Policy Interventions for Resilience and Adaptive Cities

Rajib Shaw

Abstract Policy interventions for resilience and adaptation at the local government level is challenging for many reasons, like national policy making scheme in most cases, lack of resources, changes in risk landscape, etc. One of the key issues in recent years is the emergence of new risks such as global pandemic, digital divide and digital power concentration, energy crisis, food prices, etc. These makes deeper impacts on the existing risk landscape where disasters, extreme events, climate inactions, biodiversity losses are prominent risks in terms of likelihoods and impacts. There are different tools available for measuring resilience in the urban areas, one of them is the CDRI (Climate Disaster Resilience Index), which consists of physical, social, economic, institutional, and natural dimensions of resilience. In an increasingly complex urban area, systemic risk approach becomes more pertinent to understand the interlinkages of different systems related to urban resilience. Ten specific policy measures are suggested in this chapter: (1) Implementing RCES: resource utilization and ensuring urban rural connectivity, (2) Conducting risk assessment in terms of systemic risks, (3) Developing citizen governance interface: utilizing citizen science, (4) Supporting open data and open governance, (5) Enhancing science based adaptive governance, (6) Promoting Local Production and Consumption, (7) Using HEDRM as a common tool to enhance healthy city, (8) Enhancing 1.5 deg. lifestyle, (9) Implementing Digital *Den-en-Toshi* and ensuring digital human resource, and (10) Utilizing Disruptive technologies and Society 5.0. To implement these policies, specific entry points and change agents needs to be identified.

Keywords Resilient and adaptive cities · Systemic risk · Global risk landscape · Adaptive governance · Change Agents

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1 Introduction

Policy interventions at the local government level is challenging for many reasons. Firstly, the policies mostly are formed at the national level, and local governments are mostly implementers of those policies. Secondly, most of the local governments (except the capital cities or large business hubs) are constrained with different types of resources, including financial, human, technological, etc. Thirdly, the risk landscape changes drastically over time, and it is always a challenge for the local governments to cope with the evolving nature of the risk landscape. However, in spite of these challenges, many local governments have made significant efforts in progressive policy making for resilience building and local adaptation.

As many of us are aware that in 2015, the world has witnessed several major global frameworks, named Sustainable Development Goals (SDGs), Paris Agreement on Climate Change and Sendai Framework for Disaster Risk Reduction (SFDRR). All these three frameworks have the same time frame from 2015 to 2030. An analysis of these three frameworks (Shaw et al. 2016) shows that the word "local" has been used extensively in all the three frameworks. "Local" is used in terms of local community, local government, local culture, local tradition, local adaptation, local materials, etc. The analysis has correctly pointed out that to make the global framework effective, local governance, local actions, and local leadership are extremely important.

In this short chapter, at first, a few issues and concepts are introduced, like global risk landscape, resilient and adaptive cities, and systemic risk approach. After that, ten specific policy measures are suggested for making cities resilient, adaptive, and sustainable.

2 Global Risk Landscape

World Economic Forum (WEF) publishes Global Risk Outlook in every year in January during the Davos Meeting. The analysis provides previous year's major risks and future potential risk. The report of 2020 (GRO 2020) shows that that environmental risk (like disaster, climate change, biodiversity losses) prevails the risk landscape globally in terms of likelihood and impacts (Fig. 1). The same analysis in 2021 (GRO 2021) puts infectious disease as one of the major risks in terms of impacts due to the impact of COVID-19 in the year 2020. However, there are two new risks arises, which are digital inequality and digital power concentration. In the year 2020, we have changed our lifestyle to work from home, and changed to digital education, digital health care, etc. However, the world does not have equal digital connectivity. There has been a north south divide in digital equality, and the impacts have been high in the rural areas, especially in developing countries. Even in developed countries, the impact is found in the age groups, where the older age groups have limited digital access, especially in the rural areas. This

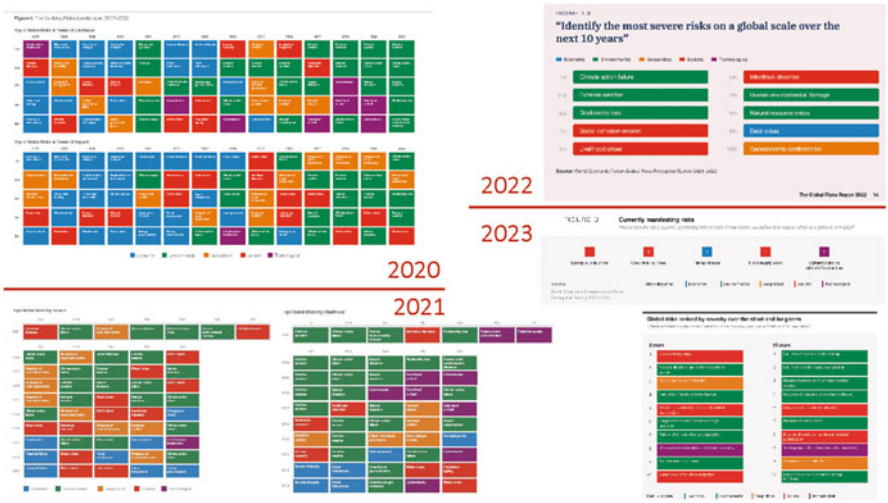

Fig. 1 Global risk landscape from 2020 to 20203

inequality has posed the challenge to access different services, and thereby is considered as a new risk.

In 2022 (GRO 2022), the same digital inequality has continued, while environmental risks have predominated other risks in spite of COVID-19 impacts, and infectious disease did not make its mark that strongly like the previous year. However, cyber security has become a new risk, while the world has been moving towards more digital services, including digital/online shopping and payment services. In 2023 (GRO 2023), the top two risks were energy crisis and cost of living, which are attributed to the Russia Ukraine war, which erupted in February 2022. Therefore, within 3 years, the global risk landscape changed drastically, with new risks such as infectious disease, digital inequality, cyber security, energy crisis, cost of living, etc. These were not perceived as major risks otherwise. The point here is that in an inter-connected world, we need to be cautious about the complex risk landscape, which changes dynamically. Although we focus on the resilience and adaptation in cities or local governments, the inter-connected nature of risks and dependency of Japanese cities and local governments to the global risk landscape, it is important to understand, analyze it, and take lessons for future preparedness.

3 Resilient and Adaptive Cities

Resilient and adaptive terms are two sides of the same coin and are closely interlinked. The more a city becomes resilient, more it becomes adaptive. Urban resilience has been a research area for many years, and there have been many ways to define urban resilience. A holistic analysis of resilience is shown by Shaw (2011). As

Fig. 2 Urban resilience assessment tool (dimension and parameters)

per the analysis, urban resilience is divided into five dimensions: physical, social, economic, environmental, and institutional. Each of these dimensions are divided into five parameters, and each parameter into five indicators. Thus, there are a total of 125 (5 × 5 × 5) indicators on which the data is collected. Figure 2 shows the details of each dimension. Physical resilience is divided into electricity, water, sanitation/solid waste, roads and housing/land use, etc. Electricity has status of interruption, % of city dwellers having legal access to electricity (a critical factor for developing country's cities), self-sufficiency of electricity production in city, back up service, and alternate energy sources, etc. Similar approach is done for other physical resilience parameters also, as well as for other dimensions. The key aspect of this analytical tool is to de-segregate the resilience concept to city services, so that the based on the analysis, the city officials can make their short-, medium-, and long-term plans. In most cases the cities were asked to develop their action plan and get it approved by the city senate so that the specific fund can be used for undertaking specific measures to enhance the resilience of the parameters, which are relatively lower and which gets priority in the plans.

One of the key aspects of resilience and adaptation is that the context of urban areas changes constantly. Therefore, the resilience assessment and adaptation pathways need to be continuedly updated. Thus, we recommend periodic resilience assessment using the same indicators and measure the progress of the adaptive measures. Due to climate change and related impacts, sometimes the natural resilience becomes lower since it factors severity and frequency of hazards. The physical resilience may increase with investment in the infrastructure development, but the social resilience may vary depending on the nature of population. Analysis shows that in some cities the key strength is the physical resilience, and for some other cities, it may be institutional or social resilience (Metro Manila 2010). Also, it is suggested to do the sub-city analysis where spatial variation of city's resilience can be understood, which may change periodically. Sub-city analysis (Bandung 2012) gives the local governments a better picture of the city's risk and resilience (both negative side and strength) and undertake adaptive measures.

The Asia chapter of recent IPCC report (Shaw et al. 2022) suggests that Asian cities will be exposed to increasing extreme temperatures and heatwaves, which may have adverse impacts on the health of the vulnerable population like aged population, children, pregnant mothers, etc. Similarly, the cities will also be exposed to droughts, leading to water scarcity and longer dry days, as well as extreme precipitation (short duration, heavy precipitation), which may trigger major flooding. Coastal cities are already exposed to sea level rise, which may be enhanced in due course. Tropical storms (typhoons in East and Southeast Asia, and cyclones in south Asia) will be intensified, and we will possibly see more severe storms in near future. The analysis suggests development of resilient infrastructures (like power, water, built infra, etc.) as well as focusing on nature-based solutions, which may be helpful to reduce the impacts heat waves in longer term. A combination of gray and green infrastructure policy is required for the optimum balance for urban adaptation measures.

4 Systemic Risk Approach

Systemic risk is a common framework used in the financial sectors, especially to evaluate the inter-linkages with other sectors. In recent years, several reports mention about the importance of systemic risk in disaster and climate change issues (GAR 2019, 2022). In an increasingly globalized world, we are getting strongly connected than ever before. There are different levels of connectivity. Urban rural areas connected with different resources such as food, energy, water, human resources, etc. Countries are connected with diplomatic relations, human resources, businesses, and many different systems such as education, healthcare, etc. (Mitra and Shaw 2022). Information and information technology brings another level of connectivity to all of us. Thus, where it is physical or virtual connectivity, a disruption in one system in one place affects a wider global system. And that is the concept of systemic risk. Therefore, to develop a resilient city, we need to strongly focus on different urban systems and its interdependence in terms of food system, water system, energy system, transport system, human resource system, etc. The supply chain and business continuity are core to avoid un-disrupted services during a shock or stress. Depending on the scale of shocks or stresses (i.e., how big a disaster event is and how long it continues for a stress event), it is important to customize the business continuity planning and resource management. Systemic risk approach provides a unique pathway to address different systems collectively and enhance the urban resilience during a major event.

5 Specific Policy Measures

Following section provides ten specific policy measures which help in conceptualizing resilient and adaptive city in an uncertain world.

5.1 Implementing RCES: Resource Utilization and Ensuring Urban Rural Connectivity

Regional Circular Ecological Sphere (RECS) is a concept proposed by Ministry of Environment of Government of Japan (MOEJ 2018) in its fifth Basic Environmental Plan. Later, it is also called Circular and Ecological Sphere (CES). The concept argues for enhancing plans and policies realizing the resource dependence in urban and rural area (Fig. 3). Three key issues are emphasized: (1) explore simultaneous solutions for economic, regional, and international challenges, (2) Maximize sustainable use of regional resources, and (3) Enriching and strengthening partnerships.

This specifically argues on the benefit sharing mechanism between urban and rural areas for the resource utilization, and the policy should encourage a series of agreements between relevant stakeholders to redistribute the benefits of a healthy watershed equitably so that the resource sustainability and maintaining a quality of life across the region**.**

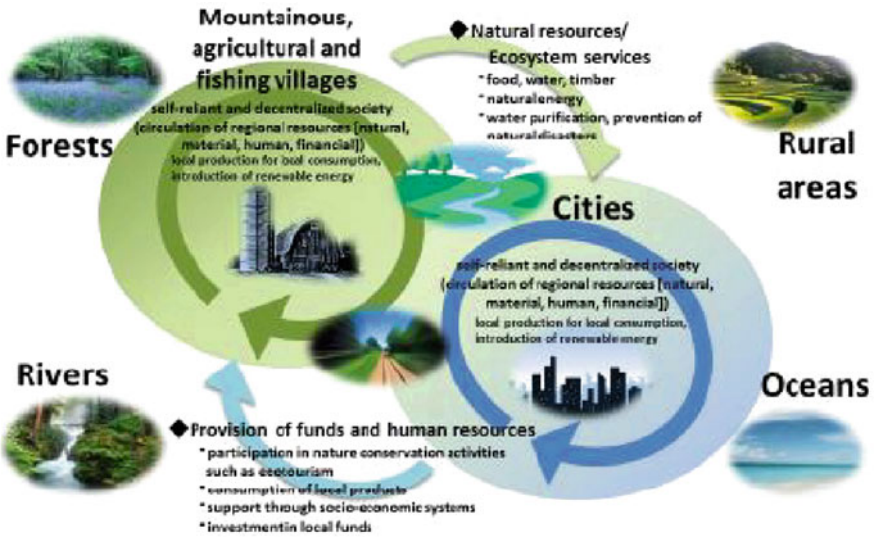

Fig. 3 Concept of RCES (Source: MOEJ 2018)

5.2 Conducting Risk Assessment in Terms of Systemic Risks

As mentioned before, the systemic risk concept is of utmost importance when we think of urban resilience. Systemic risk refers to the risk that the whole system will break down, not just the failure of individual parts. The term "systemic risks" refers to threats that have wide-reaching, cross-sectoral, or even global effects where traditional risk management and even national risk regulation are not enough (Mitra and Shaw 2022). It is critical to make proper risk assessment using systemic risk concept. The recent literature review suggests that there is hardly any tool available for assessing systemic risk in a comprehensive way. The complexity of the issue is a major challenge for developing one comprehensive assessment tool. It is suggested that the urban resilience policy should have some flexibility to allow risk assessment using systemic risk, even it is not holistic. For example, when city makes an assessment for its transport infrastructure, it needs to also take into consideration the impacts of transport failure on supply chain (goods and services) as well as health care systems and livelihood impacts of the people (business interruptions). Similarly, an interruption in the electricity system as a critical infrastructure will have deep impacts on health, education, production, transport, etc. This may not be a perfect or holistic assessment, but semi-quantitative assessment is important to understand the inter-dependency.

5.3 Developing Citizen Governance Interface: Utilizing Citizen Science

Another critical policy challenge is to develop citizen interface of governance through citizen science. Citizen science has becoming popular in the biodiversity systems, and it is now important that we utilize citizen science in the governance system to develop a resilience urban area. In a recent analysis Ozaki and Shaw (2022) have pointed out that one of the vital issues in promoting social participation of citizens could be information sharing. It also describes the cycle which citizens themselves become the main actors in generating information to promote citizen participation, and the information generated through this process leads further enhances a healthy citizen governance interface. Transparency of information sharing is a critical measure of good governance. Therefore, making specific emphasis to create citizen interface is critical for the urban resilience development program.

5.4 Supporting Open Data and Open Governance

Open data and open governance are supplementary processes to enhance citizen-based decision making in the urban area. In a recent analysis, Kanbara and Shaw

(2022) and Kanbara et al. (2022) analyzed the case of Atami landslide, exemplified that open data (here, cloud point data) helped the civic tech professional to conduct the damage assessment within 3–4 h, which was used by provincial government for the decision making in post disaster scenario. This example is a classic positive impact of open data and open governance, which brings effective decision making, as well as involve different stakeholders in providing technical advice to a resource constrained local government. However, to make it implementable, it needs different legal and higher level policy challenges. The countries which are promoting open data and open governance at the national level are prone to get the benefit of this. UNESCO has started a global campaign with different governments to make them understand the importance and benefit of open governance system. The actual global implementation may take some more time, but it is important that local initiatives starts and records success stories and good practices of open data and open governance, while the larger national policy environment for open data/open governance may take some more time.

5.5 Enhancing Science Based Adaptive Governance

In the uncertain world, the conventional scheme of governance does not work. It needs to adjust based on the local changes. While it is difficult to change the national regulations or legislative framework quite often, smaller change/adjustment in the local level is important. This is known as adaptive governance. A classic example was to respond to different types of natural hazards (like typhoon, flood, etc.) during the prolonged period of pandemic. There were adjustments of the evacuation shelter layout, shelter management, volunteer management, etc. These were not in the emergency operation manual of the local governments, and all of these can be considered as adaptive governance. Many of these were ad-hoc decisions taken by the local government during uncertainties based on the advices of the national/prefectural governments or based on the advices of outsider stakeholders like academics or civil societies. The key issue here is how science can be used for adaptive governance at the local level. For that, scenario planning, data science can play important role, which is evident in some cases of pandemic in an early time of 2020 when vaccines were not available or it was rather difficult to understand the nature of the virus. Data science played important role in future projections of COVID-19 peaks and suggested mitigation measures to local governments. Similar use to science based adaptive governance will be useful for making cities resilience and adaptive.

5.6 Promoting Local Production and Consumption

In a globalized world, we often import or export food products from a far distance, where the ecological footprint becomes very high. Local Production and Consumption (LPC) model has been promoted not only to reduce the ecological footprint, but to make cities resilient in case of disruption of services, which is often the case during disasters. For local farmers selling the products in local market brings the cost of the products, as well as farmers get larger profit. The customers also get better and fresh product, close to the farm. Thus, it is a win-win situation for all. However, it is also understandable that a city or urban area cannot produce everything locally. Here, we urge that to make the cities resilient, it is important to make an assessment of the potential of LPC in the cities and make efforts to increase the percentage of LPC. That type of assessment will help the cities to make understanding of its local resilience and prioritize the supply chain which needs to be strengthened.

5.7 Using HEDRM as a Common Tool to Enhance Healthy City

Eco-HEDRM (Health Emergency and Disaster Risk Management) is a framework for Evidence-Based Health Policy (Tashiro and Shaw 2020) from the perspective of human security under SDG 3: Ensure healthy lives and promote well-being for all at all ages. In past different disasters, HEDRM has been used in the recovery process, especially focusing on the larger dimensions of health care services. By larger dimension, it means beyond the conventional health infrastructures like hospitals or health centers and focusing on the community well-being. Eco-HEDRM brings the ecological aspects of the community well-being, and has been used during COVID-19 in different cities globally. In recent years, IoT innovation has been attracting attention toward the realization of a society in which people and nature can coexist in harmony (One Health), based on the reflection that the negative impact of human activities on the natural environment has contributed to the spread of natural disasters, climate change, and pandemics. HEDRM integration policy, which can simultaneously realize human health and eco-health, has rarely been considered in Japan, contrary to global policy trends in disaster and health crisis management. It is important to: (1) develop a conceptual model that enables the use of simple ICT-based technologies at local sites; (2) evidence building for the use of ICT for health data at local sites in Japan, and (3) development of guidelines, including ethical guidelines, for social implementation of Eco-HEDRM.

5.8 Enhancing 1.5 Deg. Lifestyle

While the global negotiations in climate change always focuses on CO_2 reduction and setting up targets by 2050 or 2070, this cannot be achieved without making sincere efforts at the local level to change the lifestyle. In a major report of 1.5° lifestyle (IGES et al. 2019), one attempt was made to fill the gap between the aspiration and reality, and to begin to propose clear targets and quantifiable benefits to climate change solutions by making changes in our lifestyles. The report states: "*In terms of the gaps between actual lifestyle footprints and the targets, footprints in developed countries need to be reduced by 80–93% by 2050, assuming that actions for a 58–76% (a 8–12% reduction every year from 2019 to 2030) start immediately to achieve the 2030 target. Even developing countries need to reduce footprints by 23–84%, depending on the country and the scenario, by 2050."* The calculation was made before the COVID-19 pandemic, and there are now new targets set up and it is almost sure that 2030 targets of SDGs and Paris Agreement cannot be achieved. It is important that the local governments, especially the cities need to start policies specifically focusing on 1.5 deg. lifestyle, make new targets and ensure that the targets are locally achieved.

5.9 Implementing Digital Den-En-Toshi and Ensuring Digital Human Resource

As mentioned previously, urban rural connectivity is the key to urban resilience. In an increasing digital world, urban rural digital connectivity becomes critical. GRO (2021) pointed out digital power concentration and digital divide as the potential future risk, when we are increasingly becoming dependent on the digital tools. "Digital Den-en-Toshi" is a concept of the Prime Minster Kishida Cabinet, which is launched in 2022. The objective is "to promote regional revitalization through digitalization, and furthermore, to realize bottom-up growth from the regions to the entire country." The following digital human resource development and securing are listed as important measures: (1) Develop and secure digital human resources in the public sectors and (2) implementation of online courses, etc. Local governments need to make strategic efforts to enhance digital penetration through different types of government services and reduce the urban rural digital divide.

5.10 Utilizing Disruptive Technologies and Society 5.0

Society 5.0 is a concept of human/people centric super smart futuristic society. Due to major demographic changes in the Japanese society, especially de-population and aging population, we need to depend more on the technologies which are

inter-connected and which severs the basic needs (Kanbara et al. 2022). We now call them "disruptive" or "emerging" technologies, however, today's emerging technologies become tomorrow's essential technologies. The local governments need to develop their resilience strategies to avail different types of disruptive technologies towards Society 5.0.

6 Conclusion

To enhance urban resilience and make a city adaptive to different types of stresses and shocks, it is important to have a good policy as mentioned above. To make the policy implementable, there needs to be capable human resources as well as a strong link with the local stakeholders such as business sectors, civil society, academia, etc. It is important to note that we need specific "*Entry points*" to the local communities to make some of the policy decisions implementable at grass roots level. It can be local issues such as waste management, water conservation, social welfare, local production, etc. Each community has its own priority, and to understand it is the first step of implementation. Co-design, co-produce and co-delivery is the sustainable approach for community involvement. Apart from the entry point, "*Change Agents*" are important avenue to enter in the community. The change agent can be local elected leader, business person, or local community-based organizations and sometimes youth led innovation. There is no "one fits all" solutions for the whole city. Depending on the nature of the city's locality, specific change agent and entry points need to be identified so that some of the policy measures mentioned above can be implemented and sustained at the local level.

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