

Chapter 2

Natural Disasters, Urban Vulnerability, and Risk Management: A Theoretical Overview

Communities will always face natural hazards, but today's disasters are often generated by, or at least exacerbated by, human activities... At no time in human history have so many people lived in cities clustered around seismically active areas. Destitution and demographic pressure have led more people than ever before to live in flood plains or in areas prone to landslides. Poor land-use planning; environmental management; and a lack of regulatory mechanisms both increase the risk and exacerbate the effects of disasters.

Kofi Annan.

In his foreword to “Living with Risk,” the United Nations’ Secretary General, Kofi Annan¹ raised awareness to human-induced conditions that increase vulnerability to natural disasters. Rapid urbanization and land degradation, globalization and socio-economic poverty, global warming and climate change are among the global trends that affect the world at large and result in the severity, if not be the cause of natural disasters.

The increasing number and impact of natural disasters reveal themselves in statistics. The unprecedented rise in the number of natural disasters exposes a need to recognize global trends influencing this rise, and confront them through a larger policy framework. Furthermore, today as more than half of the world’s population lives in urban areas, and coupling with the impacts of climate change, risk reduction in urban areas becomes more significant than ever. As the United Nations’ *Local Governments and Disaster Risk Reduction* publication explains, “[u]rban risk, city planning and the role of local governments in dealing with risk reduction have been recognized as key factors to build resilient communities and nations” (UN 2010: viii).

This chapter starts by identifying the current state of global patterns of disasters and their impacts, and continues with examining the linkages between disasters and the global trend of urbanization and climate change. The chapter also studies vulnerability and risk reduction strategies in urban areas. The chapter concludes with discussions regarding the necessary elements for successful risk reduction in urban areas.

¹ Annan, Kofi, 2002: Foreword to *Living with Risk: A Global Review of Disaster Reduction Initiatives*, (UN/ISDR). Quoted in UN/ISDR, 2003: *Disaster Reduction and Sustainable Development*. A background paper for the World Summit on Sustainable Development; <http://www.unisdr.org> (2006):1.

2.1 Disaster Patterns and Definitions

Worldwide statistics reveal the increasing number of disasters and disaster impacts within the last decades. Indeed, only within the last four decades, natural disasters have caused more than 3.3 million deaths and 2.3 trillion dollars in economic damages (WB 2010: 10). In the last three decades, two geophysical hazards, 2010 Haiti earthquake and the 2004 Indonesian earthquake and tsunami have caused the highest death toll from natural disasters. On the other hand, hydro-meteorological hazards have been the dominant hazard types, affecting Asia, mostly, with tropical cyclones and floods, Africa with drought, and Europe with extreme temperature changes and heat waves (Fig. 2.1).

In the last three decades, it has been observed that many developing countries, especially those in Asia, have increasingly been impacted with aggregated disaster events causing an impetus in their development, such as with floods. Additionally, many developed nations have been impacted with single events in their hazard prone and increasingly exposed and vulnerable urban areas, such as experienced with 2005 Hurricane Katrina in the United States and the 2011 Japan earthquake causing immense monetary damages (US\$ 210 billion and US\$125 billion respectively). The variety in disaster typology, its distribution and impacts indicates the necessity to focus on different conditions of hazard, exposure and vulnerability and to produce strategic disaster risk reduction programs and policies (Fig. 2.2).

An increasing number of hazard and risk research and studies from different disciplines in earth, engineering, and social sciences have contributed to our contemporary understanding of disasters, vulnerability and risk management.

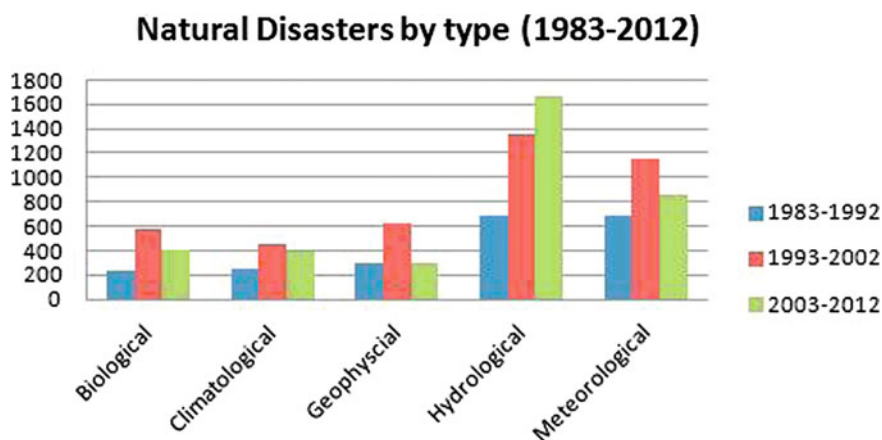


Fig. 2.1 Reported natural disasters by type (1983–2012) (by author). *Source* Raw data collected from EM-DAT: The OFDA/CRED International Disaster Database. Brussels, Belgium: Université Catholique de Louvain, Center for Research on the Epidemiology of Disasters (CRED) <http://www.em-dat.net> (Accessed 2012)

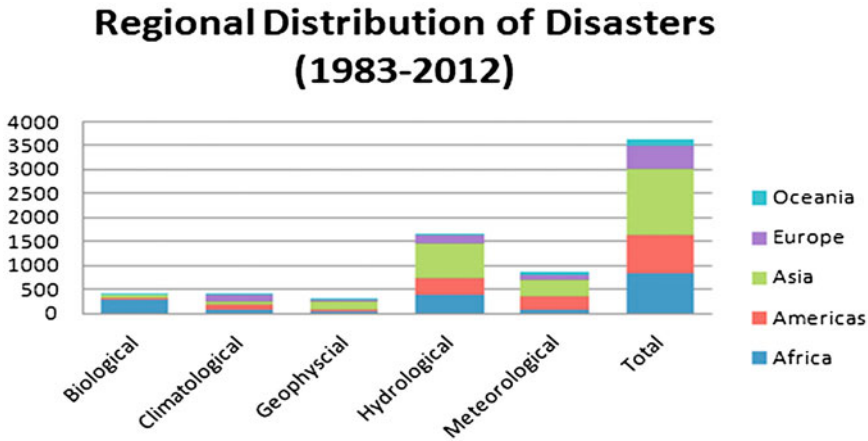


Fig. 2.2 Regional distribution of natural disasters, 1983–2012 (by author). *Source* Raw data collected from EM-DAT: The OFDA/CRED International Disaster Database. Brussels, Belgium: Université Catholique de Louvain, Center for Research on the Epidemiology of Disasters (CRED); <http://www.em-dat.net> (2012)

However, this multiple exploration is based on different theoretical approaches and definitions of hazard, vulnerability, risk, and disasters. As Cutter (2001: 3) wrote, “the distinction between hazard, risk, and disaster is important because it illustrates the diversity of perspectives on how we recognize and assess environmental threats (risks), what we do about them (hazards), and how we respond to them after they occur (disasters).” While acknowledging these disciplinary differences, this book will use definitions of these terms provided by the United Nations International Strategy for Disaster Reduction Secretariat (UNISDR).

Hazard is defined as “a dangerous phenomenon, substance, human activity or condition 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” (UNISDR 2009: 17). In most cases, its origin defines the hazard, such as natural hazards or hazards that are induced by human processes.

Vulnerability is defined as the potential for loss (human, physical, economic, natural, or social) due to a hazardous event. It is the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard (UNISDR 2009: 30). Vulnerability encompasses the conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.

Exposure is “people, property, systems, or other elements present in hazard zones that are thereby subject to potential losses. Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability of the exposed elements to any particular hazard to

estimate the quantitative risks associated with that hazard in the area of interest.” (UNISDR 2009: 15).

Risk is the possibility of harmful consequences or expected losses resulting from interactions between natural or human-induced hazards and vulnerable conditions. It is “the combination of the probability of an event and its negative consequences” (UNISDR 2009: 25). In the field of hazards and disaster research, risk is commonly expressed as the product of hazard, vulnerability and exposure.

Disaster is defined as a sudden event, such as an accident or natural catastrophe that causes great damage or loss of life. The UNISDR (2009: 09) defines *disaster* as “a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.”

According to the UNISDR terminology, “disasters are often described as a result of the combination of: the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences. Disaster impacts may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation” (UNISDR 2009: 09).

In the 2005 *World Conference on Disaster Reduction*, the current framework for disaster risk management was developed in the *Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters* and was summoned as:

1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation;
2. Identify, assess and monitor disaster risks and early warning;
3. Use knowledge, innovation and education to build a culture of safety and resilience at all levels;
4. Reduce the underlying risk factors; and
5. Strengthen disaster preparedness for effective response at all levels (UN 2005: 11–17).

This disaster risk management framework acknowledges the steps of traditional practice of disaster management (preparedness, response, recovery, mitigation), but also argues on giving attention to more “proactive strategies, which can contribute to saving lives and protecting property and resources before they are lost” (UNISDR 2004, 1:7). Emphasis is on risk reduction, which is defined as “the conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (by prevention), or to limit (by mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development” (UNISDR 2004, 2:3). This book will focus on “risk reduction” and “disaster risk management” through this framework and analyze urban risk reduction activities and disaster risk management in Istanbul in relation to sustainable development.

2.2 Urbanization and Natural Disasters

Today, more than half of the world population lives in urban areas making it essential to focus on urban areas for disaster risk reduction. The concentration of population and assets and the embedded conditions of socio-economic and spatial vulnerabilities generate disaster risk in urban areas affected by natural hazards. With the likely impacts of climate change, such as heat waves or elevation in sea-levels, today, exposure and vulnerability in urban areas deserve a special attention for disaster risk reduction.

Urbanization² and rapid population growth lead to the concentration of population in hazard- and risk- prone urban areas,³ both in mega-cities⁴ and in small- and medium- sized urban centers—although both types of urban growth represent different concerns for disaster risk.

While the majority of the urban population currently live in small- and medium-sized cities, this proportion is expected to grow at a slower pace. According to the 2011 *Global Report on Human Settlements* (UN-Habitat 2011), in 2000, 54.7 % of the world's urban population lived in cities of less than 500,000 people. This percentage is estimated to decrease to 50.4 by 2020. In contrast, while in 2000, only 8.2 % of the world's urban population lived in megacities larger than 10 million people, this percentage will increase to 10.4 by 2020; indicating the growing need to focus on rapidly increasing large and megacities for disaster risk.

The size, number, functions, and geographical distribution of medium- to large- and mega-cities create a major concern for disaster risk. In 1950, only 85 cities worldwide had populations of one million or more inhabitants. In developing countries, the number of these medium-sized cities increased six-fold since 1950. Today, there are 387 medium-sized cities, a big proportion of which are located in Africa, Asia, and Latin America (Fig. 2.3).

Due to the urban concentration of population, the greatest potential for disasters exists in the most populous cities. In 2000, the average size of the world's largest 100 cities was around 6.3 million inhabitants, increasing from 5.1 million in 1990, and from 2.1 million in 1950 (Wisner et al. 2004: 72, Satterthwaite 2005: 6). Over

² In simplest terms, *urbanization* is an increasing proportion of a population living in settlements defined as urban centers (Satterthwaite 2005: 2). The immediate cause of most urbanization is the net movement of people from rural to urban areas (which is mostly higher than urban to rural migration). It is important to note that national governments set their own population benchmarks to define what constitutes an urban area. Therefore, the scale of the world's urban population may vary according to different national standards.

³ The proportion of people living in cities is lower than the proportion living in urban centers, as a significant proportion of people live in urban centers that are too small to be called cities (Satterthwaite 2005: 22). In this book, the term *urban area* will be used to identify both urban centers, cities, and their agglomerations.

⁴ Mega-cities are cities with populations of ten million people or more. The United Nations first used the term in the 1970s to designate urban areas with populations of eight million or more. The threshold was increased in the 1990s.

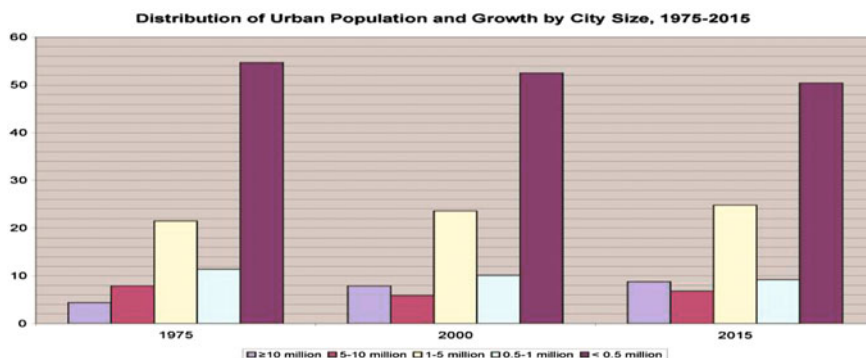


Fig. 2.3 Distribution of urban population by city size, 1975–2015 (by author) *Source* Data from United Nations Population Division (UNPD) (2002)

three-fourths of the one hundred largest cities are exposed to at least one natural hazard (UNISDR 2004: 1:59). Most of them are located in low- and middle-income nations and in hazard-prone areas particularly in Asia and in Latin America—a trend which is expected to continue within the next decade.

Mega-cities also bear major risks from natural disasters. According to data from UN-Habitat’s (United Nations Human Settlements Programme) 2009 *Global Report on Human Settlements*, based on 2010 population estimates, there are twenty megacities⁵ in the world. Ten of these megacities belong to low and lower-middle income countries, and the remaining ten belong to upper-middle and high income countries. Moreover, all megacities are exposed to natural hazards ranging from geological (earthquake ground shaking and mass movements) to meteorological (floods and storms) and climatic events (extreme heat and cold) and wildfires, indicating the necessity to think different risk reduction strategies for different conditions in megacities.

2.2.1 Urbanization and Climate Change

Climate change⁶ is expected to increase hazard exposure and risks in many urban centers, particularly—but not only limited to—those located near coastal areas. Urban areas are expected to experience the effects of climate risk with rises in sea

⁵ According to the 2010 UN population estimates, Paris, Jakarta, Kinshasa and Guangzhou (Guangdong) are other urban areas that will reach populations over ten million people by the year 2020.

⁶ According to the Intergovernmental Panel on Climate Change (IPCC), *climate change* “refers to any change in climate over time, whether due to natural variability or as a result of human activity” (McCarthy et al. 2001: 3).

levels and the accompanying coastal floods and increases in the intensity and frequency of climatic events (Bigio 2003: 91), such as intense cold and hot events or intense rain and flash floods.

Among the most anticipated risks of climate change are the effects of sea level rise and accompanying hazards on small island states and coastal cities. According to the IPCC (2012), by 2100, while the global frequency of tropical cyclones will either decrease or remain unchanged, there will be, with the likelihood of 90–99 %, increases in the average tropical cyclone maximum wind speed and an increase in heavy rainfalls associated with tropical cyclones.

Sixty-five percent of the world's urban population currently live in coastal areas, and this percentage is expected to increase to seventy-four percent by 2025 (UN-Habitat 2011). Most mega-cities are either located on seacoasts or directly linked with riverbeds, increasing the exposure in hazard-prone areas. According to the IPCC (2012), by 2100, with the likelihood of 90–100 %, sea-level rise will contribute to upward trends in extreme coastal high water levels. Potential hazards in coastal areas and cities built near rivers are coastal flooding, erosion of beaches, sedimentation in river floors, flooding, and landslides. These hazards can intensify with a combination of intensified tropical storms.

In addition to these hazards, cities are also expected to be affected by severe heat and cold events. The Special Report of the IPCC (2012) projects that, during the twenty-first century, there will be, with the likelihood of 90–99 %, increases in length, frequency, and/or intensity of warm spells or heat waves over most land areas, and, with the likelihood of 99–100 %, increases in frequency and magnitude of warm days and nights at the global scale. Extreme cold events could lead to increase use of energy and worsening air pollution conditions, while expected heat waves could worsen in cities “pronounced as heat islands” due to the heating up of the concrete buildings and paved areas.⁷

In their summary report, the IPCC⁸ (2001) stated that, “the developing countries, particularly the least developed countries have lesser capacity to adapt and are more vulnerable to climate change damages, just as they are more vulnerable to other stresses,” and continued that, “[t]his condition is most extreme among the poorest people.” Climate change is expected not only to alter the intensity and the frequency of hazards, but also to increase the vulnerability of societies, requiring a special attention to the study of disaster risk reduction in urban areas.

⁷ Munich Re Group 2005: Megacities—Megarisks: Trends and Challenges for Insurance and Risk Management. Munich Re Group Knowledge Series; at: <http://www.munichre.com> (2006):25.

⁸ Intergovernmental Panel on Climate Change (IPCC) (2001).

2.3 Vulnerability and Risk Reduction in Urban Areas

Disasters vulnerability in urban areas arises from a result of a combination of interrelated physical, socio-cultural, economic, and institutional conditions. The buildup of exposure due to concentration of population and assets, increased susceptibility due to physical condition of buildings or infrastructure, social and economic composition of residents, and lack of institutional capacity result in disasters in hazard-prone urban areas.

In urban areas, there is a strong tie between vulnerability and urban poverty,⁹ and an understanding of urban poverty encompassing both economic and non-economic factors provides insight to disaster vulnerability. On the other hand, it is necessary to stress that *vulnerability* is not identical with *poverty*; and that “not all poor people are vulnerable to disasters, and some people who are not poor are also vulnerable” (Bankoff 2003: 19). This section examines vulnerability in urban areas in two sections: (a) in informal settlements in mostly peri-urban areas and (b) in formal settlements in core cities, with the understanding that there are many overlapping elements of susceptibility in both areas and the differences between the two are increasingly disappearing, especially in the fast growing megacities in developing countries. The aim of these discussions is not to focus entirely on what is vulnerable, but also to discuss who is vulnerable and why, and to explore risk reduction strategies.

2.3.1 Vulnerability in Informal Settlements

Within the last decades, population shifts from impoverished rural economies, pressures of globalization and industrial relocation in major cities have contributed to one of the biggest urban challenges in developing countries: the expansion of urban areas and the creation of unplanned informal settlements as the sole option for newcomers. Even though informal settlements,¹⁰ squatters, and slums have

⁹ The World Bank (WB) defines poverty as an unacceptable deprivation in human well-being; which goes beyond the traditional view as measured by income or consumption; but that includes basic material needs including adequate nutrition, health, education, and shelter as well as social needs including security and empowerment (WB 2001; Ames et al. 2002). According to the World Bank’s Poverty Reduction Strategies, urban poverty is explained with dimensions of income poverty, health and education poverty, personal and tenure security, and disempowerment (Baharoglu and Kessides 2002).

¹⁰ Informal settlements have recently been defined and used under the large umbrella of the term *slum*. Standard and operational understandings of slums include both its traditional definition as declining housing areas that have deteriorated with the movement of their original dwellers to new and better areas of the cities, as well as informal settlements in urban periphery of mostly developing nations and that encompass both squatter settlements and illegal subdivisions (UN-Habitat 2003: 9). In this book, the terms *slum* and *informal settlements* are used interchangeably.

long been in existence, these settlements have grown in numbers and in spatial forms with the increase of the urban poor and their exclusion from formal housing sectors. In many cases, with urban spatial growth, formerly independent administrative and political units of settlements have been incorporated to metropolitan cities, creating peripheral municipalities and generating new challenges in urban governance.

Another impact of these migratory practices has been the reduction of the rural–urban relationships for livelihood, as the expansion of urban areas to fertile urban land has resulted in the reduction in the food supply of urban residents, increasing urban poverty and vulnerability. In *Sustainable Land Management*, Hari Eswaran and his co-authors (2011) write about the effects of the mass migration from Eastern and South-Eastern Turkey to Seyhan basin in search of jobs in irrigated plain and explain that these migratory practices and enlarging urban occupation has effected fertile soils of the delta exceeding “the settlement urban/rural farmland and the natural environment” ratios of the legislation developed for the sustainable management of this land. The disruption of agricultural production and related livelihoods by the expansion of urban land markets not only increases poverty and food insecurity, but also creates serious future climate problems with the loss of land surface necessary for the water-cycle¹¹ or environmental problems with soil erosion contributing to the silting up of drainage channels and consequently increasing vulnerability of residents who migrate from rural areas and settle in these land (Satterthwaite/Tacoli 2002: 52–70).

Along with conditions of urban poverty, informal economy, and challenged urban management systems, informal settlements and their residents have become increasingly susceptible to natural disasters. Statistics indicate that just in Latin America and the Caribbean, which is highly prone to a variety of natural hazards, 27 % of the urban population live in slums,¹² with some countries this percentage is much higher, such as in Nicaragua with 45.5 %, and Haiti with 70.1 %, indicating the increased risk in these settlements.

First, most informal settlements carry physical vulnerabilities due to their location or construction practices. These settlements are often “located on land not deemed appropriate for habitation because of its steep terrain or geological characteristics that make it prone to subsidence, landslides, or mudslides” (UN-Habitat 2003: 69). Slum dwellers and squatters often settle in these dangerous locations as the only option for their livelihoods and survival. An example is the large squatter settlement in Central Delhi that has “existed within the designated flood plain of the Yemuna River for more than 25 years” (Sanderson 2000: 98). According to David Sanderson (Sanderson 2000: 98), “[t]he settlement is forced to evacuate at least once a year to the busy roadside whilst their shelters are flooded for upwards of one month. The regular flooding is seen as the price to pay for living in the centre of the city at low cost.” In Belize, where the slum population is

¹¹ Communication with Prof. Dr. Selim Karpuz.

¹² Dodman et al. (2009).

equal to nearly half of the urban population, the “low-lying coastline accommodates approximately 45 % of its total population in densely populated urban areas such as Belize City,” and “[t]hese coastal centers represent some of the country’s most vulnerable to storm events as they lie approximately one to two feet below sea level” (WB/GFDRR 2010: 94).

On the other hand, many times, environmental degradation, loss of rural incomes and strict building codes lead the incoming populations to the only available land, to the risk-prone urban fringes. For instance, situated between the Pacific Ocean and the Andes, Lima is subject to floods, mud and landslides, and it is prone to earthquakes. With the Pan-American Highway linking Lima to other port cities, rapid urbanization along the coastline has contributed to increased levels of risk (UNISDR 2004: 1:60). Within the last decades, in addition to the city’s coastal growth, informal squatter settlements have proliferated around the fringes of Lima in unstable alluvial soil along the riverbanks or in hillsides (Oliver-Smith 1999: 248–294). Perlman (1993: 34) has argued that “counterproductive incentives” have increased the informal housing sector in this Latin American city. Perlman (1993: 34) explained that in Lima, “[t]he average period needed to acquire a house formally is nearly 7 years; to obtain a land title takes 31 months, and to secure a construction permit takes another 12 months. Thus, the vast majority of low-income families are forced into the vulnerable position of having to find housing ‘informally,’ without minimal legal protection.” Oliver-Smith (1999: 273) has written about the development of these settlements in Lima: “During the 1950s, there were 56 such settlements located on the periphery of the city; in 1984 there were 598 such *barriadas*. Now called *pueblos jóvenes*¹³ (young towns), they contained close to 40 % of Lima’s population. Older *barriadas* gradually evolved into permanent communities and grouped together to form separate municipalities.” Similar patterns of vulnerability are reported in Manila, where “informal settlements at risk of coastal flooding make up 35 per cent of the population; in Bogotá, 60 % of the population lives on steep slopes subject to landslides; and in Calcutta,” where “66 % of the population live in squatter settlements at risk from flooding and cyclones” (Pelling 2003: 28).

Inadequate building materials accompany risk by physical exposure in squatter settlements as structures are often built with non-permanent materials, such as “earthen floors, mud-and-wattle walls or straw roofs” (UN-Habitat 2003: 11). Quick makeshift structures are observed in impromptu urbanizations and sprawls of many low-income countries. For instance, the case of Mumbai’s (Bombay) sprawl is attributed to the city’s shift of its industrial base from import substituting to export orientation, and relocation of industry from central city to highways extending to periphery (Pelling 2003: 29). In his exploration of postmodern Bombay, Jim Masselos (1995: 212) wrote: “A global city like Bombay is in fact

¹³ The popularisation of *pueblos jóvenes* in official terminology, instead of the former term of *tugurios* (inner-city slums) and *barriadas* (squatter communities), is argued to be an attempt of authorities “to address the damaging effect of prejudice against slums” (UN-Habitat 2003: 10).

predominantly a village, a series of villages represented in the shanty structures that permeate the city. Shanty structures derive from village prototypes in rural India but are modified by the requirements of space and the availability of materials—plastic, tin, bits of cloth, wood and bricks, which draw on past and present materials.” Indeed, according to the 1991 census in Mumbai, 60 % of registered buildings in the city are “informal masonry and other non-engineered buildings of light material used in slum areas”¹⁴ (Wenzel and Bendimerad 2002: 117). According to the Government of Maharashtra, vulnerability of these buildings is “so bad that shaking with intensity VII is expected to significantly damage 50–75 % of them” (Wenzel and Bendimerad 2002: 117).

Most makeshift squatter settlements built with impermanent or recycled materials belong to the newcomers or to the very poor. In many cases, these settlements lack municipal services and infrastructure. For instance, a household survey carried between inter- and intra-urban entities in São Paula, Accra, and Jakarta in 1991 found out the following results in the poorest 20 % of the populations: 67 % of the poor in Accra, 31 % in Jakarta, and 19 % in São Paula had no water source at residence; 69 % of the poor in Accra, 32 % in Jakarta, and 7 % in São Paula had to share toilets with more than 10 households; and 97 % of the poor in Accra, 52 % in Jakarta, and 14 percent in São Paula had no home waste collection (McGranahan et al. 2001: 67–83). Likewise, in Nicaragua, with 45.5 of slum population, only 52 % has access to improved sanitation, and in Anguilla with 40.6 % slum population, only 60 % of the population has improved drinking water sources showing the high degree of vulnerability due to lack of infrastructure in informal settlements.

Lack of proper infrastructure facilities and unplanned urbanization schemes combine to create new hazards in informal settlements, where inadequate waste disposal in riverbeds and ravines, in addition to the urbanization of watersheds and wetlands may modify hydraulic regimes. This is the case in Quito, Ecuador, where with pressure of unplanned urbanization, approximately 3.2 kilotons of solid waste is disposed of in ravines each year, obstructing drainage and increasing flash flood hazard.¹⁵ Similarly, Kante (2005) reports that in the capital of Uganda, Kampala, the expansion of the city into the wetlands through slum building, and the dumping of waste into these wetlands and surrounding canals has resulted in several floods, as these wetlands had previously served to store water for the city.

As informal settlements grow larger and denser, lack of sanitation, clean water and garbage removal, add congested living conditions add to the disaster vulnerability of slum dwellers, resulting in further environmental and health problems. The UN Millennium Task Force on Slum Dwellers reports that lack of provision

¹⁴ It should be noted that shanties or slums in Mumbai are a combination of peripheral and inner-city settlements. Indeed, one of these inner city squatter settlements, Dharavi, which was the largest slum in Asia in the 1980 s, has a population estimated to be somewhere between 500,000 and 1 million people, but today there are four other slums in Mumbai larger than Dharavi. “Dharavi in Mumbai is no longer Asia’s largest slum”, in *The Times of India* (6 Jul 2011).

¹⁵ United Nations Development Programme (UNDP) (2004): 61.



Fig. 2.4 Sidewalk shacks built with cardboard, tin and wood material in Jamaica (Photograph by author, 2012)

for water and sanitation and high levels of overcrowding contribute to many communicable and non-communicable diseases (from respiratory infections to malaria), injury, and premature deaths (from rapid spread of vaccine preventable diseases) in several urban slums in Dhaka, Nairobi, and São Paulo (UN Millennium Project 2005: 59–60). In the Dominican Republic, where 17.6 % of the population is slum dwellers, and the proportion of the population using improved drinking water sources and improved sanitation facilities are 86–83 % respectively, “[t]he health status of the population influences vulnerability,” with food or water-borne, water contact or vector borne infectious diseases (WB/GFDRR 2010: 129). Indeed, in the Central American Countries, where there is a high rate of urban slum dwellers, estimated mortality rates for infants less than age 1 is very high; for instance in the Dominican Republic, 46; in Nicaragua, 40; and in Haiti 87 deaths occur per 1,000 births.¹⁶

In many informal settlements and peripheral municipalities, vulnerability to natural disasters does not end with such physical exposure or social fragility. Lack or inefficiency of public urban services and institutions—transportation networks, hospitals, fire- or police stations—translate into *lack of response capacities* at times of disasters. Informal land titles obtained through developers add to the limited disaster recovery of these settlers, who can neither obtain government aid nor credit with their illegal titles. Social exclusion, ethnic or immigrant status, poor education and limited job opportunities add to the income poverty of these residents, limiting their mobility and resettlement and creating one of the biggest challenges for urban policy making in the developing world (Fig. 2.4).

¹⁶ Dodman et al. (2009): 29–30.

2.3.1.1 Risk Reduction Strategies in Informal Settlements

Risk reduction strategies for informal settlements ensued the way these settlements have been perceived by officials, whether they were international development agencies or local public administrations. Many scholars describe that general attitude towards informal settlements, slum dwellers, and squatters in developing countries have usually varied from “blind intolerance to blatant hostility” (Westgate 1981: 28) by local officials in charge with urban management, who considered these settlements as a “cancerous growth on the city” (Laquian 2005: 353).

Starting in the 1950s, programs attending to the problems of these settlements focused on their eradication by bulldozing and evictions. In their exploration of the housing problems in the Third World, Jorge Hardoy and David Satterthwaite (Hardoy and Satterthwaite 1993: 111–160) summarize government justifications for these evictions in three categories: (1) city beautification programs; (2) slums as centers of crime and health problems; and (3) redevelopment for public projects.

In rare cases, these demolitions have also been targeted towards specific groups, whether be by ethnic marginalization or by political agenda. In Zimbabwe, in a slum demolition campaign in 2005, seven hundred thousand people were left homeless in what was called by the government an “urban clean up effort,” but what, according to human-rights activists, was aimed at peasants, who made up the core of the political opposition to President Mugabe’s rule (Wines 2005).

In some cases, as in the situation in Seoul between 1983 and 1988, despite the fact that the government had destroyed about 48, 000 buildings to host the Olympic Games, only a very small portion of the evicted people received new accommodations¹⁷ (Hardoy and Satterthwaite 1993: 118). In other cases, these demolitions were accompanied with redevelopment or re-housing projects, which attempted to resettle population at “considerable distances” from the city to *superbloques* of public housing, such as in the case of Venezuelan evictions of the 1950s (Hardoy and Satterthwaite 1993: 118). However, most cases of resettlement approach have been unsuccessful, for they have only transferred the problems of the urban poor to other locations without providing amenities and employment opportunities, and at times destroying the important kinship ties that many of the migrants share and connect to. Many governments have stopped using the resettlement approach as a first strategy after criticisms and the involvement of international development organizations. For instance, Laquian (2005: 354) reported that “[i]n the Philippines, it was mandated by law that people can be moved from a site only if (1) they are staying in dangerous places such as riverbanks, steep slopes, along railroad tracks, or near toxic waste dumps; (2) the occupied land is

¹⁷ A similar slum clearance campaign is experienced today in Rio de Janeiro as the government is preparing for the 2016 Olympic Games and pushing out drug gangs in the favelas and these slums are now turning into lucrative real estate opportunities for the wealthy.

needed for an infrastructure project that is required for the general welfare; or (3) an occupant is in clear violation of another person's property rights."

Increasing awareness of right to housing, as was strongly established with the 1996 Habitat Agenda, and the failure and criticisms of the repressive eviction strategies of local and national governments led to new strategies to deal with the living conditions of slum dwellers. Beginning in its earliest period in the 1970s, self-help and in situ slum upgrading policies were based on the concept that "urban poor have the capabilities to effectively deal with their own housing problems," and that, "given such assurances as security of land tenure, low interest loans, appropriate building materials, and some technical assistance," they could help upgrade their own living conditions (Laquian 2005: 362). These projects and policies focus on three main areas of concern: (1) provision of basic urban services; (2) provision of secure tenure for slum dwellers and the implementation of innovative practices regarding access to land; and (3) innovative access to credit (UN-Habitat 2003: 130).

Slum upgrading projects have proved to show success in their early stages. For instance, Indonesia's Kampung Improvement Program "upgraded existing low-income communities by improving roads and footpaths, drainage, flood control, water supply, communal toilets, and garbage collection and disposal," and the project was expanded into a nationwide effort (Laquian 2005: 363). The results of the program showed that households in project invested twice as much in home improvements than other households (UN-Habitat 2003: 130).

Another well-known project, the Orangi Pilot Project, was organized in the largest *katchi abadi* (informal settlement) in Karachi. Between 1980 and 1992, the project improved water, sanitation, and sewerage facilities through voluntary community action, benefiting about one million people. Due to the success of this project, four other community organizations carried out similar projects in Karachi; and the emphasis expanded to include building material provision, small-scale credit and livelihood improvement (Laquian: 205, 363). However, the sustainability and the success of this project could not be accomplished when applied in other communities in Pakistan. Laquian explains that failures of these applications had come from inadequate provision by municipal networks for the connections of the self-built coverage. The United Nations Human Settlements Program (UN-Habitat) reports other slum upgrading projects, in which inadequacy of municipal provisions had brought failure, when "[g]overnments did not follow through with services, communities did not maintain the facilities, and governance structures disappeared once the international experts were gone" (UN-Habitat 2003: 131).

Today, there are several initiatives to evolve slum upgrading and resettlement programs into more sustainable and integrated development approaches. In Tunisia, over a 30 year period, both the national and city governments shifted their approach from "slum" clearance to "slum" upgrading, and their focus from bringing infrastructure and public amenities to a long-term policy of supporting the

development for land for housing for non-poor groups, which increased overall supplies and reduced costs eliminating the need for informal settlements.¹⁸

What is called as “participatory slum improvement,” “integrated slum upgrading,” or “urban upgrading” projects aim at having a more holistic approach to slum upgrading and risk reduction by considering problems of communities as a whole, involving both governments and communities, and requiring empowerment of communities, in addition to financial stability and commitment of local administrations. The *Global Report on Human Settlements* states the more sustainable efforts in slum upgrading efforts to be those “that are the main plank of city development strategy with planned, rolling upgrades across the city and a political commitment to maintenance” (UN-Habitat 2003: 132). It argues that “[a]s a general rule, the more marginalized or culturally separate the group being assisted, the more participation and partnerships are necessary” (UN-Habitat 2003: 132).

The Mumbai Railway Dwellers Resettlement Project is one of the projects that have required the empowerment of the community and the involvement of the local government. This project led to the participatory resettlement of ten thousand families, who lived adjacent to the railway tracks in Mumbai, into accommodations with assurance of secure tenure and basic amenities of water, sanitation, and electricity within one year of their negotiations with the Maharashtra Government. This negotiation was made possible with the empowerment of the community through the self-organized *Railway Slum Dwellers Federation* that was aided by a non-governmental organization, SPARC, and with the transference of power from government agencies in charge with resettlement and rehabilitation to the NGO alliance (WB 2003: 125).

In *The End of Poverty*, Sachs (2005: 240–241) detailed the continuing positive effects of this alliance and the project on slum dwellers in Mumbai: “...group action has taught them that in fact they have legal rights within the city and even the possibility of access to public services if they act together... With SPARC’s initiative, the new Slum Rehabilitation Act has given added power to the communities: slum-dweller organizations are now legally empowered to act as land developers if they can demonstrate that they have agreements to represent at least 70 % of the eligible slum dwellers in a particular location,” and they “can tap into special municipal programs to gain access to real estate for community resettlement or for commercial development that can finance resettlement elsewhere.”

Another project that facilitated slum dwellers’ involvement used an integrated approach to vulnerability reduction in their high-flood risk communities in Mozambique. Developed by the UN-Habitat, this integrated slum upgrading and vulnerability reduction project aims at strengthening relationships between central government, local authorities, and resident communities. The project was promoted under the *Cities Without Slums Initiative* and included three main components: (1) support policy-making; (2) training and capacity building; and (3)

¹⁸ Dodman et al. (2009).

participatory land use planning and physical implementation at the local level (Spaliviero 2006: 106–115).

As a first step of policy-making support in Mozambique, where there has been an absence of regulatory instruments and coordinated institutional frameworks related to urban planning, the UN-Habitat co-founded the preparation of Territorial Policy Law Project in order to “set the legal framework of reference regulating all physical activities and coordinating existing laws” (Spaliviero 2006: 108–09). Mathias Spaliviero, from UN-Habitat at Mozambique wrote about the project and explained that, in addition to “strengthening the urban management technical capacity at the local level by placing skilled national professionals in the Municipalities,” this project advocated for “the active participation of the community in the planning process,” and argued that “preparedness and mitigation techniques could minimize the negative impacts of moderate flooding” (Spaliviero 2006: 109). With that, a training program, *Learning how to live with floods*, was launched in 2003. Through this awareness program, the project aimed at educating different parts of the society to issues such as “factors causing the floods, type of flood risks, different preparedness and mitigation techniques, contingency planning, community self organization, response actions” (Spaliviero 2006: 110).

As a final step of participatory land use planning, local area consultations were made confirming problems in informal settlements such as poor drainage efficiency, difficult access to safe drinking water, lack of sanitation facilities, inadequate road network, and inefficient waste management. In informal settlement areas in four cities, Maputo, Chókwè, Tete, and Quelimane, land use and disaster management plans with priority intervention and methodological instructions for slum upgrading strategies were introduced. Spaliviero argues that the involvement of the central Government, local authorities, and local communities has provided a trust and strengthening of the relationships. In Quelimane City, “under the supervision of the municipal technical staff and the coordination of a local committee, almost 400 dwellers were contracted on a rotational basis during a period of two months” (Spaliviero 2006: 113). The community selected to clean and regularize a cumulative drainage channel, and to improve their main access road that flooded after each rain event. Spaliviero describes that “[t]his positive experience has reinforced the community’s will to contribute to improving the living conditions of their own neighborhood” (Spaliviero 2006: 113). However, as previous slum upgrading projects have shown, for the sustainability of this and other projects, and their long-term maintenance and upgrading, there should be stable support from the involved agencies, both internationally and nationally, as well as a strong institutional framework, which would capacitate local governments and provide legal rights to slum dwellers.

These provisions are addressed in the evaluation of a much broader integrated urban upgrading project of the World Bank, in Riberia Azul, Salvador, Brasil.¹⁹ This program in a low-income neighborhood in Salvador, Bahia covered forty

¹⁹ Baker (2006).

thousand families, representing 6 percent of Salvador's municipal population. This area was characterized as "‘high-risk’ situated in a flood prone area, with a large number of squatter settlements, insecure land tenure, a highly polluted environment by household and industrial waste, poor social indicators, and very limited access to infrastructure and basic services".²⁰ The program combined physical interventions with investments to improve the social and economic conditions of the population. Projects included "housing and infrastructure improvements, and programs in health care, child nutrition, education, training, and employment generation through cooperatives".²¹ Community participation has been a fundamental part of this project, which was implemented by CONDER (Urban Development Company of the State of Bahia), AVSI (Association of Volunteers for International Service), and an Italian and a local non-governmental organization (NGO) partnership.

This urban upgrading project introduced housing and infrastructure works including improved access roads, storm drainage, water supply and sanitation, solid waste collection, housing improvements, and resettlement of those living in risk areas, particularly in the *palafitas* (stilt houses informally constructed over the inlet). An evaluation of the project showed that residents reported several positive benefits of housing and infrastructure improvements. However, due to hard terrain conditions, the heavily engineered new housing costs were found considerably more expensive than building new units in available plots, bringing forth the "scope for a policy shift towards providing inexpensive serviced land and access to credit rather than housing".²²

Other lessons learned from this pilot upgrading project were reported as: (a) capacity building for community associations can be highly beneficial; (b) environmental planning for individual community needs to be integrated with a broader systemic plan at the city and state level; (c) strengthening inter-governmental relations could improve service delivery; (d) clear roles and responsibilities, as well as their flexibility are needed in institutional arrangements; (e) participation is critical to successful implementation and sustainability; and (f) municipalities will need to play a greater role from the start, particularly to ensure program sustainability.²³

As observed in previous examples, the results of the Salvador slum-upgrading project indicates the significance of partnership and secure relationship between all levels of involvement from central government to local authorities and empowered local communities for the sustainability of integrated slum upgrading and risk reduction programs in informal settlements.

²⁰ Baker (2006): 1.

²¹ Baker (2006): 2.

²² Baker (2006): 23.

²³ Baker (2006): 23.

2.3.1.2 Vulnerability in Formal Urban Areas

Physical exposure to disasters is not a condition that belongs solely to the very poor, nor does it need to transfer into risk. In many cases, adequate building standards and urban planning actions alone can help manage or reduce disaster risk by physical exposure. However, these actions have been absent, or when available, not properly applied in many “formal” urban areas.

This section will explore this phenomenon in concrete urban agglomerations of the post-1950 era, encompassing the first generation building boom with concrete framed apartment buildings and the post-1980s building boom including *vista communities*, referring to vacation homes in coastal developments and hillside or seaside residences.

Initial stages of modern concrete agglomerations were in societies that previously used traditional building materials and architectural styles. Starting in the 1950s, the process of modernization coupled with rural to urban migration and initiation of private building activity changed urban landscapes in many countries. Spontaneous settlements proliferated around major cities of the Mediterranean Europe, be it Barcelona, Rome, or Naples, while many cities experienced the destruction of existing housing stock and the construction of apartment buildings.

Writing about the period from 1951 to 1981, Leontidou (1990: 142) argued that building process in this era had “erased the neo-classical architectural tradition” of Athens. Leontidou wrote, “Greater Athens was subject to an aggressive invasion of capitalism, and was changed into a reinforced concrete agglomeration, where building space was commercially exploited to the maximum degree possible. The multi-storey apartment blocks were constructed in a piecemeal process within a fragmented housing market. Most of them were low-quality constructions. Building standards declined, with the result that a large proportion of recently built housing in Greek cities is already in need of repair or even replacement” (Leontidou 1990: 142–44). During the same decades, similar style of building activity was also prevalent across the Aegean, in major cities of Turkey, where old housing stocks were being destroyed while apartment blocks were being built. Today, the seismic Southern Mediterranean cities still consist of the housing stock of the early modern concrete era. However, despite lack of adequate building regulations at the time, in many instances quality of housing constructions of this period have proved to be higher than that of post-1980 building boom.

In many developing or middle-income countries, two distinct types of housing stock may represent most of the post-1980 agglomerations. The first type is primary housing of the low- to middle-income groups in major cities of growing economies. These are housing responses to rapid population growth with higher quality material use than slums in the low-income countries, but with similar problems of physical vulnerability. The second type is primary or vacation homes of the middle and upper-middle income groups, a housing model observed from coastal cities to hillside residences.

Problems in both development types usually start with an increase in building activity with an unqualified construction sector. Oversight of control due to

inadequacy or corruptions of local governments and officials add to the problem. For instance, in the touristic Caribbean Islands of Grenada and St. Vincent and the Grenadines, “[n]ew construction, particularly in relation to tourism, continues with little formal land use planning or construction code enforcement,” as the construction codes that exist are not evenly applied (WB/GFDRR 2010: 161, 239). Likewise, “[p]oor regulated construction and land use practices” are found to be “among the biggest contributors to risk from losses” in the Island of Saint Lucia, where “[l]ack of uniform enforcement of building codes contributes to the vulnerability of island infrastructure (WB/GFDRR 2010: 229). In other cases, non-adequate applications of building codes or deficient structural configurations are the main cause of vulnerability. In Panama, which has one of the larger urban settlements in the Central America and the Caribbean region, “[t]he poor enforcement of national and local land use regulations, the uncertainty about compliance with building codes, rapid demographic growth and unplanned urban and industrial expansion” are found to be “responsible for most of the current and significant increases in vulnerability” signifying the susceptibility of populations and assets at the wake of loose enforcement or building code and regulations (WB/GFDRR 2010: 21). Many times, structural configurations are executed after the completion of buildings, as residents try to reconfigure their living spaces without consultation to architects or civil engineers (Figs. 2.5, 2.6).

Recent earthquakes have revealed that modern constructions in many urban areas lack basic earthquake resistant characteristics, even though design codes and

Fig. 2.5 Shoring of balconies in vacation homes in Playa d’Aro, Spain
(Photograph by author, 2003)



Fig. 2.6 Scaffolding in Kathmandu, Nepal
(Photograph by author, 2013)



building standards have been updated to provide safety of structures. The *Reconnaissance Report* of the Earthquake Engineering Research Institute (EERI 2003) for the 2003 Boumerdes, Algeria earthquake concluded in similar observations. The reconnaissance team examined the destruction caused by the earthquake epicentered in the province of Boumerdes, east of the capital city of Algiers. According to the report, the heavily damaged two areas had undergone different urbanization processes. The first of the damaged areas was in Algiers, where destruction had occurred mostly in new structures, and a result of the changes in the State's role in construction sector and planning system. In the 1990s, as Algeria was transforming from a rigid-state controlled system to a free-market economy, the State made major changes in planning and construction regulations. With the liberalization of construction regulations, an unqualified private sector emerged, hastily developing housing mostly with government oversight and without building permits. According to official data, in Algiers and its vicinity, "in the period during 1990–2002, 42.4–52.8 % of the individual homes were built without a legal title document, and thus without a building permit" (EERI 2003: 5). Most of these developments were along the coastal districts with high real-estate value. The reconnaissance team argues that corruption and personal interventions had interfered with the attention to the quality of construction, resulting in heavy damage to this housing stock (EERI 2003: 3–11).

On the other hand, urban development in Boumerdes had taken another path. The city was created in 1958, as part of a "French economic reform plan for

Algeria,” and it was “intended to serve as an administrative and educational outpost” (EERI 2003: 6). The EERI (2003: 6–7) team reports the emergence of three generations of buildings during the planning of Boumerdes: “the first generation of buildings, built between 1959 and 1974, has bearing walls; the second generation, built between 1974 and 1993, is primarily engineered multistory buildings built by large government-owned construction companies; and the third generation is characterized by a return to traditional architectural methods using reinforced concrete beam-column and concrete slabs with brick partitions.” According to the EERI report, damage in Boumerdes had mostly occurred in institutional²⁴ and large scaled apartment buildings (EERI 2003: 9).

The 1985 earthquake in Mexico showed similar destruction patterns to what was experienced in Algeria. According to Meli (1993), in Mexico “buildings constructed before 1950, with flexible, inadequately detailed, and almost unconfined concrete elements, have performed, in several instances, better than those with modern construction.” Meli and Alcocer (2004: 31) attribute this situation to the replacement of the thick infill and façade masonry walls with lighter and weaker partition elements without updating the detailing rules of the 1950s. Therefore, they explain, “the poorly detailed modern reinforced concrete frames exhibited more severe earthquake damage than older frames with equally poor detailing but with more substantial nonstructural elements” (Meli and Alcocer 2004: 33).

In the same earthquake, a second set of damages was recorded in mostly government-sponsored projects. Documenting the impact of that earthquake, Puente (1999) wrote that 30 % of the government hospital capacity in Mexico City was lost with the earthquake, and that most of these buildings were post-1950s constructions. According to Puente, one of the biggest damaged residential areas was the Nonalco-Tlatelolco housing estate, which was comprised of 102 separate buildings. The estate was constructed in the early 1960s, and it “was intended to be a model of state responses to joint needs for slum clearance, new housing, and improved architectural design” (Puente 1999: 306).

In assessing these damages, it is also essential to consider geologic conditions of the location. In his famous textbook on earthquakes, Bolt (2004: 279) wrote that due to considerable distance between the earthquake source and the Valley of Mexico, “few structures built on firm soil and rock suffered damage.” On the other hand, one area near the city center that was “underlain by a thick deposit of very soft, high-water content sands and clay” encompassed “most of the buildings that collapsed” in the 1985 earthquake (Bolt 2004: 280).

²⁴ Meli and Alcocer (2004: 33) explains that “the rate of distress and failure suffered by school and hospital buildings after major earthquakes is consistently higher than, or at least equal to, than of other common buildings.” They argue for the existence of two major reasons for this high rate of damage. One is related with “inconsistency among design seismic-induced loads, expected performance, and design and detailing rules,” and “the second reason is related to the more complex and irregular structural layouts” of these buildings (Meli and Alcocer 2004: 33).

Decision to build in geologically unstable or high-risk areas is a matter of available land for developers, to locate in these buildings is a matter of economics for most urban residents, but for those who wish to live in the most scenic areas, it is a matter of choice that is made with or without adequate information. Indeed, today in many developing countries, there are examples of high-income groups living with the same informality as slums or squatter settlements,²⁵ in scenic areas that are not open to settlements due to their protection or high-risk of hazards. For instance, in his research on ecological sustainability in Mexico City, Pezzoli (1998) explains that in Mexico City's green-belt zone of Ajusco, an area declared for ecological conservation in the planning departments of the city, rural land has transformed into an urban land since the 1970s. Pezzoli writes that this was not only a result of low-income groups' settlement, but also of real-estate developers and higher-income groups attracted by the "zone's greenery, clean air, and panoramic vistas" (Pezzoli 1998: 194). Pezzoli records the contradictory enforcement of zoning laws in this area by public officials favoring development of higher-income groups, while at the same time taking steps to eradicate irregular settlements with arguments about their negative impacts on the ecological equilibrium of Mexico City. According to Pezzoli (1998: 211), land speculation in Ajusco was initiated in 1974 with the construction of a scenic highway, which—according to several researchers—was "ordered by the then secretary of the highway department so that he could get to and from his residential estate."

In a similar pattern, in recent years high-income gated communities have started to appear around Istanbul's water-basins and in its northern protected forest areas, what were once associated with squatter settlements. Development of these new residences, among other reasons, is motivated around the mayor's grandiose vision for the city's development and erecting a new bridge on the northern part of the city.

In Italy, oversight or encouragement by public officials in construction and development activities is a common sight, especially in the Southern regions, where illegal constructions are attributed to different income groups. These developments range from those on the fertile slopes of Mount Vesuvius to coastal developments, and they are estimated to have risen 30 % in 2003 under the leadership of President Berlusconi and his amnesty laws. In recent years, 600 illegal constructions were discovered in an archeological park in the Sicilian Coast, as the region's mayor, who himself owned one of these residences had allowed their construction in exchange of votes (Sylvers 2004).

Vulnerability due to inadequacy or inefficient application of construction standards and building design, unavailability or disregard of planning, and

²⁵ In studying Latin American cities, Gilbert (1996: 93) argued that "hilly cities are arguably less clearly polarized than flat cities," as high-income and middle-income areas develop in close proximity to *barrios* and *favelas* on steep slopes unsuitable for formal-sector construction. Gilbert (1996: 93) wrote: "Here, every exclusive residential development appears to have its low-income neighbour next door. A functional symbiosis has developed; the urbanización provides work for the maids, shoe menders, laundresses, and the like, and the *barrio* provides cheap labor".

corruption or mismanagement by related officials are experienced everywhere from developing countries to most developed nations. In 2005, a Japanese architect admitted to falsifying building earthquake resistance data on several projects to cut costs and to win contracts. The architect was involved with two hundred structures, including high-rise residential towers, hotels, and temples.²⁶ This scandal also involved two private building certification firms, which were given authority in 1998 to certify the soundness of new constructions, as part of the government's new policy to deregulate building industry.²⁷

Political-decision making combined with poor design and land-use practices have increased the vulnerability of the ecologically hazardous Los Angeles, as well. In his work of disasters in Southern California, Davis (1998) argues that flood, fire, and earthquake tragedies of the region were unnatural and avoidable, and that they occurred as a result of generations long "market-driven urbanization that has transgressed environmental commonsense." In *Ecology of Fear*, Davis describes "historic wildfire corridors turn into view-lot suburbs, wetland liquefaction zones into marinas, and floodplains into industrial districts and housing tracts" (Davis 1998: 9). As urbanization, Davis writes, "relentlessly eroded flood control capacity by paving over watershed and reducing surface absorption, more than 110,000 homes adjacent to the Los Angeles River and Rio Hondo have become vulnerable" (Davis 1998: 36). Construction quality produced other vulnerabilities in the Los Angeles area. Building inspections after the 1994 Northridge earthquake revealed that at least one-third or more of damage in residential buildings were directly related to substandard construction. Huge pre-cast concrete department stores demonstrated similar problems in design and construction, and one expert summarized the situation as a "dangerous combination of inadequacies in building codes and an increasing drive to cut costs by designing for the minimum" (Davis 1998: 44).

In a similar manner, in Florida, investigations after the 1992 Hurricane Andrew found out "major shortcomings in construction techniques and code enforcement" (Mileti 1999: 128). Accordingly, in Southern Dade County, homes built after 1980 in new design trends suffered more damages than pre-1980 constructions. Loss of roof materials, which also led to damage in other buildings and cars, was the most frequently observed type of damage (Mileti 1999). A review of "the county's Board of Rules and Appeals found a number of instances in which changes were made under pressure from builders in the name of construction cost savings," such as the allowing of builders to use staples instead of nails to install roofs (Mileti 1999: 131). Such cases indicate that vulnerability to natural disasters can exist regardless of economic well-fare, creating an imminent danger on urban residents and increasing the need for a variety of vulnerability and risk reduction strategies and actions in urban areas (Fig. 2.7).

²⁶ "Japanese architect falsified earthquake data", in *Architectural Record*, 2006. News Briefs.

²⁷ "Earth-shaking news", in *Economist* (December 2005): 46.



Fig. 2.7 A home partially destroyed by Super Storm Sandy, Staten Island, New York (Photograph by author, 2012)

2.3.1.3 Risk Reduction Strategies

Similar to the vulnerability of communities, disaster risk reduction actions and management are also affected by social and cultural influences, personal and governmental decision-making, and legal, institutional, and economic constraints. This section will explore risk reduction activities that can be employed by local governments in order to reduce physical vulnerability. These actions can range from land-use planning to building codes and engineering, insurance and economic incentives, and public awareness campaigns; although the focus here will be that on physical planning measures.

As part of the Second Natural Hazard Assessment study in the United States, Olshansky and Kartez (1998) classified actions representing “land use management tools” to guide development in hazard-prone areas. Olshansky and Kartez (1998: 170–174) categorized these tools as:

1. *Building standards*, such as traditional building codes, flood proofing requirements, seismic design standards, and retrofit requirements for existing buildings.
2. *Development regulations* including zoning and subdivision ordinances such as flood-zone regulations, setbacks from faults, steep slopes and coastal erosion areas, and zoning standards for sensitive lands as wetlands, dunes, and hillsides.
3. *Critical and public facilities policies* to move location of public or other important facilities (such as schools, fire stations, hospitals, hazardous materials and utilities) outside of hazard areas in order to discourage development and reduce damages.

4. *Land and property acquisition* in hazardous areas with public funds and using these properties in minimally vulnerable ways. Acquisition of open space, recreation, or undeveloped lands for mitigation; relocation of existing hazard area development and acquisition of development rights.
5. *Taxation and fiscal policies* to provide incentives for people who reduce public costs in hazardous areas by applying regulations for safety, or relocating and reducing density in hazardous areas. Adversely these policies would increase taxes for those who add to the public costs of hazard area development.
6. *Information dissemination* to influence public behavior especially of real estate customers by bringing hazard disclosure requirements for real estate sellers, provide public information such as posting warning signs in high-hazard areas and education of construction professionals.

A number of studies²⁸ conducted in the United States, between 1979 and 1993, examined local government approaches in the application of these management tools for natural hazards mitigation. According to a summary of the findings of these studies, in highly hazard-prone communities, zoning ordinances and building standards are the most frequently used mitigation tools by local officials in order to regulate private construction in hazard-prone areas. On the other hand, in most cases public officials do not have a comprehensive approach to hazard mitigation, for example by not extending their policies for awareness programs or not using relocation strategies (Olshansky and Karterz 1998: 176–177).

Some of these studies and others, dating from 1979 to 1994, have also explored the factors that influence the adoption of hazard mitigation policies by local governments in the United States. Olshansky and Karterz (1998: 179–187) summarize the results of these studies²⁹ in two major categories as: controllable and uncontrollable factors. Accordingly, factors controllable by local governments

²⁸ These were survey studies on local government approaches to hazards. There was a high survey response rate ranging between 75 and 90 %; and types of informants were local planning directors or designees, and local flood coordinators. For more information on floodplain hazards, see “Coping with floods” (Burby and French 1981) and *Flood Plain Land Use Management* (Burby and French 1985). For coastal storms and hurricanes, see *Catastrophic Coastal Storms* (Godschalk et al. 1989). For earthquakes, see “A national assessment of local earthquake mitigation” (Berke et al. 1992), and for multiple natural hazards see *Sharing Environmental Risks* (Burby et al. 1991), and *Factors Promoting Comprehensive Local Government Hazards Management* (Karterz and Faupel 1995).

²⁹ These are conclusions derived from the following studies: *The Politics and Economics of Earthquake Hazard Mitigation* (Alesch and Petak 1986); “Hurricane vertical shelter policy” (Berke 1989); “A national assessment of local earthquake mitigation” (Berke et al. 1992); *Flood Plain Land Use Management* (Burby and French 1985); “Mandates, plans and planners” (Dalton and Burby 1994); *Earthquake Mitigation Policy* (Drabek et al. 1983); *Catastrophic Coastal Storms* (Godschalk et al. 1989); *Analysis of Adoption and Implementation of Community Land-use Regulations for Floodplains* (Hutton et al. 1979); *Role of States in Earthquake and Natural Hazard Innovation at the Local Level* (Lambright 1984); *Seismic Hazard in the Central United States* (Olshansky 1994); and *Preparing for California’s Earthquakes: Local Government and Seismic Safety* (Wyner and Mann 1986).

range from recognition of the problem to staff resources, lack of persistent policy advocates, interactions among participants in policy development, and linkage of hazards to other issues such as those that could reinforce the solution of another problem (Gencer 2007, 2008: 286).

Factors that are uncontrollable by local governments include community wealth and resources, “window of opportunity” that opens by local or external disasters, which can increase public awareness and attract federal and state resources, previous hazard experience, lack of “public minded” communities, national regulations and assistance, and the presence of feasible policy solutions. On the other hand, some of the factors that are described to be uncontrollable by local governments do not need to be so. Presence of a feasible policy solution or increasing awareness to create opportunity to integrate mitigation policies into local development plans should be a concern of local governments, which should be proactive rather than waiting for hazards and the subsequent disasters to occur (Gencer 2007, 2008: 286–287).

In 2001, the Institute for Business and Home Safety (IBHS) worked with the American Planning Association (APA) and the American Institute of Certified Planners (AICP) to survey nearly one thousand five hundred municipal-level planners with a questionnaire named “Community Land-Use Evaluation for Natural Hazards.”³⁰ Steinberg and Burby (2002: 22), two leaders of this study, produced a “Growing Safe” plan for communities based on eight fundamental elements:

1. Basics: a general or comprehensive plan and a planning staff;
2. Quality of data: a plan that includes or references factual data and maps;
3. Identification of issues: an explanation of natural hazards and other community issues;
4. Community support: community involvement in preparing the plan;
5. Policies: specific policies addressing hazards;
6. Coordination: consistency with federal, state, regional, and internal community plans;
7. Implementation: goals linked to specific actions;
8. Presentation and organization: a plan that is reasonable, comprehensible and easy to use.

The results of this survey indicated that as an average, communities got a grade of 48 % in this “Growing Safe” report card and that 8 % of the communities scored zero. On four of these elements—plan basics, citizen involvement, consistency and organization—plans on average scored above 50 %, whereas in the remaining issues that addressed natural hazards, they scored equal to or less than 40 %. As important factors affecting their efforts, planners identified the need for “public demand for hazards planning, followed by additional funding, support from elected officials, and technical assistance” (Steinberg and Burby 2002: 23).

³⁰ Institute for Business and Home Safety (IBHS) (2002).

Additional needs were “better mapping and data; state mandates for planning, additional staff and legislative changes” (Steinberg and Burby 2002: 23). Indeed, Steinberg and Burby concluded that communities,³¹ which were located in states that mandated local planning, and which applied safe growth strategies, had higher ratings than the others did, and that state-mandated local comprehensive plans are “the key to better performance” (Steinberg and Burby 2002: 23).

A smaller-scale study funded by the National Science Foundation (NSF) examined whether the quality of local plans changed over an eight-year period from 1991 to 1999 in jurisdictions in Florida and Washington—the two states that scored high grades in the “Growing Safe” project. The principal investigator in this study, Brody (2003) explained that the study examined which hazard mitigation components had changed in the study communities and identified factors that influenced the adoption of new mitigation tools. Plan quality was conceptualized in three components: a strong factual basis, clearly articulated goals, and appropriately directed policies (Brody 2003: 194). Results of the study indicated a significant increase in plan qualities in both states. Accordingly, “plans in Florida showed particular improvements in emergency preparedness such as evacuation and sheltering capabilities. Jurisdictions in Washington strengthened their policies to protect areas subject to flooding through permitted land uses, setbacks, and locating public facilities outside of hazard prone areas” (Brody 2003: 198). As in the IBHS study, findings also suggest that initial quality of plans and legal reform mandates by state authorities had an important effect on the planning communities. The driving force behind this increase in plan quality was different in both states. In Florida, the plan quality “appeared to be driven primarily both by a previously established policy-making momentum and repetitive loss to specific properties” (Brody 2003: 198). In Washington, the planning capacity was influenced most strongly by citizen participation. These results add to the previous findings, which indicated that the factors that impact local governments’ integrated mitigation–land use planning processes range from national policy-making, public awareness and involvement, and institutional capacity at the local level.

In the United States (U.S.) federal level, the *Disaster Mitigation Act of 2000* (U.S. Congress 2000), required state and local communities to have an approved mitigation plan in place by November 2004 in order to be eligible for pre- and post- hazard mitigation grant funds; emphasizing the importance of planning before disasters occur. FEMA’s (Federal Emergency Management Agency) *How-to-Guide for State and Local Mitigation Planning* provides guidance to local governments, and proposes an inventory assessment for estimating losses from disasters.³² This assessment requires two major tasks: (1) determining the proportion and the value of buildings, and (2) determining the population located in

³¹ Among them were statewide Florida, large cities and counties in Nevada, coastal region in North Carolina, statewide Oregon, coastal California, and growth management jurisdictions in Washington State (Steinberg and Burby 2002: 23).

³² Federal Emergency Management Agency (FEMA) (2001).

hazard areas. The Guide gives the option of extending this inventory to critical facilities, vulnerable populations, major economic elements, high-density residential areas, historic, cultural, and natural resource areas, and other important facilities such as major employers, banks, and gas stations.³³ However, this way of presenting the “detailed inventory” as an option gives way to the preparation of incomplete mitigation plans by local governments with inadequate staff or resources.

As an addition to its *how-to-guide*, FEMA provided requirements on assessing vulnerability in a later document, *Multi-Jurisdictional Mitigation Planning*.³⁴ FEMA categorizes these requirements in three criteria. Accordingly, mitigation plans should describe vulnerability in terms of: (a) types and numbers of existing and future buildings, infrastructure, and critical facilities located in the hazard area, (b) potential dollar losses to these identified vulnerable losses, and (c) providing a general description of land uses and development trends within the community, so that mitigation options can be considered in future land use decisions.³⁵ This categorization eliminates the human factor signaling the problematic way disaster mitigation is comprehended in the federal level. On the other hand, despite these shortcomings, these documents can be accepted as an initiation to the acceptance of mitigation as an important part of disaster management, and together with the Act of 2000 provide a base for more comprehensive federal programs and legislations that have been criticized by practitioners and academicians for its patchwork nature.³⁶

In the international arena, many local governments have undertaken integrated disaster risk management programs, as multilateral organizations have shifted their focus and assistance from recovery and reconstruction to disaster management. As it was explored in [Sect. 2.3.1.1](#) of this book, in the example of slum upgrading projects supported by financial and technical assistance, integrated disaster risk management programs aim at integrating risk reduction actions into local government services. These actions vary from vulnerability and risk analysis to public awareness and participation, protecting critical infrastructure, and at times larger scale projects aiming at citywide mitigation and disaster risk reduction. Some of the successful and initiating programs range in context. One of them is the Municipal Disaster Mitigation system in Manizales, Colombia based on municipal development and land-use plans, in addition to tax-incentives and voluntary housing insurance scheme.³⁷ In Manizales, the disaster risk management plan is integrated into the city’s development plan and its environmental policy and action plan, and it has been able to bring

³³ Federal Emergency Management Agency (FEMA) (2001).

³⁴ Federal Emergency Management Agency (FEMA) (2006).

³⁵ Federal Emergency Management Agency (FEMA) (2006): 26–28.

³⁶ See “Governing Land Use in Hazardous Areas with a Patchwork System” (May and Deyle 1998: 57–82) for legal programs and policies that influence land-use and development in hazard-prone areas.

³⁷ United Nations Development Programme (UNDP) (2004): 63.

together the local and regional government, the private sector, universities and representatives of community organizations into a participative process.³⁸ The Municipal Flood Management system in Cologne, Germany is another project deemed successful involving engineering systems, public awareness, emergency management, and integration of Geographical Information Systems (GIS) based flood-risk plans in urban planning (UN/ISDR 2004: 1:130).

In addition to single projects, many regional and international programs support local governments' initiatives in disaster risk reduction. Initiated in 1995 by the Asian Disaster Preparedness Center, the Asian Urban Disaster Mitigation Program (AUDMP) promotes "strategic approaches to urban risk reduction as part of urban development planning processes" (UN/ISDR 2004: 1:134). AUDMP's project activities concentrate on different issues in accordance with local priorities in ten Asian countries, covering activities such as hazard mapping and risk assessment, mitigation planning and implementation, public awareness and education, capacity-building, safer building construction, community-based approaches, and policy, legal, and institutional arrangements (UN/ISDR 2004: 1:135).

Another international program is the "Resilient Communities" project developed by the *International Council for Local Environmental Initiatives* (ICLEI). According to this project, "a resilient community encompasses the acceptance of developing capacities to identify vulnerabilities and activities to reduce them. It employs tools and strategies for hazard reduction and risk management, which include planning measures, urban design features, regulations that are enforced and the investment of resources to protect important assets. It also needs to support institutional and community-based systems for crisis management, response and recovery when necessary" (UN/ISDR 2004: 1:139). As part of this agenda, the *Earthquakes and Megacities Initiative* (EMI) developed a tool known as a *Disaster Management Master Plan* (DMMP). Wenzel and Bendimerad (2002: 119–124) of the EMI explain that a DMMP consists of five components: (1) disaster assessment, (2) disaster preparedness, (3) disaster response and relief, (4) disaster mitigation, and (5) know-how and expertise acquisition. They argue that DMMP is "a rational and efficient approach to build local capacity because it fits conventional local government operating framework," which is "driven by similar plans in areas such as urban development, land-use planning, capital planning and public safety" (Wenzel and Bendimerad 2002: 121). In recent years, with the initiation and support of international agencies, a number of hazard-prone metropolitan cities, such as Mumbai³⁹ and Istanbul, have prepared Disaster Management Master Plans, emphasizing institutional and legal changes that may pave the way to the possible employment of these intensive studies.

Another program, the *Mayor's Task Force on Climate Change, Disaster Risk and the Urban Poor*, which was launched at the Mayor's Summit in Copenhagen

³⁸ Satterthwaite (2011): 16–17.

³⁹ See "Disaster management plan for the State of Maharashtra, India" (Vatsa and Joseph 2003) for the Mumbai case.

in 2009, identifies good practice examples and propose policy and investment programs to improve the resilience of the urban poor to disaster risks and climate change. As part of a global study carried out by the World Bank as part of the Mayor's Task Force work program, the following actions are recommended to build resilience of the urban poor: (a) assessing risk at the city and community level, (b) integrating climate change and disaster risk reduction policies for the poor in urban planning and management, (c) building institutional capacity to deliver basic services and reduce vulnerability to climate and disaster risk, (d) bridging communities and local governments to work together on local solutions, and (e) opening new finance opportunities for cities to address climate change adaptation and disaster risk reduction (WB 2011).

And most importantly the UNISDR's 2010–2015 global campaign proposes a 10 step checklist for *Making Cities Resilient*:

1. Put in place organization and coordination to understand and reduce disaster risk, based on participation of citizen groups and civil society. Build local alliances. Ensure that all departments understand their role in disaster risk reduction and preparedness.
2. Assign a budget for disaster risk reduction and provide incentives for homeowners, low income communities, businesses and the public sector to invest in reducing the risks they face.
3. Maintain up to date data on hazards and vulnerabilities. Prepare risk assessments and use these as the basis for urban development plans and decisions, ensure that this information and the plans for your city's resilience are readily available to the public and fully discussed with them.
4. Invest in and maintain critical infrastructure that reduces risk, such as flood drainage, adjusted where needed to cope with climate change.
5. Assess the safety of all schools and health facilities and upgrade these as necessary.
6. Apply and enforce realistic, risk compliant building regulation and land use planning principles. Identify safe land for low income citizens and upgrade informal settlements, wherever feasible.
7. Ensure that education programmes and training on disaster risk reduction are in place in schools and local communities.
8. Protect ecosystems and natural buffers to mitigate floods, storm surges and other hazards to which your city may be vulnerable. Adapt to climate change by building on good risk reduction practices.
9. Install early warning systems and emergency management capacities in your city and hold regular public preparedness drills.
10. After any disaster, ensure that the needs of the affected population are placed at the centre of reconstruction, with support for them and their community organizations to design and help implement responses, including rebuilding homes and livelihoods (UN 2012).

2.4 Conclusion

Disasters and development have an interlinked and multifaceted relationship. They can mutually have a negative effect on each other. On the other hand, sustainable development can also help reduce disaster risks. Today, research on this complex relation is more essential than at any other time in history, as worldwide statistics indicate an increasing number of disasters as recent patterns, and as climate change is expected to increase the intensity and severity of hazards in urban areas.

Disaster statistics indicate the increasing impacts of disasters (with the exception of mortalities) within the last decades, and they reveal a general pattern in relation to geographical location and development. For instance, within the last three decades, Asia had the highest number of geophysical, hydrological and meteorological disasters, Africa experienced the highest number of biological disasters and droughts and Europe had the highest number of climatological disasters. These results indicate the global spread of disaster impacts, the existence of a variety of vulnerabilities in relation to development levels, and a need for different types of disaster risk management.

Vulnerability to natural disasters is expected to be increasingly affected by the global force of urbanization. Urbanization, together with other interlinked forces, can either generate or increase intensity of hazards (such as with climate change and land degradation), as well as having the potential to increase vulnerability to hazards (such as with globalization).

This chapter has described two images that represent disaster vulnerability of urban populations ranging from those in low-income countries to middle- and higher-income ones. It has shown that there is a strong tie between vulnerability and urban poverty, and that an understanding of urban poverty encompassing both economic and non-economic factors provides insight to disaster vulnerability in urban areas, such as in informal settlements and slums. In order to understand the full extent of the sources of urban poverty and vulnerability, it is also essential to gain an overall coherence of rural–urban linkages and to promote mutual policies such as those for land tenure, appropriate land allocation or interregional transport and infrastructure.

This chapter has also argued that, on the other hand, it is necessary to stress that *vulnerability* is not identical with *poverty*; and that “not all poor people are vulnerable to disasters, and some people who are not poor are also vulnerable” (Bankoff 2003: 19). In some instances, communities move towards new design and construction schemes with untrained professionals or insufficient inspections; or in other cases, they disregard spatial planning schemes leading to the vulnerability of these communities.

The study of various risk reduction programs in urban areas confirmed that there is no one solution to disaster mitigation and different strategies need to be applied to the needs of diverse communities. However, it also revealed the

persistent need of conditions such as “good urban governance”,⁴⁰ planning, building, and economic measures for successful risk reduction strategies. Public awareness, empowerment, and participation of urban residents are key elements to reducing vulnerability in urban areas, providing not only motivation of residents but also success in implementation with real space–time input. Coordination of involved organizations, knowledge sharing, and data gathering are other essential components. A willing and proactive local government with financial and technical resources (as part of good urban governance) is one of the foremost requirements to be able to implement integrated risk reduction practices.

Physical planning, construction and building design standards are essential elements in urban disaster risk management. However, as much as adequate zoning, building regulations, and legal tools are necessary, they can sometimes be too rigid and expensive for urban residents to employ, leading the way to an untrained informal construction sector and settlements. It was observed that the failure to analyze costs of imposing certain zoning regulations in advance “can easily imply that well-intended regulation will end up hurting the poor” (Deininger 2003: 176). Evidence has shown “the inverse relationship between informality and the imposition of regulations” in many developing countries (Deininger 2003: 176). The measures to meet strict land-use and building regulation are found “too expensive or bureaucratically cumbersome” for many, “pushing more and more housing and settlements outside the regulations”.⁴¹ Again, although some local governments develop master plans to regulate urban development and expansion, lack of consultation with cities’ residents and interest groups lead to poor results in their application.

These problems stress the significance of good urban governance in bringing together different groups to input for decisions concerning the future of the city. Such a multi-dimensional planning process can provide the way to reducing disaster risk while producing a sustainable urban development, where “environmental quality, economic growth and social justice coexist” (Beauregard 2003). The next chapter will examine how the lack of such a planning and development process has resulted in the exposure and vulnerability of the hazard-prone city of Istanbul and its residents.

⁴⁰ According to the UN-Habitat’s Governance Campaign, principles of “good urban governance” is characterized by *sustainability* in all dimensions of urban development, *subsidiarity* of authority and resources to the closest appropriate level, *equity* of access to decision-making processes and the basic necessities of urban life, *efficiency* in the delivery of public services and in promoting local economic development, *transparency and accountability* of decision-makers and all stakeholders, *civic engagement and citizenship*, and *security* of individuals and their living environment. United Nations Human Settlements Program (UN-Habitat), 2004: Principles of Good Urban Governance; at: <http://www.unhabitat.org> (2006):3–7.

⁴¹ Satterthwaite (2011): 19.

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