of forest fire area is also the policy of the government to manage forest and land fires as stated in the Regulation of the Minister of Forestry No. 12 of 2009 on Forest Fire Management, which elaborates on the scope of forest fire controls including prevention, extinction and post-fire actions. Related to early warning system, Article 5 of the regulation states that forest fire prevention activities at national level include; (a) creating forest fire hazard map, (b) developing information systems on wildfires, (c) building partnerships with communities, (d) setting standards for forest fire equipment control, (e) developing extension programs and

campaigns regarding forest fire control and (f) creating training patterns to prevent forest fires. The objective of this research is to analyze the variables that affect the hazard level of forest and land fires, to develop a spatial model of forest and land fires hazard level and to determine the distribution of forest and land fire areas in the Kapuas District of Central Kalimantan Province.

## 22.2 Method

### 22.2.1 Materials and Data

The study was carried out in the Kapuas District of Central Kalimantan Province (Fig. 22.1) from April to September 2012. Kapuas District is one area in Central Kalimantan Province where forest and land fires occurs almost every year.

Data used to build the hazard model comprised of hotspots distribution in 2009 derived from Terra Aqua MODIS satellite, Kapuas District administrative boundaries, and several maps on land cover, road network, river network, distribution of village centers, distribution of peatland and land system (RePProt). The hotspot distribution map was downloaded from Terra Aqua MODIS of NASA (National Aero Space Administration), which was accessible for free at the Fire Information for Resource Management System (FIRMS) (<https://earthdata.nasa.gov/data/near-real-time-data/firms/active-fire-data>). Map of administration boundary was obtained from the digitized map of Kapuas District administrative boundaries derived from the Regional Development Planning Agency (BAPPEDA of Kapuas) and the Kapuas District Forestry and Plantation Agency. Maps of road network, river network and village centre were obtained from the Regional Development Planning Agency of Central Kalimantan (BAPPEDA of Central Kalimantan) while map of peat depth was obtained from the Natural Resource Conservation Unit of Central Kalimantan Province (BKSDA of Central Kalimantan).

### 22.2.2 Preparation and Data Classification

Six variables were used in determining the risk of forest and land fires in Kapuas i.e. land cover, distance from river, distance from road, distance from village centre, peat depth and land system (Table 22.1). The six variables represented the driving factors of forest and land fires from biophysical and human related variables. Variables representing biophysical features were peat depth, land cover and land system, while those representing community activities features were distance from road, distance from river and distance from village centre. Jaya et al. (2008), in their research, have used seven variables to determine the spatial model of fire

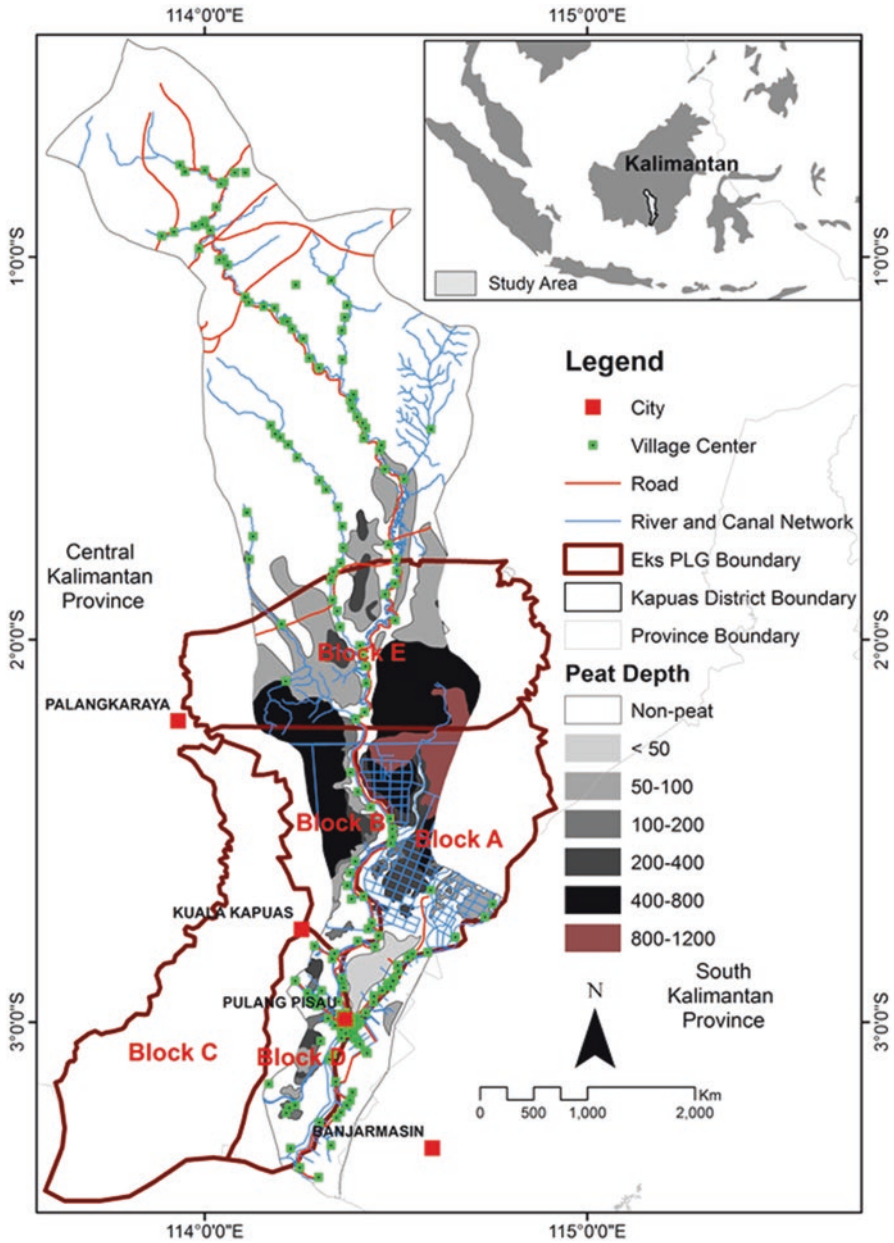


Fig. 22.1 Study area (Kapuas District, Central Kalimantan Province) (Source: Authors)

hazard index for Central Kalimantan, i.e., land system, land cover, land use, river network, road network, village centre and soil type. Human related variables have shown to have real impacts on the occurrence of forest fires (Soewarso 2003). Likewise, variables such as settlements, road networks, river networks and land use are shown to be influential in the determination of forest and land fire risks (Booyanuphap 2001).

**Table 22.1** Classifying variables that were used in developing the model

Variable	Factor	Class	Remark		
X1	Land cover	Secondary Forest Dry Land	Classification by Ministry of Environment and Forestry		
		Mining			
		Dryland Agriculture and Shrubs			
		Bushes			
		Dryland Agriculture			
		Water Body			
		Ricefield			
		Secondary Swamp Forest			
		Settlement			
		Swamp			
		Open land			
X2	Distance from the river	Buffer with interval 1000 m (1 km)	Classification by BIG		
		X3		Distance from the road	Buffer with interval 1000 m (1 km)
					X4
X5	Peat depth level	Non-peat	Classification by Wetland International		
		Very Shallow			
		Shallow			
		Moderate			
		Deep			
		Very Deep			
Extremely Deep					

(continued)

**Table 22.1** (continued)

Variable	Factor	Class	Remark
X6	Land system	Mountains (MOU)	Classification by RePPRoT
		Tidal (mangrove and nipah) (TMN)	
		Steep volcanic plugs (SVP)	
		Undulating plains with several wide valleys (UPV)	
		Hillocky plain (HP)	
		Steep hills (SHI)	
		Rolling plain and sandy remnants (RPS)	
		Terrace remnant (TER)	
		Hillocky plains with cuesta-shaped ridges (HPC)	
		Dissected dip slopes of cuestas (DDS)	
		Hills with moderately steep dip and steep scarp slopes (HMS)	
		Undulating sandy terraces (UST)	
		Meander belts within very wide river floodplains (MBW)	
		Permanently waterlogged plains (PWP)	
		Steep narrow ridges (SNR)	
		Alluvial floodplains between swamps (AFS)	
		Swampy floodplains mainly within terraces (SFM)	
Peat basin margins (PBM)			
Peat-covered sandy terraces (PCS)			
Peat basins or domes (PBD)			

Source: Ministry of Environment and Forestry 2010, Geospatial Information Agency (BIG) 2000, Region of Physical Planning Programme for Transmigration (RePPRoT) 1987 and Wetland International 2000–2002

### ***22.2.3 Correlation Between Scoring Classes of Each Variable and Hotspot***

Calculation of actual scores, estimated scores and rescaled scores for each variable were determined based on the hotspot density. The hotspot that was in building the scores has a confidence value above 50%. According to Giglio et al. (2003), Confidence Level is used to determine the classes categorized as low confidence (> 30%), nominal-confidence (30–80%) or high-confidence (> 80%) for all fire pixels.



The confidence value of a hotspot is quite varied across different parts of the world. Within the Kapuas District, hotspots with confidence value above 50% can adequately describe forest and land fires that occurred (Thoha et al. 2014).

Actual score is the ratio between the numbers of actual hotspots with expected hotspot expectation, while estimated score was calculated using trend line model derived for each variable. Classes' scores in the variables were obtained from formula 22.1 and 22.2, developed by Jaya et al. (2008).

$$E_i = \left[ \frac{T \times F}{100} \right] \quad (22.1)$$

$$X_i = \left[ \frac{o_i}{e_i} \right] \times \frac{100}{\sum \left( \frac{o_i}{e_i} \right)} \quad (22.2)$$

Where:

$X_i$  = Actual score of the class (sub-factor) in the variable.

$O_i$  = Average number of hotspots per variable class.

$E_i$  = Expected number of hot spots.

$T$  = Total hotspots.

$F$  = Percentage of area per variable class.

Based on the trend line between the actual score of each variable class with the class code, the estimated score could be attained following the non-linear regression equation with a coefficient of determination that was relatively higher. To obtain the same standard score among all factors that were used in developing the model, the scores were recalculated to acquire the rescaled scores. Scale score was formulated based on the formula by Jaya et al. (2008) with a minimum value of 10 and a maximum value of 100, as shown by Eq. 22.3.

$$\text{Score } R_{\text{out}} = \left[ \left( \frac{\text{Score } E_{\text{input}} - \text{Score } E_{\text{min}}}{\text{Score } E_{\text{max}} - \text{Score } E_{\text{min}}} \right) \times (\text{Score } R_{\text{max}} - \text{Score } R_{\text{min}}) \right] + \text{Score } R_{\text{min}} \quad (22.3)$$

Where:

Score  $R_{\text{out}}$  = the value of the rescaled score

Score  $E_{\text{input}}$  = estimated score input

Score  $E_{\text{min}}$  = minimum value of estimated score

Score  $E_{\text{max}}$  = maximum value of estimated score

Score  $R_{\text{max}}$  = maximum value of rescaled score

Score  $R_{\text{min}}$  = minimum value of rescaled score

### 22.2.3.1 Weighting Variables

In this research, analysis of the correlation between the number of hotspots per km<sup>2</sup> (hotspot density) with variable score of forest and land fire risk was conducted to determine the variable weight. The significant variables ( $p$  value  $>0.05$ ) were compared with other selected variables which were used to construct a linear regression model using hotspot density as the predictor variable. The weight of each variable is the proportions of each coefficient ( $\alpha$ ) of linear regression to the sum of all coefficient regressions.

### 22.2.3.2 Development of Fire Hazard Model and Model Visualization

Resulting rescaled scores for each factor were used to calculate the composite scores of several variables. Stepwise regression model was used to determine the composite score that described the correlation between the number of hotspots per km<sup>2</sup> (hotspot density) and the corresponding factor scores. Hotspot density was measured based on spatial analysis using the calculate density tool with radius of 10 km. Data used to create the relationship equation of composite scores and hotspots density were obtained from the whole Kapuas District. Composite scores were determined by CMA method, with weight derived from the coefficient of each corresponding composite factor. Based on the score and weight of each variable, a mathematical equation was formulated (Eq. 22.4):

$$Y = W_1X_1 + W_2X_2 \dots + W_iX_i \quad (22.4)$$

Where:

Y = Model Composite Score

W<sub>i</sub> = Weight ith-Variable

X<sub>i</sub> = ith-Variable Scale Score

Forest and land fires hazard map was produced based on the visualization of spatial model using Eq. 22.4. The distribution of the model value was classified using the natural breaks classification method provided in GIS software and classified into three and five classes.

### 22.2.3.3 Model Accuracy Test

The accuracy of the forest and land fire hazard model was then tested to measure how well the model predicts real conditions. In each model, the hazard level was classified into two groups, that is, 3 classes and 5 classes. The classification applied the natural breaks method provided in Geographic Information System processing tool. Using the 2006 hotspot density with confidence  $>50\%$  as a

reference, an accuracy test was performed using a confusion matrix, also known as error matrix, by overlaying the polygon area references with fire hazard model map. Accuracy score was calculated using the following formula (Eq. 22.5).

$$OA = \left[ \left[ \frac{\sum_{n=1}^{\infty} X_{ii}}{N} \right] \times 100\% \right] \quad (22.5)$$

where:

OA = overall accuracy

X<sub>ii</sub> = sum of column i and row i (the diagonal)

N = sum of all columns and rows that were used

#### ***22.2.4 Determining the Distribution of Forest and Land Fires Hazard Level***

In determining the level of forest and land fires hazard, the method of Composite Mapping Analysis (CMA) was used with some modification by Jaya et al. (2008) from the original mapping analysis (Jaya et al. 2007). According to Hepner (1999), CMA method is the main technique used to model the risk to communities. This method combines separate spatial data layers to produce a meaningful correlation of the spatial relationships between these data (Boonyanuphap et al. 2001). Boonyanuphap (2005) has also used the CMA method in determining the spatial model of deforestation prone area. Distribution of the level of forest and land fires hazard was determined by creating a hazard map of forest and land fires, which was derived from spatial models, by calculating the extent of each hazard class and classifying the distribution of forest and land fires risk according to administrative area, and variables with significant roles in predicting the hotspot. The steps required to establish the level of forest and land fire hazard is described below in Fig. 22.2.

Finally, method of CMA was used to determine the correlation between actual score and each variable effecting the forest and land fires. Actual score described the fire activity resulted from the proportion of the number of hotspots by area of each variable. CMA method could also be used to determine the weight of significant variables and to determine the spatial model for the hazard level of forest and land fires. Based on the spatial model, the distribution of forest and land fires hazard by administrative area in the District of Kapuas was established.

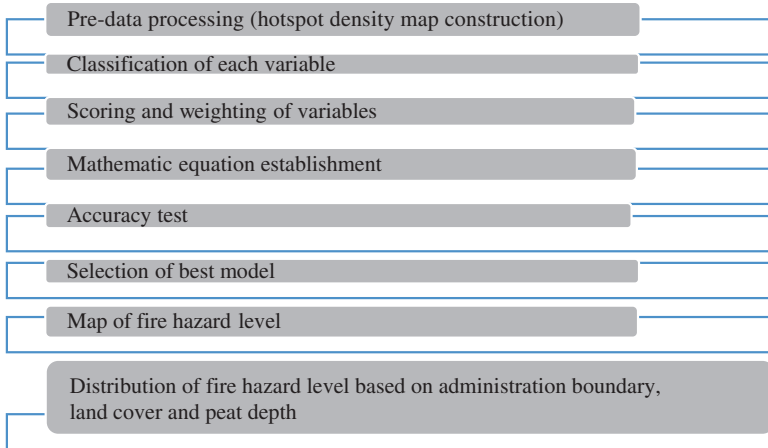


Fig. 22.2 Framework for determination of forest and land fire hazard level

## 22.3 Results and Discussion

This section discussed the correlation pattern between fire activity and each causal variable of the fire, and the significant variables in determining the fire hazard level. In addition, this section also described the distribution of the hazard level of forest and land fires in the District of Kapuas and the implementation of the hazard model for forest and land fires management.

### 22.3.1 *Relationship Between Fire Activity and Causal Variables Effecting Forest and Land Fires*

The scores that were calculated in each variable class produced a pattern that described the relationship between fire activity, and variables contributing to forest and land fires in Kapuas District. The relationships between the actual score with variables classification code are given in Figs. 22.2, 22.3, 22.4, 22.5, 22.6 and 22.7, while the score scale of each variable is presented in Table 22.2. The estimated scores that were calculated from the regression equation between the actual score and land cover classes followed a polynomial (cubic) pattern with coefficient determination ( $R^2$ ) of 96.6% (Fig. 22.3). Such pattern indicated that lands with low vegetation density would attain higher scores.

In unmanaged land, outsiders could easily perform burning activities both intentionally and unintentionally without being monitored. Examples of intentional burning activity are bush fire to open the way for hunting and transporting timber and in search of fish and hideaways of hunting games, while unintentional burning activity includes negligence of smoking and flames from cooking (Akbar 2011).

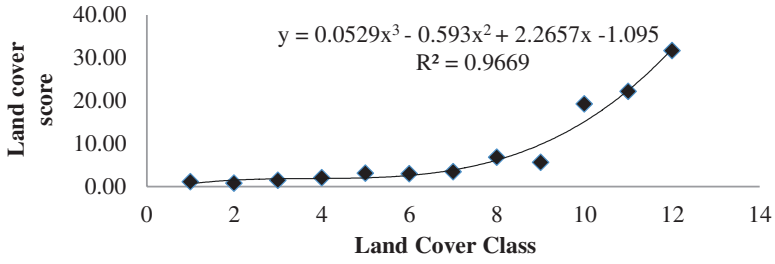


Fig. 22.3 Relationship between actual score and land cover class

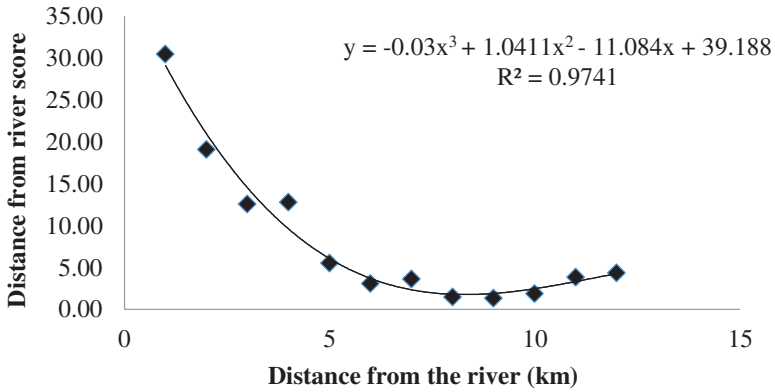


Fig. 22.4 Relationship between actual score and distance from the river

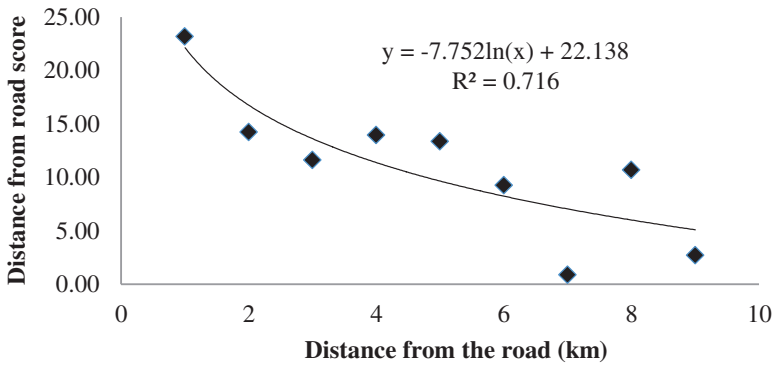


Fig. 22.5 Relationship between actual score and distance from road

Relationship between actual score and distances from rivers and canals, similarly, followed a polynomial (cubic) pattern with coefficient determination ( $R^2$ ) of 97.4% (Fig. 22.4). Figure 22.4 showed that the closer the distance to the river, the bigger is the estimated score. The highest score was found at 1 km from river and

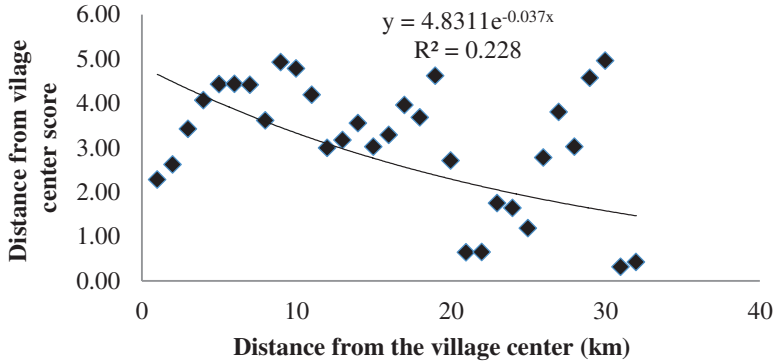


Fig. 22.6 Relationship between actual score and distance from village centre

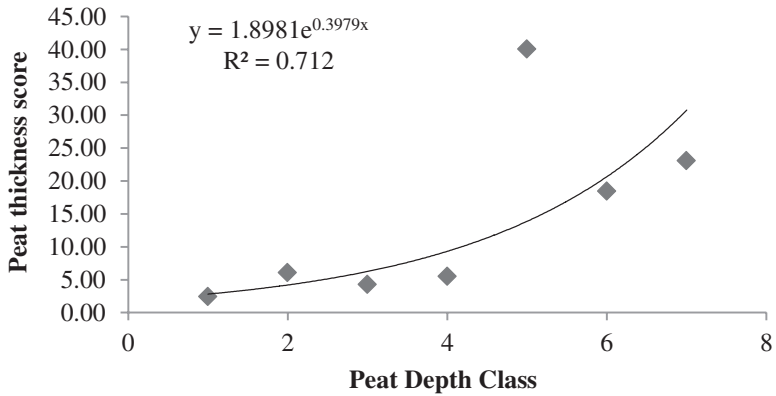


Fig. 22.7 Relationship between actual score and distance from peat depth class

canal. This was because rivers and canals are used as public accesses to perform various activities especially for cultivating and transporting timbers in the swamp forest. Lands located close to the rivers were generally easier to manage, since they were in close proximity to transportation roads, easy to monitor and near water sources. Therefore, forest and land areas which were located near rivers and canals were the most vulnerable in terms of fire.

According to Hecker (2005) and Hoojier et al. (2008), more than 4000 km of canals were built in the peatland area of MRP, which were mostly located within the Kapuas District. This provided access for allow human activities. The construction of the canals has increased the drying up of the peatland and turning it into a fire-prone area. Soewarso (2003) also notes similar situation in the peat swamp forest of Sugihan River, where areas close to rivers and canals showed higher chances of fire incidents.

Figure 22.5 showed the relationship between actual score and distance from road that followed a logarithmic pattern with determination coefficient ( $R^2$ ) of 71.6%. Figure 22.5 indicated that the closer the forest or land to the road, the greater was

**Table 22.2** Rescaled score per variable class for establishing fire hazard map in Kapuas

Code.	Variable	Class score
X1	Landcover	(1) Secondary dry land forest (10.00), (2) Mining (12.56), (3) Dry land agriculture mixed shrubs (13.42), (4) Shrubs (13.54), (5) Dry land agriculture (13.84), (6) Water body (15.26), (7) Paddy field (18.75), (8) Secondary swamp forest (25.24), (9) Settlement (35.68), (10) Swamp (50.99), (11) Open land (72.12), (12) Swamp shrubs (100.00)
X2	Distance from river	1 km (100.00), 2 km (73.08), 3 km (51.84), 4 km (35.68), 5 km (24.01), 6 km (16.24), 7 km (11.76), 8 km (10.00), 9 km (10.35), 10 km (12.23), 11 km (15.03), 12 km (18.17)
X3	Distance from road	1 km (100.00), 2 km (71.61), 3 km (55.00), 4 km (43.22), 5 km (34.08), 6 km (26.61), 7 km (20.29), 8 km (14.82), 9 km (10.00)
X4	Distance from village centre	1 km (100.00), 2 km (96.14), 3 km (92.36), 4 km (88.6), 5 km (85.03), 6 km (81.47), 7 km (77.98), 8 km (74.56), 9 km (71.20), 10 km (67.92), 11 km (64.69), 12 km (61.54), 13 km (58.44), 14 km (55.41), 15 km (52.43), 16 km (49.52), 17 km (46.66), 18 km (43.86), 19 km (41.11), 20 km (38.42), 21 km (35.79), 22 km (33.20), 23 km (30.67), 24 km (28.18), 25 km (25.75), 26 km (23.36), 27 km (21.02), 28 km (18.73), 29 km (16.48), 30 km (14.28), 31 km (12.12), 32 km (10.00)
X5	Peat depth	(1) Non-peat (10.00), 2) Very shallow (14.46), 3) Shallow (21.10), 4) Moderate (30.98), 5) Deep (45.66), 6) Very deep (67.51), 7) Very very deep (100.00)
X6	Land system	1) Mountains (MOU) (10.00), (2) Tidal (mangrove and nipah) (TMN) (10.59), (3) Steep volcanic plugs (SVP) (11.30), (4) Undulating plains with several wide valleys (UPV) (12.15), (5) Hillocky plain (HP) (13.17), (6) Steep hills (SHI) (14.39), (7) Rolling plain and sandy remnants (RPS) (15.86), (8) Terrace remnant (TER) (17.61), (9) Hillocky plains with cuesta-shaped ridges (HMS) (19.71), (10) Dissected dip slopes of cuestas (DDS) (22.23), (11) Hills with moderately steep dip and steep scarp slopes (HMS) (25.25), (12) Undulating sandy terraces (UST) (28.87), (13) Meander belts within very wide river floodplains (MBW) (33.21), (14) Permanently waterlogged plains (PWP) (38.40), (15) Steep narrow ridges (SNR) (44.63), (16) Alluvial floodplains between swamps (AFS) (52.10), (17) Swampy floodplains mainly within terraces (SFM) (61.04), (18) Peat basin margins (PBM) (71.76), (19) Peat-covered sandy terraces (PCS) (84.60), (20) Peat basins or domes (PBD) (100.00)

the estimated score of fire activity. The highest score was found on areas closest to the road (1 km) due to easier access for the purposes of land management and ownership. Lands that were close to the road were often burned for the purpose of opening new agricultural land, plantation and maintenance of private land. The farther the lands were from the road, the lower the possibility of being burnt due to lower access. This pattern showed similar pattern as the variable of distance from rivers and canals as they were the main transportation means to reach various locations within Kapuas District. Similarly, Boer et al. (2007) also note that in a significant portion, fires in Central Kalimantan occurred close to the road network, which could be used to predict the causes of fires.

The relationship between distances from village centre with fire activity showed that the farther the distance was from the village centre, the lower was the probability of fire activity (Fig. 22.6). The highest score was found on areas in close proximity to the village (1 km). In determining the best estimated score pattern, the relationship between actual score with distance from village centre followed an exponential pattern with coefficient determination (R<sup>2</sup>) of 22.8%. In reality, people tend to clear and burn lands close to the village to allow easier monitoring and managing the land. Land allocated for transmigration and cultivation areas could also drove an area to be prone to fire. Similar situation was also observed by Stolle et al. (2003) who found that the fires in Jambi Province were caused by human related factors such as the existence of settlements in transmigration projects and land allocation for special uses.

Table 22.2 shows a rescaled score of each variable for establishing the fire hazard model in Kapuas.

The relationship between actual score and peat depth followed an exponential pattern with coefficient determination (R<sup>2</sup>) of 71.2%, that is, the deeper the peatland, the bigger would be the estimated score (Fig. 22.7). The highest score or high fire activity was found to occur in the very deep (extremely deep) peatland areas, due to the limited area of moderate depth peatland that could be cleared. Deep peatland are still available in large area and easily accessible, thus increased the intensity of land clearing in this area.

Similar to the relationship between actual score and peat depth, estimated scores from regression equation between actual score and land system also followed an exponential pattern with coefficient determination (R<sup>2</sup>) of 86.0%, indicating that the higher the peat characteristics of a land, the higher was the prediction score (Fig. 22.8). The highest score was found in peat basin dome (PBD) system or Barah (BRH) indicating a peat swamp forest ecosystem. Secondary swamp forest in peatland areas were the place where fire activity were likely to occur as indicated by the high hotspots density. This results is supported by Langner and Siegert's (2009), who found that repeated fires occurred as a response to the 15 years of peatland drainage during the years of 2002, 2004, 2006 and 2009 in the former MRP location.

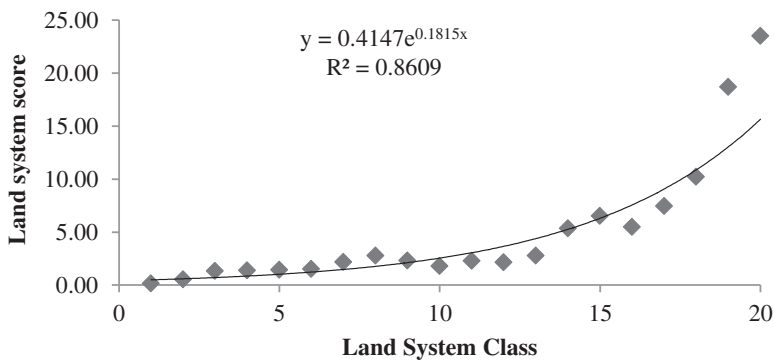


Fig. 22.8 Relationship between actual score and distance from land system class



### 22.3.2 *Spatial Model of Forest and Land Fires Hazard Level*

Analysis of stepwise regression of the six variables stated in Table 22.2, yielded three non significant variables ( $\alpha > 0.1$ ), i.e., distance from river (X2), distance from village centre (X4) and land system (X6) with an R2 value of 40%. Consequently, the composite score model (hazard score) to develop forest and land fires hazard score used the three significant variables namely land cover (X1), distance from road (X3) and peat depth (X5), to estimate the hotspots density. Linear regression analysis of these three variables resulted in R2 of 42.2% with each variable weight shown in Table 22.3.

From the variables weights in Table 22.3, a model equation for forest and land fires hazard score in Kapuas District, Central Kalimantan Province was formulated as follows:

$$\text{Composite score} : 0.161 \times 1 + 0.109 \times 3 + 0.730 \times 5$$

where:

- ×1 is rescaled score of land cover
- ×3 is rescaled score of distance from road
- ×5 is rescaled score of peat depth

From the mathematical equation above, the weights related to human activity and biophysical variables could be calculated. In Kapuas District, human related variables (distance from road and land cover) had a weight of 27.0% while the biophysical variables (peat depth) had a weight of 73.0%. According to the model with three variables, in predicting fire activity, peat played the most important role in forest and land fires, with weighted value of almost 75%. This indicated that peatland were fire-prone areas in Kapuas District, hence it should become the main focus in controlling forest and land fires. In addition, land cover and distance from road were also important variables in the prevention of forest and land fires. Thoha et al. (2014) have found that peatland in conservation areas and unmanaged lands in Kapuas District were fire-prone.

Other associated human variables in this study, were land cover, settlements, mining, rice fields, agriculture dry lands and peatland as shown in Table 22.1. Samsuri et al. (2010) have found that land cover had a high weight in determining

**Table 22.3** Coefficient score and weight of composite score of forest and land fires hazard level in Kapuas

Variable	Coefficient	Weight
Land cover	0.001440	0.16118
Distance from road	0.000974	0.10902
Peat depth	0.006520	0.72980

the level of forest and land fires hazard in Central Kalimantan. Road is very important factor in the occurrence of forest and land fires because it opens people’s access to use the land. While in West and East Kalimantan, roads, rivers and village centre are the dominant variables in determining fire risk in (Jaya et al. 2008). Thus, both human related and biophysical variables were interconnected. Biophysical related variables provided the fuels and the means of fire to occur, while human related variables were significantly determined the occurrence of fire on areas with specific characteristics.

Currently, research on the determination of fire-prone areas has been developed using a wide variety of maps. Jaya et al. (2008) research on the spatial model of forest fires hazard in Central Kalimantan using Composite Mapping Analysis (CMA) method, and found that human related variables such as distance from village and distance from road have contributed as much as 52% as compared to biophysical variables, namely land cover, that contributed only 48%.

Determination of the forest and land fires hazard levels and zones were done using a quantitative approach (empirical) by means of Composite Mapping Analysis method. The model was built based on composite scores, which was composed through statistic equations that described the relationship between the number of hotspots per km<sup>2</sup> (y) with composite scores (hazard scores) of each corresponding variable (x), as follows:

$$y = 1.015 \times 3 - 2.987 \times 2 + 2.875 \times -0.122$$

where:

Y: Hotspot density

X: Composite Score Model

The established forest and land fires vulnerabilities model was a polynomial model with determination coefficient (R<sup>2</sup>) of 73.8%, meaning that the model resulted from the relationship of composite score model with hotspot density was adequately accurate. The accuracy test of forest and land fires hazard class showed that the classification of five classes into three classes improved the accuracy from 57.7 to 78.8% (Table 22.4). Thus, in developing forest and land fires hazard level, the level should be divided into three classes.

Extent of each fire hazard level, composite score, hotspots density and fire hazard map are presented in Table 22.5 and Fig. 22.9 by dividing the Y score into three classes.

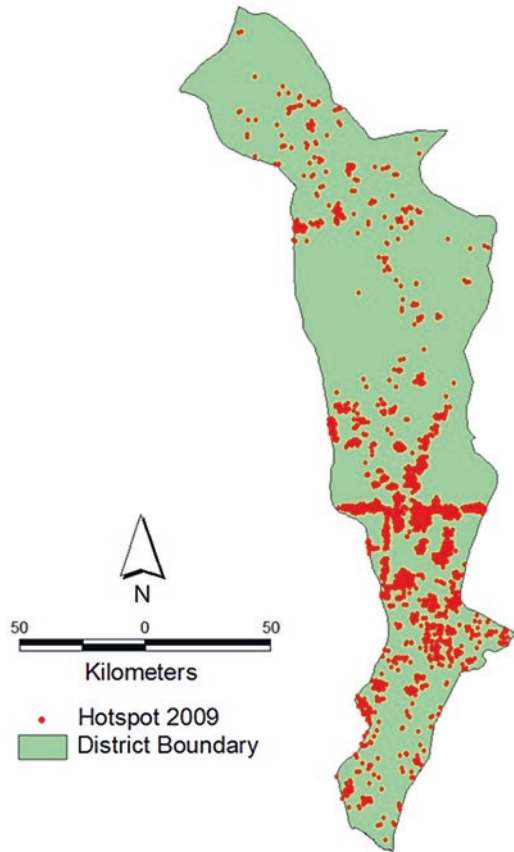
**Table 22.4** Coincidence matrix of Z model and hotspot from observation results

Number of classes	Accuracy
5 classes	57.7
3 classes	78.8

**Table 22.5** Extent of fire with three levels of hazard

Hazard level	Extent (ha)	Composite score	Hotspot density	Area percentage (%)
Low	1133930.4260	10.00–27.91	0.082–0.0291	69.3161
Moderate	412345.0360	27.91–42.10	0.091–0.539	25.2063
High	89607.4460	42.10–100.00	0.539–1.678	5.4776

**Fig. 22.9** Hotspot distribution in Kapuas



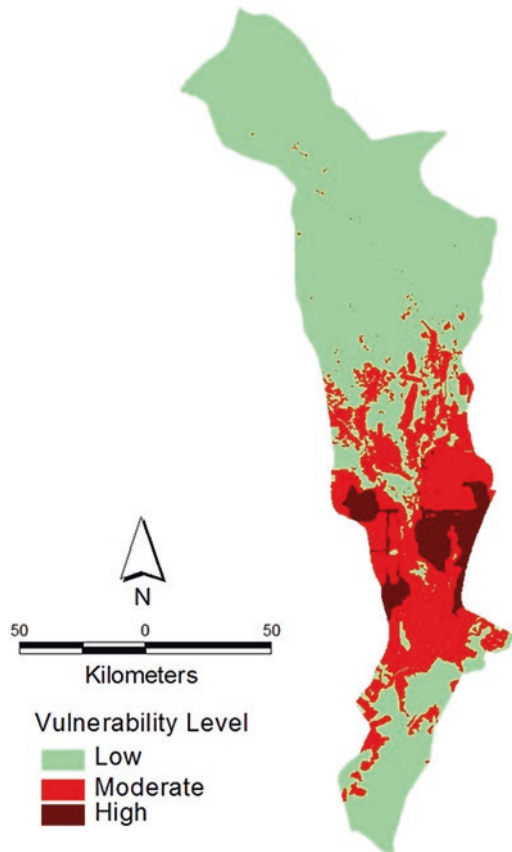
### 22.3.3 *Distribution of Fire Hazard Level and Its Implementation in the Management of Forest and Land Fires*

Forest and land fires hazard map, which was built by using a model coupled with locations analysis and area distribution based on administration, peat depth and land cover class, were very useful to provide additional information for policy makers to determine the priority efforts to prevent forest and land fires. Knowing the

detail information of data, location distribution and dominant activities occurring in an area, should provide the basis for setting priority strategy and technical implementation of forest and land fires early warning system. Figures 22.9 and 22.10 shows hotspot distribution and forest and land fires hazard map with three risk levels.

Results of the spatial analysis of fire hazard map with administrative boundaries indicated that areas with high hazard level were found in three Sub-districts namely Basarang, Dadahup and Mantangai. Areas with high hazard level were obtained by overlaying the hazard map with peat depth map. All of these areas were found to be on peatland areas. Most of Mantangai Sub-district was located on the former MRP area. Likewise, the majority of Dadahup District is located on transmigration peatland area, and so is Basarang Sub District that is also located on transmigration area with moderate to thin peatland (KFCP 2009). Sidiyasa (2012) analyzes that the MRP area in Mantangai, particularly the southern part, has suffered heavy damage due to canal construction to dry the peatland, where as a result, frequent annual fires occurred in the dry season.

**Fig. 22.10** Forest and land fires hazard map with 3 hazard levels



Besides the distribution of fire hazard level based on specific area characteristic, the hazard model could also determine the dominant model variables in predicting forest and land fires. This study found that the dominant model variable is peat depth, shown by its highest weight in the model (Table 22.2). This suggested that for peatland especially the deep peat areas should be given priority in prevention programs through the development of early fire warning system.

Based on the distribution of land use, lands with high hazard levels were mostly located on unmanaged land, namely secondary swamp forest, shrub swamps and open land. Fires were frequently used for land clearance. Treatments of combustion are mostly done by the time the new fields opened from secondary forest or shrub (Akbar 2011). This information could be used as a priority reference for early warning activities on unmanaged areas in Kapuas District. Extension program, patrol, warning board and distribution of information were alternative activities that needed to be established intensively on unmanaged areas.

Forest and land fire hazard maps could be used to assist in policy making for development planning. Policy makers could create medium and long-term development programs referring to the fire hazard map that was established. Through identification of the causes and distribution of fire-prone areas, policy makers could develop programs to reduce the fire hazard level at district and village scales. Several development programs based on the forest and land fires hazard map could be proposed to the Kapuas District Government such as increasing the productivity of unmanaged land, protection of peatland conservation areas, providing incentive scheme for land clearing without burning, and water management in peatland.

The forest and land fires hazard map established from this study showed the potential to be used as input for policy makers in determining a low-emission-development from forest and land fires. Based on this study, various stakeholders in Kapuas District should give development priority for the improvement of land productivity, peatland conservation and water management in peatlands. The study also suggested that it is important to develop a time-series forest and land fires hazard map and to include socio-economic variables into the model.

## 22.4 Conclusion

The variables with significant roles in spatial modeling of forest and land fire hazard were peat depth, land cover and distance from road. These variables were used to develop the model of  $y = 1.015 \times 3 - 2.987 \times 2 + 2.875 \times -0122$  where the coefficient determination was 73.8% and could be used to predict hotspots density per km<sup>2</sup>. The model of land and forest fires hazard level using three variables had an accuracy of 78.8% for the categorization of three classes and 57.7% for five classes. The highest peat depth class had a weight of 72.9% in determining the forest fire possibility through hotspot density. High hazard areas were mostly distributed in deep peat areas, found under land cover class of secondary swamp

forest and shrub swamp and in close proximity to the road. Highly hazardous areas in Kapuas District were found to be located in the Sub-districts of Basarang, Dadahup and Mantangai.

This study provided suggestions to the Kapuas District stakeholders to enhance intentions to improve land productivity, to protect peatland conservation area and to manage water in peatland. The study concluded on the importance to develop time-series forest and land fires hazard maps and to include socio-economic variables in the model.

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## Chapter 23

# Tsunami Resilient Preparedness Indicators: The Effects of Integrating Religious Teaching and Roles of Religious Leaders

Wignyo Adiyoso and Hidehiko Kanegae

**Abstract** Many public education programs on disaster preparedness have been less effective due to a lack of considering communities' social, cultural, religious and local contexts. Much disaster research associated with religious aspects focuses on the negative effect of religious teachings on preparedness behaviour. This chapter fills a gap by presenting a positive view of religious teachings that are capable of encouraging disaster preparedness.

The aim of this research is to examine the effectiveness of risk information media (leaflets) comprising religious messages in persuading people to take tsunami preparedness. Tsunami Resilient Preparedness (TRP) indicators consist of a tsunami early warning system (TEWS), Emergency Plan (EP) and Capacity (CA), at each level from the individual, family and community to society and are used to measure tsunami preparedness. To investigate changes in tsunami preparedness action as an effect of risk information, this study uses two approaches: development of risk information and a pre and post survey involving 173 community members living in tsunami prone areas in Yogyakarta, Indonesia. A paired t-test and an independent t-test are used to analysis the change in mean score between pre-test and post-test and compare mean score in both groups.

Results show that intervention leaflets containing Islamic messages were effective in influencing residents both in increasing their knowledge and their behaviour in most TRP except for TEWS-individual and society, EP-community and CA-individual. Increases in most of TRP indicators are also present in the sub-group reinforced by religious leaders. This study is valuable in providing a framework for how policy makers should take into account the important effect of religious teachings in encouraging people to take action for disaster preparedness.

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**Keywords** Risk communication • Tsunami preparedness • Religious information • Islamic teachings • Intervention • Yogyakarta • Indonesia

## 23.1 Introduction

There has been increasing in frequency and unpredictable natural disaster in the last decade that severely affecting human life over the world, including Indonesia. Located in a meeting of four tectonic plates (Australian, Philippine, Eurasia and Pacific), Indonesia is one of the most vulnerable countries to disaster risks in the world (UNISDR 2009). In terms of human exposure, for example, Indonesia ranks: 1st for tsunami hazard out of 76 countries, 1st for landslide among 162 countries, 3rd for earthquake out of 153 countries, and 6th for floods out of 162 countries (Adiyoso 2013; UNISDR 2009). The development of disaster public education became a top priority considering the absence of disaster awareness in the past that caused loss of life more than: 165,708 due to Sumatra Tsunami 2004, 1,300 due to Nias Earthquake 2005, 5,778 due to Yogyakarta Earthquake 2006, 645 due to South Java Tsunami 2006 and West Sumatra Earthquake 2010 leaving 1117 people killed (UNDP-Indonesia 2008).

Islam is the dominant religion in Indonesia, with approximately 202.9 million identified as Moslem (88 of the total population) as of 2009 (Rachmalia et al. 2011). It makes Indonesia as a largest Moslem population in the world. While disasters do not discriminate race, gender, region and culture, imminently that Moslems are the most vulnerable group in Indonesia. The 2004 December tsunami triggered by earthquake measuring 9.0 on Richter Scale in northern Sumatra Island has killed 123,000 people, 33,000 people missing and 406,000 people displaced (Rachmalia et al. 2011) who majority was Moslem. In addition, in terms of tsunami disaster, most of the Indonesia population (60 %) lives in the coastal areas, and about 17 % or 21.5 million people living in villages along the coastline (Hidayati 2011). Although efforts have been made to educate people for preparing such disaster, the level of community preparedness, especially living in the coastal areas is still low (Hidayati 2011).

In developing countries, like Indonesia, people perceive hazard based on cultures and religious beliefs instead of modern science (Lavigne et al. 2008). Kemkens (2013) reported that after 2004 tsunami Sumatra, most people including religious leaders and educational people interpreted the disaster as a punishment from Allah because of human sin. Other interpretations of religious and traditional beliefs that natural disaster is God's wrath were spreading during 2006 Earthquake and 2006 and 2010 eruption of Mount Merapi in Yogyakarta, Indonesia (Kemkens 2013).

Research studying disasters found that people perceive hazard is often regarded as an important predictor of people decision to take preparation from natural hazard (Ronan and Johnston 2009). Even though public education on disaster preparedness has become a central issue on disaster management, evaluation of disaster prepared-

ness indicates that people living in disaster prone areas show the low of level preparedness (Paton 2003). Coppola and Maloney (2009) points out that the failure of people in taking preparedness for natural disaster was caused the ineffectiveness of risk communication programs for lacking in considering community characteristic, culture (religions) and view of disasters.

However, study conducted by Adiyoso and Kanegae (2013) concludes the views that God's punishment (fatalistic view) in disaster is not associated with preparedness motivation. Although people hold such belief, they often use logic thinking in responding tsunami disaster. Given such fatalistic belief, it is more caused social pressure from religious leader who often voices that natural disaster is caused by God's wrath (Cody 2005). This is consistent with Kemkens's argument (2013) that although people believe that natural disaster is viewed as God's action they possibly rejected that natural disaster is as God's punishment. As argued by Nasution (2011), in Holy Koran, there are many verses that encourage people to take preparation for disaster. For example, Koran (Ali 'Imran) 3: 200 mentioned "*O you who have believed, persevere and endure and remain stationed and fear Allah that you may be successful*". Another the need for preparation is mentioned in Qur'an (An 'am) 6:131 and (*Al-Hasyr*) 59: 18. These verses can be interpreted that it is necessary for people living in the disaster-prone areas should be prepared from disaster. Adiyoso and Kanegae (2014a) find that there is an increase in Moslem beliefs that promoting "positive views" of Islamic teachings will encourage people to take disaster preparedness albeit limited only intention to take action.

The aim of the research is to examine effectiveness of risk information media (leaflet) comprising religious messages in changing people to take tsunami preparedness. The authors utilize indicators called Tsunami Resilient Preparedness (TRP) developed by Adiyoso (2013) to measure the tsunami preparedness action done by individual and community. Another objective is to evaluate the effectiveness of the role of religious leaders who encourage and reinforce intervention leaflets in influencing people to take TRP. This study argues that religion messages inclusion and risk persuasion in disaster information is an effective strategy to influence people to adopt tsunami preparedness strategies. This study used two approaches: development of risk information and pre and post survey involving 173 community members living in tsunami prone areas in Yogyakarta, Indonesia. Paired t-test and the Independent t-test are used to analysis the change of mean's score between pre-test and post-test and comparison mean's score in both groups.

The paper is structured as follows. Literature review discusses three issues such as concept of fatalistic and positive views in Islamic teachings, development of tsunami preparedness indicators and effective risk information in influencing people to take action on disaster preparedness. A pre-post-survey and development of risk intervention are explored in the method. The results section presents finding on how different leaflets (intervention and non-intervention) and religious leaders influence community tsunami preparedness. Finally, lesson and challenges for DRR as well as research and practical implication are discussed.

## 23.2 Literature Review

This study argues that positive view of religious teachings integrating into risk information is capable to encourage people to take tsunami preparedness. Hence, it is necessary to discuss the negative and positive of Islamic teachings in responding to disaster, the development of tsunami preparedness indicators and how to develop effectiveness of risk information.

### 23.2.1 *Fatalistic Versus Positive View in Islamic Teachings on Disasters*

The relationship between religion and natural disasters is often associated with the concept of fatalistic view. The concept of fatalistic view refers to belief that because natural disaster is god's will so people can do nothing (Ghafory-Ashtiany 2009; Lavigne et al. 2008). Paton and Johnston (2006) describe this concept relates to locus of control in psychology. While people with an internal locus believe that such hazard events can be reduced, external locus of control is associated with the belief that human has limited power to manage such disasters. After disaster happened especially which affected many people killed, debate whether a disaster was caused by god's punishment or not, has been raised. Duncan et al. (2012) for example, compiled an archive about religious reaction to a major earthquake and volcanic eruption that occurred between 1900 and 2008 in countries predominantly Christian. They found that of 61 discrete events, seventy percent show evidence that people responding using religious frame of reference (Duncan et al. 2012). In addition, after the devastating tsunami 2004 some Islamic clerics stated that God was angry with Aceh people since they abandoned Koran and Hadith (Cody 2005). As to other places, some religious leaders voiced a direct connection between natural disasters and human sins such as in the Greatest Eastern Japan Earthquake 2011 (Horvat n.d), Haiti Earthquake 2010 (Newlands n.d.), Hurricane Katrina in USA (Campbell and Yates 2006), and recent disasters in Indonesia (Oktavinanda 2012). However, another finding showing that the religion plays a positive role in disaster. Study conducted by Gillard and Paton (1999) in Fiji Island among Christians, Hindus, Moslem reported that religious beliefs were helpful during crisis.

Islam is one of the religions among Judaism and Christianity sharing view on natural disaster as god punishment. Kosim (2012) argues that natural disaster is as a God's punishment because of human sin. He refers the Holy Quran which explicitly mentioned the story about Allah's punishment and natural disaster such as earthquake, floods, stone rain, typhoon, drought and famine. It is also cited in the Hadith saying that God punishes people who act immoral action (Kosim 2012; Adiyoso and Kanegae 2014a; Adiyoso 2013).

In contrast, there has been argument on positive aspect of Islamic teachings related to disaster. The Holy Qur'an suggests that humankind should learn on

natural phenomenon and how to cope with natural disaster (Nahadi et al. 2011: 3; Nasution 2011). Hidayat (2011) argues that such fatalistic view is as a result of the problem in interpreting Holy Qur'an. In Islamic tradition, according to Hidayat (2011), although the field of study on how to interpret the meaning of Holy Qur'an has been developed for a long time ago, there is a gap between common people understanding of the Qur'an. There have been two different categories of interpretation of Qur'an language. The first is called *muhkamat* or 'finite or certain meaning' and the second is *mutasybihat* or 'interpretable' (Madjid 2011: 38).

In addition, the interpretation of religious teachings is sometimes also varying depending on religious leaders. In a traditional community, religious leader is a person who has better knowledge in religious teachings (Hidayat 2011). Religious leaders are an educated person in religion issues who has an authority to deliver religious teachings to the followers. It is acknowledged the important role of religious leaders in shaping social construction in Indonesia history (Sulasaman 2012). Hence, community members are depended on the religious leaders almost of all aspect of their life.

Hidayat (2011) gives a fundamental and important idea on how to understand the religion language from the hermeneutic perspectives. He argues that any Holy book as representing God' messages to Prophet involved in God's level and human level (prophet) communication. Human should interpret the meaning of language not only based on the words stating in the Holy book, but it should be understood based on the social context when God's messages transferring to the prophet (Ghafory-Ashtiany 2009).

In conclusion, although the majority of Islamic interpretations of disaster tend to have a fatalistic view, the newer interpretation of natural disaster event have started to encourage people to protect their life and taking such preparedness efforts are not against God's will. Evidence from disaster researches confirm that religious interpretation are still important in understanding how people response to such disaster. However, the positive aspects of religious teaching have been rarely studied. The next section examines the development of tsunami preparedness indicators to easily measure the change of tsunami preparedness action.

### ***23.2.2 Tsunami Resilience Preparedness (TRP) Indicators***

Given that tsunamis are a unique disaster, often called low probability, high impact events, they require more attention from disaster managers. The current concept of preparedness applied is not sufficient. This sub-section examines a proposed approach of tsunami preparedness based on disaster resilience which requires social collaboration between community members and wider society.

The concept of preparedness has a variety of dimensions supported by a number of activities (Sutton and Tierney 2006). The ultimate goal of preparedness is to enhance life safety when disasters occur. The Federal Emergency Management Agency of the United States identifies 13 elements that should be addressed by

disaster managers. Those elements are laws and authorities, hazard identification and assessment, hazard mitigation, resource management, direction, control, coordination, communication and warning, operations and procedures, logistics and facilities, training, exercise, public education, finance and administration (Sutton and Tierney 2006). However as stated by Adiyoso and Kanegae (2014a, 2014b) the concept of preparedness has been criticized by many experts, such as disaster preparedness planning based on a military approach and focusing solely on responding during emergencies and post-disaster (Smith 2003).

The concept of tsunami preparedness should be in line with the concept of disaster culture in which it is similar to the resilience concept (Adiyoso 2013). A simple and general culture of safety has been defined by Campbell and Yates (2006) who stated that all members of community should be aware of local hazards and to actively engage in reducing the risks. Culture of disaster should have core capacities (e.g. knowledge, skill) and change of stage. While core capacities have been discussed in the variety of natural disaster, different capacity is also suggested by Murata et al. (2010) in the context of tsunami disaster.

Given the characteristics of a tsunami disaster, there is a certain preparedness capacity that should be employed by the community. Literature references and best practices provide abundant prescriptive disaster preparedness, however this is limited for tsunamis. Adiyoso (2013) examines critical tsunami preparedness that can potentially save people from tsunami disasters. Adiyoso (2013) introduced the Tsunami Resilient Preparedness (TRP) indicators that developed a combination of three dimensions of tsunami preparedness, Tsunami Early Warning System (TEWS), Emergency Plan (EP) and, Capacity (CA), across four social levels: individual, family, community and society, as shown in Table 23.1.

Three aspects of tsunami preparedness are a fundamental requirement for people to act in preparation for a tsunami disaster.

**First**, TEWS, is a basic element in saving live when a tsunami strikes a community and has four interrelated-elements: (i) understanding and detecting hazard (risk knowledge), (ii) checking and developing warning tools; (iii) communicating risk and how respond (dissemination of communication), and (iv) ability to respond (UNISDR 2005). The recent big tsunami disasters have brought about the development of TEWSs including engineering, technology, government, news media, disaster drill, type of warning, signing evacuation route and shelter (Sorensen and Rogers 1988; Pearson 2012: 3).

**Second**, EP, requires people to prepare in response to tsunami disasters such as knowing tsunami signboards, evacuation route/shelters in their areas and knowing and keeping emergency phone numbers. It is also important that people should discuss issues related tsunamis and how to prepare for tsunamis with neighbors/community and understanding safe places or meeting points in their area (Adiyoso and Kanegae 2014a; Fraser et al. 2012; Sutton et al. 2006). EP also includes preparing disaster kits such as flashlights, transistor radios, food, water, first aid, multi purposes tools, communication means and valuable documents. After March 11th tsunami in Japan, some evacuees were isolated and had delayed access to food because they did not have sufficiently stock of food and water (Otsuki 2012).

**Table 23.1** Variables for tsunami resilience preparedness (TRP)

TRP	Variables	Indicators
TEWS	1. TEWS-individual	1. Knowing natural sign of tsunami
		2. Knowing communication mean for TEWS
	2. TEWS-family	3. Discussing information of TEWS
		4. Discussing information about evacuation route/shelter with family members
	3. TEWS-community	5. Understanding the meaning of TEWS
		6. Participating in tsunami drill or visited/practiced evacuation route/shelters
	4. TEWS-society	7. Understanding the meaning of TEWS developed by government
		8. Participating in tsunami drill organized by government
EP	5. EP-individual	9. Knowing tsunami signboards, evacuation route/shelters
		10. Keeping emergency phone number
	6. EP-family	Preparing disaster kits such as
		11. Flashlight,
		12. Transistor radio
		13. Food
		14. Water
		15. First aids
		16. Multi purposes tools
		17. Communication means
18. Documents		
7. EP-community	19. Discussing issues related tsunami and how to prepare for tsunami with neighbor/community	
	20. Understanding safe places or meeting point,	
8. EP-society	21. Understanding how to contact local government and to find out information before and during tsunami disaster	
	22. Sharing phone number with relative from outside community	
CA	9. CA-individual	23. Knowing about causes of tsunami
		24. Knowing tsunami hazard (map)
	10. CA-family	25. Sharing/discussing tsunami hazard (map)
		26. Discussing/sharing past tsunami with family members
	11. CA-community	27. Participating/attending community meeting organized by local community
		28. Visiting/finding information in tsunami facilities (poles, siren tower)
12. CA-society	29. Attending/participating meeting (e.g. dissemination, workshop, and training) organized by external community at least 1 time a year	
	30. Regularly searching/updating tsunami information from different source information/media	

Source: Adiyoso (2013)

**Third**, CA is related to the ability of a community to maintain awareness, attitude and behavior before a tsunami occurs, respond during a crisis and recover after a disaster (Adiyoso et al. 2014). The idea of CA in tsunami preparedness is similar to the community development concept (Ife 2002) where the wider community is involved in tsunami preparedness and can maintain it the long term. The problem of knowing the tsunami hazard, sharing/discussing the tsunami hazard, participating/attending community meetings and finding information in tsunami facilities will be more effective when involving the community (Ife 2002). Research on disasters has pointed on the need to focus preparedness on family and community level (Phillips and Fodham 2010). The roles of individuals, family, community and society is reflected in the concept of self-help, mutual-help and public-help that success in preparing the disaster. As Paton and Johnston (2006) suggest, the link between the individual and the household effectively influences the effectiveness in the preparation, response and recovery process.

The TEWS, EP and CA above reflect the process of stages in which in preparedness from the simple actions to more comprehensive strategies which involved different layers of actions and considerations.

### ***23.2.3 Risk Communication and Disaster Preparedness***

This sub-section discusses the integration of religious aspects into risk communication. Risk communication has been widely used for increasing public awareness and how to prepare for technological hazards, health issues and natural hazards. However, comparing to the public health sector and technological hazards, research on risk communication related to natural hazards is limited. Risk communication by definition is to exchange information between individuals and groups to deal with the knowledge, perceptions, attitudes and behavior associated with the risk (Betinghaus and Cody 1987; Covello et al. 1989; Heath and O’Hair 2009). The U.S. Department of Health and Human Service (2002; 14) gives a broader definition of risk communication as the way different agents (individuals, groups and institutions) communicate interchangeably with each other concerning the risk, perception of risk and how to deal with risk using different media.

From the risk communication perspective, the objectives of risk communication are: informing and education, stimulating behavioral change to take protective measures, issuing of disaster warnings and emergency information, exchange of information and having a common approach to risk issues (Covello et al. 1989). Other objectives of risk communication involve the public in risk management decision making, refuting myths and misconceptions and increasing the level of government credibility (Copolla 2007; Heath and Bryant 2000). Coppola (2007) categorizes risk communication as one part of public education in disaster reduction including public awareness and a disaster education program. Increasing risk knowledge encourages people’s awareness about the potential threat that may affect them. Some research on risk perception focused on how to develop risk communication that can

sensitize the public to a better perception of risk (Andersen and Spitzberg 2009; Krimsky and Golding 1992).

In terms of disaster preparedness, however, the most crucial function of risk communication is to raise awareness, to give better perception and to change behavior. As stated by Coppola (2007), public preparedness through risk communication should address the public in raising awareness of the hazard and guiding behavior in anticipating the hazard. Therefore, the objectives of risk communication are not only limited to improving knowledge, increasing risk perception and awareness, but should also address preparedness behavior. Murata et al. (2010) underline the importance of the process of translating knowledge into action by providing disaster information to facilitate better community preparedness for tsunami.

The limitation of current risk communication in disaster prevention is in providing risk information and letting people decide whether or not to take disaster preparedness measures. This issue has been raised by Toshinari (2008) who suggests risk communication should be comprehensively integrated within tsunami preparedness information. Toshinari (2008) gave an example how individuals received maps for evacuation but failed to utilize them when needed. So any real action to ensure the risk information is adopted by population is important. The ultimate goal of risk communication in DRR is to ensure the public have risk knowledge, become aware of risk, change their attitude and in turn take preparation for tsunamis (Ajzen and Fishbein 2010).

This literature review has discussed the basic framework of this study, on how tsunami preparedness indicators were developed based on three basic dimensions across four social levels. To verify the relationship between religious factors and tsunami preparedness, how to effectively develop a risk communication program has been explored. It has highlighted how using conventional risk communication is insufficient to address tsunami preparedness behavior.

### 23.3 Study Method

This study argues that including religious messages and risk persuasion in disaster information will be effective in influencing people to adopt TRP. Data is obtained using pre and post survey as well as from a leaflet-intervention program involving 170 community members in Yogyakarta, Indonesia.

Two different leaflets were used. By using a printed media, messages can be read many times, are easy to store and residents are familiar with such information. The first type is an “intervention leaflet” where risk information is developed based on ideal presentation, a persuasive message and containing religious messages such “God will help and safe human kind if people make efforts for preparing disaster” and “preventing from death causes disaster is not against God”. These were distributed to an “intervention group”. The second type is a “conventional leaflet” or one developed by a local government and distributed to another community as a “non-intervention group” or control group. It contains no specific information on how to



prepare before and respond when a tsunami occurs. Importantly, this leaflet does not contain any religious messages.

The community studied comprises five spatial areas called *rukun tetangga* (RT) or neighbor associations, namely: RT-1, RT-2, RT-3, RT-4 and RT-5. RT-4 and RT-5 were included as the “intervention group” or community A. The number of respondents in this group included 85 people. RT-1, RT-2 and RT-3 were included in community B or the “non-intervention group” where the number of respondents was 88 people. As this study also investigates the role of religious leaders in influencing residents to adopt tsunami preparedness, Group A (intervention group) was divided into two separated sub-groups, namely sub-group A1 (RT4) “reinforced by religious leader” (N = 42) and sub-group A2 (RT5) “not reinforced by religious leader” (N = 43).

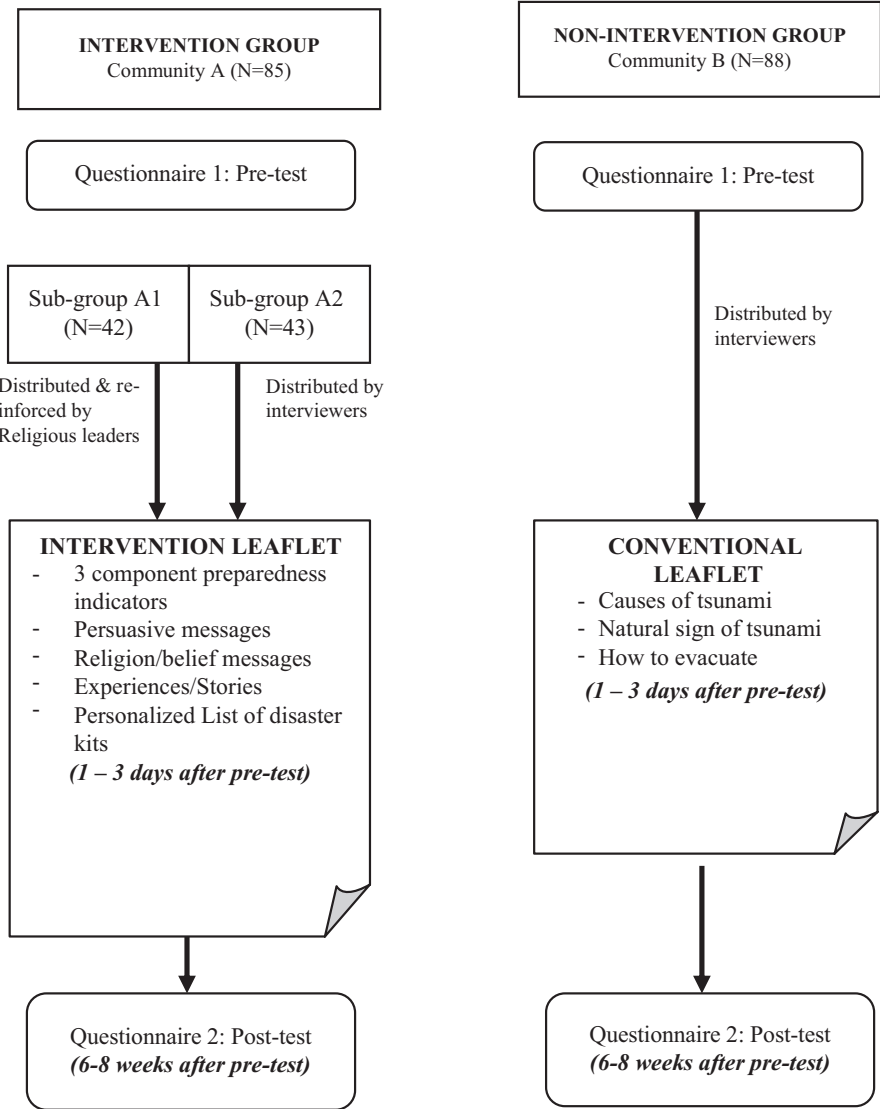
The process of distributing leaflets in the two communities is outlined in Fig. 23.1.

The intervention leaflet for intervention group has information about the causes of tsunami, signs of tsunami, expert prediction of tsunami occurrence, specific action how to prepare (before) and how respond (during emergency) tsunami disaster. The leaflet contained messages reflecting religious values. For example, in terms of optimistic view, such message “God will help and safe human kind if people make efforts for preparing disaster” was included. This message about the important of efforts have been acknowledged as important point to encourage people to hard work as well as praying to God. Another message containing Islamic teaching was that “preventing from death causes disaster is not against the God”. For the conventional leaflet (non-intervention) used leaflet developed by local government contained general information about tsunami and how to respond it. There is no specific information how to prepared before and respond when tsunami occur. Importantly, this leaflet did not contain religious messages.

The community in groups A and B were distributed different leaflets 1 week after the first interview (pre-test) conducted by interviewer. In group A, the distribution of leaflets in sub-group A1 was done by the interviewer and religious leaders while in A2 only by the interviewer. In promoting such messages, religious leaders were assigned to explain the contents of the intervention leaflet and emphasize that Islamic teaching is recommended in preparing for tsunami disasters both in community meetings and at other events.

To gather data about residents receiving, discussing, trusting, finding leaflets useful and participating in disaster activities, residents in both communities were asked in questionnaire 2 (post-survey): (1) whether they received leaflet or not, (2) how often they read the leaflet, (3) how much they trusted the content of the leaflets, (4) how they perceived beneficial information, (5) whether they discussed the leaflet with their family and (6) whether they involved of exposed by disaster program after receiving leaflet. All answers were measured using 5-point scale except for (1) which required only “yes” or “no” answers.

The indicators (as shown in Table 23.1 previously), were measured using three answers “Yes”, “No” and “I am not sure”. The answer “Yes” meant that residents have known/understood or done the TRP asked, while “No” answer meant that



**Fig. 23.1** The design of risk information distribution (leaflet) in different communities in Yogyakarta (Source: Authors)

residents have not known/understood or done the TRP asked. “I am not sure” answer meant that residents have known/understood partially or done some activities the TRP asked. The more residents answer “Yes” the more they are prepared. However, as this experimental study took short time (8 weeks) in between pre-test and post-test, therefore in questionnaire 2, some indicators of tsunami preparedness action that could not measure directly were changed using “intention” to do tsunami preparedness (Ajzen and Fishbein 2010).

However, when analyzing comparison among and between each group change of scoring (coding) was adjusted. While the paired t-test is used to compare mean's score between pre-test and post-test each group, the independent t-test explores the effect on different leaflets (independent variables) on TRP (dependent variables) (Brace et al. 2005; Ghozali 2011).

## 23.4 Findings

This section presents data on the effectiveness of leaflets containing religious messages and the role of religious leaders in persuading people to adopt tsunami preparedness. The first sub-section shows the general characteristics of both communities dealing with the response to distributed leaflets. The next sub-section will compare the differences of people in taking tsunami preparedness between the intervention group (intervention leaflet) and the non-intervention group (conventional leaflet). Different effects of the role of religious leaders through the reinforced intervention leaflet on different sub-groups of the community are presented in the third sub-section. In the discussion section, theoretical and practical implications of the findings are discussed.

### 23.4.1 *Both the Intervention and Non-intervention Group Treat and Respond to the Leaflets Similarly*

Before analyzing the different effects of leaflets in two different groups of communities, it is necessary to investigate to what extent residents in the two groups received, read, discussed, trusted and felt the leaflets were useful.

Almost all residents received leaflets distributed either by interviewers or a religious/community leader and only one resident reportedly did not receive a leaflet. In terms of reading the leaflets, 68 % read the leaflet once in the intervention group (community A) and 58 % in the non-intervention group (Community B). The percentage of residents reported to have read the leaflets twice were 28 % in non-intervention and 26 % in intervention group respectively. Only 12 % of residents in non-intervention and 1 % in intervention group read the leaflets three times. Two percent of residents in non-intervention and 5 % residents in intervention group said they never read the leaflets.

The data shows the percentage number of residents who discussed the leaflet once was 64 % in non-intervention and 57 % in intervention group, whilst 19 % of residents discussed the leaflets twice in the non-intervention group and 8 % in the intervention group. Thirty-five percent of residents in the intervention and 13 % residents in non-intervention group reported that they never discussed the leaflets

**Table 23.2** Independent sample test between intervention group and non-intervention group

Leaflet types		Levene's test		T-test for equality of means		
		F	Sig.	t	df	Sig.(2-tailed)
Reading leaflet	Equal var. assumed	14.087	0.000	2.514	168	0.013*
	Equal var. not assumed			2.523	157	0.013*
Trust on leaflet	Equal var. assumed	0.694	0.406	1.031	163	0.304
	Equal var. not assumed			1.038	159	0.301
Perceived benefit of leaflet	Equal var. assumed	1.736	0.189	1.317	164	0.190
	Equal var. not assumed			1.316	162	0.190
Discussing leaflet	Equal var. assumed	21.171	0.00	4.134	168	0.000*
	Equal var. not assumed			4.141	165	0.000*
Involved in disaster activities	Equal var. assumed	20.076	0.000	2.121	170	0.035*
	Equal var. not assumed			2.157	115	0.033*

Source: Authors

\*p < 0.05

with their family members. Table 23.2 shows a comparison of Independent Sample Test between intervention group and non-intervention group in perceiving and utilizing the leaflets.

As can be seen in Table 23.1, in terms of reading leaflets, there were differences ( $t = 2.514$ ,  $df = 157$ ,  $p = 0.13$ , 2-tailed) between the two communities, where residents in non-intervention groups read more leaflets than the intervention one. Trust of residents towards the contents of the leaflets shows no significant difference between the two communities ( $t = 1.031$ ,  $df = 168$ ,  $p < 0.05$ , 2-tailed). Similarly the resident's perception of the leaflet's benefit did not show significant differences between groups ( $t = 1.317$ ,  $df = 164$ ,  $p < 0.05$ , 2-tailed). Concerning whether or not residents discussed the leaflet with their family, the results show that the community that received the conventional leaflet were more active in discussing the material ( $t = 4.141$ ,  $df = 165$ ,  $p = 0.000$ , 2-tailed). To investigate the possibility that residents either in intervention and non-intervention groups involved in disaster risk reduction program during pre-test and post-test, community exposed by conventional leaflet (non-intervention) are more involved in disaster activity ( $t = 2.157$ ,  $df = 170$ ,  $p = 0.035$ , 2-tailed).

Although there were differences in mean score between the two communities when reading and discussing the leaflets and being involved in disaster activities, it should be noted that all those differences were experienced by the community in the non-intervention group. This implies that residents in the non-intervention group were very active in reading and discussing the leaflet and involving in disaster activities. These findings were very important to verify that there is no significantly different treatment between the intervention and non-intervention groups in dealing with leaflets.

### **23.4.2 Increase in Change in Major TRP as Effect of Leaflet Containing Islamic Messages**

In order to evaluate the impact of different leaflets in both communities, a two-step analysis was conducted. Firstly, the change of mean rating of tsunami preparedness in the pre-test and post-test (paired t-test) in two groups was evaluated. If changes in tsunami preparedness only occur and are significantly different in the intervention group, it can be concluded that the intervention leaflet is effective and vice versa. If both the intervention's and the non-intervention's mean score in pre and post-test are increasingly changes, the comparison of changes score in both intervention and non-intervention group should be analyzed using an Independent Sample T-Test. The effect of the intervention leaflet in the intervention group will be first examined following the effect of the conventional leaflet on TRP in the non-intervention group.

#### **23.4.2.1 Effect of Intervention Leaflet on TRP in the Intervention Group**

To better demonstrate the different effect of intervention and non-intervention, Fig. 23.2 shows the level of preparedness before and after intervention. In detail, it shows the comparison data between Non-Intervention and intervention group in the TEWS, Emergency Plan and Capacity elements of preparedness covering Individual, Family, Community and Society level with pre and post-test. In the TEWS-Individual, for example, during the pre-test, the number of community members reaches 26 % in group of non-intervention and 29 % for intervention group. After duration of intervention, the level of preparedness of both groups increased with 64 % for Non-intervention group and 81 % for Intervention group.

From Table 23.3, out of 12 TRP indicators of resident in intervention groups, most of them were significantly different between pre and post-test. The intervention leaflet has affected residents in TEWS-individual ( $t = 2.371$ ,  $p = 0.020$ , 2-tailed), TEWS-family ( $t = 7.462$ ,  $p = 0.000$ , 2-tailed), and TEWS-community's score from 0.23 in pre-test to 0.44 in post-test ( $t = 7.321$ ,  $p = 0.000$ , 2-tailed). The intervention leaflet failed to influence residents in preparing TEWS-society.

In contrast, the intervention leaflet has been successful in encouraging all residents in the intervention group to adopt EP on an individual, family, community and society level. Paired t-test analyses shown that mean score of EP-individual accounted for 0.41 in pre-test to 0.52 in post-test ( $t = 4.447$ ,  $p = 0.000$ , 2-tailed), while EP-family accounted for 0.40 in pre-test to 0.69 in post-test ( $t = 11.480$ ,  $p = 0.000$ , 2-tailed). EP-community also was significantly changed between pre-test at 0.11 and post-test at 0.16 ( $t = 3.154$ ,  $p = 0.000$ , 2-tailed). EP-society was changed and accounted for 0.38 in pre-test to 0.54 in post-test ( $t = 5.832$ ,  $p = 0.000$ , 2-tailed).

The intervention leaflet influenced residents in CA-individual, CA-family, and CA-society. Table 23.3 shows that the significant change was in CA-individual ( $t = 5.189$ ,  $p = 0.000$ , 2-tailed), CA-community ( $t = 6.841$ ,  $p = 0.000$ , 2-tailed), and

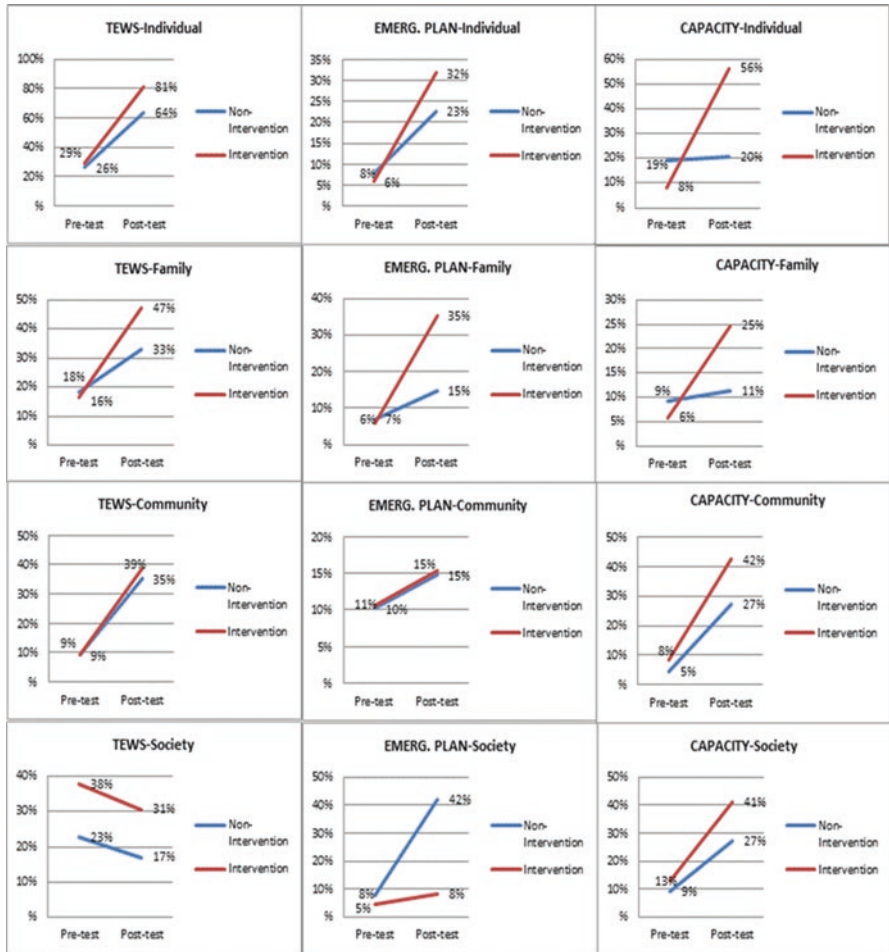


Fig. 23.2 Comparison of non-intervention and intervention group in the TEWS, emergency plan and capacity elements of preparedness with pre and post-test (Source: Authors)

CA-society ( $t = 6.355, p = 0.000, 2$ -tailed). Only CA-family was not significantly change from pre-test to post-test.

The intervention leaflet is found to be effective in influencing resident in intervention group to take TRP TEWS such as knowledge about tsunami, sharing discussing information of TEWS and evacuation route with family members. It also influence intention to participate in tsunami drill organized by community but not for participating in a tsunami drill organized by the government. In terms of EP, the intervention leaflet was effective in influencing residents in improving their knowledge about tsunami facilities in their areas and emergency phone numbers, intention to prepare disaster kits, discussing and sharing tsunami information with neighbors

**Table 23.3** Paired-sample test of community exposed with intervention leaflet

Indicators	Community in intervention group (N = 85)				
	Pre-test (mean: 0–2)	Post-test (mean: 0–2)	t	df	Sig (2-tailed)
TEWS-individual	0.24	0.29	2.371	84	0.020*
TEWS-family	0.19	0.48	7.462	84	0.000*
TEWS-community	0.23	0.44	7.321	84	0.000*
TEWS-society	0.43	0.34	1.888	84	0.062
EP-individual	0.41	0.52	4.44711.48	84	0.000*
EP-family	0.40	0.69	3.154	84	0.000*
EP-community	0.11	0.16	5.832	84	0.002*
EP-society	0.38	0.54		84	0.000*
CA-individual	0.080.08	0.240.12	5.1891.974	8484	0.000*
CA-family	0.18	0.43	6.841	84	0.150
CA-community	0.09	0.34	6.355	84	0.000*
CA-society					0.000*

Source: Authors

\* p < 0.05

and understanding how to contact local government to find out information. In addition, the intervention leaflet also affected CA such as knowledge of causes of tsunami and hazard map, intention to participate in community meeting and searching/ updating tsunami information from different sources (information/media). Residents showed no change in CA-family such as sharing/discussing tsunami hazard map and past tsunami with family members.

**23.4.2.2 Conventional Leaflet Also Affect TRP in the Non-intervention Group**

As is shown in Table 23.4, the conventional leaflet also affected residents in most indicators of TRP.

Compared to the intervention group, the change TRP in the non-intervention group as a result of the conventional leaflet was less than in the intervention group. The conventional leaflet affected residents in non-intervention group adopting TRP TEWS-individual (t = 3.471, p = 0.001, 2-tailed), TEWS-family (t = 3.393, p = 0.001, 2-tailed) and TEWS-community (t = 2.797, p = 0.006, 2-tailed). TEWS-society did not change.

In addition, the conventional leaflet influenced residents in EP-individual’s score at 0.34 in pre-test and at 0.41 in post-test (t = 2.815, p = 0.006, 2-tailed), EP-family’s score at 0.31 in pre-test and at 0.48 in post-test (t = 7.518, p = 0.000, 2-tailed), and EP-society at 0.26 in pre-test and at 0.41 in post-test (t = 4.431, p = 0.000, 2-tailed). The conventional leaflet failed to influence residents in preparing EP-community.

**Table 23.4** Paired-sample test of community in non-intervention group

Indicators	Community in non-intervention group (N = 88)				
	Pre-test (mean: 0–2)	Post-test (mean: 0–2)	t	df	Sig (2-tailed)
TEWS-individual	0.26	0.35	3.471	87	0.001*
TEWS-family	0.20	0.34	3.393	87	0.001*
TEWS-community	0.21	0.30	2.797	87	0.006*
TEWS-society	0.33	0.27	1.695	87	0.094
EP-individual	0.34	0.41	2.815	87	0.006*
EP-family	0.31	0.48	7.518	87	0.000*
EP- community	0.16	0.18	0.893	87	0.374
EP-society	0.26	0.41	4.431	87	0.000*
CA-individual	0.11	0.18	1.884	87	0.063
CA-family	0.09	0.13	1.354	87	0.179
CA-community	0.16	0.30	4.397	87	0.000*
CA-society	0.09	0.24	4.571	87	0.000*

Source: Authors

\*p < 0.05

The conventional leaflet influenced residents in the non-intervention group only in TRP CA-community, CA-society (t = 4.397, p = 0.000, 2-tailed) and CA-society (t = 4.571, p = 0.000, 2-tailed). CA-individual and CA-family were not significantly changed from pre-to post-test.

In summary, there was also an effectiveness of conventional leaflet in influencing resident in non-intervention group in increasing TRP in TEWS-individual, TEWS-family, and TEWS-community. In addition, conventional leaflet has influenced residents in EP-individual, EP-family, and EP-society. Residents in non-intervention group were affected only in TRP CA-community and CA-society.

**23.4.2.3 Comparison Effects of Leaflets on TRP in Intervention and Non-intervention Community**

We conclude that the effect of the intervention leaflet was greater than the conventional leaflet. However, in order to verify this data, an Independent Sample-test was conducted to compare significant change between the intervention and non-intervention group. Table 23.5 shows that the mean score of 7 out of 12 TRP variables in the post-test were significantly different between the conventional and intervention leaflets.

The intervention leaflet affected residents’ knowledge of TEWS-family (Levene’s test p = 0.794, t = 2.298 df = 171, p = 0.023, 2-tailed) better than the conventional leaflet with a mean difference of 0.136. Another significant difference in mean score between the two groups was for TEWS-community. In the intervention group it was 0.44 and in the non-intervention group 0.30 (Levene’s test p = 0.946, t = 4.964, df = 171, p = 0.014, 2-tailed). TRP EP-individual was also significant in intervention (Levene’s test p = 0.008, t = 2.519, df = 171, p = 0.013, 2-tailed). The next most



**Table 23.5** Independent-sample test between community intervention group and non-intervention group

Indicators		Levene's test	T-test for equality of means				
		F	Sig.	T	df	Sig. (2-tailed)	Mean difference
TEWS-individual	Equal var. assumed	1.399	0.239	1.325	0.187	0.187	0.064
	Equal var. not assumed						
TEWS-family	Equal var. assumed	0.069	0.794	2.298	0.023	0.023*	-0.136
	Equal var. not assumed						
TEWS-community	Equal var. assumed	0.005	0.946	2.496	0.014	0.014*	-0.140
	Equal var. not assumed						
TEWS-society	Equal var. assumed	5.843	0.017	1.379	0.170	0.170	-0.074
	Equal var. not assumed						
EP-individual	Equal var. assumed	7.258	0.008	2.525	0.013	0.013*	-0.103
	Equal var. not assumed						
EP-family	Equal var. assumed	2.829	0.094	4.983	0.000	0.000*	-0.209
	Equal var. not assumed						
EP-community	Equal var. assumed	0.460	0.499	0.389	0.698	0.698	0.017
	Equal var. not assumed						
EP-society	Equal var. assumed	5.296	0.023	2.423	0.016	0.016*	-0.126
	Equal var. not assumed						
CA-individual	Equal var. assumed	0.636	0.426	1.478	0.970	0.970	-0.065
	Equal var. not assumed						
CA-family	Equal var. assumed	0.003	0.958	0.038	0.012	0.012*	0.001
	Equal var. not assumed						
CA-community	Equal var. assumed	1.423	0.235	2.551	0.058	0.158	-0.134
	Equal var. not assumed						
CA-society	Equal var. assumed	0.510	0.476	1.906	0.021	0.021*	-0.097
	Equal var. not assumed						

Source: Authors

significant TRP in intervention compared to non-intervention was EP-family (Levene's test  $p = 0.094$ ,  $t = 4.983$ ,  $df = 171$ ,  $p = 0.000$ , 2-tailed). The intervention leaflet was also more effective in TRP EP-society where the differences of mean was  $-0.126$  (Levene's test  $p = 0.023$ ,  $t = 2.423$ ,  $df = 171$ ,  $p = 0.016$ , 2-tailed). In terms of TRP Capacity, there were only two significant differences, namely CA-community and CA-society.

CA-community showed significant differences (Levene's test  $p = 0.235$ ,  $t = 2.551$ ,  $df = 171$ ,  $p = 0.012$ , 2-tailed) in intervention compared to the non-intervention group. Like CA-community, CA-society was also significant (Levene's test  $p = 0.476$ ,  $t = 1.906$ ,  $df = 171$ ,  $p = 0.058$ , 2-tailed) compared to the non-intervention group.

In conclusion, the intervention leaflet partially affected residents in adopting TRP such as TEWS-family, TEWS-community, EP-individual, EP-family, EP-society, CA-community and CA-society.

### ***23.4.3 Effect of Intervention Leaflet Reinforced by Religious Leader***

#### **23.4.3.1 Change of TRP in Sub-group Reinforced by Religion Leader**

As can be seen in Table 23.6, out of 12 TRPs of residents in the sub-group reinforced by the religious leader, most of them were significantly different between pre and post-test.

The role of the religious leader has affected residents in TEWS-family's score from 0.32 in pre-test to 0.62 in post-test ( $t = 5.252$ ,  $p = 0.000$ , 2-tailed), TEWS-community's score from 0.26 in pre-test to 0.49 in post-test ( $t = 5.820$ ,  $p = 0.000$ , 2-tailed). Additional information by the religious leader does not seem to influence residents in preparing TEWS-individual and TEWS-society.

The religious leader successfully influenced residents in the sub-group he/she was involved in to adopt all elements of TRP in terms of emergency planning across all four social levels. Paired t-test analyses shown that the score mean of EP-individual accounted for 0.46 in pre-test to 0.60 in post-test ( $t = 3.814$ ,  $p = 0.000$ , 2-tailed), while EP-family accounted for 0.46 in pre-test to 0.78 in post-test ( $t = 9.632$ ,  $p = 0.000$ , 2-tailed). EP-community also was significantly change between pre-test at 0.18 and post-test at 0.25 ( $t = 2.614$ ,  $p = 0.012$ , 2-tailed). EP-society was change and accounted for 0.42 in pre-test to 0.62 in post-test ( $t = 4.470$ ,  $p = 0.000$ , 2-tailed).

Reinforcement of religious leader influenced residents in sub-group reinforced by religious leader in CA-individual, CA-community and CA-society. Table 23.5 shows that the significant change was in CA-individual with pre-test at 0.07 and post-test at 0.27 ( $t = 4.470$ ,  $p = 0.000$ , 2-tailed), CA-community with pre-test at 0.25 and post-test at 0.55 ( $t = 5.252$ ,  $p = 0.000$ , 2-tailed), and CA-society with pre-test at 0.08 and post-test at 0.43 ( $t = 6.577$ ,  $p = 0.000$ , 2-tailed). CA-family was not significantly change from pre-test to post-test.

**Table 23.6** Paired-sample test of sub-group reinforced by religious leader

Indicators	Sub-group reinforced by religious leader (N = 42)				
	Pre-test (mean: 0–2)	Post-test (mean: 0–2)	t	df	Sig (2-tailed)
TEWS-individual	0.25	0.32	1.961	41	0.057
TEWS-family	0.32	0.62	5.252	41	0.000*
TEWS-community	0.26	0.49	5.820	41	0.000*
	0.51	0.43	1.096	41	0.280
TEWS-society					
EP-individual	0.46	0.60	3.814	41	0.000*
EP-family	0.45	0.78	9.632	41	0.000*
EP- community	0.18	0.25	2.614	41	0.012*
	0.42	0.62	4.470	41	0.000*
EP-society					
CA-individual	0.07	0.27	4.470	41	0.000*
CA-family	0.14	0.18	1.000	41	0.323
CA-community	0.25	0.55	5.252	41	0.000*
	0.08	0.43	6.577	41	0.000*
CA-society					

Source: Authors

It is evident that the intervention leaflet supported by the religious leader was successful in encouraging residents to undertake TRP, particularly for the following: TEWS-family, TEWS-community, EP-individual, EP-family, EP-community, EP-society, CA-individual, CA-family, CA-community and CA-society.

### 23.4.3.2 Change of TRP in Sub-group Non-reinforcement

The change in pre-test and post-test of mean's score of residents in sub-group non-reinforcement can be seen in Table 23.7. The sub-group not supported by the religious leader changed in TRP TEWS-family, TEWS-community, EP-individual, EP-family, EP-society, CA-individual, CA-community and CA-society.

Paired t-test analyses shown that score mean of TEWS-family accounted for 0.07 in pre-test and 0.34 in post-test ( $t = 5.257$ ,  $p = 0.000$ , 2-tailed), while TEWS-community accounted for 0.20 in pre-test to 0.38 in post-test ( $t = 4.556$ ,  $p = 0.000$ , 2-tailed). TEWS-individual and TEWS-society did not change.

Furthermore, the significant change in EP-individual's score was 0.36 in pre-test and 0.44 in post-test ( $t = 2.468$ ,  $p = 0.018$ , 2-tailed), EP-family's score at 0.35 in pre-test and at 0.60 in post-test ( $t = 6.883$ ,  $p = 0.000$ , 2-tailed), and EP-society at 0.34 in pre-test and at 0.47 in post-test ( $t = 3.800$ ,  $p = 0.000$ , 2-tailed). There is no significant change in preparing EP-community.

Another change of TRP in sub-group non-reinforcement was in CA-individual was significantly change with pre-test at 0.09 and post-test at 0.22 ( $t = 2.886$ ,  $p = 0.006$ , 2-tailed), CA-community with pre-test at 0.12 and post-test at 0.31

**Table 23.7** Paired-sample test of sub-group non-reinforcement

Indicators	Sub-group non-reinforcement (N = 43)				
	Pre-test (mean: 0–2)	Post-test (mean: 0–2)	t	Df	Sig (2-tailed)
TEWS-individual	0.23	0.26	1.431	42	0.160
TEWS-family	0.07	0.34	5.257	42	0.000*
TEWS-community	0.20	0.38	4.556	42	0.000*
TEWS-society	0.35	0.26	1.666	42	0.103
EP-individual	0.36	0.44	2.468	42	0.018*
EP-family	0.35	0.60	6.883	42	0.000*
EP-community	0.05	0.08	1.775	42	0.083
EP-society	0.34	0.47	3.800	42	0.000*
CA-individual	0.09	0.22	2.886	42	0.006*
CA-family	0.02	0.07	2.075	42	0.044
CA-community	0.12	0.31	4.446	42	0.000*
CA-society	0.09	0.26	2.858	42	0.007*

Source: Authors

(t = 4446, p = 0.000, 2-tailed) and CA-society with pre-test at 0.09 and post-test at 0.26 (t = 2.858, p = 0.007, 2-tailed). CA-family was not significantly change from pre-test to post-test.

Although residents’ TRP in the sub-group without the religious leader’s support changed over the course of pre- to post-test, the next section will examine if these were significant differences compared to the sub-group that received the support of the religious leader.

### 23.4.4 *Effect of Intervention Leaflet Reinforced by Religious Leader*

To verify the differences between “sub-group reinforced by religious leader” and “sub-group non-reinforcement”, an independent-Sample Test was conducted. Table 23.8 shows that mean score of 9 TRP out of 12 TRP in post-test were significantly difference between sub-group reinforced by religious leader and sub-group non-reinforcement. However, given that both communities shared the same non-significant in TEWS-society and CA-family in pre-test and post-test, only seven TRP will be analyzed by comparing score means between them.

The roles of religious leader in reinforcing intervention leaflet affected residents’ knowledge of TEWS-family with mean’s score at 0.62 was better than residents in sub-group non-reinforcement (Levene’s test p = 0.084, t = 3.451 df = 83, p = 0.001, 2-tailed). Another significant difference of mean’ score was EP-individual, in sub-group reinforced by religious leader in sub-group non-reinforcement (Levene’s test p = 0.392, t = 2.964, df = 83, p = 0.004, 2-tailed). Next significant TRP was

**Table 23.8** Independent-sample test between sub-group reinforced by religious leader and sub-group non-reinforcement

Indicators		Levene's test		T-test for equality of means			
		F	Sig.	T	df	Sig. (2-tailed)	Mean differences
TEWS-individual	Equal var. assumed	0.346	0.558	1.034	83	0.304	0.066
	Equal var. not assumed						
TEWS-family	Equal var. assumed	3.064	0.084	3.451	83	0.001*	0.282
	Equal var. not assumed						
TEWS-community	Equal var. assumed	0.165	0.685	1.257	83	0.212	0.104
	Equal var. not assumed						
TEWS-society	Equal var. assumed	1.228	0.271	1.941	83	0.056*	0.173
	Equal var. not assumed						
EP-community	Equal var. assumed	14.517	0.000	2.862	79	0.005*	0.169
	Equal var. not assumed						
EP-society	Equal var. assumed	0.964	0.329	2.271	83	0.026*	0.154
	Equal var. not assumed						
CA-individual	Equal var. assumed	0.659	0.419	0.855	83	0.395	0.052
	Equal var. not assumed						
CA-family	Equal var. assumed	17.398	0.000	1.991	65	0.051*	0.109
	Equal var. not assumed						
CA-community	Equal var. assumed	0.015	0.903	2.970	83	0.004*	0.234
	Equal var. not assumed						
CA-society	Equal var. assumed	0.673	0.415	2.357	83	0.021*	0.173
	Equal var. not assumed						

Source: Authors

EP-family, with sub-group reinforced by religious leader in non-intervention (Levene's test  $p = 0.006$ ,  $t = 3.388$ ,  $df = 73$ ,  $p = 0.001$ , 2-tailed). Reinforcement of religious leader also better affected in TRP EP-community with the differences of mean was 0.169 (Levene's test  $p = 0.000$ ,  $t = 2.862$ ,  $df = 78$ ,  $p = 0.005$ , 2-tailed). Another significant difference between sub-group reinforced by religious leader and sub-group non-reinforcement was EP-society (Levene's test  $p = 0.329$ ,  $t = 2.271$ ,  $df = 83$ ,  $p = 0.026$ , 2-tailed).

CA-community was significant differences with sub-group reinforced by religious leader has higher mean's score than sub-group non-reinforcement (Levene's test  $p = 0.903$ ,  $t = 2.970$ ,  $df = 83$ ,  $p = 0.004$ , 2-tailed) as well as CA-society (Levene's test  $p = 0.415$ ,  $t = 2.357$ ,  $df = 83$ ,  $p = 0.021$ , 2-tailed).

Overall, the role of religious leader in supporting intervention leaflets partially influenced residents in adopting TRP, particularly for TEWS-family, EP-individual, EP-family, EP-community, EP-society, CA-community and CA-society.

### **23.5 Discussions: TRP Increases When Risk Information Contains Religious Messages and Role of Religious Leader**

Previous section shows that data analyzed supports the hypotheses proposed that risk information developed using religious messages are effective in influencing people to take tsunami preparedness. This section will discuss theoretical and practical implication drawn from the literature review.

Although intervention and non-intervention have changed score of means in pre-test and post-test, it is clear that effects of leaflet developed containing religious messages have been affecting greater the changes of TRP's resident in intervention group than non-intervention group. Intervention leaflet influenced residents in increasing to take TRP TEWS-family, TRP TEWS-community, EP-individual, EP-family, EP-society, CA-community and CA-society. Intervention leaflet developed contained religious messages was effective in influencing resident not only their knowledge (attitude) but also behavior (action) such as TEWS-family, TEWS-society, all EP indicators, CA-family, community and society. Although some indicators were measured using intention to behavior (Ajzen and Fishbein 2010), the power of Theory Plan Behavior in predicting people behavior from intention is categorized a high.

These findings also support risk communication research where messages are essential factors in the persuasion process (Bettinghaus and Cody 1987; Heath and Bryant 2000). As stated by Andersen and Spitzberg (2009, p. 221) effective risk communication must be redundant across media and sources, as showing in the role of religious leader in this context that it functioned as a multiple channel that consistent with the intervention leaflet.

Interestingly, intervention leaflet has been successful influencing TRP in community and society level instead of individual. Significant finding on TEWS-community, EP-community, EP-society, CA-community and CA-society is meaningful because the residents have intention to participate in tsunami drill organized by community and government. This finding is very important since the basic principles of tsunami preparedness should be based on community development (Ife 2002), meaning that community action is more powerful rather than individual action.

Another finding also shows that sub-group reinforced by religious leader also increase in their preparedness behavior particularly in TEWS-family, EP-individual, EP-family, EP-community, CA-community and CA-society. This finding is consistent with Sulasman's idea (2012) that the role of religious leader is very vital in shaping community not only related to religious issues but also daily life problem faced by community members. From the risk communication perspective, as stated by Andersen and Spitzberg (2009: 221) that communication must be redundant across media and sources, the role of religious leader in its context also functioned as a multiple channel that consistent with the intervention leaflet.

It is clear that this study gives direction on how policy makers and disaster managers involving in Moslem community by clearly stating or putting a certain message from the Holy Quran such as "God will help and safe human kind if people make efforts for preparing disaster", "preventing from death causes disaster is not against the God" into any media information or event persuading people to prepare for tsunami disaster.

## 23.6 Conclusions

This study examines the effect of integrating religious messages into tsunami risk communication leaflets in Yogyakarta community in determining people's uptake of tsunami preparedness. This findings show the important role of Islamic teachings and religious leaders in changing perceptions about tsunami preparedness. This study is valuable for policy makers could take into account the important effect of religious teachings in encouraging people to take action for disaster preparedness.

Practically, the result of study is able to show that government could address the problem of providing tools of intervention in reducing tsunami disaster by integrating religious messages. Given the fact that million religious people in the world are living in the disaster prone areas, including Indonesia, this study gives new perspectives in the strategy framework for disaster risk reduction that need for shifting from religious teachings as a constraint factors (fatalistic view) becoming positive factors for individuals in protecting their life from natural disaster.

This study was involved only residents on their belief of whether preparing in tsunami preparedness is accordance with the Islamic teachings or not. However, one of the limitations of this study is that it was depended on people' subjective thinking and evaluating on religious leader. It will be have better insight and in-depth

information if can tap religious leader's views on tsunami preparedness. Therefore, it is recommended that the next study should investigate religious leader's views on tsunami preparedness. Another limitation of the study is that this study did not involve residents holding non-Islamic religion. It would be valuable if future study has information on the effect on non-Muslim resident on Islamic religious leader.

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## Chapter 24

# Social Capital and Disaster Preparedness in Indonesia: A Quantitative Assessment Through Binary Logistic Regression

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**Abstract** A combination of exposure to a broad range of natural hazards and widespread socio-economic vulnerability makes Indonesia one of the most at risk countries to disasters in the world. Consequently, the Indonesian population is accustomed to living with various high impact events such as floods, earthquakes, tsunamis, volcanic eruptions and landslides. Ongoing exposure to hazards means disaster preparedness is crucial for Indonesia to reduce the impacts of disasters.

Many studies have found that developing social capital holds great potential for disaster preparedness, response and recovery at individual, community and national levels. However, in Indonesia, comparatively few studies on disaster preparedness deal with issues of social capital. To address this gap, this study aims to analyze the role of social capital in disaster preparedness in Indonesia using the dataset of the Social Resilience Module of the 2014 National Socio-Economic Survey. A binary logistic regression was used to quantitatively investigate the effect of different social capital factors on disaster preparedness.

The results indicated that social capital positively influences knowledge of disaster preparedness. Persons with a high level of trust, tolerance, social networking and collective action tend to have a higher knowledge of disaster preparedness. Tolerance and social-networking are the most influential factors, while the effect of trust and collective action are more moderate but still statistically significant. These findings represent useful empirical evidence for policy makers to invest in and utilize social capital for building disaster risk preparedness programs in Indonesia.

**Keywords** Social capital • Disaster preparedness • Binary logistic regression • Indonesia

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## 24.1 Introduction

Indonesia is located at the juncture of four major tectonic plates: the Asian, Australian, Indian Ocean and Pacific Ocean plates. The country has a tropical climate with high rainfall intensity and is located along the Pacific Ring of Fire, which gives rise to Indonesia's many active volcanoes. These conditions make Indonesia among the most vulnerable countries to various natural disasters such as volcanic eruptions, earthquakes, tsunamis, floods and landslides. In 2010, the global risk advisory firm, Maplecroft, released the Natural Disaster Risk Index (NDRI), which ranked Indonesia as the second highest disaster-prone country globally (WHO 2016). While according to the 2015 World Risk Index (WRI) (BEH and UNU-EHS 2015), Indonesia ranks at 35 out of 171 other countries. Based on data from the National Agency for Disaster Management (BNPB) for the period of January – June 2016, there were 1081 disasters events comprising 229 deaths and disappearances, 264 injured peoples and 1,708,862 evacuated peoples (BNPB 2016). Research conducted by Siagian (2014) found that about 4.02% of districts of Indonesia have high social vulnerability, which mostly located in the Eastern region of Indonesia.

Although it remains impossible to predict when and where a hazard event will occur, disaster preparedness can help minimize loss of life, injuries and damage to infrastructure. The Hyogo Framework for Action also highlighted the importance of disaster preparedness in saving lives and livelihoods (UNISDR 2005). Unfortunately, research conducted by BNPB found that the level of disaster preparedness of Indonesian communities and local governments in 33 districts/cities is still relatively low compared to other countries (Samantha 2012).

Having stated how critical the issue versus the condition given limited resources to rely on, this study attempts to expose the real condition across the nation. In specific, the current study attempts to explore the role of social capital and personal as well as household's preparedness on the natural disasters. Interestingly, the current study will base on household and their activities on building trust, and tolerance as well as responsibility on finding way out from disasters attack.

Some studies have found that forms of social capital such as trust, tolerance, social networks and collective action also have a great potential for disaster preparedness, response and recovery at individual, community and national levels (Brunie 2007; Sadeka et al. 2015). To date, only a few studies on disaster preparedness in Indonesia dealt with social capital issues. Most existing studies mainly discuss the role of social capital on health function and poverty reduction (for example Miller et al. 2006; Nasution et al. 2015).

To fill this gap, this study aims to investigate the influence of social capital on disaster preparedness in Indonesia based on empirical data from the Social Resilience Module of the 2014 National Socio Economic Survey (SRM-NSES 2014). This survey is a national yearly survey conducted by the national government of Indonesia. The total number of household samples are around 75,000 with the sampling is designed to estimate the figure until provincial level.

For inference purposes, this study used a statistical model with the binary response variable that known as logistic regression. This statistical method is widely used to determine the effect of several predictor variables on a binary response variable. In this study, the response variable is a dichotomous variable represents two level of disaster preparedness. The predictor variables are four factors of social-capital, i.e. Trust, Tolerance, Social-networking and Collective-action.

This chapter is structured as follows. Following the motivation for the study, given in this sub section, the next sub section reviews some literatures and states the research hypotheses. The third sub section details the source of data and methodology used in the study. The fourth sub section discusses the findings. The fifth section provides recommendations for using the results to derive policy implications. A conclusion is given in the final sub section.

## 24.2 Literature Review and Hypotheses

This sub section briefly explains the concepts of social capital and disaster preparedness, and how they relate towards the prevention of natural disasters. The discussion starts with the concept of social capital and its important roles for the advancement of personal and community development. Then the concept on disaster preparedness is elaborated based on some literatures. The linkage between social capital and disaster preparedness is then discussed in more detail.

### 24.2.1 Social Capital

Social capital is one of human capital assets that refer to norms and networks facilitating cooperation among people either within or between groups (BPS 2013). Developing and strengthening social capital is one of an essential part of human development. Social capital increasingly plays a significant role in community development as widely discussed (See for example; Putnam 1995; Woolcock 2000; Kim 2006; Keely 2007; Tzanakis 2013). In general, social capital can be defines as the values of human interaction in a community for their benefits and advancements. The concept gained popularity in the United States during 1916 where it underlined how neighbors could work together to oversee schools. Tzanakis (2013) argues that “social capital works best as an individual-level concept, which loses much of its intended heuristic utility if it is automatically elevated to characterize communities, nations or parts of the globe”. Hence, social capital to some is indeed the individual level enhancement and tends to develop by group’s activities through trust and bonding.

Putnam et al. (1993) marked that social association as trust, norms and networks people engagement can improve a society’s efficiency in overcoming dilemmas of collective action. Moreover, he uses social capital as an attribute of the social

structure in which a person is embedded, and emphasize that social capital is “not the private property of any of the persons who benefit from it”.

Further, Putnam (1995) underlined the role of social capital in the United States of America that influenced the advancement of the nation. His argument brought many consequences that pointed out how significant social interaction influenced many programs that involve human networks. For instance, he examined how generational change also came out as a very significant factor. He stated that, “a very civic-minded generation, born in the first third of the twentieth century, is now passing from the American scene. Their children and grandchildren (baby boomers and Generation Xers) are much less engaged in most forms of community life”. By making the analogy to the concept of physical and human capital using the assumption that tools and training enhance individual productivity, social capital should therefore be valued through types of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit (Putnam 1995).

In line with Putnam’s view, Coleman (1988) in Brunie (2007) highlighted that social capital facilitates particular forms of action and cooperation. Social capital covers how individuals interacting and networking contributes to the achievement of a variety of outcomes. In short, Coleman (1988) defined social capital as the values and capacity of individuals within a group in supporting their common needs to enhance their targets and outcomes that works with trust within a community. As social capital includes networks, norms of collective action and trustworthiness, its contribution is highly important to speed up disaster preparedness and recovery (Sadeka et al. 2015).

In Indonesia, the concept of social capital has basically been growing strongly as what is usually termed the culture of *gotong royong* (mutual aid). It is a collective efforts and sharing responsibility for public needs or celebration within their society. The main essence for this cultural cooperation is the trust and vision to make it work together, which for quite a long time has been working well within all members of communities across the nation. As a social asset, *gotong royong* has been a kind of remedy for any community burdens where any challenge could be solved. For example, the work of *gotong royong* is vividly exhibited in the work on the national Independence Day celebration. Indeed, the *gotong royong* is one of the essential successful ways to improve neighborhood development. Unfortunately, notes about these kind of values captured on sociology application rather than social capital as is as the process of community’s development. Due to the socio-economic development, people increasingly busy and tend to be individual so that the trust as the main essence for *gotong royong* tend to be disappeared over time. Moreover, personal engagement to improve the social network has been lost along with the increasing mobility of people. Hasbullah (2006: 89) states that in Indonesian society, there has been a transformation of the social capital from traditional forms to modern forms. This transformation led to a shift in the meaning of social capital itself. The transformation has also led to changes in the structure of society. On the other hand, urbanization as a consequence of uneven economic growth also led to a reduction of personal bond and personal trust among individual in community.

### ***24.2.2 Disaster Preparedness***

Disasters in this discussion refer to event that brings a serious disruption of the functioning of a community or a society (UNISDR 2015). Disasters, particularly natural disasters usually come unexpectedly. Preparation and clear steps are an urgent need as most disasters involve widespread human, material, economic or environmental losses and impacts, which exceed the ability of the affected community or society to cope using its own resources (UNISDR 2015). In general terms disasters are often described as a result of the combination of: exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences.

Disaster preparedness as the important aspect to save more life and limited damages has been widely discussed. Sadeka et al. (2015), defined preparedness as consisting of measures that enable different units of analysis – individuals, households, organizations, communities and societies – to respond more effectively and recover faster when disasters strike. In line with this collective action to overcome disaster, Federal Emergency Management Agency (FEMA) stated that preparedness as the steps and preparation made, including: leadership, training, readiness and exercise support, and technical and financial assistance (FEMA 2010). In line with FEMA, Sutton and Tierney (2006) identified that preparedness focusing on supporting citizens, communities, states, local and tribal governments. Moreover, the professional emergency workers mitigate the effects of disasters, improve response to community needs after a disaster, and launches effective recovery efforts also identified as the other important aspects in disaster attack.

Kim (2006) further extensively elaborates how social capital plays a role in individual and community development. Using a multilevel regression model, it is showed social capital works better at the individual level before it goes to its community-level. Hence, trying to invest in individual level of social capital will significantly increase preparedness and the ability level of the community to access resources from personal and even limited and varied sources. Thus, disaster preparedness and response activities create new types of social capital. Recent studies show that social capital strongly contributes to a community's ability to plan for and respond to disasters. Coleman (1988) has elaborated how human capital has been the essential key asset towards the formation of social capital.

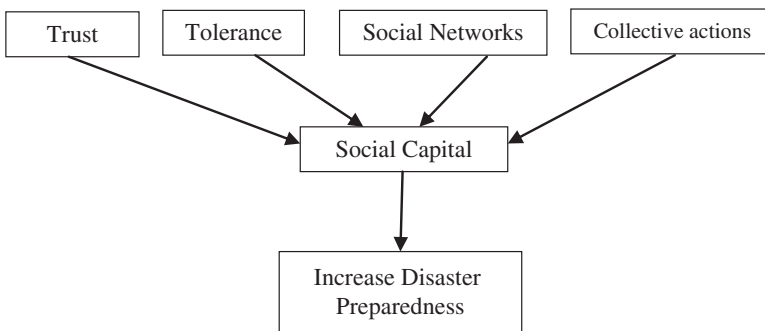
### ***24.2.3 Linkage Between Social Capital and Disaster Preparedness***

This sub-section aims to discuss the relationship between how social capital and disaster preparedness in particular how it reduces risk of disasters. Some factors that are believed to progressively develop within a community play a significant role in saving people's lives. These are referred to by other scholars as bonding, bridging

and linking (Kim 2006). The other aspects like trust and tolerance along with various social networks and collective actions might be also play a significant role. The way how social capital helps any dangerous condition depends heavily on how individuals as well as the community have access to the support they need. Therefore, actions towards any future risks of disasters rely very much on the internal condition of the individual and their household as well as community awareness about steps towards anticipation. Figure 24.1 shows how social capital factors that consist of trust, tolerance, networking and collective actions among group of community and how they influence disaster preparedness.

Disaster preparedness are the activities and measures taken in advance to ensure effective response to the impact of hazards, therefore, the role of social capital is undoubtedly important to anticipate and save more lives as well as belongings. Disaster preparedness activities include the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations (UNISDR 2004). Essentially, disaster preparedness is one of precautions for minimize losses due to disasters. However, emphasis is increasingly being placed on recovery preparedness—that is, on planning not only in order to respond effectively during and immediately after disasters but also in order to successfully navigate challenges associated with short- and longer-term recovery (Sutton and Tierney 2006).

Disaster preparedness hence should be the most important factor to reduce the impact of any natural disaster. Social scientists, emergency managers and public policy makers generally organize both research and guidance around four phases of disaster risk reduction: mitigation, preparedness, response, and recovery. This is in line with the National Disaster Management Policy for its Medium-term Development Plan 2015–2019 (BNPB 2014), which is to reduce disaster risk and increase the resilience of communities in the face of disasters.



**Fig. 24.1** Linkages between social capital and disaster preparedness (Source: Authors)



### 24.2.4 Hypotheses

Actions of disaster preparedness are theoretically closely related to social capital. Therefore in this study, based on empirical data, the following hypotheses are statistically tested:

- (a) Trust has an influence on disaster preparedness of households
- (b) Tolerance has an influence on disaster preparedness of households
- (c) Social networks have an influence on disaster preparedness of households
- (d) Collective actions have an influence on disaster preparedness of households

## 24.3 Methodology and Data

This section explains briefly the study area, the tool of data analysis, data source and the definition of indicators used to constitute each social capital factor. The discussion starts with the study area of Indonesia. Then the binary logistic regression as the main tool of statistical data analysis is explained briefly. The last subsection gives the description about the data source and the definition of variables.

### 24.3.1 Study Area

Indonesia is located between 6°08' North latitude and 11°15' South latitude and between 94°45' West and 141°05' East longitude (BPS 2015). It lies between Asian continent and Australian continent and between Indian Ocean and Pacific Ocean.

Administratively, Indonesia is divided into provinces, and each provinces is divided into districts which made up of regencies (Indonesia: *Kabupaten*) and cities (Indonesian: *Kota*). Districts are divided into sub-districts (Indonesian: *Kecamatan* and sub-districts are divided into villages (Indonesia: *Desa*). Currently, there were 34 provinces, 514 districts (consist of 416 regencies and 98 cities), 7024 sub-districts and 81,626 villages (BPS 2015). These 34 provinces spread over five main islands (Sumatera Island, Jawa Island, Kalimantan island, Sulawesi Island and Papua island) and four archipelagos (Riau Archipelago, Bangka Belitung archipelago, Nusa Tenggara archipelago and Maluku archipelago).

According to the 2010 census, total population of Indonesia was 237.6 million people. This makes Indonesia as the fourth most populous country in the world after China, India and the USA.

### 24.3.2 Binary Logistic Regression

In addition to inferences analysis, this study performs descriptive analysis using some summary tables and charts constructed from the dataset. For inferences purpose, this study uses statistical method called as logistic regression. This regression method is used to determine the effect of each social capital factor on disaster preparedness. This regression model is commonly used to explore the effect of one or more predictor variables when the response is a categorical variable. If the response variable consists of two categories (dichotomous) then the model is called a binary logistic regression.

Binary Logistic Regression is a special type of regression where a binary response variable is related to a set of predictor variables, which can be discrete and/or continuous. Binary logistic regression estimates the probability that a characteristic of interest is present (e.g. estimate probability of “success”) given the values of independent variables (Azen and Walker 2011).

Let  $(Y_i, X_i), i=1, 2, \dots, n$  be a set of paired-data of  $n$  randomly selected sample persons from a population of interest.  $Y$  is a binary response variable

$$Y_i = \begin{cases} 1 & \text{if the } i\text{th is success} \\ 0 & \text{if the } i\text{th is fail} \end{cases}$$

Clearly, in this case, “success” is one of the categories of  $Y$  variable. If  $X_i=(X_1, X_2, \dots, X_k)$  be a set of predictor variables and  $x_i=(x_1, x_2, \dots, x_k)$  is the observed vector of the predictor variables for the  $i$ th observation, then the model of binary logistic regression can be written as:

$$\pi_i = P(Y = 1 | X_i = x_i) = \frac{\exp(\beta_0 + \beta_1 x_{1i} + \dots + \beta_k x_{ki})}{1 + \exp(\beta_0 + \beta_1 x_{1i} + \dots + \beta_k x_{ki})}$$

or

$$\text{logit}(\pi_i) = \log\left(\frac{\pi_i}{1 - \pi_i}\right) = \exp(\beta_0 + \beta_1 x_{1i} + \dots + \beta_k x_{ki}).$$

If assumed  $Y_1, Y_2, \dots, Y_n$  are independent to each other, then vector  $\hat{\beta} = (\hat{\beta}_1, \hat{\beta}_2, \dots, \hat{\beta}_k)$  as the estimates of vector of parameters  $\beta = (\beta_1, \beta_2, \dots, \beta_k)$  can be determined using a procedure in statistical methods called maximum likelihood. Furthermore, if it can be proved statistically that  $\beta_j \neq 0$  at any stated level of significance (generally 0.05), then it means the  $j$ -th predictor ( $j = 1, 2, \dots, k$ ) is significantly affecting on response variable  $Y$ . In any output of statistical software if the  $p$ -value of any  $\beta_j$  is less than 0.05, it conclude that the  $j$ -th predictor is significantly affecting on response variable  $Y$  (Agresti 2002).

Interpretation in logistic regression is based on the Odds Ratio (OR) that mathematically is  $\exp(\beta)$ . For dichotomous categorical predictor variable  $X_j$  where

$$X_j = \begin{cases} 1 & \text{if } X_j = \text{first category} \\ 0 & \text{if } X_j = \text{second category,} \end{cases}$$

Then the OR of the first category to the second category is  $\exp(\beta_j)$ . It means that code =0 set as the reference. For the predictor variable with  $C > 1$  categories, usually it is set the smallest code as the reference and then creates  $(C - 1)$  dichotomous dummy variables for each other categories (Hosmer and Lemeshow 2005). In this case, interpretation is based on OR of each dummy variable.

Theoretically, OR is the quantity measures the likelihood/tendency of any category in predictor variable to fall into the category of  $Y = 1$ , compared to the reference category. In practice, the estimation of OR is calculated as  $\widehat{OR} = \exp(\widehat{\beta})$ . It is used to compare the odds of any categories in any predictor variables to the reference category. For any dichotomous predictor variable  $X_j$ , if the value of  $\widehat{OR} = 1.5$ , then it can be concluded that category with  $X_j = 1$  has a tendency to fall in the category of  $Y = 1$  is 1.5 times greater than category with  $X_j = 0$ .

### 24.3.3 Data

The dataset for this study is obtained from the SRM-NSES 2014. The survey was conducted in October 2014 in all Provinces and districts of Indonesia with sample size around 75,000 households. Data and information were collected through interviews with respondents who are the head of household or their spouse of the selected households. About 95.26% of the target sample of the survey can be interviewed. In the dataset, there are no variable which directly represents disaster preparedness. To deal with this limitation, this study is using variable of “know how to rescue from disasters” from the questionnaire of SRM-NSES 2014 as the proxy of response variable (Y-variable). This variable has two level of answer “yes” or “no”. Hence the Y is coded as follows:

$$Y_i = \begin{cases} 1 & \text{if the } i\text{th respondent knows how to rescue from disaster (“yes” answer)} \\ 0 & \text{if the } i\text{th respondent do not knows how to rescue (“no” answer)}. \end{cases}$$

The predictor variables (X-variables) of this study are four factors of social capital, i.e. Trust, Tolerance, Social-networking and Collective-action. These variables are constituted from a combination of several indicators. Such indicators are selected from several questions in the questionnaire of SRM-NSES 2014 that are theoretically constituent for each of the factors. The scores of each factor are calculated as the aggregate score of their indicators. Table 24.1 shows factors and indicators of social capital.

**Table 24.1** Factors as predictor variables and their constituent indicators

Factors (1)	Indicators (2)
Trust (X <sub>1</sub> )	1. Trust to leave the house to neighbors
	2. Trust to leave the children (age 1–12 years) to neighbors
	3. Trust in community leaders can help resolve the problem of citizens
	4. Trust in religious leaders can be a moral example
	5. Trust in the village officials can carry out their duties well
Tolerance (X <sub>2</sub> )	6. Agree children making friends with different ethnicity
	7. Agree children marry with different ethnicity
	8. Agree when other religious groups conduct activities in the neighborhood where respondent live
Social networks (X <sub>3</sub> )	9. Agree when other ethnic groups conduct activities in the neighborhood where respondent live
	10. Participation in attended a society meeting in the neighborhood where respondent live
Collective action (X <sub>4</sub> )	11. Participation in joint activities to public interest
	12. Participation in joint activities to assist other people
	13. Participation in religious activities
	14. Participation in society social activities

Source: Identified from the Questionnaire of SRM-NSES 2014

To simplify the analysis, the total score of each X variable then categorized as follows (by any cut-off point of their total scores):

X <sub>1</sub>	Trust (1 = High, 0 = Low)
X <sub>2</sub>	Tolerance (1 = High, 0 = Low)
X <sub>3</sub>	Social-network (1 = Never, 2 = Rare, 3 = Often).
	For interpretation purpose, it is changed into two dummy variables as follow;
	X <sub>31</sub> = First dummy (1 = Rare, 0 = others)
	X <sub>32</sub> = Second dummy (1 = Often, 0 = others)
X <sub>4</sub>	Collective action (1 = High, 0 = Low)
X <sub>5</sub>	Area of Residence (1 = Rural, 0 = Urban)

These four variables (X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub> and X<sub>4</sub>) of social capital become the exposure variables in the binary logistic regression model. In other words, the analysis will focus mainly on the effect of these variables. With the assumption that characteristics of households who live in urban areas are different from those in rural areas, then the Area-of-Residence (X<sub>5</sub>) is considered as the control variable in the model.

## 24.4 Results and Discussion

This section describes the result of the data analysis. The first sub section describes the result of a descriptive analysis using some summary-tables and data visualization with graphs. The later describes the results of binary logistic regression analysis for inferences purposes, which expose how factors of social capital influence disaster preparedness across the areas in Indonesia.

### 24.4.1 Descriptive Analysis of the Population of Study

This subsection expresses some findings through summary-tables and graphs calculated from the dataset aimed to analyze descriptively about the population of study. In order to provide a more efficient description, the population of study was divided into six groups based on six largest islands in Indonesia. This separation is based on differences in social characteristics of the people and the difference of potential disaster risks. Table 24.2 shows percentages of villages with disaster risk status, based on the six main islands in Indonesia.

As is shown in Table 24.2, almost half of households (45.17%) stated that they live in the village with high risk of disasters. This finding is a consequence of the geographical position of Indonesia in a highly vulnerable country to disaster. As can be seen in this table, Java has the smallest percentage of village with disaster risk and hence considered as the safest island, merely because that it is the most populated island. In other words it means that the numbers of households who live in disaster risk area are actually larger than the other main islands.

The other important fact is more than 70% of the Indonesian population are living on the main islands of Jawa and Sumatera. This condition leads to increase the risk of disaster because Jawa and Sumatera are located near the pacific ring of fire. According to BNPB (2016) these two main islands are the most frequent areas for earthquakes.

**Table 24.2** Percentages of households by main island and disaster risk status of the villages

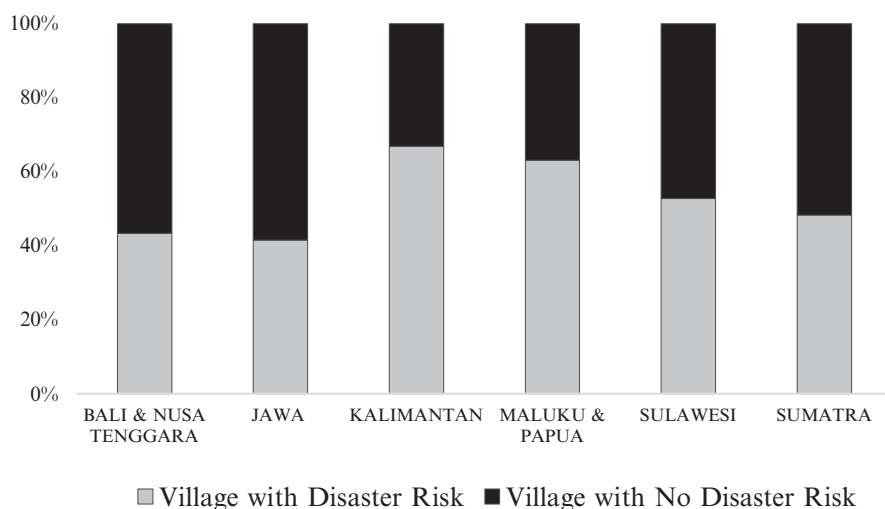
Main Island	Village with disaster Risk		
	Yes	No	Total
(1)	(2)	(3)	(4)
Bali & Nusa Tenggara	43.37	56.63	100
Jawa	41.54	58.46	100
Kalimantan	66.86	33.14	100
Maluku & Papua	63.12	36.88	100
Sulawesi	52.77	47.23	100
Sumatera	48.29	51.71	100
<b>Indonesia</b>	<b>45.17</b>	<b>54.83</b>	<b>100</b>

Calculated from the dataset of SRM-NSES 2014

Visualization of the distribution of households who claim to live in the village with a disaster risk can be seen in Fig. 24.2.

Table 24.3 shows the percentage of households who claim to have experienced disasters. It identifies that more than half of the households have experienced disasters (59.32%). This percentage is larger than the percentage of households who claimed to be residents in villages with disaster risk from Table 24.1 (45.17%). This finding indicates there are parts of households who are not lives in the village with no potential to disaster, but in fact they are experienced to disaster strike. In fact, especially for the urban area, floods strike mostly unpredictable in the tropical country like Indonesia.

In addition, more than 60% of households in Jawa claim to have experienced disasters. While in Bali, Nusa Tenggara and Kalimantan this tends to be less.

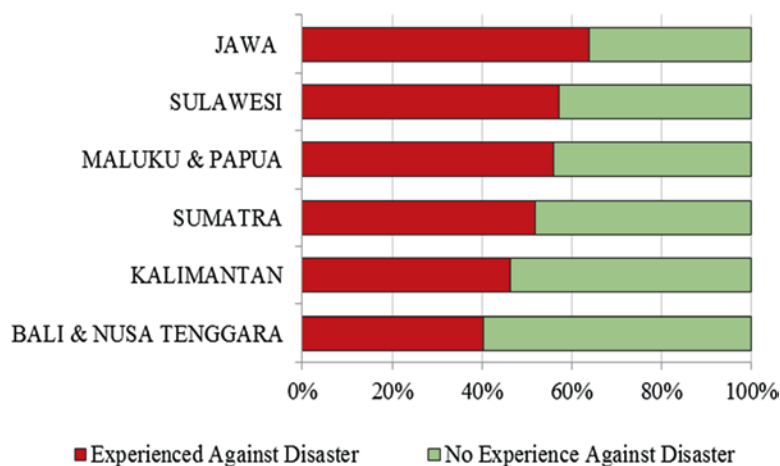


**Fig. 24.2** Percentage of households who claim to reside in a village with disaster risk (Source: Visualized from Table 24.2)

**Table 24.3** Percentage of households by main island with experience against disaster

Main Island	Experienced against disaster		
	Yes	No	Total
(1)	(2)	(3)	(4)
Bali & Nusa Tenggara	40.19	59.81	100
Jawa	63.83	36.17	100
Kalimantan	46.38	53.62	100
Maluku & Papua	55.88	44.12	100
Sulawesi	57.21	42.79	100
Sumatera	51.90	48.10	100
Indonesia	59.32	40.68	100

Source: Calculated from the Dataset of SRM-NSES 2014



**Fig. 24.3** Percentage of households by their experience against disaster (Source: Visualized from Table 24.3)

**Table 24.4** Percentage of households who live in the disaster risk area by main island and most feared type of disaster

Main Island	The most feared disaster							Total
	Storm	Flood	Earthquake	Tsunami	Volcanic Eruption	Landslide	Others	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bali & Nusa Tenggara	8.03	14.77	47.60	5.70	5.79	12.20	5.92	100
Jawa	7.13	31.08	23.72	2.46	23.25	6.79	5.58	100
Kalimantan	7.04	62.44	8.34	–	–	4.89	17.29	100
Maluku & Papua	3.54	39.32	31.47	1.85	7.28	12.99	3.55	100
Sulawesi	9.62	51.81	24.86	0.65	1.48	7.82	3.77	100
Sumatera	6.01	28.78	43.96	6.33	2.16	2.20	10.55	100
Indonesia	7.09	32.98	28.11	3.03	15.72	6.41	6.67	100

Source: Calculated from the Dataset of SRM-NSES 2014

Figure 24.3 clearly shows distribution of percentage of households who experienced disasters on each of the main islands.

Another important characteristic of disasters is the disaster type. Among all households living in a village with disaster risk, there are at least 7 types of disasters that people are concerned about (Table 24.4).

The most feared type of disaster varies by island. Households who live in Sumatera are most worried about earthquakes and tsunami, which could be understood because the entire west coast of Sumatera is passed by the Pacific Ring of Fire. The people who live in Sumatera have also been traumatized by the large scale

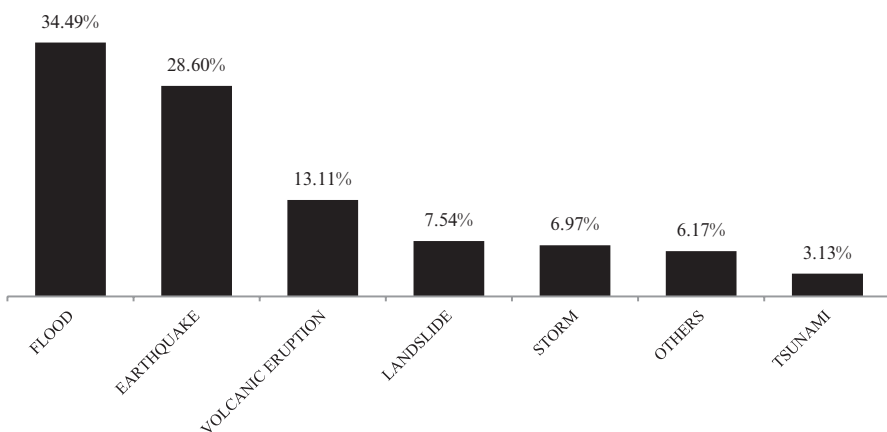
of the 2004 tsunami in Aceh. In fact, Sumatera is an island with the most frequent number of earthquakes. On the other hand, no households in Kalimantan are concerned about tsunami or volcanic eruptions. This can be understood as they live far from the Pacific Ring of Fire and there are also no active volcanoes on Kalimantan. However, they might be worried about forest fires and floods as an impact of climate change.

In general, floods and earthquakes are main types of disasters which are most feared by households as clearly shown in Fig. 24.4. This figure illustrates the type of disaster feared by households who live in a village with disaster risk. It is interesting to note that although the 2004 big earthquake and tsunami caused many victims in Indonesia, this type of disaster is less feared by households (only about 3%). This condition can be understood because only the West coast of Sumatera and South coast of Jawa has potential for earthquake and tsunami. Both these regions are located near the Pacific Ring of Fire.

Vulnerability towards disasters becomes worse as only a small number of Indonesian households have ever participated in disaster rescue training. As summarized in Table 24.5, there are only about 2.2% of households who live in a village with disaster risk who actually participated in a disaster risk simulation. Sumatera Island has the highest percentage of households participating in disaster rescue simulations. This can be understood as after the big earthquake and tsunami in 2004, a lot of attention from government and non-government organizations was given to people in Sumatera Island, especially Aceh and Padang provinces.

For the purpose of comparison, Fig. 24.5 visualizes the distribution of households based on their participation status in training of how to rescue from disaster strike. Clearly, it shows that Jawa and Sumatera, as the two most populated islands in Indonesia, have large proportion of participation in disaster rescue training.

Regarding the question of whether someone knows how to rescue from disaster, there is an impressive finding, i.e. more than 70% of the total households claimed



**Fig. 24.4** Percentage of households who live in the risk area by the most feared type of disasters (Source: Visualized from Table 24.4)

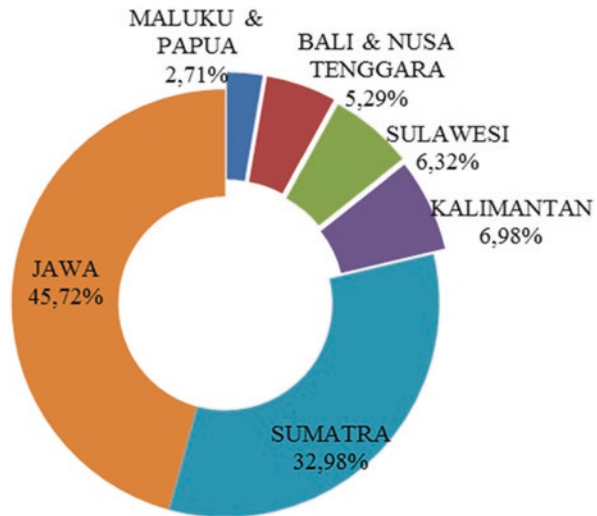


**Table 24.5** Percentage of households living in the risk area by their participation in disaster rescue training

Main Island (1)	Participation on training how to rescue from disaster		Total (4)
	Yes (2)	No (3)	
Bali & Nusa Tenggara	2.33	97.67	100
Jawa	1.92	98.08	100
Kalimantan	1.82	98.18	100
Maluku & Papua	1.83	98.17	100
Sulawesi	1.80	98.20	100
Sumatera	3.42	96.58	100
<b>Indonesia</b>	<b>2.19</b>	<b>97.81</b>	<b>100</b>

Source: Calculated from the Dataset of SRM-NSES 2014

**Fig. 24.5** Distribution of participating households in a simulation on disaster rescue training (Source: Calculated and visualized from the Dataset of SRM-NSES 2014)



that they know how to rescue in the case of disaster. This finding is an indication that in general most households are aware on the issue of disaster preparedness. Detailed information by the main islands is prepared in Table 24.6.

As previously discussed, from the total households who live in a disaster risk area, there are only around 2.2% who have received training on how to rescue from a disaster. However, considering total households, it is shown that more than 70% of them claim to know how to rescue in the case of a disaster. This phenomenon is an indication of the role of social capital in the community. This significant role of social capital in disaster preparedness is showed in the next subsection by using binary logistic analysis.

In the next section, the present study uses the variable “know how to rescue from disaster” as the response variable and uses some social capital factors as predictor variables in logistic regression analysis.

**Table 24.6** Percentage of households by main island and their knowledge of disaster rescue

Main Island (1)	Knowing how to rescue from disaster		Total (4)
	Yes (2)	No (3)	
Bali & Nusa Tenggara	68.19	31.81	100
Jawa	70.61	29.39	100
Kalimantan	73.11	26.89	100
Maluku & Papua	71.51	28.49	100
Sulawesi	65.73	34.27	100
Sumatera	73.22	26.78	100
Indonesia	70.66	29.34	100

Source: Calculated from the Dataset of SRM-NSES 2014

### 24.4.2 Inference Analysis by Binary Logistic Regression

In this section, the effects of some factors of social capital on household’s preparedness of disaster are analyzed using binary logistic regression method. Based on the dataset of SRM-NSES 2014 and logistic regression analysis, the main output of binary logistic regression analysis is provided in Table 24.7.

With all of the p-values near zero, this means that all of the predictor variables existing in the model are statistically significantly affecting the Y-variable as the response variable. The positive value of regression coefficient  $\hat{\beta}$  means their effects are positive. This empirical evidence shows that all of the social-capital factors, i.e. Trust, Tolerance, Social-network and Collective-action, positively affect on disaster preparedness. This finding is consistent with Brunie (2007) and Sadeka et al. (2015). From the above output, the estimated logit-equation can be written as:

$$\text{logit}(\hat{\pi}) = 0.908 + 0.017X_1 + 0.440X_2 + 0.253X_{31} + 0.291X_{32} + 0.068X_4 - 0.560X_5$$

This logit-equation tells that simultaneously, all of the social-capital factors significantly affect disaster preparedness. Since their effects are calculated simultaneously, then  $\widehat{OR}$  of each factor should be interpreted at the same level of all others predictor variables, as shown in Table 24.8.

As is shown in Table 24.8, after controlling the model by Area-of-Residence (Urban/Rural), there are two factors of social capital that most influenced the knowledge of disaster preparedness. These two factors are Tolerance and Social Network, with an estimated odds ratio of around 1.6 and 1.3 respectively. As a control variable, Area-of-Residence gives the negative response. It means that people who live in the rural area have less knowledge of disaster preparedness than those who live in urban areas. Assuming that rural people have higher social-capital than urban people, it looks like it is not in accordance with such an assumption.

**Table 24.7** Main output of binary logistic regression analysis

Factor of social capital	Variable	$\hat{\beta}$	p-value (Sig.)	$\widehat{OR} = \exp(\hat{\beta})$
Trust	X <sub>1</sub>	0.017	0.000	1.017
Tolerance	X <sub>2</sub>	0.440	0.000	1.553
Social Network	X <sub>3</sub>	–	–	–
Dummy-1	X <sub>31</sub>	0.253	0.000	1.287
Dummy-2	X <sub>32</sub>	0.291	0.000	1.338
Collective action	X <sub>4</sub>	0.068	0.000	1.070
Area of Residence	X <sub>5</sub>	–0.560	0.000	0.578
Constanta ( $\hat{\beta}_0$ )	–	0.908	0.000	2.479

Source: Summarized from the output of Binary Logistic Regression Analysis

**Table 24.8** Interpretation of odds ratio estimation

Factor of social capital	$\widehat{OR}$	Interpretation	Practical meaning
		(Assume all other predictor variables set at the same level)	
Trust	1.02	Person with the higher level of the trust attitude are 1.02 times more likely to have knowledge of how to resque than those who have lower level of the trust	The higher the level of trust then the higher the knowledge of disaster preparedness
Tolerance	1.55	Person with the higher level of tolerance attitude are 1.55 times more likely to have knowledge of how to resque than those who have lower level of the tolerance	The higher the level of tolerance then the higher the knowledge of disaster preparedness
Social Network	–	Person who rarely do social network activities are 1.29 times more likely to have knowledge of how to resque than those who never do the social network activities	The higher the level of social network then the higher the knowledge of disaster preparedness
Rare	1.29		
Often	1.34	Person who often do social network activities are 1.34 times more likely to have knowledge of how to resque than those who never do the social network activities	
Collective action	1.07	Person with the higher level of collective action are 1.07 times more likely to have knowledge of how to resque than those who have lower level of collective action	The higher the level of collective action then the higher the knowledge of disaster preparedness
Area of Residence	0.58	Person who live in rural area are 0.58 times less likely to have knowledge of how to resque than those who have lower level of collective action	–

Source: Summarized from Table 24.7

However this finding might be an indication that social media such as Email, WhatsApp, Line, and the like, gives a significant contribution for urban communities to access more information about disaster preparedness. Based on the dataset of SRM-NSES 2014, it is found those urban populations who have an access to the internet is around 20%, whereas the rural populations is only around 4%. There are also some other possibilities of knowledge transfer of disaster preparedness for the urban population, i.e. through the formal education, considering that in general, there are more people with tertiary education in urban areas than in rural areas (BPS 2015).

## 24.5 Conclusions and Recommendations

In conclusion there are several main findings that can be highlighted to capture and elaborate the role of social capital on Disaster Preparedness in Indonesia, based on empirical analysis of SRM-NSES 2014. Consistent to Brunie (2007) and Sadeka et al. (2015), this study found empirical evidence i.e. the positive effect of social capital in disaster preparedness. Some important points and findings are concluded as follow.

Firstly, among all households who live in the risk areas for disasters, there are only around 2.2% who have already got training of how to rescue in the case disaster strike. However, more than 70% claimed to know how to rescue from a disaster. These empirical findings might be an indication that people eventually learned the knowledge of disaster preparedness through the mechanism of social capital among their community.

Secondly, as a consequence of geographical located of Indonesia, this study revealed that more than a half or for 59.32% of households in Indonesia have experienced on at least one type of disaster strike. Consequently, with current population of nearly 250 million in total, the knowledge of disaster preparedness became an important aspect to reduce many risk of death due to disasters strike. By lack and insufficient knowledge on disaster preparedness, people will remain in great danger and vulnerable to any disaster risks.

Finally, based on the result of inference analysis using logistic regression, this study found that social capital factors such as trust, tolerance, social-network and collective-action have positively affected knowledge of disaster preparedness. The higher the level of those factors will tend to increase the knowledge of disaster preparedness. Tolerance and social-network are the factors that most influenced knowledge of disaster preparedness, while trust and collective-action tend to have less effect. Moreover, all of those four factors of social capital positively and simultaneously influence the knowledge of disaster preparedness. These empirical findings consistent with the result of some other studies mentioned previously.

Based on the findings stated above, this study recommends that both central and local government need to empower people in disaster risks areas to utilize some

factors of social-capital. Specifically, a detailed recommendation can be identified as follows.

Firstly, the most affected factor of the social capital on the knowledge of disaster preparedness is tolerance. It is recommended to improve this attitude through the educational institution especially for elementary and junior school by inserting the tolerance attitude in the curriculum.

Secondly, social-networking is other important social-capital factors that have strong effect on knowledge of disaster preparedness. In the current digital era, it is recommended to use social media such as Email, WhatsApp, Line, and the like as the tools to promote information on disaster preparedness. The dataset of this study found there are more than 70% of Indonesian population use hand phone and almost 30% of them has access to internet.

Thirdly, further study needs to distinguish the effect of social capital on disaster preparedness between coastal and non-coastal communities. It is known that Indonesia is an archipelagic country with the second longest coastline in the world. Such study is important because the characteristic of social capital of peoples who live in the coastal area is different to those who live in the non-coastal area. Moreover the types of disaster which strike are more likely to be different between coastal and non-coastal area.

Finally, since the current study is a nation-wide analysis, a downscaling study is needed to identify the local-specific problems on disaster preparedness especially for some areas with high risks of disasters. By conducting a study on a small area that potential to disaster strike, the study can be carried out in more detail using the combination of quantitative and qualitative methods.

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# Chapter 25

## Measuring Community Resilience to Natural Hazards: Case Study of Yogyakarta Province

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D.T.P. Kusumawardhani, Saut Sagala, and Anggun Mayang Sari

**Abstract** The concepts of community resilience have been utilized in the discussion on related to disaster risk reduction (DRR) and there has been a proliferation of concepts and frameworks for understanding and measuring resilience. This study builds on these measures of resilience by developing an Integrated Concept of Community Resilience (ICCR) adapted to include Indonesian context-specific dimensions such as different forms of cultural capital, governance and spatial planning. Specifically, existing forms of cultural capital, namely *gotong royong* (collective action) have long been rooted in many Indonesian societies and therefore play an important role in increasing community resilience. At a larger scale, community resilience is also influenced by external factors such as the governance system and spatial planning.

The objective of this chapter is to develop and apply the ICCR framework in the Sleman and Bantul Regencies in the Special Region (Daerah Istimewa) of Yogyakarta, which are threatened by volcanic and earthquake hazards respectively. The analyses were based on data from 200 household questionnaires, focus group discussions and in-depth interviews. The ICCR was then translated into indicators that are analyzed statistically. The result of the assessment showed that the resilience index of Sleman Regency is higher than that of Bantul Regency, although the average resilience index in Sleman and Bantul is moderate except for spatial planning in Bantul which is low. Based on the results obtained, the ICCR can be applied as a measure of community resilience and help to highlight ways and possible interventions for strengthening resilience.

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**Keywords** Integrated concept of community resilience • Yogyakarta • Community resilience

## 25.1 Introduction

Indonesia is one of the countries highly at risk to natural hazards hence strengthening the resilience and reducing the vulnerability of communities is extremely necessary. This paper proposes a community resilience concept that takes into account multiple factors, that built upon previous concepts of resilience proposed by other authors (Bruneau et al. 2003; Adger 2006; Cutter et al. 2008a, b) but enhanced in accordance with the circumstances in Indonesia, in Indonesia, people's resilience is affected by many complicated elements, including cultural capital, risk governance and spatial planning, which are not main points explored by the aforementioned authors for developing community resilience.

The aim of this chapter is to develop our new understanding on how community resilience in Indonesia can be comprehensively identified and strengthened. This paper examines an integrative concept of community resilience in Indonesia by integrating social, economic and cultural community capitals with disaster risk governance systems and spatial planning. The specific objectives are:

1. To propose a new framework for community resilience that incorporates internal dimensions of social, cultural and economic capital and external dimensions of risk governance and disaster based spatial planning.
2. To develop an ICCR index by combining the two dimensions in order to build an integrated concept of community resilience (ICCR) to natural disasters that can be applied at national and local levels in Indonesia.

The risk of natural disasters may be reduced, however, if people have sufficient coping capacities. In Indonesia, cultural capital embedded in societies for a long time is seen as playing an important role in capacity building and strengthening community resilience. The role of cultural factors in shaping people's behaviour in the face of natural hazards has been emphasized by several anthropologists (e.g. Torry 1979; Oliver-Smith 1996; Oliver-Smith and Hoffman 1999; Renn and Rohrmann 2000 in Lavigne et al. 2008). This study shows the important reasons for combining all those functions in strengthening community resilience in Indonesia. Since 1900, disaster events in Indonesia have showed increasing tendency (EM-DAT 2016), which not only manifest in social impacts but also in economic cost. This data also indicates that disaster risk in Indonesia had increased significantly over the development stage since 1960. Despite fairly rapid economic growth in Indonesia, this tendency shows that communities have become more vulnerable to disasters (EM-DAT 2016). This was mainly because disaster risk reduction was not a primary priority in development planning, both nationally and locally.

In Indonesia, disaster management faces a lot of challenges due to the expanse of areas prone to natural disasters and occupied by significant populations. Therefore,



disaster management should be based on community empowerment. Strengthening community resilience is an important strategy to reduce disaster risk. As explained above, people's resilience in Indonesia is not only based on internal factors embedded in society but also on external factors that contribute to as discussed by Pendall (2008). Therefore it is very important to look at community resilience in Indonesia comprehensively and not only from one side. The ICCR seeks a breakthrough in strengthening community resilience based on a number of factors that influence it. It provides a comprehensive point of view of resilience from a different angle.

Disaster community resilience is basically influenced by socio-economic factors and is the focus of the DROP model (Cutter et al. 2008a, b). In contrast to this, the ICCR concentrates not only on socio-economic factors but also takes into account risk governance and spatial planning as well as the advantages of culture that have long been owned by people in Indonesia for strengthening community resilience. In the ICCR the internal dimension of resilience is influenced by the socio-economic and cultural capital embedded in people's lives that has an impact on people's vulnerability.

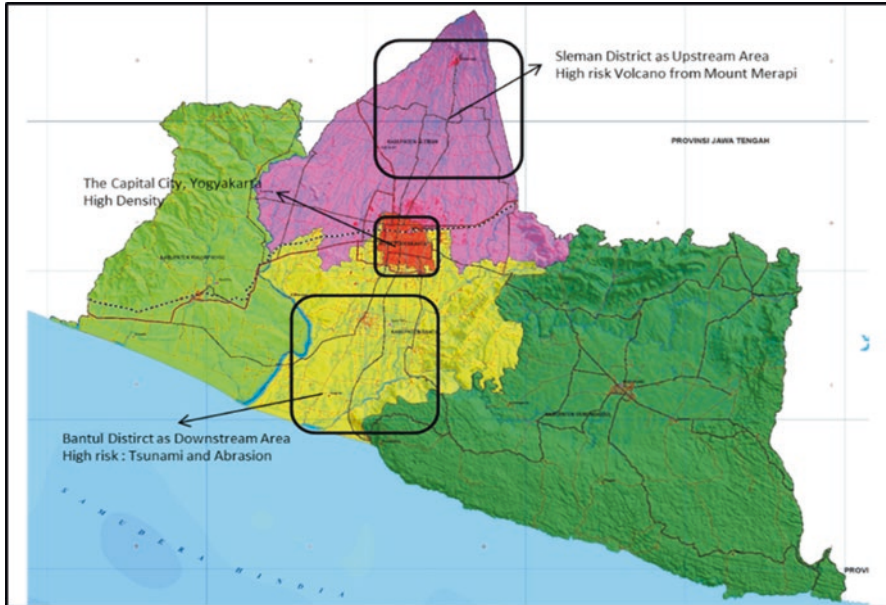
This study was carried out in the northern part of Yogyakarta Province, specifically at Sleman Regency on the slope of Mt. Merapi, which erupted in 2010, and in Bantul Regency in the southern part of Yogyakarta Province, where an earthquake struck in 2006. Sleman is constantly threatened by the volcanic hazards of Mt. Merapi, therefore the people in Sleman are familiar with the danger of eruptions. Whilst for people in Bantul, the 2006 earthquake was the first such experience for many, therefore they did not have much prior experience or knowledge of this hazard type.

This chapter is organised as follows: Section two describes conceptual framework used in this study and the methodology for building the ICCR household questionnaire and the ICCR index, including the equation for measuring the resilience index. Section three comprises a literature review of concepts of community resilience. Section four contains the findings, including the study location of Sleman and Bantul Regencies and the result of the ICCR household questionnaire survey on social, economic and cultural, risk governance system and spatial planning factors. Section five entails a discussion in which we discuss the result of the survey, the methodology, literature review and the implementation of the ICCR. Lastly, in our conclusion we summarize all sections and make some recommendations.

## 25.2 Methodology

### 25.2.1 *Preview of Sleman and Bantul Regency*

Sleman and Bantul are two of the regencies of Yogyakarta City. Yogyakarta is a Special Region (Daerah Istimewa) in Indonesia (Fig. 25.1). Sleman is located in the north of Yogyakarta City near Mount Merapi, whereas Bantul is located in the south



**Fig. 25.1** Administration map of Yogyakarta special region

of Yogyakarta City, close to the Opak Fault system. In general, the people in Yogyakarta Province are widely regarded in Indonesia as upholding a strong cultural heritage. Yogyakarta has become one of a significant number of growing cities in Indonesia with massive transformations in urbanization, industrialization and tourism. The target villages were selected base on BNPB (National Body Indonesia Disaster Risk Management) criteria, namely high, moderate and low village resilience. The household respondents were the heads of households, husband or wife. If the husband or wife was not at home, the respondent chosen was an adult son or daughter. The questions can be found in the appendix. The interview with selected residents was conducted in collaboration with the Faculty of Social Science and Politics of the University of Gajah Mada, Yogyakarta.

### **25.2.2 Data Collection Methods**

Figure 25.2 shows the methodology for household questionnaires data collection, focus group discussions (FGD) and in depth interviews with local stakeholders in Sleman and Bantul. Questionnaires were distributed in six villages; three in Bantul Regency and three in Sleman Regency.

Questionnaires were designed to obtain quantitative data on the effectiveness of the ICCR concept to measure community resilience spatially. The results of the questionnaires were also objected to determine the factors that are necessary to

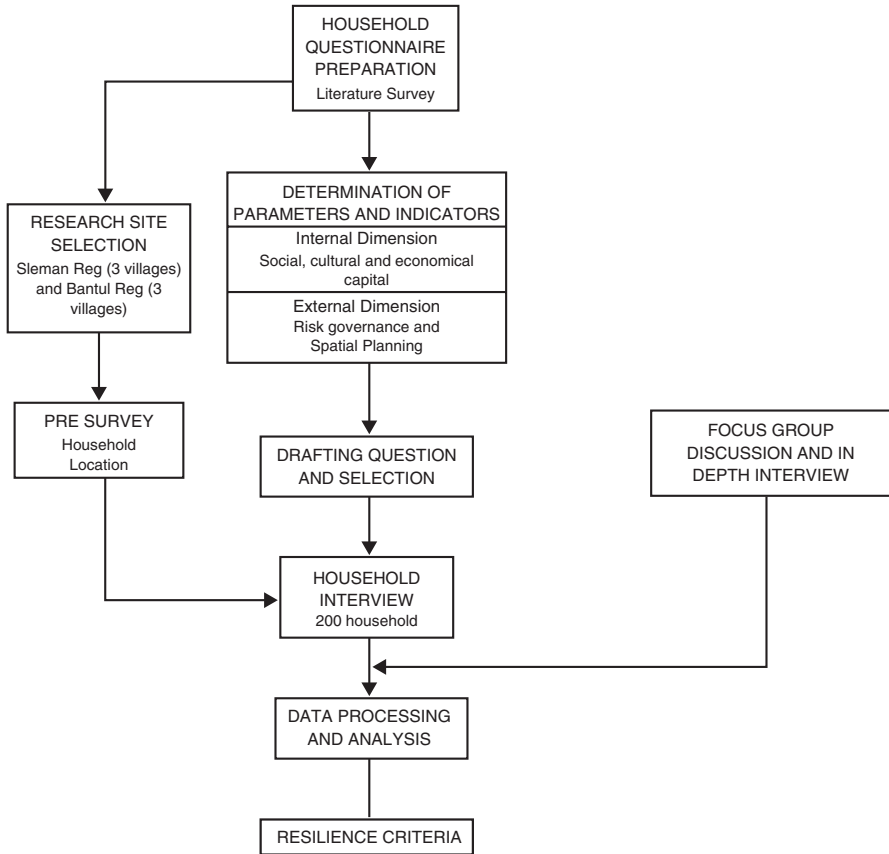


Fig. 25.2 Data collection methods

strengthen resilience. As mentioned before, the methodology applied in this study contained household questionnaires as well as focus group discussions and in-depth interviews with disaster management stakeholders located in Sleman and Bantul Regencies. Focus group discussions and in-depth interviews were also carried out with stakeholders in Yogyakarta Province to find information on Province policy concerning the efforts made to strengthen resilience. Next, the sequence of activities in the methodology that is used is described. First, the preparation stage which includes a literature review and determining the main issues that affect community resilience in Sleman and Bantul based on the ICCR conceptual framework, such as social, economic and cultural, risk governance system and spatial planning issues, and how to conceptualize these issues.

This process was continued by collecting and selecting the relevant indicators and parameters, both internal and external, and drafting and building the questions that would be used. The survey locations are based on village levels that were selected according to the BNPB (Indonesia Disaster Management Board) criteria

for Disaster Resilient Villages. Sleman and Bantul regency were both selected for this study due to being prone to volcanic and earthquake hazards. Three villages were selected from each regency. A pre-survey was conducted to select hazard prone households, particularly along the lava flow path and volcanic ash zones in Sleman from the 2010 Mt. Merapi eruption and from among the most damaged homes from the earthquake in Bantul. The household interviews were carried out in collaboration with the Faculty of Social Science and Government of the University of Gajah Mada, Yogyakarta. In the meantime qualitative data was also collected based on focus group discussions and in-depth interviews with relevant stakeholders in Yogyakarta Province, Sleman and Bantul, in order to find out more information and to confirm the quantitative data. The next step was data processing and analysis to find the ICCR criteria or index for Sleman and Bantul.

## 25.3 Literature Review

This section provides an overview of the concept of community resilience to be used as a basis for the development of the ICCR. In this section, the underlying factors that affect community resilience are discussed, such as social and economic capital and their influence on people's vulnerabilities.

### 25.3.1 *Disaster Resilience*

This section discusses the concept of resilience as already developed by several authors (Anderson and Woodrow 1989; Adger 1999, 2000; Bruneau et al. 2003; UNISDR 2004; Bankoff et al. 2004; SDR 2005, in Cutter et al. 2008a, b; Adger 2006; Pendall 2008; Djalante et al. 2011; Sagala and dan Bisri 2011; Kuhlicke 2013; Siagian et al. 2014). Resilience corresponds to the capacity for learning and adaptation in a system (Adger et al. 2005). It reflects the degree to which a complex adaptive system is capable of self-organization (versus lack of organization or organization forced by external factors) and the degree to which the system can build its capacity for learning and adaptation. It has been widely recognized that social and economic factors, which form part of the causes of vulnerability, are important issues in strengthening resilience against natural disasters. In fact, cultural factors are also known to have a significant contribution for capacity building and strengthening community resilience (Adger 2000; Cutter et al. 2008a, b).

Vulnerability plays a very important role in determining community resilience and is a more widely used term to explain the relationship between humans and their environment (Adger 2006). Economic vulnerability is associated with the decline of the casualties' ability to boost income activities, to reclaim broken or missing assets, to repay debts or to regain a job and can potentially reduce resilience. On the other hand, social vulnerability is the inability of the exposed social

group or individual to adapt to the hazard or environmental change that affects their livelihood (Adger 1999; Friend and Moench 2013). In Indonesia, economic vulnerability is commonly manifested as an inability of an individual or community to accomplish their basic needs (Siagian et al. 2014; Yustiningrum 2015). Economic vulnerability is not only affected by the availability of natural resources but also by external factors such as institutional policies, which can have a knock-on effect on resilience (Adger 1999). Furthermore, community vulnerability closely relates to underlying socio-economic and external factors such as institutional, political commitment and cultural factors as well as adaptive capacity.

In spite of vulnerability, resilience is always linked with a capacity of a system to adapt or respond to singular, unique and often very sudden events that can change people's lives (Kuhlicke 2013). The most effective solution is to prevent the development of dangerous areas (Burby et al. 1999). Capacity is defined as a combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster (UNISDR 2004). Capacity may include physical, institutional, social or economic means as well as skilled personal or collective attributes such as leadership and management. Capacities depend on the ability of the government in implementing disaster risk governance, which are also responsible for the establishment of important policies to protect society from disaster risk (Djalante et al. 2011). In addition, how sustainable development systems are planned (Sagala and dan Bisri 2011) will also affect community resilience.

### 25.3.2 Culture and Resilience

Societal culture in Indonesia has long been shaped for an important role in strengthening resilience. The cultural heritage found in various regions in Indonesia makes an important contribution to increasing the social capacity of people such as demonstrated by communities in Sleman, Yogyakarta, who live on the slope or near the active volcano, Mt. Merapi (Lavigne et al. 2008). The Javanese people in Sleman possess strong cultural traditions. In this context, their cultural capital has shaped their risk perception, social beliefs, as well as their socio-economic constraints. Their risk perception comprises an estimated probability, based on their continuous experience of eruptions since 1900, that hazards will affect them (Badan Geologi Indonesia 2014). Cultural theorists emphasize that individual's decisions to face hazards of various origins are embedded in social and cultural values (Douglas and Wildavsky 1982; Dake 1991; Douglas 1992).

Perhaps the most widely known form of cultural capital is *gotong royong*, which plays an important role in public life in Indonesia. In general, the practical implementation of the tradition of *gotong royong*, for example, involves local residents working together to volunteer to help neighbors repair houses or with grieving.

Local wisdom also plays an important role in disaster risk reduction. As shown by the experience of the people in Simelue Island during the tsunami disaster in

1907 and 2004 (AdooMc et al. 2006), indigenous people around this island have used their traditional knowledge to prepare for, cope with and survive disasters for millennia. Their methods and practices originate within community experience and are maintained and disseminated through non-formal means developed over several generations. They are subject to adaptation and become part of a community's way of life as a means of survival. One example of local wisdom shown by the residents of Simelue Island is *Smong*, a type of folklore taught by their ancestors since the tsunami struck the island in 1907. It describes a series of events including the shaking of ground due to an earthquake and receding seawater before a tsunami strikes. *Smong* helped save many lives on Simelue Island during the 2004 tsunami disaster.

### **25.3.3 Governance and Resilience**

Djalante et al. (2011) emphasizes the importance of adaptive governance in disaster risk reduction for strengthening community resilience. According to Djalante (2014), there are four important characteristics of adaptive governance for managing resilience: polycentric and multilayered institutions, participation and collaboration, self-organization and networks, and learning and innovation. These can help broaden, strengthen and fast-track our understanding and implementation of resilience.

In the aftermath of the tsunami disaster in Aceh in 2004, there was a change in the disaster risk governance system in Indonesia. The government established a new law in disaster risk management in 2007, known as Law No. 24 of 2007, which was implemented to protect all communities from disaster risk. With the creation of this law, the Disaster Risk Governance system in Indonesia was reformed. This law is focused on all stages of the disaster risk management cycle and contributes greatly to the recommendations of the Hyogo Framework for Action on disaster risk governance (UNISDR 2005).

### **25.3.4 Spatial Planning and Resilience**

A simple definition of resilience is the ability of the city to absorb a disturbance whilst maintaining its functions and structures (Holling 1973). Spatial planning plays an important role in protecting people and resources against natural disasters. Concerning territorial development, potential natural disasters should always be considered. Therefore, spatial planning is one of the most important factors that affects community resilience and forms part of the ICCR.

Spatial planning provides tools that can be effective in reducing disaster risks at wider scales (Brody 2003; Burby 1998; Burby and Dalton 1994; Burby and French 1981), such as floodplain zoning, hazardous areas and built up areas. By mitigating the hazard through schemes such as flood control programs, building codes, insurance and disaster relief, it is possible to significantly reduce the risks and minimize the potential for casualties and property damage during large hazardous events.

This may also provide protection for sensitive environmental features and increase people's resilience. Spatial plans have a strong correlation with how development planning is implemented, both nationally and locally. Sustainable development needs to consider not only development in the economic sector but also social and environmental factors. Therefore, sustainable development needs to incorporate disaster-based spatial planning.

## **25.4 A Proposal for an Integrated Concept of Community Resilience (ICCR)**

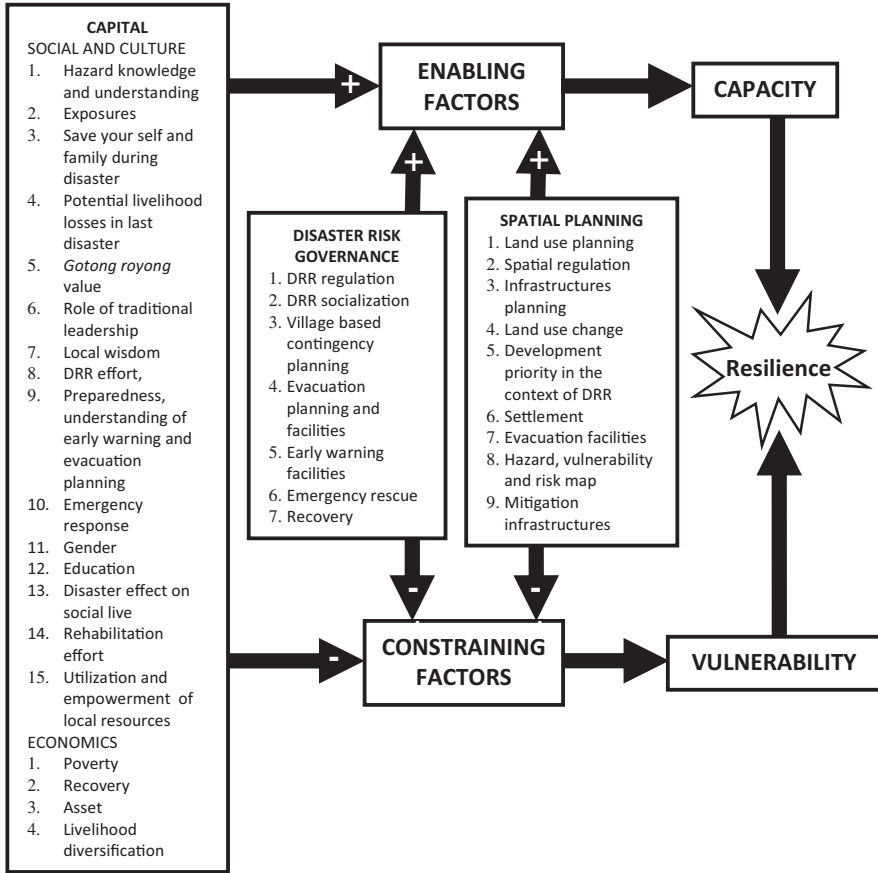
The Integrated Concept of Community Resilience (ICCR) is developed based on the concept of community resilience outlined previously, such as the DROP method developed by Cutter et al. (2008a, b). Nevertheless, the ICCR is developed in an Indonesian context and not only introduces the effect of social and economic capital but also the influence of cultural capital, risk governance and spatial planning in community resilience. The following section will explain the framework used to build the concept, including the factors that influence the ICCR, the index equation and range.

### **25.4.1 *The ICCR Framework***

The ICCR provides a new conceptual framework of disaster resilience measurement in Indonesia to improve and build comparative assessments and may be applied at the local, community or national level for multi-hazards (Fig. 25.3). The framework contains wider indicators of community resilience. Figure details all the base indicators considered necessary to build community resilience in Indonesia, including social, economic and cultural capital as well as risk governance and spatial planning.

This framework provides comprehensive indicators which combine all base indicators for community resilience strengthening to build the ICCR. Integrated community resilience is defined as the ability of the system, community or society exposed to multiple hazards of geophysical or climatological origin, to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by positively maintaining internal dimensions such as social, economic and cultural factors and positive support from external dimensions such as risk governance and land use planning.

In this study, the ICCR was tested on the two communities threatened by volcanic and earthquake hazards in Yogyakarta. Nevertheless, the concept also considers all hazards (multi-hazard) caused by either geophysical or climatological phenomena with a modification of the indicators. In the ICCR, community resilience is measured with the same base indicators for multiple hazards.



**Fig. 25.3** The integrated concept of community resilience (ICCR) framework

Previous resilience scholars focused on the degree to which social infrastructure is capable of organizing itself to increase capacity for learning from past disasters and provide better future protection and improve risk reduction measures (Adger 2000, Bruneau et al. 2003, SDR 2005, in Cutter et al. 2008a, b).

Community resilience in Indonesia is significantly affected by the vulnerability of people such as people’s mobilization in the hazard area, poverty issues and a lack of hazard understanding or knowledge. However, resilience can be strengthened by increasing people’s capacities by using cultural capital, increasing social and economic capital such as public knowledge, poverty reduction and understanding about the potential disasters, as well as improving the risk governance system and land use planning. These indicators can be enabling factors for community resilience if they have a positive impact and or constraining factors if they have a negative impact. This concept can be applied nationally or locally with some adjustment spatially.



The diversity of culture in Indonesian society as an internal dimension of resilience is an important factor for increasing community capacity as shown in many places in the face of disasters or other environmental issues. This study proposes an integrated concept to strengthen community resilience (ICCR) in Indonesia by combining these internal and external factors that can be an enable or constrain community resilience.

#### 25.4.1.1 Internal Factor

Internal factors consist of social, economic and cultural capitals that are attached to the community.

##### Social and Economic Capital

Social capital contributes to increasing or decreasing vulnerability or capacity and may influence community resilience. If social and economic capital may be considered an enabling factor, therefore, capacity will increase but if social and economic capital represents a constraining factor, vulnerability will increase. The major problems of social capital in Indonesia in disaster risk reduction are demographic condition, in which mobilization in the hazard-prone areas and the community's hazard knowledge may cause vulnerability to increase, whereas the major economic concern is poverty. In the context of social, cultural and economic capital the ICCR indicators consist of: The knowledge and understanding of the natural hazard threat; Experience of the natural hazard; Damage to property and response during the last disaster; Recovery potential, Involvement in a DRR program; Involvement of army and police in emergency response; Evacuation planning; Evacuation facilities.

##### Cultural Capital

Cultural heritage is an asset that contributes towards the resilience building of communities. In many initiatives to reduce disaster risk it became increasingly evident that disaster risk reduction and preparedness are closely tied to the effective management of culture and natural heritage at all levels. However much more needs to be done to protect the present for future generations. In the ICCR, cultural capital is indicated by *Gotong royong* and traditional or local wisdom.

##### Gotong Royong

*Gotong royong* is a social tradition of solidarity in Indonesia, which has historically been part of many communities (Kusumawardhani 2014). *Gotong royong* in the ICCR is an important factor that may increase community coping capacity to strengthen resilience. It can be seen as a form of mutual cooperation and an element

of social capital, and can be defined as the ability of a community to work together to achieve common goals, in various groups. Burt (1992) sees the sense of mutual cooperation as a community's ability to perform associations (interactions) with each other that is manifest as a force that is very important not only for economic life but also for every aspect of social existence, such as sharing information about the dangers of natural hazards. Meanwhile, Cox (1995) defines social capital as a set of human relations processes supported by a network, norms and social trust that allows efficient and effective coordination and cooperation for mutual benefit and virtue. *Gotong royong* may be indicated by people's collaboration, as an example of environmental protection or collaboration in emergency response, evacuation etc.

### Traditional or Local Leadership

Traditional leadership in the context of disaster risk reduction can inspire people to act. People who are included as traditional leaders were originally traditional elders (*penetua*), and now include community leaders or religious leaders. They have the ability to coordinate and revitalize the values of cooperation and mutual cooperation in the form of: (1) Communicating the natural signs that can be observed during a disaster; (2) inviting community residents to improve the evacuation route or open a new path; (3) motivating community residents to evacuate through a route determined by a contingency plan; (4) increasing public awareness for nature conservation around disaster-prone areas (5) raising funds and savings for preparation when disaster occurs.

### Local Wisdom

Local wisdom is explicit knowledge that has emerged from a long period and has evolved together with the community and the environment in the local system. This process of co-evolution is so long and attached to the community that it makes local knowledge a source of potential energy for the system of collective knowledge of the community in a dynamic and peaceful life. Local wisdom refers to the understanding of local knowledge not merely as a reference to a person's behaviour, but further, the ability to make life in civilized society more dynamic.

#### **25.4.1.2 External Factors**

##### Risk Governance

External factors consist of risk governance systems and spatial planning. Risk governance systems refer to the institution in which policy, process and mechanism are implemented to reduce the potential loss due to hazard. The governance system relates a lot to the political and economic institution as well as the capacity of the

individual actor (Ahrens and Rudolph 2006). The political commitment to disaster governance systems plays an important role in the delivery of community-based disaster management policies. In the context of risk governance, the indicators used in this concept consist of the availability of disaster risk reduction (DRR) regulation in terms of: Contingency planning, Disaster socialization, Evacuation planning, Shelter availability and facilities, Evacuation routes, Early warning systems, and Emergency response.

### Spatial Planning

The development of a region is closely related to either sustainable or unsustainable spatial planning. Spatial planning has emerged as an important instrument for achieving sustainable development and enhancing quality of life. The attention to disaster risk reduction in spatial planning, however, has increased over recent decades due to more frequent occurrences of natural hazard events. As well as a new approach, the notions of urban resilience and resilient planning have gained increasing attention and interest over recent years in the fields of environmental management and urban planning. Concepts such as mitigation, adaptation and resilience have become more prominent in the light of these developments, as they have much to do with preventing disaster risk and climate-related disturbances. Six indicators were used to determine the influence of disaster-based spatial planning on community resilience. The indicators that were used in ICCR include: Availability of signboards; Reachable shelters; Availability of risk maps; Mitigation infrastructure; Spatial regulation; Negative land use change.

### 25.4.2 The ICCR Index

All the factors and its indicators carry an equal weight. The calculation of the contribution and role of each factor is based on the equation below:

ICCR index of social, cultural and economic capital (SCE) to the total maximum SCE data = Eq. 1.:

$$\frac{\text{total\%questionnaire data of SCE}}{\text{total of \% maximum questionnaire data of SCE}} \tag{1}$$

ICCR index of disaster risk governance (DRG) to the total maximum DRG data = Eq 2.:

$$\frac{\text{total\%questionnaire data of DRG}}{\text{total of \% maximum questionnaire data of DRG}} \tag{2}$$

**Table 25.1** The integrated concept to strengthen community resilience (ICCR) index

Range	Resilience
0–30	Low
30–60	Medium
60–100	High

ICCR index of disaster-based spatial planning (DBSP) to the total maximum DBSP data = Eq 3.

$$\frac{\text{total\%questionnaire data of DBSP}}{\text{total of \% maximum questionnaire data of DBSP}} \tag{3}$$

The range of the ICCR index is shown in Table 25.1.

## 25.5 Findings and Discussions

### 25.5.1 The ICCR Framework

#### 25.5.1.1 Internal Factors

##### Socio-Economic and Cultural Capital

Yogyakarta has experienced a number of earthquakes before but these events were not as powerful as the Bantul earthquake on 27 May 2006, which killed about 6000 people. The generation that grew up at this time had relatively little experience of earthquakes, so they lacked earthquake preparedness and knowledge. The people in Bantul only have the knowledge of the aftermath of the quake. Focus group discussions indicated that only some people in Bantul had ever participated in capacity building exercises from the local disaster management, therefore they had a more appropriate response during the earthquake. On the other hand, in Sleman, the questionnaire data (Fig. 25.6) shows that many people have hazard knowledge and experience because Mt. Merapi erupts frequently and often for more than 3 months at a time. There are 15 indicators that are used to measure community resilience in Sleman and Bantul (Fig. 25.4).

The questionnaire data also shows that the majority of people in Sleman were evacuated before the eruption to shelters provided by the local government, so they could get out of harm’s way. This evidently shows that local disaster management in Sleman demonstrates more preparedness because Mt. Merapi erupts frequently. On the other hand, in Bantul the majority of people did not show a proper response except the people that participated in disaster socialization. Generally, people were evacuated after the earthquake event.

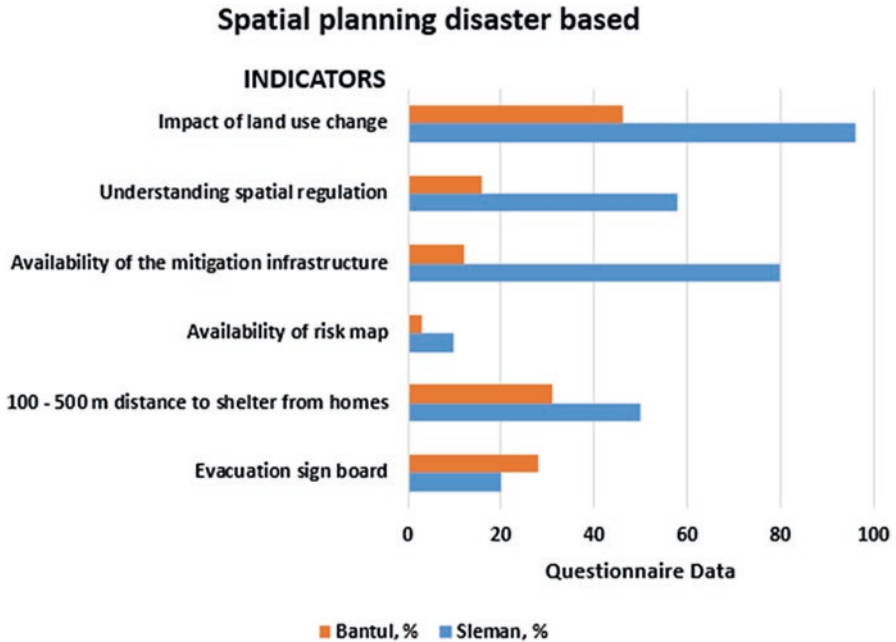


Fig. 25.4 Survey results of spatial planning

The earthquake destroyed quite a lot of homes and other buildings in Bantul. However, only a few homes were damaged in Sleman. Because, the local government provided the evacuation shelter before the eruption, many people in Sleman were evacuated. In Bantul, however, there were no evacuation shelters provided and people were evacuated after the disaster instead. Compared with the community in Bantul, most people in Sleman recovered from the disaster more quickly, whereas in Bantul the recovering processes took more time, in particular the recovery time for damaged buildings or homes. Essentially, the faster people recover from risk the more resilient they are considered to be.

The availability of disaster regulation and DRR law, which is issued by the national or local disaster management agency, is a vital part of disaster management to protect the community against disaster impacts. The survey showed that in Sleman and Bantul the disaster management agency had issued the regulation or DRR law, however, most people was not aware.

Understanding or experiences of the natural hazard potential and its intensity may strengthen resilience. This knowledge can be obtained by local experience or from informal or formal education. In 2010, Sleman Regency was again affected by Mt. Merapi, which erupted and killed 242 people (BAPPENAS 2011) and in 2006, Bantul Regency suffered earthquakes that killed about 6000 people (World Bank 2006). The survey showed that the people in Bantul had a lack of understanding of natural hazards compared to the people in Sleman region. The long history of Mt. Merapi’s eruptions can be used by the people as a lesson to improve their hazard

preparedness and awareness. Whereas people in Bantul had never experienced earthquakes before, consequently their preparedness and resilience were lower. From this point of view it can be considered that the people in Sleman are more prepared for the next disaster. However, the experiences of the earthquake disaster are an important education for the people in Bantul which can be used to increase their preparedness and awareness, for example, of the need to improve building quality and construction.

Based on the questionnaire results, it is shown that disaster dissemination had been given in Sleman before disasters, however, based on the FGDs in Bantul, disaster dissemination was given consistently after the earthquake event in 2006, in anticipation of the next earthquake disaster. Disaster dissemination can be an important indicator for good disaster risk governance.

Aid after a disaster will speed up the recovery stage, and by extension may strengthen community resilience. Survey results showed that the risk governance system in Sleman and Bantul has been running well in providing assistance to the people affected by the Mt. Merapi eruption and earthquake disasters. Based on the indicators developed in the ICCR it can be seen that people in Sleman are more resilient to natural disasters compared to communities in Bantul. However, the overall result of the application of the ICCR to Sleman and Bantul showed that community resilience in both areas is categorized as 'moderate'.

### **25.5.1.2 External Factors**

#### **Risk Governance**

There are 13 detailed indicators which are used to determine the influence of risk governance on community resilience in Sleman and Bantul (Fig. 25.5). The questionnaire data showed that not many people in Sleman and Bantul understand DRR regulation, including the 2007 Disaster Risk Reduction Law No. 24, and fewer people understood the village level contingency planning but many understood the local level contingency planning. A lot of respondents know of disaster dissemination events but only some respondents, less than half of the people in Sleman and Bantul, participated in this socialization. This could be because only a few people are aware of the natural hazards that threaten them or consider disaster dissemination a waste of time. Alternatively, disaster dissemination was too rarely carried out by the local disaster management for enough to participate.

Disaster dissemination involves providing knowledge to the public to understand the natural hazards and how to reduce associated risks. The introduction of vulnerabilities, risks and evacuation methods are some of the subjects that are very important in the dissemination. However, the dilemmas encountered in the disaster risk governance system could have caused a difference perception in assessing the potential risk of a disaster, such as the risk intensity, between communities and local and national disaster risk management. To address the issues, risk perception needs to be delivered with a balanced point of view based on how information on the

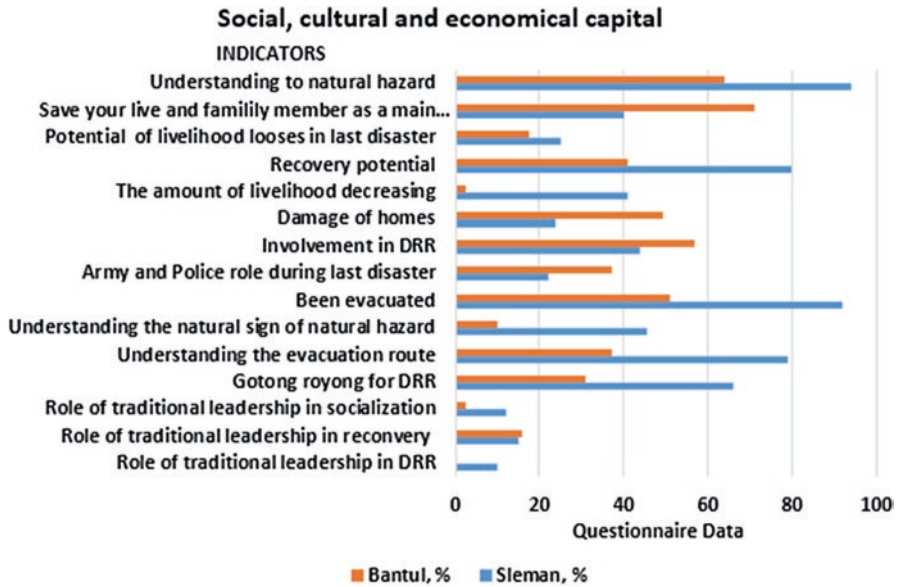


Fig. 25.5 Survey results for social, economic and cultural capital

source of risk is communicated in the risk management system as well as with the communities, at the beginning of the hazard with uncertainty processes. Risks need to be perceived by the general public. The main focus should place risk on the cognitive and affective aspects of the perception process.

### Spatial Planning

Household questionnaire data on spatial planning (Fig. 25.6) shows that the impact of land use change on community resilience in Sleman is almost 100%, whereas in Bantul it is about 43%. It goes to show that land use change in Sleman is more intensive, which tends to decrease community resilience. For example, deforestation that occurred in Sleman has tended to increase societal vulnerability. The field observation in Sleman indicated that many areas were built for the sake of the tourism sector. Deforestation also affected the path of hot and cold lava flows, particularly if rain intensity is high, and could represent a secondary hazard for the people in Sleman. Land use change may have a positive or negative impact depending on its effect on a community. To be a positive impact, land use change needs to be based on sustainable development that gives more priority to social and environmental factors, not only to economic consideration. Land use changes that have a positive impact on the environment may reduce community vulnerability to disasters and strengthen community resilience. In this questionnaire, data of negative land use change were collected.

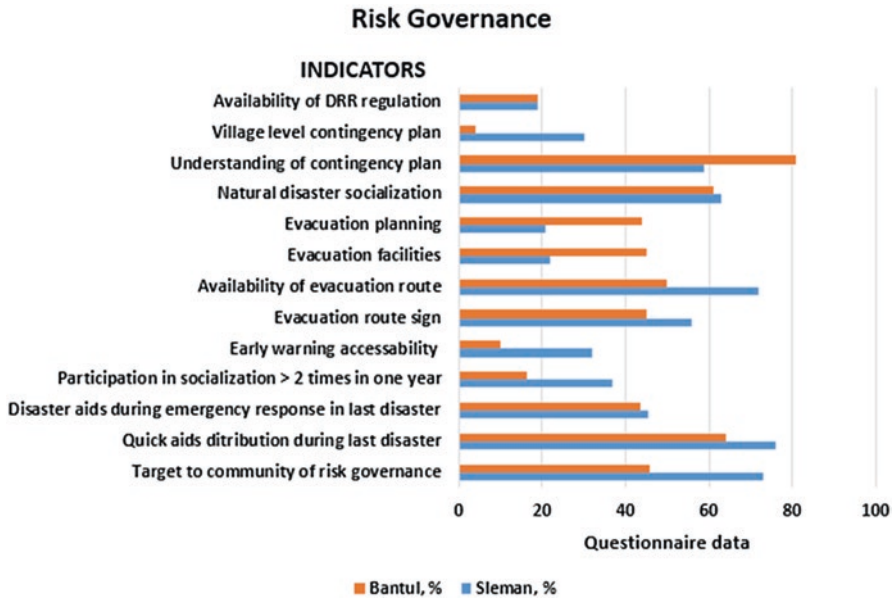


Fig. 25.6 Survey results of risk governance

The section of the household survey that dealt with spatial planning (Fig. 25.6) shows that more people understand the spatial regulations in Sleman compared to Bantul. Others indicators showed that mitigation infrastructures are more available in Sleman rather than in Bantul. The local government of Yogyakarta has long built dams as infrastructure to mitigate the volcanic hazard which was built to anticipate the lava flow. Local disaster management has already published the risk maps of associated Mt. Merapi hazards. However, infrequent socialization has resulted in many respondents not understanding the risk map. More shelters were built in Sleman because the length of preparedness time grants this. The field observation showed that many evacuation roads and signboards were available in Sleman. However, fewer evacuation signboards were installed in the Bantul area.

Many efforts have been made by local disaster risk management in Sleman, for instance, the local disaster risk management agency (BPBD) in Sleman has proposed paying more attention to educational factors of the hazard refugees by establishing a sister school which can help each other during emergency as contingency planning. Increasing community awareness to Mt. Merapi's hazards and secondary hazards is also a main priority program of local disaster management. The problems recorded in the focus groups discussions indicated that although their awareness is relatively high, community preparedness was still low.



**Table 25.2** The integrated concept to strengthen community resilience (ICCR) index of Sleman and Bantul

Indicators	ICCR Index	
	Sleman	Bantul
Social, cultural and economic capital (SCE)	43.3 (medium resilience)	35.2 (medium resilience)
Disaster Risk Governance (DRG)	43.25 (medium resilience)	37.7 (medium resilience)
Disaster-Based Spatial Planning (DBSP)	36.3 (medium resilience)	15 (low resilience)

### 25.5.2 *The ICCR Index Results*

Resilience is calculated based on the indicators by using Eqs. 1, 2 and 3 (Table 25.2).

Based on all the indicators, the overall result of the resilience criteria in the ICCR in Sleman and Bantul is 'moderate' resilience, except for spatial planning in Bantul which is low.

The ICCR index (see Table 25.2) of social, economic and cultural capital in Sleman is 43, whereas in Bantul it is 35.2. Therefore, there are still opportunities to improve community resilience against disasters in Sleman and Bantul by strengthening social, economic and cultural capital. In particular, community resilience can be strengthened by increasing people's participation in disaster risk reduction (DRR) activities and utilizing traditional cultural factors in the face of natural disaster risks.

The ICCR index for risk governance in Sleman is 43.25 and in Bantul 37.7. Therefore, the role of risk governance systems needs to be improved in order to strengthen community resilience in both Sleman and Bantul.

The questionnaire data also shows that in Sleman the disaster-based spatial planning index is 36.3 while in Bantul it is as low as 15. The role of spatial planning towards community resilience in Sleman is greatly influenced by the land use change indicator, which gives a negative impact on community resilience. Whilst in Bantul almost all indicators show that the contribution of spatial planning to community resilience is low.

The main problem in strengthening community resilience in Indonesia is finding ways to increase public participation and private institutions in the effort of disaster risk reduction. In addition, the coordination between stakeholders involved in disaster risk reduction and the implementation of sustainable development programs should also be improved, therefore ensuring the effective running of disaster risk reduction management. The overall result of the ICCR showed that community resilience in Sleman and Bantul is still moderate. To become more resilient it is necessary to intensively empower the social, economic and cultural capital of the community. Also, disaster risk governance should be improved by building on the capacity and the quantity of human resources in the management. Other tasks include the need to need to implement sustainable development planning nationally and locally so that spatial planning is in line with the consideration of disasters.

## 25.6 Conclusion

Community resilience against natural hazards in Indonesia is not only influenced by internal factors such as vulnerability or capacity but also by external factors, in this case, the system of risk governance and disaster-based spatial planning. Internal factors consisted of social, cultural and economic dimensions, which can trigger people's vulnerability or capacity. Cultural heritage, which is found in many societies in Indonesia, plays an important role in strengthening resilience against natural disasters. While external factors are influenced by the system of risk governance and disaster-based spatial planning, they can have either a positive or negative impact on resilience. If they have a positive impact, therefore, it may contribute an enabling factor to the community to anticipate disaster impacts. However if they have a negative impact, it may create constraining factors that increase vulnerability or reduce capacity.

Therefore the integrated community resilience concept (ICCR) is purposed to combine all these four factors that influence people's resilience. The system of risk governance is significant because risk governance in Indonesia is a relatively new achievement with a limitation in terms of the quality and quantity of human resources, whereas disaster-based spatial planning is significant because many areas in Indonesia are prone to natural hazards, and many development programs are still focused on economic consideration and pay little attention to social and environment factors. Yogyakarta Province was chosen to test this concept in selected communities in Sleman and Bantul Regencies, which were threatened respectively by a volcanic eruption in 2010 and earthquakes in 2006. This study shows that the ICCR can be used to measure and build people's resilience in Indonesia against multiple hazards and can be implemented widely either by local or national disaster management to increase community resilience. The resilience index of Sleman and Bantul was found to be moderate, except for spatial planning in Bantul, which was low.

## Appendix

QUESTIONNAIRE: INTEGRATED RESILIENCE SURVEY AGAINST  
NATURAL DISASTER, 2015

CONFIDENTIAL

Indonesian Institute of Sciences (LIPI)

I. LOCATION IDENTIFICATION		
01. Number:		<input type="text"/> <input type="text"/> <input type="text"/>
02. Regency	1. Sleman      2. Bantul	<input type="text"/>
03. District		<input type="text"/>
04. Villages		<input type="text"/> <input type="text"/>
05. Sub-villages		
06. RW/RT, Home No.		
07. Address	1. Shelter	<input type="text"/>
	2. Family homes	
	3. Own homes	
	4. Others	
Respondent identity		
1. Name:		6. Education of respondent
2. Age: year	3. Gender:	Never go to school      1
	Male                      1	Not finish primary school      2
	Female                      2	Finished primary school      3
		Senior High School      4
		Junior High School      5
University      6		
4. Status in the household	5. Number of household member	11. Total number of household income
Head of household      1	Male                      : .....	Rp .....
Wife/Husband      2	Female                      : .....	
Son/daughter/in law      3	Total                      : .....	
Other family      4		
7. Typical of household head main job:	8. The main job income in a month	
	Rp .....	
9. Secondary job of household heads:	10. Secondary job income of household head in a month:	
	Rp.....	
INTERVIEWER IDENTITY		
01. Name: .....	03. Examiner: .....	
02. Date of interview: .....	04. Date of examine: .....	

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**A. SOCIAL, CULTURE AND ECONOMIC CAPITAL**


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1	Do you know that your places are prone to natural hazard?	8	Did army or police role in rescue program significance during disaster?
	a. Yes		a. Yes
	b. No		b. No
2	Was your livelihood decreases in last disaster?	9	Did you evacuate during last disaster?
	a. Yes		a. Yes
	b. No		b. No
3	Was your home damage in time of last disaster	10	Did you understand of natural sign of disaster?
	a. Yes		a. Yes
	b. No		b. No
4	Did you ever experience natural disaster in your place in last five years?	11	Did you involved in <i>gotong royong</i> program in particular for DRR?
	a. Ever		a. Always
	b. Never		b. Never
5	Did you save your family as a main priority response?	12	Were there traditional leadership role in DRR in your village?
	a. Yes		a. Yes
	b. No		b. No
6	Effort to find a new livelihood (recovery potential)	13	Were there traditional leadership role in recovery stage?
	a. Yes		a. Strong
	b. No		b. Weak
7	Did you involved in DRR effort in your village?	14	Were there traditional leadership role in disaster socialisation?
	a. Yes		a. Strong
	b. No		b. Weak

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**B. RISK GOVERNANCE**


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15	Were there DRR regulations in your village?	22	Do you know the route to evacuation place?
	a. Yes		a. Available
	b. No		b. Unavailable
16	Were there village level contingency planning?	23	Did you see the evacuation sign in your village?
	a. Available		a. Available
	b. Unavailable		b. Unavailable
17	Do you understand the meaning of contingency plan	24	Could you access the early warning before disaster?
	a. Yes		a. Available
	b. No		b. Unavailable

---

B. RISK GOVERNANCE			
18	Did you participate in natural disaster socialization?	25	Do you think the early warning systems are available in your village?
	a. Available		a. Yes
	b. Unavailable		b. No
19	Did you know about evacuation planning during disaster?	26	Did you participate in disaster socialization with > 2 times in one year?
	a. Yes		a. Yes
	b. No		b. No.
20	What is your opinion about the facilities for evacuation place?	27	Were there available disaster aids during emergency response in last disaster?
	a. Available		a. Yes
	b. Unavailable		b. No
21	What was your opinion regarding the speed of aids distribution during last disaster?	28	What was your opinion the target of risk governance direct to community?
	a. Good enough		a. Good enough
	b. No		b. No

C. SPATIAL PLANNING DISASTER BASED			
29	Did you see the evacuation sign board in your village?	32	Do you know the availability of mitigation infrastructures in your village?
	a. Yes		a. Yes
	b. No		b. No
30	Were the evacuation shelter reachable (100–500 m) from your home?	33	Do you understand the spatial regulation in your village?
	a. Yes		a. Yes
	b. No		b. No
31	Do you know the availability of disaster risk map in your environment?	34	Did you thing there were the negative impact of land use change in your village?
	a. Yes		a. Yes
	b. No		b. No

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