Chapter 8 Urbanising Risk



More investment in infrastructure and the built environment will be required over the next 40 years than has occurred over the last 4 millennia. How disaster risk is addressed in the construction and real estate development sectors is therefore going to shape the future of disaster risk reduction.

Where investments in urban development generate new risks or exacerbate existing ones, the **cost of disasters** is often spread across communities and sectors. These **shared costs are not well accounted for** and **responsibilities are not well defined**. A number of disincentives work against businesses investing in reducing disaster risk in urban development, including the promise of **high profit from speculative investment** and **ineffective public regulation**.

Large-scale infrastructure projects and new approaches to sustainable urban development provide **opportunities for engaging** private investors and the construction sector in **new public-private partnerships for resilient investment**.

8.1 Urban development and the future of disaster risk reduction

Whether or not disaster risk is factored into investment decisions in urban development will have a decisive influence on the future of disaster risk reduction.

The future of disaster risk reduction will be largely played out in city regions. As highlighted in Chapter 2, investments in real estate development and infrastructure in areas exposed to earthquakes, tropical cyclones and tsunamis have contributed to a massive increase in the hazard exposure of produced capital in some regions, particularly in Asia. However, in many cities and countries that have successfully attracted investment in transport and energy infrastructure, ports, airports, housing, industry and services, investment in disaster risk reduction and the capacities to implement have often lagged behind.

As a consequence new patterns of intensive risk have been produced. Worldwide, expected annual average losses to urban produced capital, from earthquake and cyclonic wind damage alone now represent approximately US\$180 billion per year (see Chapter 3). At the same time, the transformation of city regions, through badly planned and managed urban development and environmental modification, has generated new hazards and extensive risks that now are responsible for comparable, additional levels of loss (see Chapter 4).

Historically, much urban growth in low and middle-income countries has occurred through informal mechanisms of land acquisition, building and infrastructure provision. Mortality aand extensive risks are disproportionately concentrated in these countries, where a large proportion of low-income households lives in informal settlements in hazard-exposed areas. GAR09 and GAR11 analysed in detail the nexus between weak urban governance, the growth of informal settlements and the accumulation of disaster risk in low and middle-income countries.

This chapter complements that analysis by illustrating some of the key challenges and opportunities associated with managing disaster risk in formal processes of urban development and infrastructure development—not only in low and middle but also in high-income countries.

As this chapter will highlight, at present there are only limited incentives for businesses in the urban development sector to invest in risk reduction. However, there is evidence that this incentive structure may be changing. Investing in resilient and sustainable urban development is becoming a compelling value proposition for business, particularly when it is structured through partnerships with the public sector (Global Construction Perspectives and Oxford Economics, 2011).

8.2 The new wave of urbanisation

More investment in infrastructure and the built environment will be required over the next 40 years than has occurred over the last 4 millennia. Consequently, the construction and real estate development sectors are estimated to grow by almost 70 percent by 2020.

The world is increasingly urban.ⁱ By 2050, the world's urban population (including those living in small urban centres) will represent about 70 percent of a projected global population of 9 billion.ⁱⁱ The proportion of the labour force in the industry and services sector, which has now reached 65 percent, has grown at approximately the same rate as the urban population (Global Construction Perspectives and Oxford Economics, 2011).

The urban population of sub-Saharan Africa is expected to grow from 298 million in 2010 to 596 million in 2030 and 1,069 million in 2050 (United Nations, 2012). The urban population of India is expected to grow from 379 million in 2010 to 606 million in 2030 and 875 million in 2050. Other regions and countries with high, expected growth include North Africa and China.

Historically, this represents a major shift in the distribution of the world's urban population and its largest cities. In 1970, the urban population of Europe represented 30.5 percent of world urban population; by 2050, this figure will have dropped to 9.5 percent. In contrast, the urban population of sub-Saharan Africa represented only 4.1 percent of world urban population in 1970; by 2050, it is expected to increase to 17.1 percent (Ibid.). Clearly this new wave of urbanisation represents a major business opportunity. More investment in infrastructure and built environment will be required over the next 40 years than has occurred over the last 4 millennia (WEF, 2012). Consequently, the construction and real estate development sectors are estimated to grow dramatically in the next 10 years (Global Construction Perspectives and Oxford Economics, 2011).

One estimate projects investment in urban development to increase by 67 percent—from US\$7.2 trillion in 2011 to US\$12 trillion by 2020ⁱⁱⁱ (Global Construction Perspectives and Oxford economics, 2011). A total of US\$97.7 trillion will be spent on construction globally during the next decade and by 2020, construction will account for 13.2 percent of world GDP (Ibid.).

Analysis of the commercial real estate sector also shows that after the financial crisis of 2007–2008, investment has bounced back to over US\$400 billion globally in 2012 (Figure 8.1).

Although a huge business opportunity, this investment represents a challenge for disaster risk reduction. Much of this new urbanisation will unfold in hazard-exposed countries such as India and in regions with weak disaster risk management capacities, as in sub-Saharan Africa.



Figure 8.1 Direct commercial real estate investment, 2007–2012

(Source: UNISDR, based on Jones Lang LaSalle (2013))

The sheer volume of investment in urban development and infrastructure expected in the coming decades means that the future of disaster risk reduction is at stake. If this investment takes place, as it has in the past, without factoring in risk considerations, then the new wave of urbanisation will be accompanied by another wave of disaster risk accumulation. This will threaten the resilience, sustainability and competitiveness of countries, cities and businesses alike. Conversely, if incentives and regulations to encourage risk-sensitive investment are put in place, the new wave of investment may become a unique opportunity to further disaster risk reduction.

8.3 The urban development process

Part of the disaster risks produced through investments in urban development and infrastructure are spread across communities and sectors to become shared costs. These shared costs are produced through large numbers of individual

public and private investment decisions and non-decisions taken over the long term—making it difficult to attribute responsibility.

Urban development as a business sector involves a wide range of stakeholders. These include landowners and those who buy land and property for speculative development; building professions that design and supervise construction; banks, investment funds and others that finance urban development; construction and engineering businesses, which range from huge multinationals to local building companies; the insurance industry; utility and service providers; and public sector bodies that are meant to plan and regulate urban development.

As Figure 8.2 below shows, business investments in urban development are influenced by a range of factors and involve different stakeholders. The urban development process typically moves through a process that includes several stages: pre-project (developing the design brief, concept and technical

Figure 8.2 Factors that influence the production of risk in urban construction



(Source: Johnson et al., 2012)

design of a site); pre-construction (developing proposals, tender documentation and procurement); construction; and post-completion (including operation and maintenance).

Decisions to manage disaster risk may be taken during any of these different phases and reflect the interaction between stakeholders involved and factors that influence their actions. These factors include risk awareness; pricing of insurance; the existence and enforcement of risk-sensitive landuse plans or building codes; and public policies to promote growth and investment. But ultimately, as in any other sector, trade-offs exist between the risks and costs and potential gains and profits. For example, as discussed in Chapter 2, even risk aware businesses may decide to invest in hazard-exposed areas with other comparative advantages, reflecting the imperative of economic growth and a conscious trade-off in which high levels of return on capital are considered sufficient to offset potential risks and losses.

In urban development, identifying these trade-offs is complicated for many reasons. Many intensive risks have long-return periods, meaning that for investors in urban development, the risks have low

Table 8.1 Types of risk-inducing construction practices and who bears the burden of risk

Types of risk-inducing construction practices	Who bears the burden of risk
Building in hazard-prone locations	
 Building on flood plains Building in coastal areas subject to storm surge Building on seismic fault lines or areas prone to liquefaction Building on steep slopes at risk of landslides Building near to bushfire or forest fire areas 	 Businesses and residents that are users of the buildings are directly impacted when there is a disaster event Losses not covered by insurance must be covered by public sector or by individuals
Construction in one area exacerbates risks in neighbouring areas	
 Coastal erosion in adjacent areas caused by engineering techniques used in the project Infilling of wetlands, lagoons, swamps, mangroves increases flooding in other areas Elood-reducing infrastructure ie: numping embankments 	 Business and people located nearby who feel worse impacts (ie: more intense flooding) because of the development Risks are passed onto the public sector, which often becomes responsible for recovery and risk reduction Impacts felt most strongly in informal settlements lacking

- Flood-reducing infrastructure, ie: pumping, embankments causes greater flooding elsewhere
- Use of non-porous surfaces increases run-off
- Pumping out groundwater is causing subsidence and increasing earthquake suceptibility
- Impacts felt most strongly in informal settlements lacking infrastructure

Building designs or construction methods that do not account for known risks and / or lack of risk reducing infrastructure

- In seismic areas, designs or construction methods that are not earthquake-proof
- In flood areas, buildings that are not raised, or having critical building infrastructure located in basements
- Foundations that are not deeply set can cause buildings to move in floods
- Inadequate site drainage

- Businesses and residents that are users or owners of the buildings are impacted when there is a disaster event
- Losses not covered by insurance must be covered by individuals or by government

visibility and are downplayed. Even when they have been assessed, the risks may be ignored given the expectation of a high short-term return on capital. At the same time, risks are produced through large numbers of individual public and private investment decisions and non-decisions taken over long periods-making it difficult to attribute responsibility, ownership or liability. While real estate development and infrastructure projects may generate new disaster risks, these are then transferred from developers to the ultimate users of urban development, reducing accountability. As Table 8.1 shows, investments in urban development and infrastructure produce shared risks and costs for the public sector and for other businesses and communities

8.4 Speculative gain and public regulation: the disincentives for disaster risk management in real estate development

In principle and in most countries, local, city or national governments regulate investments in urban development. However, even when disaster risk considerations have been factored into planning and regulatory frameworks, there have been major challenges to implementation in practice.

At present there are only limited incentives for businesses in the urban development sector to invest in reducing disaster risks. The short-term profitability of speculative urban development, weak or ineffective public regulatory frameworks, which rarely take disaster risk into account; and the absence of clear channels of responsibility and accountability for risks and costs generated conspire against risk-sensitive investment.

Speculative investment

The first of these disincentives is represented by potential profits from short-term speculative investment in land and property. Historically, investment in urban development has been driven as much by the profits to be made as by demand from a growing population and productive sector (Harvey, 1985). In rapidly growing economies, land and property speculation thrives. Asset prices and rents in many economically successful urban areas have increased sharply leading to increasingly segregated

Box 8.1 Real incentives for investment of private capital in Dhaka's real estate

The growth of Dhaka's industry and service sectors over the last 20 years has triggered a boom in the city's real estate sector. For example, whereas only 30 garment-manufacturing companies existed in the country in 1980, in 2011, the number had risen to 5,150 with many located in Dhaka. The garments sector now represents 70 percent of Bangladesh's net exports.

However, other factors have also contributed to the real estate boom. Remittances have proved a robust source of financing and the change from multigenerational households to nuclear families has increased demand for urban housing. An increase in rents by 250 percent from 1990 to 2007 stimulated investment in real estate. Today, the construction industry employs 2.4 million in Dhaka, which in 2010–2011 contributed about 25 percent of national GDP, of which 19 percent was from private investment. These figures represent the formal real estate sector and do not include significant investment and construction in informal settlements in Dhaka and other urban centres of Bangladesh.

Regulation of real estate development is rarely effective. Developers require approvals from different authorities whose regulations and approval criteria are poorly coordinated. Combined with limited public sector capacity and temptation by developers to bypass steps in the approval process, disaster risks are rarely assessed and are transferred from poorly regulated developments to public authorities, infrastructure users and private households. cities, in which low-income households as well as small businesses find themselves pushed towards the urban periphery or onto hazard-exposed areas.

In Brazil, for example, prime urban land is held by landowners in anticipation of profits through future sales while low-income households settle in areas with limited basic infrastructure and services (Kataria and Zerjav, 2012). Perversely, these poor quality services often come at a high price and are another profit-generating stream in the informal market for water and energy (Ibid; Baker and Mc-Clain, 2009).

In Dhaka, Bangladesh, as Box 8.1 highlights, the country's sustained macroeconomic growth, low interest rates for savings, increased access to credit and a growing formal working sector have all contributed to a major flow of investment into speculative real estate development.

The short-term profitability of speculative urban development does not encourage consideration of disaster risks, which may only manifest as losses after the development has been sold. Investors or developers rarely take responsibility or accountability for the disaster risk that may be generated and sold on. In the case of the shared risks that are generated, the situation is further complicated because risks can rarely be attributed to a single investment decision, but are generated by layers of successive investments over decades.

There is now consensus that the flow of speculative financial capital into the real estate sector in the United States of America led to an over-accumulation of capital in that sector and risks in the financial sector triggered the global crisis that began in 2007–2008 (Castells et al., 2012). The evidence of an over-accumulation of disaster risk in hazard-exposed cities (see Chapter 4) has analogous causes, given that so much land and property development, particularly in housing, responds to speculative investment.

Ineffective public regulation

The second disincentive is ineffective public regulatory frameworks. In most countries, local, city or

Box 8.2 The build-up of risk in Lagos, Nigeria

With a recorded growth rate of more than 20 percent, construction and real estate development is one of the fastest growing sectors in Nigeria. Including the informal sector, the private sector is responsible for providing almost 90 percent of national housing stock. This growing role was actively stimulated by the government via its role in supporting development of real estate developer associations and restructuring the housing finance market (Henshaw, 2010).

However, while sound urban development policies exist, implementation of building and safety codes remains marred by corruption and limited capacity (Onakuse and Lenihan, 2007). About 80 percent of artisans engaged in the construction industry is either unskilled or uncertified owing to the absence of standardised training (Ede, 2011; Aniekwu and Ozochi, 2010; Kayode et al., 2008). Moreover, about 70 percent of Lagos' population lives in informal, poorly regulated settlements (Adelekan, 2012).

Consequently, disaster risk has been increasing. Although land zoning regulations take flood risk into account, they are not based on hazard and risk assessments. Urban development has increasingly taken place on marginal, flood-prone and unsafe lands. Coastal development has increased losses to wetlands, changes in the area's hydrology and increased flood risk, which affects the urban poor (Adelekan, 2012).

Floods in 2010 and 2011 highlighted increasing risk, with the latter event resulting in the highest claim settlement in the history of the Nigerian insurance industry and significant un-assessed costs to low and middle-income households and the public sector. In addition, hazard-mitigation measures to reduce the risk generated by uncontrolled urban development have generated huge costs to the Lagos state government. national governments have legal responsibilities to regulate investments in urban development. A large variety of instruments are used for regulatory purposes. These include master plans or high-level planning guidelines to orient the longer-term development of a city or region; city or local level landuse and zoning plans and planning regulations; building standards and regulations as well as specific requirements for large projects, such as environmental impact assessments (EIA).

In principle, these regulatory frameworks could and should be used to discourage investments in real estate or infrastructure that contribute to increasing disaster risk. In practice, regulation alone is rarely effective in managing disaster risks, for a number of reasons.

First, the way that urban investment has been planned, regulated and implemented over past decades has changed substantially. In many higherincome countries, from the mid-1950s to the mid-1970s, there was a strong culture of public intervention and investment in governmentplanned and implemented urban development and land use (Kataria and Zerjav, 2012; Glesson and Low, 2000). But from the mid-1970s onward, there was a gradual shift in focus from directly investing in urban development to facilitating increased private investment—deregulating markets and privatising state-owned land (Mukhija, 2003; Alexander, 1986).

While publicly planned urban development was not necessarily risk sensitive, this shift in focus encourages speculative development, which as highlighted above is not conducive to disaster risk management. In Serbia, for example, rapid privatisation of housing stock, including public housing estates that previously had been heavily subsidised by national and municipal government budgets, has resulted in the rapid decay of buildings and increased disaster risk (Kataria and Zerjav, 2012). In Chile, deregulation and de-zoning of urban land has also led to unregulated construction on hazard-exposed areas with inadequate overall building quality (Smolka and Sabatini, 2000).

Many low and middle-income countries also adopted legislation and planning mechanisms to regulate land use, building and urban development; or inherited inappropriate mechanisms from the colonial era, but generally with significantly weaker capacities in implementation and enforce-

Box 8.3 Rapid growth of construction sector equals rapid growth of disaster risk in Viet Nam

Viet Nam has experienced rapid economic growth and urbanisation in recent decades. In parallel, private investors in the real estate sector have gained more power to shape urban planning and development. Increasing pressure to build in hazard-prone areas comes from migration and urbanisation, which is exacerbated by speculative real estate development driven by opportunities for short-term profits. Many areas previously zoned as subject to flood risk are being developed as residential and industrial sites, not only in large cities such as Ho Chi Minh City but also in smaller urban centres.

For example, Can Tho City, with a population of 350,000, is the demographic and economic centre of the Vietnamese Mekong Delta. Major new residential and industrial developments are planned in the Cai Rang district at the confluence of the Hau and Can Tho Rivers with high flood risk. The city district's zoning plans reflect this risk only partially; for example, future flood risk scenarios were not included.

Real estate developers heavily influence zoning plans in the city. Approval has been sought to build almost double the number of new residences allowed for in the district's master plan. While not all of these will be developed, agricultural land and floodplains will be converted to residential areas creating a patchwork of development, open spaces and fallows, which interrupts natural drainage flows in the city and aggravates flood risk. As a consequence, authorities may be forced into large public investments in flood mitigation infrastructure.

In Italy, damages (and often deaths) caused by flooding make it to the news almost every year. During the 20th century, Italy was recorded as Europe's second country most affected by flooding, with about 3,000 flood disasters (Llasat and Siccardi, 2010). The flood that affected the Veneto region in October 2010 was estimated to have caused €3.7 billion in damages (European Commission, 2011), and damages from events that affected Liguria and Toscana in October 2011 were valued at €722 million (European Commission, 2012). In November 2012, six people vanished during the flood affecting Toscana.^{iv}

Although physical factors such as climate, topography and morphology contribute to flood hazard, the way river basins have been intervened (for example, canalising rivers) has been an important factor contributing to current flood risk.^v In Northern Italy, excessive extraction of ground water has led to heavy subsidence in the Po Valley, reaching 0.7 cm per year (Carminati and Martinelli, 2002), which in turn increases flood hazard.

The urbanisation of floodplains has also contributed to increased flood risk, particularly since the 1960s. Different laws and policies have been adopted to regulate land use (Luino et al., 2012). But local autonomy to designate the areas that can be built up, along with the fact that flood risk assessments are not an 'exact' science, has in some cases allowed developers to keep building in floodplains (Ibid.). However, it is not only a matter of legislation—regulations are not always respected. For example, in Campania, population growth and speculative development has extended city boundaries towards flood-prone areas and also contributed to landslide risk in the area (Di Martire et al., 2012).

(UNISDR)

ment. These mechanisms were often used to structure urban space in a way that segregated higher and lower-income households and formal and informal areas of cities (Mitlin and Sattertwaite, 2013). As Box 8.2 exemplifies, in some cases, this has resulted in city governments completely losing control over urban development (UN-HABI-TAT, 2012).

In recent years, however, a counter trend has emerged. In middle-income countries with successful economies, formerly ineffective or non-existent planning and regulatory mechanisms have been strengthened, enabling city governments to exercise some control and authority over urban development.

Second, even where regulatory mechanisms do exist and when disaster risk considerations have been factored into these mechanisms, there have been major challenges to implementation in practice. More than half of the countries reporting on progress against the HFA in 2011–2013 recognise that they lack risk-sensitive mechanisms to regulate investment in urban development. For example, in Bangladesh, the government acknowledges that the country does not have risksensitive policies for land zoning and the regulation of private real estate development (Government of Bangladesh, 2012). Risks may also be generated by inaction and non-decisions, which weaken accountability and responsibility. In Turkey, construction takes place that ignores the country's relatively strong building codes (Yönder and Turkoglu, 2010; Balamir, 2012; Sengezer and Koç, 2005).

As Box 8.3 highlights, investors and developers are often able to influence and manipulate land-use zoning plans designed to regulate disaster risk.

As Box 8.4 illustrates, similar challenges are faced in high-income countries.

In the United Kingdom, where flood risk management has been debated for decades, a policy that requires local planning authorities to identify risks posed by floods to new development has existed since 2006. However, a sequential approach in the planning process allows planning permission to be granted for development on floodplains if the developer can show that no alternative sites exist. In the United Kingdom, 2012 was a particularly wet year, with second highest rainfall recorded in about 100 years. In November 2012, in some locations, rainfalls of a return period above 100 years were recorded (NERC (CEH), 2012). Flooding affected many parts of the country, causing losses estimated at about £1 billion, with more than 1,000 homes damaged or destroyed. Insured losses represented about half of the total cost (AON Benfield, 2012c). This was the worst damage since the 2007 floods, which in turn had triggered reforms in the United Kingdom's management of flood risk.^{vi}

So what went wrong again in 2012? Existing regulation and guidance on required risk assessments (Government of the United Kingdom, 2006) and the new National Planning Policy Framework (Government of the United Kingdom, 2012) might not have provided the Environment Agency with enough authority to stop development (Barclay, 2012). The rate of construction in the floodplain has continued to increase (Committee on Climate Change, 2012), which increases exposure and risk (Bosher, 2012; Barclay, 2012).

But this is not the only issue. From one perspective, regulation would appear to be successful. Since 1989, 7 percent to 11 percent of new housing in the United Kingdom has been built in areas with "high flood risk" (Bosher, 2012). Between April 2008 and March 2011, the Environment Agency reported that the rate of planning permits granted against their advice was reduced from an annual rate of 4.6 percent to 0.9 percent.

However, existing flood risk 'zoning' only accounts for river and coastal flooding. Therefore development can still take place in areas subject to surface water and flash flooding. Insufficient drainage and culverts blocked owing to lack of maintenance were important contributors to the 2012 flooding. Substantial cuts in funding to the Environment Agency and to local flood risk management initiatives (Bennett, 2012) might have contributed further.

Also, areas protected by flood defences are not defined as 'high risk'. Therefore, many new developments were built on areas protected by flood defences (thus, strictly speaking, not at risk of flooding). To maintain the same standard of protection for such developments, the government needs to heavily invest in the maintenance of such structures. Thus, increasing development in areas protected by flood defences, or continuing to build new defences, may be unsustainable in the long term (Committee on Climate Change, 2012).

However, public acceptance of curbing new developments in floodplains or reducing the standard of protection from floods is limited. The Humber Estuary is a case in point. Being particularly vulnerable to sea level rise, the maintenance of the current standard of protection provided by flood defences is not viable in the whole estuary. After extensive consultation with residents and local business, there was little support for proposals to 'make space for the water' (Government of the United Kingdom, 2008).

Households and businesses clearly need to be more aware of risks when deciding where to buy a house or establish a business. In the United Kingdom, information on flood risks is freely available. Despite this, a recent survey showed that in London, less than one-third of small and medium-sized businesses at risk are adequately equipped against floods.^{vii} Currently, the government has an agreement with insurers that oblige them to provide policies to those who live in areas with a yearly probability of 1 in 75 (or lower) of being flooded (Bennett, 2012a). Although this does not protect all households (e.g. those at higher risk of flooding and those who cannot afford insurance), it provides a certain degree of security. This agreement is, however, expiring in 2013.

(Source: UNISDR)

In practice, developers have received planning permits to build on flood-prone areas, especially in densely populated areas such as Greater London (Bosher, 2012). As Box 8.5 highlights, building in flood-prone areas has had a direct and decisive influence on economic losses in the United Kingdom in recent years. There is little evidence, therefore, to show that disaster risk in urban development can be managed by public regulation alone, even in countries with strong institutions and a high level of capacities. The attractive short-term returns on capital to be gained from speculative real estate development, the potential collusion between different stake-



(Source: UNIDR based on World Bank and PPIAF, PPI project database^{ix})

holders in the urban development process and loop-holes in regulation itself, all conspire against an effective management of disaster risks.

8.5 Infrastructure development and risk transfer

Infrastructure investments at the scale required to meet sustainable economic and developmental goals will increasingly rely on private sector engagement, particularly in low-income countries. The OECD estimates that by 2030, annual investment requirements for telecommunications, road, rail, electricity (transmission and distribution) and water are likely to total about US\$53 trillion, an average of 2.5 percent of world GDP (OECD, 2007). When electricity generation and other energy-related infrastructure investments in oil, gas and coal are added, the total would be more than US\$70 trillion or 3.5 percent of world GDP (Ibid.).

The need for such investment is particularly critical in low-income countries. For example, the World Bank estimates that African countries need to

Box 8.6 Delhi metro exposed to multiple risks

A metro line to connect Delhi, India, with a new suburb is one of the city's biggest recent infrastructure projects. This privately financed project, however, may contribute to increasing earthquake and flood risk in the city.

In terms of direct risks, more than 50 stations on this new line are located in areas of high earthquake hazard, exposing the line to earthquakes of up to a magnitude of 8 on the Richter scale (see Figure 8.4). One of the stations was also built in a high flood hazard area. In both cases, hazard information was available on municipal zoning maps. As a result, the metro line is exposed to high flood and earthquake risk even for short return periods of 1–10 years (IIHS, 2012).

Figure 8.4 Delhi metro lines overlaid on the seismic micro-zoning map, and location of Shastri Park metro station in floodplains of the Yamuna riverbed



(Source: IIHS, 2012)

This direct risk to metro stations and rail line structures has been addressed and reduced owing to application of risk-sensitive building codes. However, this is not necessarily the case for new real estate developments surrounding the stations. For example, following construction of the station in the floodplains, further commercial expansion is planned in the area without consideration of risk (IIHS, 2012).

Decision-making for such large-scale infrastructure projects is a complex process in any country or city. But in planning and implementing such projects, disaster risks are constructed and then transferred to the ultimate users of the infrastructure, irrespective of zoning and risk maps (IIHS, 2012). Despite awareness of earthquake and flood risk, much of the expansion of Delhi (Figure 8.5) has taken place in highly hazard-prone areas.





Delhi 1992, 8.7 million Delhi 2000, 13.7 million Delhi 2011, 16.3 million

(Source: IIHS, 2012)

spend about 9 percent of their GDP on new as well as on the operation, maintenance and expansion of existing infrastructure to reach the Millennium Development Goals by 2015 (World Bank, 2008a). However, this has not translated into actual spending, owing to budget constraints in many countries. Actual expenditure on infrastructure in Africa has been only half of the required 9 percent over the last 40 years (lbid.).

Private participation in the development of infrastructure, including private financing, is thus sought to bridge the gap between needs and available public resources. The World Bank's database on private engagement in infrastructure projects^x shows that despite fluctuations, this has been increasing in low-income and middle-countries since the mid-1980s (Figure 8.3). Investment in major infrastructure projects structures how cities and their regions grow. If disaster risk considerations are not factored into their design, collapsed and damaged critical infrastructure can be a serious cause of business interruption and a source of indirect disaster loss for city regions. But even when the infrastructure itself is disaster proof, it can lead to other investments in hazard-prone areas that increase disaster risk. Infrastructure projects, therefore, have a major potential to generate shared risks and costs.

Major infrastructure projects are increasingly developed as public-private partnerships (PPPs), in which a varying proportion of the investment and risk is carried by the public sector and by private investors. Depending on how these PPPs are structured, who owns these risks may not be clearand part of

Box 8.7 Impact of dike rupture in Colombia, the Netherlands and Japan

Over the last 40 years, construction of dikes has been the principal strategy for flood hazard mitigation in the floodplains of Colombia, particularly on the Magdalena and Cauca Rivers that cross the country from south to north. Between 1970 and 1990, 715 km of dikes were constructed along the river and 626 km in lateral canals in the Cauca river basin alone (OSSO, 2012c). Although dikes provide flood protection, they explicitly or implicitly encourage development and increased exposure on areas where flood hazard has been reduced.

During the 2010/2011 ENSO episode in Colombia, dykes failed in at least 42 percent of the country's departments, and were responsible for a significant proportion of total flood losses (OSSO, 2012c). During and following the disaster, a significant proportion of resources invested in rehabilitation and reconstruction was used to rehabilitate or reinforce dykes (US\$884 million by Colombia Humanitaria and US\$21 million by the Adaptation Fund), potentially reproducing or aggravating the risks that existed before the disasters (Ibid.).

In contrast, the Netherlands, with two-thirds of its population and 60 percent of its land below sea level, had been investing in dyke construction for decades, turning floodplains into polders^{xi} for agricultural and urban development (Orie and Stahel, 2012). A series of floods in the 1990s, associated with dyke failures, led to a new approach that effectively "depolderises" the country (Ibid.). By deepening riverbeds and moving dykes away from the river, rivers can expand into floodplains at almost 40 locations along the major rivers.^{xii} Although costs for this strategic shift are an estimated €2.2 billion, the social and environmental benefits are expected to be even higher (Orie and Stahel, 2012).

In Japan, the 2011 tsunami triggered a review of design concepts for levees against possible tsunami impact. The main innovation was a classification of disaster risks into two categories: extensive and intensive risk. In the revised designs, levees are required to withstand extensive risks with a return period of 10 to about 100 years (Government of Japan, 2012b). In other words, levees have to be built to protect populations from high-frequency risk. For intensive risks, which are likely to happen with a return period of more than 100 years, build-ing levees would usually neither be a guarantee for protection nor do they show positive cost-benefit ratios. Therefore, in addition to infrastructures, the government focuses on resident evacuation and other prepared-ness measures for such events.

the risk may be transferred from the private to the public sector.

In India, the country's Eleventh Five Year Plan allocated more than US\$500 billion for infrastructure investment up to 2012, of which a substantial portion was earmarked for the engineering and construction sectors (PwC, 2008). Increasingly, in India, PPPs are emerging where private investment finances publicly managed construction.

As Box 8.6 shows, these partnerships do not necessarily lead to improved disaster risk assessment and management, and may underplay disaster risks or lead to their transfer as shared costs to the public sector or to city residents.

The construction of infrastructure to control floods, such as dykes, may also generate shared risks and costs, as it facilitates real estate development in flood-prone areas that appear to be protected. The consequences of dyke failure may be worse than the risks that were supposed to be addressed by the infrastructure in the first place (Box 8.7). Unless the ownership of the risks that can be generated by large infrastructure projects is made explicit and the responsibilities of both private and public partners clarified, there may be insufficient incentive for the private partners to invest in risk reduction. At the same time, the public partners are often unaware of how much new risk they are really taking on.

8.6 Towards a new incentive structure: disaster risk reduction as a value proposition in urban development

Through partnerships, businesses are able to reduce their own losses as well as support the public sector to more effectively manage and reduce disaster risks. Resilient infrastructure systems underpin resilient business and resilient business underpins prosperous cities and countries.

On 6 July 2011, businessman Donald Trump and Panama's President Ricardo Martinelli participated in the inauguration ceremony of Trump Ocean Club, Panama, a luxury international hotel and casino.^{xiii}

Box 8.8 Addressing flood risk in Scotland – joint private and public action

Compared with other parts of the United Kingdom, Scotland has been comparatively successful in reducing its exposure to flood hazard. Since 1995, new construction in floodplains has been reduced to almost zero as a result of a national planning policy that prohibited the building of residential property in areas of high flood risk.

The Scottish success was the result of working closely with private real estate developers and insurers. Planners in local governments were legally obliged to set up Flood Liaison and Advice Groups (FLAG) (Crichton, 2012) as non-statutory advisory groups of public and private sector representatives with insurers playing a key role in their establishment. Between 2000 and 2003, the Association of British Insurers (ABI) was instrumental in helping to establish 19 FLAGs with 28 Scottish local authorities covering more than 90 percent of the Scottish population. These groups also brought together property developers, landowners, water departments and suppliers, emergency planners, hydrology consultants, representatives from the national rail network, the police, fire and rescue services and many more. With local government's land use planners, development control officers and neighbouring authorities, all issues related to water management were addressed on a catchment-wide basis, making available critical hydrological and flood risk information to all stakeholders. Many groups convened information sharing events and involved community groups.

The success of this initiative is undisputed. Only one local authority, Moray, did not engage and continued construction in floodplains. Consequently, it now has serious problems with flooding and access to flood insurance. In other parts of the United Kingdom (see Box 8.5 above), local communities are not directly involved in flood planning and there is no mechanism in place for planners to consult with developers, insurers and other key stakeholders across the catchment area. Urban developers who sell properties immediately after development will have lower stakes in an integrated approach to disaster risk management. However, developers who own, lease and/or manage buildings even after construction will have a vested interest in protecting profits from losses, including those associated with disasters. Mori Building, a Japanese private developer, is such a company, and it has recognized the need to explicitly deal with earthquake risk in the construction and maintenance of its developments. It has begun to promote an urban development concept that seeks to build "a city to escape into rather than a city from which people run away". Its biggest development includes, for example, a local power plant constructed under consideration of both earthquake risk and CO2 reduction goals. During the aftermath of the Great East Japan Earthquake, the plant had the capacity to produce and sell surplus electricity to outside areas that experienced power outages. The company has housed and trained employees with specific responsibilities for disaster management and undertakes regular emergency drills.

Mori Building has not made this investment without calculating the costs and benefits. A survey of office requirements of more than 1,000 companies in Tokyo, conducted in April 2011 just after the major disaster, revealed that the most important criteria for selection was earthquake resilience (92 percent), followed by proven disaster management by the company managing the building (55 percent), and back-up of electricity to avoid power outages (51 percent). Although the result of this survey was clearly biased by the immediate disaster experienced by companies, the success of Mori's approach to take concerns seriously speaks for itself: its large commercial buildings with office space are fully occupied.

(Source: Mori Building (2012))

The Trump Ocean Club represented a new high-water mark in Panama's burgeoning real estate sector.

Unfortunately, the inauguration represented a high-water mark in more ways than one. The ceremony will now mainly be remembered for the severe flooding in the Punta Pacifica area where the Club was built and for televised images of the VIPs struggling through the flood-waters.^{xiv} While it had rained heavily, the floods were caused by inadequate drainage infrastructure that had not kept pace with the city's growth and could no longer cope with peak run-off. The capacity of the drainage system had also been reduced due to the accumulation of cement from real estate projects in the drains themselves.^{xv}

As this case highlights, investments in urban development may generate shared risks and costs for the city as a whole, such as increased flood hazard. But these shared risks can also boomerang back to affect businesses and investors, including through damaged reputations. As businesses are starting to understand how these shared risks and costs can affect them, a new incentive structure for risksensitive urban development is beginning to emerge.

There is growing evidence of the emergence of expanded risk governance frameworks in cities. Urban governments that seek to attract investment are entering into innovative partnerships with businesses (Box 8.8) as well as with low-income communities to address climate change, improve security and effectively manage risk (Johnson et al., 2012). And new approaches to urban development that highlight environmental and social sustainability are becoming a key value proposition for the construction and real estate sector. Reducing the risks associated with flooding and other hazards fits easily into this new narrative of urban development.

In urban environments, governments can seek to include businesses and investors in planning and decision-making instead of seeking to control private investment through regulation only (Johnson et al., 2012). The construction sector is an example where there are particularly important pre-project and pre-construction stages where disaster risk should be considered and where both private and public stakeholders can play a critical role (IIHS, 2012). Further, incentives for private urban developers to invest in and market their disaster risk management efforts already exist and need to be articulated more clearly to promote replication (see Box 8.9). However, risk considerations are often included too

late in the process when they have limited scope to influence project design and completion. Stakeholders have varying levels of incentives for including disaster risk reduction measures in the planning process. Often whether or not they engage in the





(Source: IIHS and UCL, based on IIHS, 2012 and Johnson et al., 2012)



In 2007, **Chicago** undertook an assessment of its exposure and vulnerability to climate change. Applying stateof-the-art climate models and risk information, the assessment focused on key infrastructure and developed a number of scenarios to evaluate the incremental costs of climate change (Oliver Wyman, 2008). Directly involved in the assessment were 18 different city departments that provided the input required for analysis of probable economic impact of climate change on the city's capital investments, internal operations and budgets (Ibid.).

The assessment highlighted rising temperatures and higher levels of rainfall as the main future drivers of dramatically increasing energy and maintenance costs. Annual energy costs in the high emissions scenario were estimated at nearly 14 times the costs in the low scenario, meaning that efficiency gains in energy consumption would yield the highest returns (Oliver Wyman, 2008).

In July 2005, **Mumbai** experienced heavy rainfall of half of its annual average within 24 hours, which resulted in flooding of more than 60 percent of the city with poor and vulnerable populations suffered significant impact with an estimated total loss between US\$240 million and US\$250 million (Hallegatte et al., 2010). Mumbai's disaster risk management plan of early 2005 had not anticipated the massive direct losses as well as indirect impacts after the floods in the form of epidemics from contaminated water and food. After the event, the municipal government updated its plan to include post-event impacts such as the spread of communicable diseases. Significant investments were made in flood control, both structural and non-structural (United Nations, 2010).

However, Mumbai still faces the serious challenge of flood risk owing to a high prevalence of informal and unsafe settlements, high density of construction on the shoreline and continuing land reclamation efforts that go hand-in-hand with the degradation of its coastline, including loss of mangroves and wetlands around the city.^{xvi}

(Source: UNISDR)

process is a function of stake and influence, which may vary for each stakeholder during different phases of a project. Incentives for including safety and disaster risk reduction measures in the planning processes of the project may be increased by raising their stakes; for example, by improving public participation processes, the capacities of the implementation agencies and regulatory bodies, and enforcing Professional Acts and making professionals more liable for their practice (Figure 8.6).

As Box 8.10 shows, the first step towards developing a joint business case for urban planners and business investment is often a risk assessment that is either commissioned by the city council or the Mayor's office or by the business itself.

Similarly, regulation that ensures the carry-over of insurance policies from developers to property owners could contribute to the practice that risk assessments of investments not only focus on the construction phase of the project but take into account the lifespan of the building (IIHS, 2012).

Businesses in the real estate sector can also play a

Figure 8.7 Green roofs on the building of Quito's water utility

key role in raising awareness of disaster risks. For example, in the United States of America, the Federal Alliance for Safe Homes (FLASH) has built a unique coalition of more than 100 organizations ranging from local governments to private sector enterprises, to the insurance industry and the federal government, all committed to reducing damage from natural hazards (Government of the United States of America, 2012). It has helped to educate Americans on how they can lessen the impacts of hurricanes, floods, fires, earthquakes, and other natural hazards on their homes.

Green building is increasingly being mainstreamed as a key component of this value proposition and in cities' efforts to develop more socially and environmentally sustainable living spaces (Carpenter, 2013). Green buildings attract higher rents, higher asset values and more stable tenancies (Brugmann, 2012). Real estate developers increasingly market aspects such as energy-efficiency, social space (Carpenter, 2013) and low environmental impacts as factors of competitiveness. And it is likely that disaster risk management will likewise become





part of this value proposition.

For example, in Ecuador, Quito's water utility (Empresa Pública Metropolitana de Agua Potable y Saneamiento de Quito) is encouraging sustainable risk reduction through water conservation, environmental education and climate change adaptation. This includes the promotion of sustainable urban drainage systems, including using green roofs that reduce the risk of urban flooding by ab-

Box 8.11 Social and green cities in low-income countries

In the city of Thimpu, Bhutan, the local government has begun to develop an urban planning process that takes account of the interrelationship between environmental sustainability, effective disaster risk management and human well-being. The Thimpu Structure Plan is based on "Principles of Intelligent Urbanism,"^{vuiii} acknowledging the needs of different occupations and lifestyles in the spatial organisation of the city. The plan is organized around 22 themes, including the achievement of a "balance with nature and tradition, conviviality and creating the 'city of our dreams'" (Figure 8.8).

Fig 8.8 The Thimpu Structure Plan lays out the existing river front and planned enhanced development of urban green spaces and social meeting points





(Source: Thimpu Structure Plan^{xix})

To achieve balanced industrial and residential development, environmental management and social and individual well-being, the municipality has employed a development suitability matrix that lays out the degrees of inter-compatibility of different types of land use.^{xx} The matrix includes considerations of rainfall levels and temperature and of climate extremes, to encourage low-risk land-use planning. It supports development of multiple land uses to enhance livelihood diversification and sustainable development to strengthen the city's economic resilience. However, there has been criticism in the local press regarding the slow implementation of the plan and its increasingly outdated features, as its original timeframe ended six years ago.

In addition, Thimpu is still challenged with limited capacity in disaster risk management, including early warning and emergency funding, watershed management and access to risk information. But the municipal government's attention not only to physical safety in planning economic development within the city but also to lifestyles and a social-environmental balance in the city landscape is an approach that may well prove to build mid- to long-term resilience.

(Sources: Government of Bhutan, 2004; IIED, 2012a)

sorbing rainfall water and reducing the inflow into urban drainage systems (Figure 8.7). Green roofs are symptomatic of the new value proposition in urban development. They can reduce energy costs, improve air quality, reduce flood risks, mitigate urban heat islands and contribute aesthetic and environmental values to urban areas.

These innovations are happening as part of a renewed recognition of the role of urban design and planning to produce urban spaces that are not only attractive and functional but also social, sustainable and safe (Soja, 1996; Sassen, 2010). They are taking place not only in large global cities such as New York or Tokyo or in high-income countries, but also in low-income countries, such as in Bhutan, for example (Box 8.11).

In the Republic of Korea, the national government has developed tax policies and other financial incentives to reduce private investors' uncertainty and stimulate public-private partnerships (PPPs) for urban green growth (OECD, 2012). These were developed in its First Five-Year Action Plan for Green Growth of 2009 and include construction subsidies, compensation for base cost and infrastructure credit guarantees (Ibid.).

Such examples show that business will invest in green urban infrastructure when the right incentives, mainly associated with cost recovery and competitive pricing, are provided (Johannessen et al., 2013). Certification initiatives and agreed standards can promote this further; for example, in Sweden, collaboration between various government departments, municipalities, building and energy companies, property owners, consultants and architects is working to develop a sustainability certification for city areas (Karlsson, 2012). Although this initiative does not yet explicitly consider disaster risk, such tools can be adapted to include assessments of drainage and run-off capacity, flood risk and heat absorption, to name a few (Johannessen et al., 2013).

A good example of a certification programme is

Box 8.12 PPPs in Canterbury, New Zealand

Infrastructure provides services, utilities and linkages, which allow cities to function and indeed present lifelines for business and community. Infrastructure networks are often large, complex and interdependent systems, meaning that failure in one network can compromise the entire system.

A good example of how PPPs can reduce risks to infrastructure networks was highlighted in the 4 September 2010 and 22 February 2011 earthquakes near Christchurch, New Zealand, which caused damage of US\$4 billion and US\$12 billion, respectively. The Christchurch Engineering Lifelines Study (Christchurch Engineering Lifelines Group 1997) undertaken in the 1990s, addressed a range of hazards including earthquakes, snow and wind-storms, flooding and tsunamis. A key feature of the project was the wide involvement of engineers and managers from utility organisations, including local authorities, and private and public companies. After the study, Christchurch's utility companies built disaster risk management into their daily business practices. Interorganisational collaboration was facilitated and formalized through the Canterbury Lifeline Utilities Group.

These efforts paid off when the earthquakes struck. Thanks to investments in reinforcement before the earthquakes, the Port of Littleton was able to resume operations within days—despite heavy damages to the port and major losses owing to demolished commercial buildings. Telecommunications buildings that had also been reinforced were able to continue to operate. Most bridges had been retrofitted by Christchurch City Council and the New Zealand Transport Agency and successfully survived the quakes; and US\$6 million of investment in seismic strengthening work by Orion, the local electricity distribution company, saved more than US\$65 million in direct losses.

In contrast, residential losses were high owing to Christchurch's history of land-use decisions, which allowed development on land susceptible to liquefaction, lateral-spreading and subsidence in the event of earthquakes.

the U.S. Green Building Council's LEED Neighbourhood Development rating system, which incorporates disaster risk reduction concepts, particularly with regard to flood protection.^{xxi} If these and other similar certification programmes can be expanded and fully include risk neutrality within their criteria, they can become another powerful incentive for businesses to invest in disaster risk reduction.

At the same time, the construction of resilient infrastructure can also be a key value contribution. As Box 8.12 shows, PPPS can be used to reduce risks and shared costs. Resilient infrastructure systems underpin resilient business and resilient business underpins prosperous cities and countries.

Notes

i The urban population of Asia more than tripled between 1970 and 2011, from 506 million to 1,895 million, and is projected to increase to 2,703 million by 2030 (UNDESA, 2012). The urban population of Africa almost quintupled between 1970 and 2011, from 87 million to 414 million and is expected to reach 744 million by 2030. Latin America and the Caribbean have a far slower urban growth rate than other regions, but this is only because a very high proportion of its population already lives in urban areas.

ii UNDESA World Population Prospects, the 2010 revision: http:// esa.un.org/unpd/wpp/index.htm.

iii Expressed in 2010 prices and exchange rates.

iv wwww.ansa.it.

www.cirf.org.

vi e.g. the Flood and Water Management Act, 2010.

vii www.rics.org/uk/knowledge/news-insight/news/businessesin-the-capital-unprepared-for-flood-risk.

viii The value is expressed in 2005 US dollars; the GDP deflator is taken from World Development Indicators of the World Bank. Countries are classified according to GNP per capita: low-income countries = US\$1,025 or less; lower middle-income countries = US\$1,026 to US\$4,035; upper middle-income countries = US\$4,036 to US\$12,475.

ix http://ppi.worldbank.org.

x The database covers infrastructure projects in energy, telecommunications and transport and water sectors of low and middle-income countries that meet three criteria: a) projects that are owned or managed by private companies, b) projects that directly or indirectly serve the public and c) projects that reached financial closure after 1983. For the detailed database description please see: http://ppi.worldbank.org/resources/ppi_methodology.aspx (accessed 28th February 2013).

xi The Dutch word "polder" refers to dry land created by enclosing floodplains (or shallow waters) with dykes.

xii For more information on the Dutch "Room for the Rivers Programme" see: Government of Netherlands, http://www.rijksoverheid.nl/ministeries/ienm#ref-verkeerenwaterstaat and http://www.ruimtevoorderivier.nl/meta-navigatie/english/.

xiii http://www.ticotimes.net/Current-Edition/News-Briefs/Donald-Trump-inaugurates-Latin-America-s-tallest-building-in-Panama_Thursday-July-07-2011.

xiv http://www.youtube.com/watch?v=ivJ7O1fqjhM.

xv http://www.bbc.co.uk/news/world-latin-america-14152439.

xvi See Government of Maharashtra: http://www.visionmumbai. org/images/projects/Document_EC%2039th%20%20meeting%20 minutes_Final_120412120808.pdf (accessed 25/2/2013); http:// www.indianexpress.com/news/post1947-land-reclamation-tripled-in-mumbai-study/960419 (accessed 25/2/2013); http://india. blogs.nytimes.com/2012/11/01/what-if-mumbai-gets-hit-by-astorm-like-sandy (accessed 25/2/2013).

xvii Information provided directly to UNISDR. For more information on Quito's water utility, see: www.emaapq.gob.ec.

xviii http://www.dudh.gov.bt/Thimphustructural/Index.html.

xix http://www.dudh.gov.bt/Thimphustructural/Index.html.

xx http://www.dudh.gov.bt/Thimphustructural/maps/develop-ment_matrix.gif.

xxi http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148.