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 hydrometerological and geophysical hazards. Hydrometerological 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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R. Djalante et al. (eds.), *Disaster Risk Reduction in Indonesia*, Disaster Risk Reduction, DOI 10.1007/978-3-319-54466-3_2

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; Surono 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 interlinkages 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

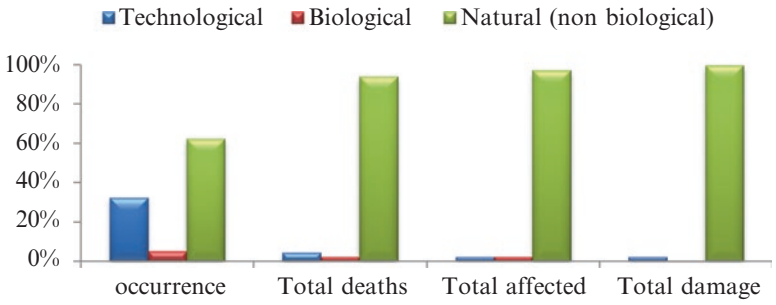

Fig. 2.1 Comparison of number and impacts of technological, biological, hydro-meteorological and geophysical disasters in Indonesia (EM-DAT 2016)

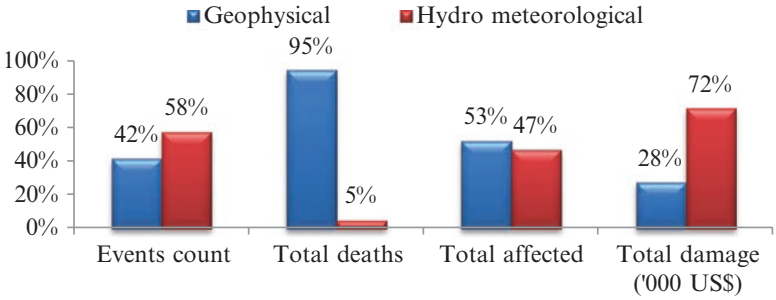

Fig. 2.2 Number and impacts of disasters caused by geophysical and hydro-meteorological hazards in Indonesia (Modified from EM-DAT 2016)

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
Total		429	237,578	29,011,349	29,260,308

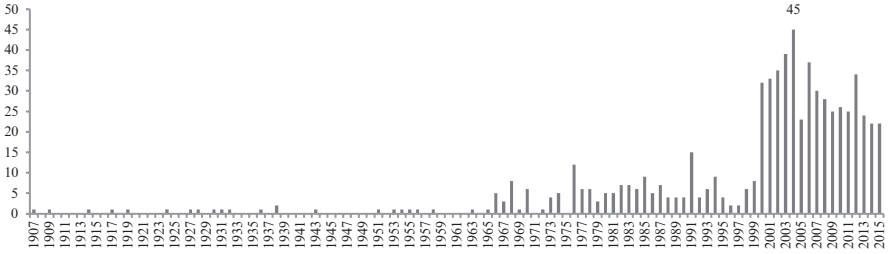

Fig. 2.3 Number of disasters in Indonesia from 1907 to 2015 (EM-DAT 2016)

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

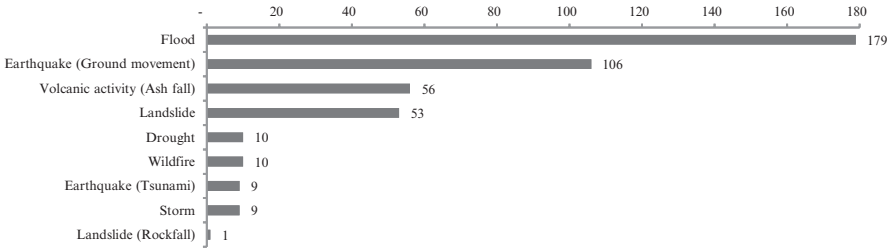

Fig. 2.4 Number of different types of disasters in Indonesia from 1900 to 2015 (EM-DAT 2016)

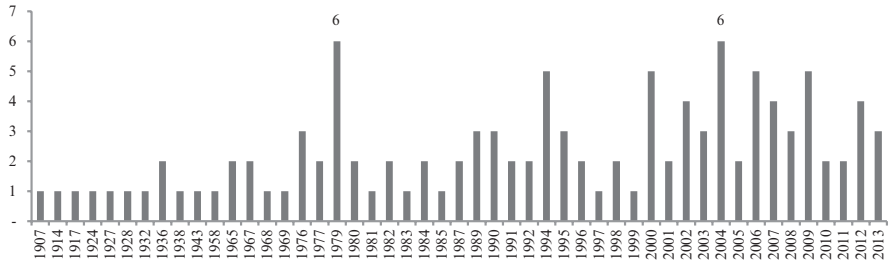

Fig. 2.5 Number of flood disasters in Indonesia from 1907 to 2015 (EM-DAT 2016)

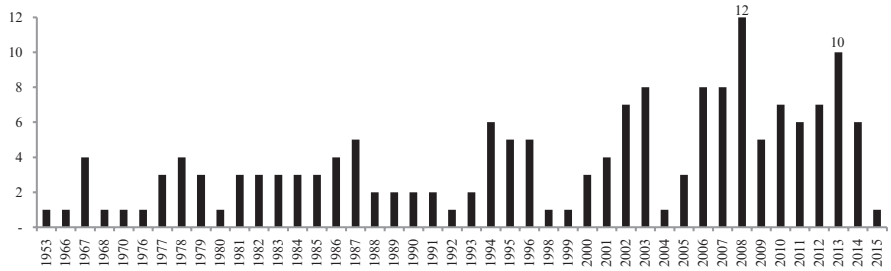

Fig. 2.6 Number of earthquake disasters in Indonesia from 1953 to 2015 (EM-DAT 2016)

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

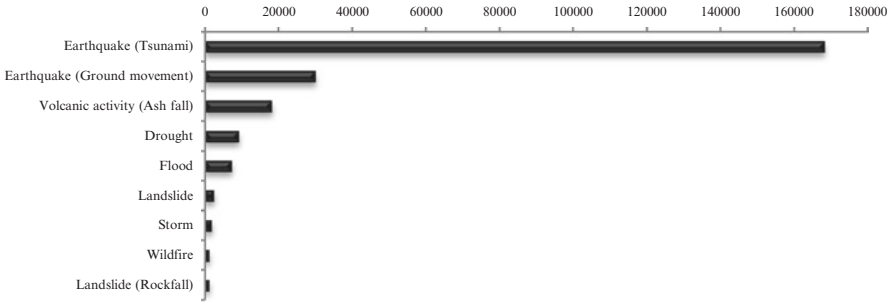

Fig. 2.7 Number of total deaths caused by disasters disaggregated by types between 1900 and 2015 (EM-DAT 2016)

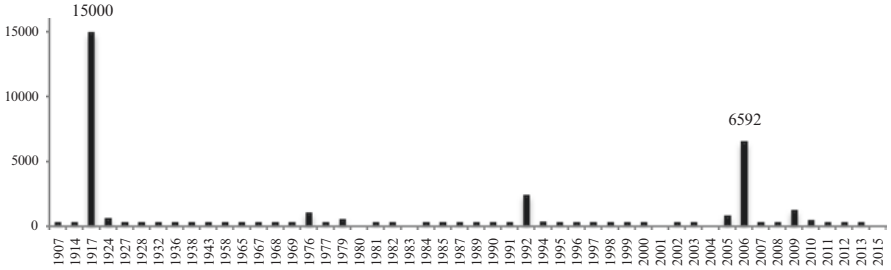

Fig. 2.8 Number of people killed by disasters in Indonesia per year, without the 2004 tsunami (EM-DAT 2016)

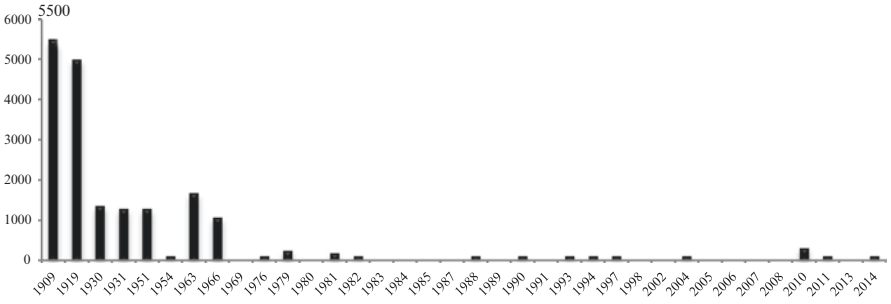

Fig. 2.9 Number of people killed by volcanic activity in Indonesia per year from 1900 to 2015 (EM-DAT 2016)

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).

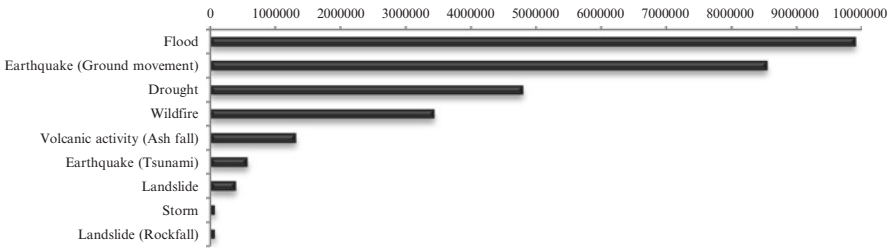

Fig. 2.10 Total number of people affected by different types of disasters in Indonesia from 1900 to 2015 (EM-DAT 2016)

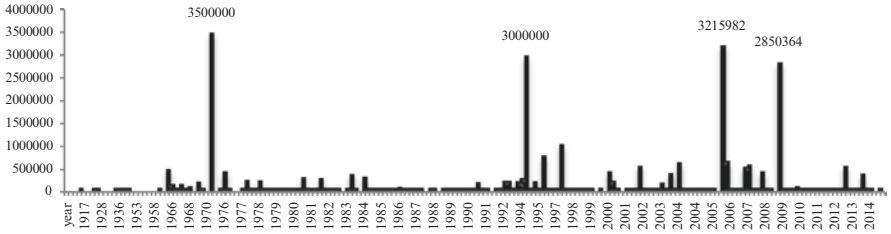

Fig. 2.11 Number of people affected due to disasters per year in Indonesia from 1900 to 2015 (EM-DAT 2016)

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.

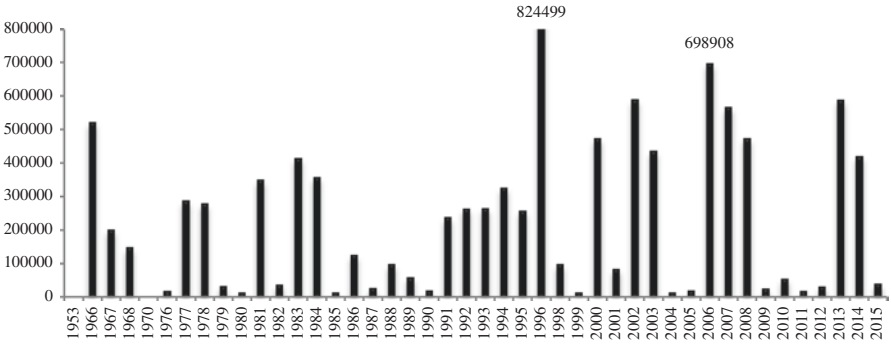

Fig. 2.12 Number of people affected by floods per year from 1953 to 2015 (EM-DAT 2016)

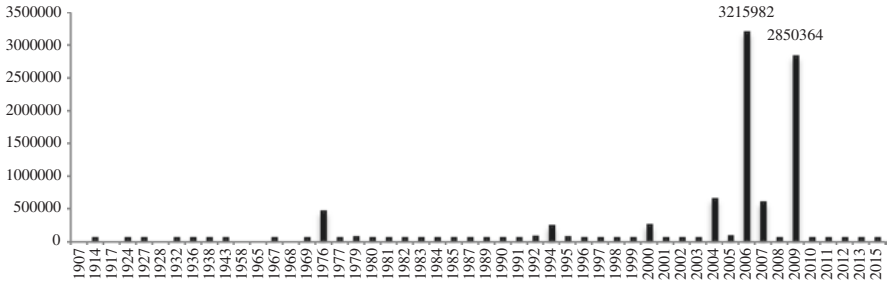

Fig. 2.13 Number of people affected by earthquakes per year from 1900 to 2015 (EM-DAT 2016)

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).

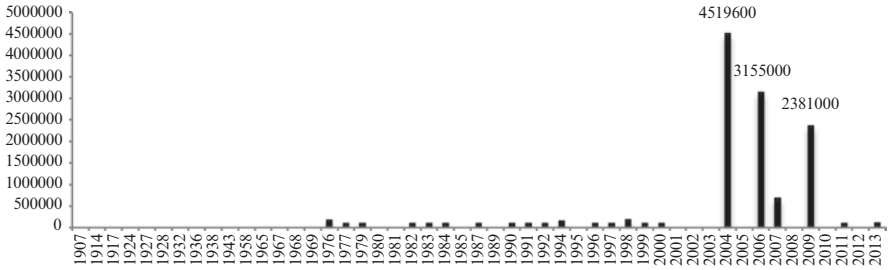

Fig. 2.14 Amount of damage caused by disasters per year in Indonesia from 1900 to 2015 (EM-DAT 2016)

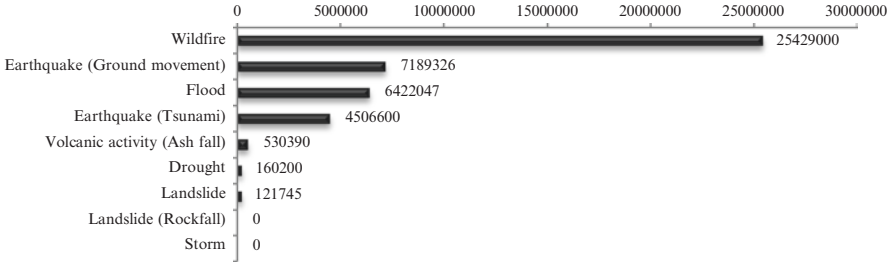

Fig. 2.15 Total damage caused by different types of disasters from 1900 to 2015 in Indonesia, in USD (EM-DAT 2016)

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.

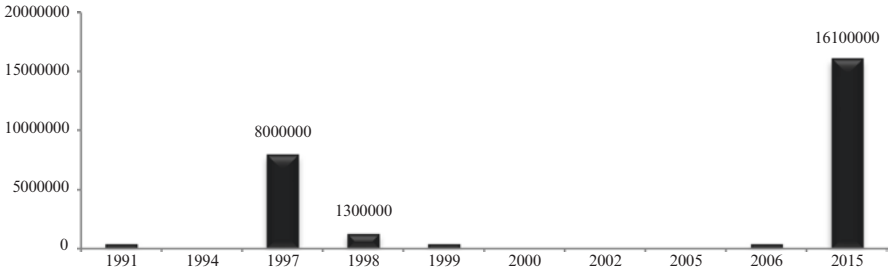

Fig. 2.16 Total annual damage caused by forest and wildfires in Indonesia from 1990 to 2015 (EM-DAT 2016)

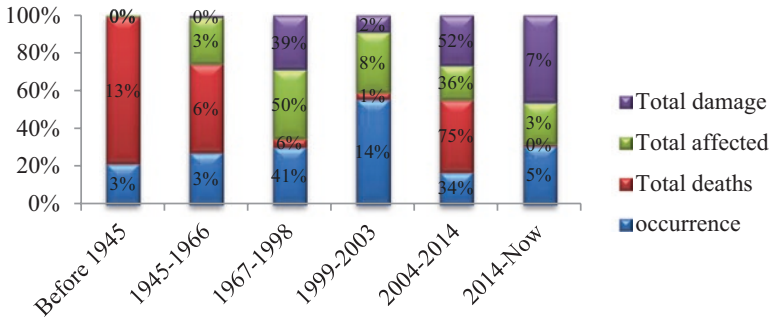

Fig. 2.17 Percentage of occurrences and impacts of disasters in six different periods in Indonesia from 1990 to 2015 (EM-DAT 2016) (The values are to be added horizontally within the same color/category)

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; Kandlbauer 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-nineteeth 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			*Regeling op de Staat van Oorlog en van Beleg* (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 */Badan Keluarga Korban Perang)*
	1946			Law 16/1946 on emergency situation (*Keadaan Bahaya)*
	1957			Law 74/1957 on emergency situation (*Keadaan Bahaya)*
	1959			Perppu 23/1959 on emergency situation /*Keadaan Bahaya*

	03–01-1963	Mount Agung eruption (Bali)	Deaths 1584	
	1966	Java and Lombok drought	Deaths 8000	The national board for natural disaster management (BP2BAP/*Badan Pertimbangan Penanggulangan Bencana Alam Pusat)*
	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 National 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/*Badan Koordinasi Nasional Penanggulangan Bencana*
				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 PBP/*Badan Koordinasi Nasional Penanggulangan Bencana and penanganan pengungsi*)
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/*Badan Koordinasi Nasional Penanggulangan Bencana*)
				Indonesia tsunami rehabilitation and reconstruction board (BRR/*Badan Rehabilitasi dan Rekonstruksi)*
	2005			World conference on disaster reduction (WCDR)
				Hyogo framework for action 2005–2015 (HFA)
				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
	22-12-2006	Flood all over Indonesia	Total affected 618,486	National disaster management Agency (BNPB) BPBD at the provinces and local governments formed
	2007	Highest number of people affected by disaster in 1 year (mostly due to flood)	More than 4.7 million people affected	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
	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 (*Renas PB*) 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
	2012			AMCDRR in Yogyakarta
	17-01-2013	Jakarta flood	Damages USD 3,000,000	Jakarta Governor Joko Widodo (2012–2014)
2014–2016: managing urban risks, climate change and achieving sustainable development	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
	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 *(Karhutla/ Kebarakaran Hutan dan Lahan)* 6 Provinces in Kalimantan and Sumatra were declared at state of haze emergency
	2015			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, coincidently 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_2 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.

Acknowledgment Riyanti Djalante receives an Alexander von Humboldt Fellowship for Experienced Researchers which facilitates her research in Germany at the United Nations University Institute of Environment and Human Security. In Indonesia, she is affiliated with the Local Government of Kendari city and the University of Halu Oleo.

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	

EM-DAT (2016b)

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