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Reducing risk in a changing climate: Changing paradigms toward urban pro-poor adaptation

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Abstract

This paper analyses how disaster risk management paradigms have gradually developed since the 1960s, shaped by practical experience of-and the debate about-the rising number of disasters, growing urbanization, and changing climatic conditions. In this context, climate change is shown as driving an urban pro-poor adaptation agenda, which could allow current shortcomings in urban risk reduction to be overcome. However, as past lessons in disaster risk management are rarely considered, any potential for improvement remains untapped. Possible ways of rectifying this situation are discussed, and a comprehensive framework for the reduction of both disaster and climate risks is presented.

Keywords: *Climate Change, Adaptation, Disaster Risk Reduction, Urban Development, Poverty Reduction.*

INTRODUCTION

Over the past decades, the frequency of so-called 'natural' disasters has grown significantly worldwide[1]. The number of such disasters has quadrupled during the last 30 years, resulting in escalating human and economic losses (UNISDR 2006). It is the developing countries that bear the highest burden in terms of the human lives and proportion of gross domestic product lost in such disasters, and it is the urban poor who are particularly at risk. Poverty reinforces the vulnerability of the urban poor to natural hazards, and disasters make their already precarious living conditions worse, creating a vicious circle of poverty. The threat of climate change presents an even more worrying outlook, as the urban areas already at risk from disasters are the ones most likely to be impacted by climate change in the future (IPCC 2007a,b; Moser and Satterthwaite 2008).

Despite this, scant attention has been paid to the effects that disasters and other climate change impacts have on urban dwellers (Bicknell et al. 2009). Consequently, little consideration has been given to urban risk reduction both in theory and in practice. This is because the debates in disaster risk management and urban development planning have each evolved on a largely independent basis (Wamsler 2009). Recent developments have, however, promoted a process of integration[2] of the two fields: a process that is currently being challenged by the growing climate change agenda.

Against this background, the paper's objective is to assess the potential of the growing debate and increasing knowledge regarding climate change for further integrating disaster risk management into urban development planning. The paper explores, first, the interlinkages between disasters, climate change, and urban poverty (section 2) and, second, the changing discourses in disaster risk management and the integration and divergence processes associated with urban development planning (sections 3 and 4).The positive and negative influence of climate change on these discourses and processes are then analyzed (section 5), as is any potential such influence has for promoting the (better) integration of risk reduction into the work of urban actors (section 6). On this basis, a comprehensive risk management framework for urban pro-poor adaptation is presented. This addresses risk reduction associated with disasters and climate change and its sustainable integration into urban development, including pre- and post-disaster responses. As it takes into account the analysis of past advances, mistakes, and misconceptions, this framework has the potential to close the gaps identified not only between the fields of disaster risk management and urban development

[1] Note that the term disaster (and thus disaster risk management) in this paper includes everyday small-scale and large-scale disasters, and thus changing climate conditions in terms of both climatic extremes and variability.

[2] Note that the terms convergence and mainstreaming in this paper are also used to describe this integration process.

planning, but also between the disaster risk management and climate change communities. Finally, section 7 summarizes related conclusions.

This paper is based on research undertaken from 2005 to 2009, combining expert interviews at a global level and field studies in El Salvador and Colombia, with follow-up desk-top studies. The methodology was based on the idea of 'transdisciplinarity' to assure a fusion of scientifically based knowledge with the experience-based know-how of lay people (Dunin-Woyseth and Nielsen 2004; Gibbons et al. 1994; Nowotny et al. 2001). Different stakeholders-including disaster risk and climate change experts, urban planners, architects, practitioners and urban dwellers living at risk-took part in a collective endeavor to achieve research excellence combined with relevance for practice. As a first step, the interlinkages between disaster risk and urban planning were analyzed, together with how these are addressed in practice. Methods included text review, group discussions, semi-structured interviews, and observation. On the basis of the gaps and challenges identified, strategies and measures for improved urban risk reduction were developed. The next step took the form of a series of workshops in Costa Rica, El Salvador and Sweden, at which participants were asked to use and evaluate preliminary research outcomes with the aim of achieving a cross-fertilization of ideas and knowledge from different sources. This was finally followed up by desk work during 2008-2009, which analyzed the outcomes in the light of recent developments, as well as the similarities and differences between disaster risk reduction and climate change adaptation[3].

DISASTERS, CLIMATE CHANGE AND URBAN POVERTY

This section explores the interrelation between disasters, climate change, and urban poverty, and shows how urban development planning, rather than fostering urban resilience, often contributes to an increase in disasters, climate risk, and poverty. In the following, key aspects are highlighted to illustrate the reciprocal interconnection between (a) disasters and climate change, (b) disasters and urban development, (c) urban development and climate change, and finally (d) disasters, climate change, and urban poverty.

Disasters and climate change are closely interlinked. In fact, although not all disasters can be associated with climate change and increased greenhouse gas emissions, on average two-thirds of all disasters are climate-related (UNISDR 2002) and weather-borne disasters account for almost all the growth in the number of natural disasters since 1950 (Satterthwaite et al. 2007). The increase or decrease in greenhouse gas emissions due to disasters, which in turn influence climate change, is the reverse interlinkage, although less studied. Examples are (a) wild fires and volcanic eruptions releasing carbon emissions that are stored in biomasses, (b) volcanic dust and associated pollution resulting in a reduction of direct solar radiation and thus global cooling, and (c) the destruction of forests or other land use changes, reducing the availability of carbon sinks.

Both climate-related and non-climate-related disasters negatively impact urban development. Historically, urban centers were and still often are perceived as places of refuge from disasters and as buffers against environmental changes (Pelling 2007). Today, however, they are better described as hotspots of disasters and risk (Pelling 2007), with disasters leading not only to the disruption of city functions but also to intensification of urban hazards, the creation of new hazards, increased urban inequalities and poverty, and a reduction in the development resources invested in the built environment (Wamsler 2009; Bosher 2008).

Even worse, urban development is not only affected by disasters, but is also one of the main reasons for increased risk. In fact, urban development frequently increases vulnerability to natural hazards, leads to the creation of new hazards, and intensifies exposure to existing hazards. The creation of intensified or new hazards as a result of inadequate urban development is not only related to the production of greenhouse gases but can also be caused by a number of other issues, including lack of open space provision and proper infrastructure to absorb storm water, as well as inadequate settlement and building features, such as electrical equipment that attracts lightning (World Watch 2007). Furthermore, urban development increases risk by constantly changing the patterns of vulnera-

[3] This paper thus builds on the outcomes of research undertaken from 2005 to 2008. Based on follow-up desk-top work during 2008-2009, these outcomes were further expanded and are presented in this paper.

bilities and hazards (making them virtually impossible to control), and by reducing the coping capacities of the urban poor and of national and municipal institutions to deal with disasters and risk (Wamsler 2009).

Moreover, urban development and climate change are also directly connected, and frequently have adverse effects on each other. In simple terms, inadequate urban development strongly increases greenhouse gas emissions through, for instance, changes in land use and increasing energy consumption, while climate change negatively impacts urban growth (DFID 2004c; World Bank 2008). The negative impacts on sustainable urban growth of changing climatic conditions do not simply amount to an increase in the number and frequency of weather-borne disasters and associated socioeconomic and physical damage in urban areas. Other equally worrying examples are the increased spread of vector-, food-, and waterborne diseases, as well as shortages of energy supply, food, and water, all of which place intolerable pressure on urban infrastructures and services (IPCC 2007b).

More indirect impacts of climate change on urban development are the expected millions of environmental refugees and urban migrants created by (rural) disasters, such as sea level rise, desertification, and catastrophic weather-induced flooding or landslides. As Bogardi, Director of the Institute for Environment and Human Security at the United Nations University, Bonn, argues: 'There are well-founded fears that the number of people fleeing untenable environmental conditions may grow exponentially as the world experiences the effects of climate change.'[4] Other indirect impacts are rising temperatures that thaw out the layer of permanently frozen soil below the surface of the land, or rising water tables due to sea level rise, which cause the ground to shrink and undermine the foundations of buildings. This results in damage to structures such as railway tracks, highways and houses, as well as landslides, which in turn can cause further destructions.

The examples show that the negative impact of climate-related disasters on urban development can be created both directly and indirectly by climate change. In turn, disasters reinforce other climate change impacts and global warming, again negatively affecting sustainable urban development. This can also be illustrated by climate-related flooding: this generally affects food security and the water and energy supply, which are already impacted by climate change. This, in turn, leads to land erosion, landslides, disease outbreaks, and contamination.

From the analysis above, it follows that climate change, disasters, and associated urban development intensify global poverty and deepen social divisions, affecting the poor more than the rich. In addition, both planned and unplanned urbanization cause climatic changes, are themselves affected by climate change, and influence the way in which climate change impacts the urban poor, thus causing negative feedback loops.

Despite the interlinkages and associated negative feedback loops just described, it is commonly argued that cities offer significant opportunities for combating the increasing impacts of disasters and climate change (World Bank 2008; Dawson et al. 2009). Cities, as hotspots of disaster risk, could also hold the key to slowing and eventually stopping climate change (Satterthwaite et al. 2007). Indeed, adequate housing and living conditions and pro-poor urban governance can be critical to the success of climate change mitigation and adaptation, including impact reduction and the support and care of those adversely affected (UN-HABITAT 2007).

CHANGING PARADIGMS OF DISASTER RISK MANAGEMENT

The predominantly negative impact of urban development on existing disaster and climate risk, as described in the previous section, is, among other things related to the fact that the discourses, paradigms, and related practice in the field of disaster risk management have evolved somewhat independently from those of urban development planning. In accordance with the focus of this paper, changes and paradigms are now analyzed that have influenced disaster risk management's different divergence and integration processes with urban development planning and related programs.

The key concept underlying disaster risk management is the notion of risk. In essence, risk

[4] See http://www.ehs.unu.edu/article:130

can be understood as the probability of adverse effects, while disaster risk management is seen as the reduction of that probability by minimization or prevention of those adverse effects. The way in which different research communities and stakeholders define risk dictates how risk management is addressed. Slovic (1999: 689) states that

> Whoever controls the definition of risk controls the rational solution to the problem at hand. If risk is defined one way, the one option will rise to the top as the most cost-effective or the safest or the best. If it is defined another way, perhaps incorporating qualitative characteristics and other contextual factors, one will likely get a different ordering of action solutions. Defining risk is thus an exercise in power, as is its management.

Similarly, Douglas (1992) promotes the idea that 'risk language' has a social function in that it is often used to express blame and to accept or reject responsibility.

Risk research or science has a long tradition in sociology, psychology, philosophy, economics, and other disciplines. Its genesis was in the 1950s, and since then it has undergone a constant development, which has generated various disciplinary trends, risk definitions, and theories (Persson 2007a). In the present context, it is mainly 'outcome risk' that is researched, that is, the consequences of certain well-defined events (Sahlin and Persson 1994). Moreover, contemporary conceptions of risk researchers are typically agent-centered. These entail that risk emerges in a decision situation (e.g. Luhmann 2005) and/or is man-made (e.g. Douglas 1992; Beck 1992). In fact, many risk researchers argue that a specific risk for a person exists or emerges only with his/her decision and that this risk is 'manufactured' and not of external, natural origins. Other risk researchers, such as Starr (1969), Rescher (1983), and Persson (2007b), disagree with these conceptions. In fact, they identify a so-called 'risk-taker fallacy', pointing out that there are also risks that people do not take, but (unintentionally) run. This recognizes that 'risk runners' are not necessarily synonymous with 'risk takers'. Against contemporary conceptions, Persson (2007b) further argues with the so-called 'risk production fallacy', stating that not all risk needing to be managed is man-made. He thus suggests that risk man-made or natural has to be manageable in order to be called risk (as opposed to hazards, which Persson [2007b] defines as unmanageable).

In contrast with the risk research trends described above, disaster risk management is still a relatively new field of knowledge and activity that has undergone its own seemingly independent evolution. The field is developing slowly, as is its multifaceted process of institutionalization (Twigg 2004). An analysis of the existing literature shows that disaster risk management has emerged and is evolving, not so much from theory and science, but based on empirical work experiences. As Sperling and Szekeley (2005: 11) state, 'Disaster risk management originated from humanitarian assistance efforts and the accumulated experiences of exposure to disasters and increasingly incorporated scientific advances.' It has, in fact, evolved mainly through the practical use, and related analyses, of different approaches to managing risk that were carried out and evaluated by the humanitarian and development communities (cf. Wijkman and Timberlake 1984; Maskrey 1989).

Moreover, disaster risk management has developed in the opposite direction to risk research. Although, according to contemporary perceptions in disaster risk management, there is no such thing as a 'natural' disaster, risk was first understood and dealt with as a purely natural issue. That first understanding is referred to as the 'naturalistic paradigm' (Ferrero and Gargantini 2006) or the 'technocratic approach' (Bankoff et al. 2004); contemporary perceptions fall within the 'multidisciplinary paradigm', which states that all disasters are of socio-natural origin (Ferrero and Gargantini 2006). A description of the developments leading to these changes follows.

Traditionally, discussions about disasters took place in the arena of humanitarian emergency relief (Twigg and Steiner 2002). Until the 1970s the dominant view was that 'natural' disasters were synonymous with natural events (or so-called hazards), such as an earthquakes, floods, landslides, windstorms, volcanic eruptions, wild fires, water surges or drought. Disaster risk (R) was thus equated with hazard (H):

$$R = H \qquad (1)$$

In other words, a natural hazard was, ipso facto, seen as a disaster. The magnitude of a disaster was considered to be a function of the magnitude of the hazard, with the latter being considered as an inevitable one-off event (Twigg and Steiner 2002). Consequently, the emphasis not only of researchers, but also of national governments and the international community, was on pure disaster management, that is, on searching for ways to improve post-disaster assistance and, in the best case scenario, making advance preparations to improve existing response capacities (Aysan and Davis 1992). Consequently, in many countries of the developed and developing world, national emergency agencies were established or restructured during this period. For instance, in 1978 the Federal Emergency Management Agency of the United States of America (FEMA) was created to house civil defense and disaster preparedness. El Salvador's National Emergency Committee COEN was founded in 1976 (Decreto No. 498).

From the early 1970s onwards, urban actors became increasingly involved in the ongoing discussions about disasters, first, because of the need for adequate shelter in times of emergency and reconstruction (Davis 1975), and second, because it was found that the same natural hazard can have varying impacts on the built environment. A general trend thus evolved to associate disasters more with their physical impact than with their natural triggers. This promoted conventional building practices, engineering, and urban planning, mainly for formally built areas, as an important means of mitigating disasters (UNDP 2004). An example from this period is UNDRO (1976), which focuses on physical planning, settlement management, and building measures. Its focus on the pre-disaster context is exceptional for this period. Despite this trend, in many countries efforts to reduce risk by these means have been minimal because of their high financial cost (UNDP 2004) and the fact that their failure to meet the needs of the most vulnerable was quickly identified (Stein and Vance 2007).

Beginning slowly in the 1970s, but with an increased emphasis during the 1980s and 1990s, researchers in the social sciences triggered a shift in thinking by pointing out that the impact of a natural hazard depends mainly on the vulnerability of the people affected (Maskrey 1993 1989; Wijkman and Timberlake 1984; Blaikie et al. 1994). In fact, with the advent of the term 'disaster risk management' (replacing the term 'disaster management'), the focus of attention moved to social and economic vulnerability[5] and was further reinforced by the mounting evidence that natural hazards have widely varying impacts in different countries/regions and on different social groups within those countries/regions (UNDP 2004). The idea that disaster risk (R) equates both to hazard (H) and to vulnerability (V) now started to be promoted by different researchers (e.g. Blaikie et al. 1994):

$$R = H + V \qquad (2)$$

From the early 1990s onwards, a growing literature emerged in Latin America and the Caribbean, Asia and Africa, born of increasing working experiences in disaster reduction and related social science research carried out by developing-country researchers and institutions. In Latin America, for instance, researchers joined forces through the social studies and disaster prevention network 'La Red', created in 1997. Literature related to this network forms the basis of many of the contemporary approaches to disaster risk management being discussed and advocated at the international level (e.g. Lavell 1994, 1999 ; Martínez López 1999).

In parallel, after a quiet beginning in the late 1970s, but mainly during the 1990s, engineering and urban planning were gradually removed from the disaster risk management agenda. Most (socially oriented) authors and program managers now accorded only secondary importance to the built environment and related planning practices. Indeed, they commonly neglected planning (including social housing and infrastructure development), perceiving it not as a vitally important risk reduction measure, but as a purely physical measure dealing only with the symptoms of the problem and not the causes (UNDP 2004).

During the 1990s to 2000s many pilot programs in the field of disaster risk management emerged in developing countries. These were prompted by the International Decade for Natural Disaster Reduction (IDNDR) between 1990 and 1999 and by a number of highly destructive large-scale disasters that occurred at the end of the

[5] Until the 1980s 'vulnerability' received little attention as a distinct concept. It then began evolving from the very restricted concept, measured by reference to physical indicators, to a broad and complex process (Pelling 1997; Moser 1998). One of the first uses of the term 'vulnerability' was around the 1980s (cf. Chamber 1983). Adger (2006:269), 'Eakin and Luers (2006), Bankoff et al. (2004), Pelling (2003a), Füssel and Klein (2006), Cutter (2003), Ionescu et al. (2005) and Kasperson et al. (2005), for example, present significant reviews of the evolution (…). These build on earlier elaborations by Liverman (1990), Dow (1992) (…) and others (…).'

1990s, which resulted in increased resources being made available by international agencies. However, despite the start of a shift away from disaster management toward the reduction of risk, the post-disaster context (i.e. emergency relief, rehabilitation, and reconstruction) remained the focus of research and intervention, with only a few exceptions, such as those mentioned by Aysan and Davis (1992). However, within the post-disaster context, the debates shifted toward the 'mainstreaming' of disaster risk management. In El Salvador, for instance, several programs from this period, and the research related to them, emphasized the importance of mainstreaming disaster risk management into reconstruction programs (e.g. GTZ 2003a,b).

With the beginning of the 2000s, the growing experience gained within the above-mentioned pilot programs in the field of disaster risk management, combined with ongoing conceptual developments (e.g. Cuny 1983; Anderson 1985), resulted in the gradual evolution of a common understanding of disaster risk management. Disaster risk management is now generally seen as a mainstreaming (i.e. crosscutting) topic, and the causal factors of disasters are understood to be directly linked to development processes, which generate different levels of vulnerability (UNDP 2004).[6] Hence, the integration of disaster risk management into development planning (i.e. the pre-disaster context) has become the main focus of the professionals working in risk reduction (cf. Lewis 1999; Pelling 2003b). The United Nations International Strategy for Disaster Reduction (UNISDR), established in 2000, has helped to raise the profile of this development-focused discourse, especially since the 2005 World Conference on Disaster Risk Reduction in Kobe, Japan. Since then, UNISDR has promoted the idea that the reduction of disaster risk requires a long-term engagement in development processes including urban development planning and hence promoted increased engagement in this field by international organizations[7].

This shift in thinking has been reflected not only in the literature, but also on the ground. Examples are the move away from emergency organizations toward development organizations as the national counterparts for disaster risk management. In this context, Lavell (1999:1) states:

> One of the results if not one of the causes of the growing concern for the development impact of disasters has been an increase in the number and types of institutions involved with the disaster problematic. These are no longer limited to the humanitarian preparedness and response organizations as was essentially the case toward the end of the last decade.

Another example of how the shift in thinking has influenced practice can be seen in the 'disappearance' of pilot programs on disaster risk management, since disaster risk management is no longer understood as a separate working field or sector, but as a mainstreaming or crosscutting topic for all types of development sector programs. As a result, greater inclusion of special, but mainly added-on, disaster risk management components can be observed within different development sector programs. With sectors such as rural development, agriculture, and health apparently being more 'popular' than urban development, there is now almost a complete absence of urban disaster risk management (Wamsler 2009).

Today, disaster risk management is considered to be a constantly evolving and integral paradigm that not only incorporates most of the different trends and perceptions mentioned above, but is also indispensable for cost-effective development and sustainable poverty reduction.[8] Within this framework, risk is defined by UNISDR (n.d.) as: 'The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human induced hazards and vulnerable conditions.' Accordingly, risk is conventionally expressed by:

$$R = H * V \qquad (3)$$

Compared to equation 2, this representation has

[6] Note that since the early 1970s, the issue of the relationship of disasters and development has been alluded to in intermittent written and verbal discussions; however, it 'fade[d] repeatedly, as increased demand for emergency action has focused on necessarily short-term responses' (Lewis 1999:xiv).
[7] See, for instance, www.unisdr.org/eng/about_isdr/isdr-mission-objectives-eng.htm

[8] In this context, changing discourses in development studies also brought about the deconstruction of 'poverty', revealing its economic, political, social, psychological, and environmental components, and then reconstructed around the concept of vulnerability (Pelling 1997). Poverty researchers are now using it in an even broader way (e.g. Moser 1998).

improved, as, from a mathematical point of view, probabilities are multiplied and not summed. The multiplication further clearly illustrates that even if the hazard is small, the resultant risk can become multiplied and thus extremely high.

The 'Pressure and Release (PAR) Model' of Blaikie et al. (1994) looks in detail at the two different risk components: hazard and vulnerability. The model conceptualizes the role of hazard and the role of vulnerability in the production of risk and allows a theoretical chain of explanation to be constructed between global and local forces. Entitled the 'progression of vulnerability', this chain has three main levels: global 'root causes'; intermediate 'dynamic pressures'; and local 'unsafe conditions'. Root causes, acting at the most remote, macro level, are best seen as dominant structures that underlie the allocation and distribution of resources and power. Unsafe conditions are the most visible producers of vulnerability and can be seen acting at the local household level. Examples could be substandard buildings or inadequate local economies and structures. Acting between the global and local forces are the intermediate, dynamic pressures 'that "translate" the effects of root causes into the vulnerability of unsafe conditions' (Blaikie et al. 1994: 24). Dynamic pressures can be, for instance, urbanization as well as inadequacies in training, institutional systems, or government regulations.

The growing interest of some researchers and practitioners in 'responding to' the negativity of the term 'vulnerability' and linking risk (and risk reduction) further with people's positive capacities (C) and related livelihood assets/capital (Davis et al. 2004), was reflected in the development of the following extended risk equation (UNISDR 2002):

$$R = H * V / C \quad (4)$$

The growing interest in capacities and associated assets/capital resulted in further emphasis being given to participatory bottom-up approaches for risk reduction, although at first the term 'capacities' was mainly related to the way people react during and in the immediate aftermath of disasters. Until recent years, related programs and learning experience came almost exclusively from the rural context. In both definitions (i.e. equations 3 and 4), vulnerability is today generally understood as the opposite or antithesis of resilience or resistance (Benson and Twigg 2007). On the basis of equation 4, and predicated on the development of disaster risk management as described above, risk reduction is usually based on an analysis of past disaster events and their associated hazards, vulnerabilities, and capacities, and not on disaster forecasts.

CHANGING PARADIGMS - IN AN URBANIZING WORLD

The near absence of urban disaster risk management, as identified in the previous section, is a subgroup of the general pitfalls to mainstream disaster risk management in development work that organizations have faced during the 2000s (Christoplos et al. 2001). However, compared to other development sectors, the integration of disaster risk management into urban development is confronted with additional challenges. One of the critical issues in this regard is the fact that the conceptual disaster risk management framework described in section 3 has evolved with a rural bias. In the main, related concepts such as risk and vulnerability, and tools such as vulnerability and capacity assessments, were developed with a rural focus and based on working experiences in rural environments (Pelling 1997; Davis et al. 2004; Wisner at al. 2004).

It is only recently that building and urban planning practices have once again started to be recognized by international agencies as important risk reduction measures and have re-emerged in the key literature (e.g. UNISDR 2005a; UNDP 2004). The most important drivers of this change have been the increasing experience (and thus recognition) of growing urbanization, the negative influence of urbanization on existing risk (Pelling 2007), and the differences between rural and urban disasters (Moser et al. 1996, Hamza and Zetter 1998; Pelling 2003a). However, alternative strategies needed to be sought to replace the conventional building and planning practices, which because of their deficits and the changing disaster risk management discourses, were gradually 'deleted' them from the disaster risk management agenda from the late 1970s onwards (cf. section 3).

Increasing attempts have thus been made to factor risk reduction into more bottom-up, participatory urban planning strategies and programs and to 'translate' disaster risk management concepts and tools to the urban context (e.g. Mitchell 1999; Sanderson 2000, 2001). Examples are approaches such as livelihood-based urban planning for disaster risk management, which was also implemented in the context of the CARE project entitled 'Mainstreaming mitigation to reduce urban poverty'. This research has positively influenced these attempts, providing analyses of (a) urban dwellers' coping strategies and associated assets/capital, (b) the practical needs of urban actors to sustainably reduce risk, and (c) past efforts to mainstream disaster risk management into urban development planning (Wamsler 2006, 2009).

Because of the rural bias in the field of disaster risk management mentioned above, local coping has been little systematized within an urban context (Twigg 2004). Advances in related issues have led to the identification of coping strategies for prevention, mitigation, preparedness, self-insurance, and recovery (Wamsler 2007). The last two were revealed to be crucial in terms of complementing conventional risk reduction efforts and helping slum dwellers to recover from disasters and also from local small-scale hazards. Such hazards were shown not only to have immediate and short-lived impacts, but also delayed and long-lasting effects. These effects cannot always be counteracted solely through measures aimed at preventing hazards, mitigating vulnerabilities, or improving people's preparedness to respond in the immediate aftermath of a disaster. Risk financing and stand-by for recovery, which aim to increase people's capacity to recover from hazards (and disasters), were thus identified to be an important complementary measures in terms of supporting the urban poor to better cope with disaster and climate risk (Wamsler 2007a, 2009). This has resulted in a better definition of the different measures available to reduce urban risk and, in turn, in the extension of the definition of risk to include the lack of capacity to recover from hazards/disasters (LCRec) as an additional risk component.

Moreover, some researchers have revealed a gap between the paradigms of disaster risk management and the practical needs of urban actors (Bosher 2008). According to Wamsler (2007b, 2009), planners and other urban actors have generally believed the risk management approaches, as described in section 3, to be of little use for their program planning and design. The main arguments put forward are: (a) the vagueness of the definition of disaster risk and its practical significance in identifying associated risk reduction measures; and (b) the vagueness of both the definition and the practical meaning of the term 'mainstreaming' of disaster risk management. Indeed, the few investigations that did advance the discourses on mainstreaming disaster risk management did not specifically address urban actors or urban development planning (e.g. Benson and Twigg 2006; IDB 2004a,b; IDEA/IDB 2005; Mitchell 2003; Tearfund 2005; UNDP 2004; UNDP/UNISDR 2006; UNISDR 2003, 2005b). Thus, these investigations are not, for the most part, applicable within the urban context. Only Benson and Twigg (2007) and Rossetto (2006) include some general aspects regarding construction design, building standards, and site selection.

This research further identified the increasing practical, but as yet unsustainable, efforts to mainstream disaster risk management within urban development planning. In fact, whenever intolerable conditions and needs on the ground were driving such an integration process (as was the case in El Salvador after Hurricane Mitch in 1998 and the 2001 earthquakes), it was often supported and implemented in such a way that there was an unfruitful overlapping of the two fields. In other words, the integration process resulted in only temporary improvements or even increased competition between different organizations and duplicated their efforts (Wamsler 2007b).

The developments described promoted new conceptual advances which began to influence the discourses in disaster risk management. These were guided by a desire to bridge the divide between urban research and practice, to better address urban actors' needs for risk reduction, and to take into account new urban-specific knowledge on risk generation and coping. They led to an enhanced, more operational understanding of risk, which can be expressed through the following equation:

$$R = H * V * LC_{Res} * LC_{Rec} \qquad (5)$$

where LCRes stands for the lack of capacity to respond to disasters and LCRec for the lack of capacity to recover from disasters. Note that this understanding is not generally used in equation form in the literature. However, the written definition of risk is increasingly including capacities to recovery (e.g. UNISDR 2008b). Compared to equation 4, this definition does not mix variables with positive and negative connotations. In addition, each of the risk components is directly linked to specific risk reduction measures. In fact, while equation 5 expresses the initial risk situation of a specific slum area at a given point in time, equation 6 (which follows) illustrates how this risk can be minimized through the implementation of well-defined risk reduction measures:

$$R = \frac{H}{P_{Rev}} * \frac{V}{M} * \frac{LC_{Res}}{P_{Rep}} * \frac{LC_{Rec}}{R_F + S_R}$$

where PRev stands for prevention, M for mitigation, PRep for preparedness, RF for risk financing and SR for stand-by for recovery. See Table 1 for the definition of the risk components and the respective measures mentioned.

As was the case with equations 1-4, the objective of the extended equations 5 and 6 is not to actually calculate risk, but to help tackle risk more effectively. The extension of the definition of risk, in comparison to former concepts (described in section 3), can help urban actors to, first, analyze existing risk in a specific area and, second, search for adequate measures to reduce each of the risk components. This allows the complementary risk reduction measures to be differentiated one from the other, which, subsequently, helps in properly designing and combining them (Wamsler 2009). In this context, the capacities and associated assets/capital for preventing, mitigating, preparing, risk financing, and recovery would need to be analyzed, as indicated in equation 6.

In addition to extending the understanding of risk and better defining the measures to reduce it,

Hazard (H)	Climate-related (i.e. atmospheric and hydrological) or non-climate related (i.e., geological) event that has the potential to cause harm or loss, which can be caused by purely natural forces or be human-induced (e.g. caused by increase in greenhouse gas emissions or environmental degradation). *It is identified based on both past occurrences and climate change forecasts.*
	⇒ Measure 1 for risk reduction *and adaptation*
Prevention (P_{Rev}) (or hazard reduction)	Measure that aims (to increase the capacity) to avoid or reduce the potential intensity and frequency of existing *or likely future* hazards that threaten households, communities, and/or institutions, and *which has the potential to be adjusted to future changes in risk.*
	Risk component 2
Vulnerability (V)	Degree to which systems are susceptible to loss, damage, suffering, and deaths in the event of a hazard or disaster. It thus describes the existing *or future* condition and setting of an area exposed to existing *or future* hazards. It distinguishes between physical, social, economic, environmental, organisational and institutional vulnerability.
	⇒ Measure 2 for risk reduction *and adaptation*
Mitigation (M) (or vulnerability reduction)	Measure that aims (to increase the capacity) to minimize the *existing or likely future* vulnerability of households, communities, and/or institutions to potential hazards/disasters *and, which has the potential to be adjusted to future changes in risk.* This includes the reduction of physical, socioeconomic, environmental, and institutional vulnerabilities.
	Risk component 3
Lack of capacity to respond to hazards/ disasters (LC_{Res})	The means by which households, communities or organizations are able to use available resources, assets, and abilities to respond to adverse effects during and in the immediate aftermath of potential *future* hazards or disasters.
	⇒ Measure 3 for risk reduction *and adaptation*
Preparedness (for response) (P_{Rep})	Measure that aims (to increase the capacity) to establish effective response mechanisms and structures for households, communities, and/or institutions so that they can react effectively during and in the immediate aftermath of potential *future* hazards/disasters, *and which has the potential to be adjusted to future changes in risk.*
	Risk component 4
Lack of capacity to recover from hazards/disasters (LC_{Rec})	The means by which households, communities, and organizations use available resources, assets, and abilities to recovery from the adverse effects of *possible future* hazards or disasters.
	⇒ Measures 4–5 for risk reduction *and adaptation*
Stand-by for recovery (S_R) (or preparedness for recovery)	Measure that aims (to increase the capacity) to establish appropriate recovery mechanisms and structures for households, communities, and/or institutions that are accessible after a *future* hazard/disaster, *and which has the potential to be adjusted to future changes in risk.* This includes mechanisms and structures for both rehabilitation and reconstruction.
Risk financing (R_F)	Measure that aims (to increase the capacity) to transfer or share risk so as to establish a "security system" (safeguard) for households, communities, and/or institutions and that comes into force after *future* hazard/disaster impacts, has the potential to be adjusted *to future changes in risk*, and helps people obtain "readily available" compensation.

Source: Adapted from Wamsler (2009)

Table 1. ***Systematization of disaster (and climate) risk and respective measures to reduce each risk component.*** *Note that, in order to factor changing risk patterns into disaster risk management, changes to the original concepts presented in section 4 are in Italics (cf. section 6).*

this study has supported further advances regarding the concept of disaster risk management integration (Wamsler 2007b). On the basis of past failures and lessons, this concept has been divided into disaster risk management programming and disaster risk management mainstreaming, and a set of different strategies has been identified to complement each. Three strategies relate to the integration of disaster risk management into program implementation at local household level; two to the integration of disaster risk management at the institutional level of the implementing and donor organizations; and another two to the promotion of sustainable disaster risk management in the work of other related implementing and training institutions (see Table 2). The conceptual changes described contributed to the existing body of knowledge at the global, national, municipal, and local levels, driving the convergence of urban development planning and disaster risk management. This is evidenced by the various references in sector-specific literature lists (of different universities and of key professional literature), on Web pages (such as the Web page of the ProVention Consortium), and in the publications of cutting-edge stakeholders and theoreticians (e.g. Benson and Twigg 2007; World Watch 2007; UN-HABITAT 2007; ProVention Consortium 2007; Satterthwaite et al. 2007; Bosher et al. 2007, 2008; Balamir 2007). The influence of the conceptual changes in practice has been demonstrated through their use in development programming by international and national organizations. Among the organizations that have made use of related concepts are FUSAI (Fundación Salvadoreña de Apoyo Integral), FUNDASAL (Fundación Salvadoreña de Desarrollo y Vivienda Mínima), CEPRODE (Centro de Protección para Desastres), UN-HABITAT (United Nations Human Settlement Programme), and Plan International. However, as is analyzed in the next section, the growing climate change debate and the increasing knowledge related to this pressing issue are currently challenging both the theoretical and practical advances in urban risk reduction.

Strategy 1	Direct stand-alone DRM/*A*	DRM/A programming (i.e. implementation of programs separately from and additionally to the organization's core work) to specifically address risk and disaster occurrence.
Strategy 2	Direct integrated DRM/A	Adding DRM/A programming elements to the organization's core work to specifically address risk and disaster occurrence within existing program areas.
Strategy 3	Programmatic mainstreaming of DRM/A	DRM/A mainstreaming within program implementation (i.e., adjustment of the core work of the organization) to reduce risk and increase the capacities of program beneficiaries to cope with risk and disasters (or, at least, to ensure that risk is not increased and capacities not reduced).
Strategy 4	Organisational mainstreaming of DRM/A	Institutionalization of DRM/A to sustain and support its mainstreaming (and programming).
Strategy 5	Internal mainstreaming of DRM/A	DRM for reducing the organization's own risk (i.e. its offices and staff) and thus allowing it to become more disaster-resilient.
Strategy 6	Synergy creation for DRM/A	Coordination with and complementation of the work of other (implementing) organizations for improved DRM/A mainstreaming (and programming).
Strategy 7	Educational mainstreaming of DRM/A	Shift toward non-conventional sectoral planning to integrate DRM/A into the philosophies that drive related disciplinary and sector-specific work, by making universities and other training institutions (decide to) facilitate the sustainable integration of DRM into the sphere of activity of sector-specific actors.

Source: Adapted from Wamsler (2009)

Table 2. ***Systematization of the concept of disaster risk management integration/mainstreaming***
Note that, in order to factor changing risk patterns into disaster risk management, changes in the original concepts presented in section 4, are in Italics (cf. section 6). DRM = Disaster risk management. A = Adaptation.

CHANGING DISCOURSES - IN A CHANGING CLIMATE

With climate change challenging the convergence of disaster risk management and urban development planning, the following questions are inevitable: (a) how does climate change impact existing risk? (b) how does climate change impact existing risk reduction efforts? and (c) how does climate change influence the current paradigms of disaster risk management, that is, the understanding of risk, risk reduction, and the integration of risk management into urban development planning?

Impact of climate change on existing risk

As already described in section 2, climate change and disasters are directly interlinked. The way disaster risk is currently defined, as described in previous sections (cf. equations 4 and 5), can assist in further analyzing the interconnection between climate change and disasters in a more systematic way. This definition is based on the understanding that hazards (both natural and human-induced) do not, themselves, cause disasters. In fact, disasters occur because of the combination of a hazardous event, an exposed, vulnerable area, and ill-prepared populations, communities, and institutions. Climate change influences all three aspects, as illustrated in Table 3.

Impact of climate change on existing risk reduction efforts

The previous section makes it clear that current informal and formal mechanisms for disaster risk management and related economic planning may not be adequate in the future. Indeed, in many countries, existing mechanisms already fail to meet the current level of risk (Sperling and Szekely 2005). Most infrastructure developments or settlement policies of the past did not, for instance, anticipate the hazards or the magnitude of hazards of today. Worse still, there may be no experience that can be used as a basis for addressing the changing patterns of risk now forecast for the future (Sperling and Szekely 2005; Schipper and Pelling 2006; Tearfund 2008; Thomalla et al. 2006). Table 4 summarizes the possible impacts of climate change

Impact of climate change on risk (i.e. all three risk components/factors)	
Hazard exposure (potential climate-related hazards are, for instance, wind, rain/precipitation, snow, sunshine, temperature/heat, etc.)	• Changes in the intensity, magnitude and frequency of existing climatic hazards of a specific region, which, in turn, can lead to disasters. Examples are the increased frequency of: - Higher maximum temperatures and heat waves – and thus related drought and wildfires, - Increased summer drying – and thus related drought and wildfires, - Intense precipitation events – and thus related floods, erosion, and landslides, - More intense peak wind intensity – and thus windstorms (e.g. hurricanes), - More frequent El Niño events – and thus related drought and floods. • Emerging hazards induced by climate change that may be new to a region in recent history and often present thresholds events. Examples: - Retreat of glaciers – and related sea-level rise, floods, and/or glacial lake outburst, - Spread of climate-sensitive diseases into regions where these diseases did not previously occur, - Wildfire.
Vulnerability of communities to specific hazards (both climate-related and non-climate-related)	• Increasing vulnerability through a range of different aspects directly caused by climate change, particularly through: - Ecosystem degradation (e.g. erosion, thaw of permanently frozen soil layer, resulting, for instance, in unstable constructions, or coral bleaching and related coastal floods), - Shortages in energy, water, and food availability (e.g. leading to malnutrition, disease, conflict)., - Changes to climate-sensitive livelihoods (e.g. damage to crops, reduced yields, resulting, for instance, in malnutrition and displacements). • Indirect impact of climate change through climate-related hazards/disasters on vulnerability. Examples are: - Displacement of populations due to disasters (e.g. environmental refugees, rural–urban migration, and related urbanization can in turn lead to increased hazard exposure), - Disruption or loss of agriculture, settlements, commerce, and transport, increasing the pressures on urban infrastructure.
Lack of capacity to respond and/or recover (from hazards/ disasters)	• Reduction of the capacity of people, communities, and institutions to respond to and recover from hazards/disasters directly caused by climate change, for instance, through: - Shortages in energy supply, affecting communication mechanisms and structures, - Increasing number of multi-hazard events, making adequate responses difficult. • Indirect impact of climate change through climate-related hazards/disasters. Examples are: - Reduced community cohesion and action for risk reduction with the better-off and labor force leaving because of climatic stressors, - Lack of knowledge on the locally adequate coping strategies of displaced people, - Impact/damage on vital institutions (micro financing institutions, aid organizations, etc.). • Withdrawal of insurance companies from the increasing number of risk areas.

Sources: Sperling and Szekely (2005), Schipper and Pelling (2006), IPCC (2007 a,b), Wamsler (2009).

Table 3. *Impact of climate change on existing risk*

on disaster risk management programs and their implementation. It also illustrates how the characteristics of the current disaster risk management paradigms, as described in sections 3 and 4, relate to these impacts.

Impact of climate change on changing paradigms of (urban) disaster risk management

The last two sections show that if sustainable risk and poverty reduction are to be achieved, climate change concerns need to be factored into the understanding of risk, into the concept of disaster risk management, and into the strategies for integrating disaster risk management and urban development planning. However, despite the obvious interlinkage between disasters and climate change (and the efforts to tackle related risk), the climate change and disaster risk management discourses have rarely overlapped (Sperling and Szekely 2005; Satterthwaite et al. 2007; UNDP 2002; UN IATF/DR 2006; Schipper and Pelling 2006).

The climate change discourses developed step by step from initial concerns regarding the causes of climate change, through the desire to model its potential effects, to concerns about how societies and economies could reduce greenhouse gas emissions and also adapt to changing climatic conditions (UNDP 2002). In fact, the discourses that emerged at the end of the 1990s first focused on the effects of greenhouse gas emissions on altering patterns of hazard, leading to increasing disaster risk and, consequently, disasters. In other words, the dominant view was that climate risk was synonymous with a climate-related hazard, such as temperature, wind, and precipitation and associated drought, wildfire, sea level rise, flooding and landslide. Climate risk was thus equated with hazard (H), which can be compared with how disaster risk management was understood during the 1960s (see section 3 and equation 1). Unlike disaster risk, however, climate risk refers only to weather-related and human-induced hazards. The initial focus of attention was thus on policies and programs to reduce greenhouse gas emissions (Thomalla et al. 2006). The climate change community calls these measures 'mitigation' while in the

Characteristic of current risk reduction efforts	Impact caused by climate change	
	General	Examples of concrete consequences
DRM based on past risks (i.e. the analysis of past hazards, vulnerabilities, and capacities & a time planning horizon based on near-term trends).	- Unsustainable risk reduction measures due to new, intensified, magnified or more frequent hazards in a specific area.	- Destruction of improved infrastructure and housing due to unexpected high levels of flood.
	- Unsustainable risk reduction measures due to the non-inclusion of hazards, such as heat waves and sea level rise, which are not considered in the conventional DRM approach.	- Disappearance of whole project areas due to sea level rise.
	- Unsustainable risk reduction measures due to increased and changing patterns of vulnerability	- Diversification of cropping systems to reduce economic vulnerability, causing increased vulnerability in a situation of increased climate-related floods.
	- Unsustainable risk reduction measures due to reduced capacities of people, communities, and institutions to respond and recover.	- Financial institutions needing to cancel recovery financing schemes because of the increasing numbers of people missing loan repayments due to increased impacts of climate-related disasters.
Action is generally only taken if risk situation of a specific area has in the past led to disasters.	Changing patterns in risk (e.g. changes in average climatic conditions and variability that may modulate vulnerability to certain disasters) are not addressed before they actually have led to a disaster."	No program implementation in areas that might experience the greatest change in risk patterns.
Focus on mainstreaming in development planning.	Increasing number of climate-related disasters leading to diversion of funds toward relief and recovery.	Decreasing funding for DRM. Lost window of opportunity for risk reduction in a post-disaster context.
Independent institutional and political setting from adaptation.	Increasing number of climate-related disasters leading to increasing importance being given to climate change agendas, and growing debates on, and diversion of funds towards adaptation.	Decreasing funding DRM. Loss of past conceptual advances and lessons learned from the field of disaster risk management.
Comprehensive approach that includes socioeconomic, environmental, institutional, and physical/structural, aspects – with no specific focus on the latter.	Increasing impact of climate-related disasters with most obvious impacts on the built environment. Increased attention toward adaptation with a strong infrastructure agenda.	Decreasing funding for DRM. Increased involvement of urban actors in adaptation.
Strong support of participatory, capacity, and asset-based approaches for risk reduction.	More top-down focus of the climate change agenda, leading to diversion of funds away from participatory approaches.	Loss of related past conceptual advances and lessons learned from the field of disaster risk management. Only slowly increasing interest in participatory, capacity and asset-based approaches for adaptation.

Sources: Sperling and Szekely (2005), Tearfund (2008), Thomalla et al. (2006), Wamsler (2009).

Table 4. ***Impact of climate change on risk reduction efforts.*** *DRM = Disaster risk management*

field of disaster risk management the term 'mitigation' is used to describe measures to reduce people's vulnerability (cf. Table 1).

With increasing evidence accumulating on climate change and its potential impacts, these discourses broadened toward the argument that greenhouse gas emissions and the subsequent change in climate variability influence not only hazards, but also patterns of vulnerability (UNDP 2004). Today, discussions are dominated by this understanding, namely, that climate change causes disasters through increasing not only the number and the intensity of hazards, but also the vulnerability of people facing these hazards. In other words, the predominant idea is that climate risk is equated with hazard (H) and vulnerability (V) (cf. equation 2).

The changes described led to an increasing interest in addressing not only the causes of hazards, but also people's vulnerability to those hazards, triggering a growing adaptation agenda. Strong emphasis here is placed on physical vulnerability. In other words, there is comparatively little concern regarding social, economic, environmental and organizational vulnerabilities. As Prowse and Scott (2008: 42), for instance, state: 'Adaptation is about tackling the effects of climate change, mainly through increasing the resilience and capacity to cope with its physical impacts.'

The discourses in climate change adaptation are, thus, today strongly dominated by a major infrastructure agenda, with a focus on the formally built environment, which is reminiscent of the disaster risk management discourse of the early 1970s (cf. section 3). This trend is even stronger in the developed word. Consequently, as was the case back then, engineers, planners, and other urban actors are becoming increasingly involved, and physically based terminology, such as 'climate-proofing' or 'climate protection' abounds (e.g. DFID 2004g, Moser and Satterthwaite 2008).

The developments described show how it is only recently that the scientists and organizations examining the problem of global climate change have gradually expanded their science-based discourse toward an interest in adaptation to changing climatic conditions. As stated by UNDP (2002: 14):

> With this gradual turn to adaptation considerations and an increase in its salience, the climate change adaptation community has clearly commenced to take up on a topic that is very close and complimentary to the traditional preoccupations of the risk and disaster community. How to live with and adapt to climatic extremes and how to promote more resilient and secure communities are questions that are at the centre of concerns for both communities.

As a result, adaptation and disaster risk management measures can, for the most part, be seen today as synonymous. In simple terms, there is an extensive overlap between the two fields that address risk reduction in the field of weather-borne disasters (i.e. climatic extremes and variability). In addition to these activities, the field of disaster risk management also targets other, non-climate-related hazards, such as earthquakes and volcanic eruptions. However, as impacts related to these are influenced by climate factors, these activities are directly linked to adaptation. In contrast, the field of adaptation additionally targets the climate change impacts of increasing climate-related variability, disease, and shortages of water, food, and energy supply. However, as these are factors that influence people's vulnerability to all types of hazards, the activities associated with them are directly linked to disaster risk management (Wamsler 2009).

Because of the overlap described, an international trend has recently evolved that promotes the integration of the disaster risk and climate change concerns of the so-called 'Hyogo' and 'Kyoto' communities, as well as the integration of their combined concerns into poverty reduction efforts (e.g. AFDP et al. n.d.; Davies et al. 2008; DFID 2004b-n; FAO 2008; IDS 2007a-d; Mani et al. 2008; McKenzie Hedger et al. 2008; Mitchell and van Aalst 2008a,b; O'Brian et al. 2008; Sperling and Szekely 2005; Tearfund 2008; Thomalla et al. 2006; UNISDR 2008a,b). The term 'Hyogo community' refers to the disaster risk management community that committed itself to the Hyogo Framework for Action 2005-2015 (UNISDR 2005a). The term 'Kyoto community' refers to the climate change (mitigation) community that committed itself to the Kyoto Protocol (established in 1997 and entered into force in 2005), an agreement under the United Nations Framework Convention on Climate Change (UNFCCC). However, the described trend seems mainly to be influencing disaster risk management paradigms, and, to date, has had comparatively little influence on discourses on adaptation.

The current climate change discourse is thus comparable with the disaster risk management discourse up to the 2000s, when disaster risk management was still seen as a new field of work and not as a crosscutting topic to be integrated in other fields. Consequently, there are still few strategic discourses on how to best mainstream adaptation into the (a) post-disaster response, (b) post-disaster recovery, and (c) pre-disaster planning of the different development sectors. Only few adaptation studies start to recognize this by referring to different 'aspects' of adaptation (e.g. Moser and Satterthwaite 2008). The terms used by Moser and Satterthwaite (2008) to describe the different aspects are 'immediate post-disaster response', 'rebuilding', 'pre-disaster damage limitation', and 'protection'; these terms are comparable to the integration of disaster risk management/reduction into the conventional disaster management phases/stages of post-disaster response, post-disaster recovery, and pre-disaster planning/development (divided here into preparedness and other type of risk reduction, such as prevention and mitigation).

Yet another development, similar to past advances in disaster risk management, is the emergence of interest in local capacities (and associated assets/capital) for adaptation (cf. equation 4), which is evidenced by the workshops and literature that is gradually beginning to appear on more participatory bottom-up approaches (e.g. Chatterjee et al. 2005; Huq and Reid 2007; IDRC 2008; Prowse and Scott 2008; Moser and Satterthwaite 2008). Only few, such as van Aalst et al. (2008) explicitly build on the knowledge base arising from participatory risk reduction (cf. section3).

In conclusion, climate risk differs from disaster risk in that, to date, its understanding and mainstreaming has been little theorized, and discussions relating to the integration of the two concepts have been few. Despite this, it can be argued that current developments are positively advancing the discourse in disaster risk management toward (integrating) urban pro-poor adaptation. This is because of the coincidence of (a) the current dominant physical discourses in climate change adaptation, (b) the increasing efforts involved in merging the fields of disaster risk management and adaptation, and (c) the fact that increasing urbanization has, for the first time, led to more than half of the world's population living in urban environments. The results are, first, an increasing interest in understanding the specific linkages between urbanization, greenhouse gas emissions, and vulnerability to the impacts of climate change and disasters, and second, a greater involvement on the part of planners in addressing these issues.

THE WAY FORWARD: A COMPREHENSIVE FRAMEWORK FOR DISASTER AND CLIMATE RISK MANAGEMENT

The current discourses toward urban pro-poor adaptation, described in the previous section, have the potential to further drive integration of disaster risk management into urban development planning. However, this potential remains untapped. The barriers are threefold. First, past developments and associated knowledge in (urban) disaster risk management are frequently not taken into account. While literature emanating from the climate change community is frequently not based on the theoretical knowledge-base of disaster risk management (cf. section 3 and 4), it generally cites the commonly known measures for risk reduction and provides associated examples from disaster risk management (programs). The duplication of efforts, and the repetition of past and painfully learned lessons, are likely to be the result. Second, the current paradigms of disaster risk management, presented in sections 3 and 4, do not, in general, take changing climatic conditions into account. Third, the different terminology used by the professionals working in disaster risk management and climate change (adaptation) often presents a further barrier, rather than actually leading to cooperation (UN-IATF/DR 2006).

To harness potential arising from further integration of disaster risk management into urban development planning, the three barriers mentioned above need to be addressed. This can be done by (a) building on the current paradigms in (urban) disaster risk management, including the conceptualization of risk, risk reduction, and related mainstreaming, and (b) factoring into these concepts knowledge on the changes, both determinable and uncertain, in patterns of hazards, vulnerability, and capacities to respond and recover. Tables 1 and 2 show that the changes required are minimal but crucial in terms of bringing about a more dynamic and flexible approach to risk reduction: one that leads to measures that are able to adjust to future changes in risk, as well as the uncertainty and longer planning horizons associated with it.

The outcome is a comprehensive and pro-poor risk reduction approach that is tailor-made to also counteract the additional risks arising from climate change. It is based on people's capacities/assets, and addresses risk associated with disasters and climatic changes and the sustainable integration of its reduction into urban development (including pre- and post-disaster responses).[9] In this context, disaster and climate risk can be defined as: The probability of harmful consequences or losses resulting from the interactions between natural or human-induced hazards, vulnerable conditions, and the lack of capacity of households, communities, and/or institutions to respond to and recover from hazards or disasters. The term 'harmful consequences and losses' refers here to both small-scale and large-scale disasters, and thus not only to climatic extremes but also other climatic variability. Adaptation for risk reduction is thus understood as a crosscutting topic and approach that brings together all measures aiming to minimize existing or potential future risk within a society. Adaptation for risk reduction can be implemented-and is essential-before, during, and after disasters, and thus needs to be mainstreamed not only in development work, but also in disaster response and recovery.

CONCLUSION: CHANGING PARADIGMS TOWARD PRO-POOR URBAN ADAPTATION

In an era of climate change and urbanization, rethinking current approaches to risk and associated poverty reduction is inevitable. The way in which risk is defined by different actors and research communities influences how disaster risk management is addressed (i.e. investigated, promoted and implemented). An enhanced understanding of risk thus has a strong bearing on the type of measures implemented to tackle risk and the priorities given to them.

This paper shows how the paradigms in disaster risk management, built around the understanding of risk, have gradually developed since the 1960s. Step by step they have been shaped by (a) the growing debate and practical experience with respect to disasters and risk management, (b) new knowledge on urbanization and related risk generation, (c) efforts to bridge the divide between urban research and practice, and (d) more recently, the scientific advances on the issue of global climate change. These advances have been reshaping the separate debates of the disaster risk management and climate change communities, driving an urban pro-poor adaptation agenda. This offers the potential of overcoming the current shortcomings and incomplete approaches with regard to risk reduction and its integration into urban development planning. This potential remains untapped, as past developments in urban disaster risk management, and associated knowledge, are generally not taken into consideration. The changes required in current disaster risk management paradigms to address this situation are presented in this paper. The result is a comprehensive risk management framework for urban pro-poor adaptation that addresses the risk reduction associated with disasters and climatic changes and its sustainable integration into urban development planning.

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[9] The presented framework is in line with the slowly increasing interest in participatory and asset-based adaptation (e.g. Moser and Satterthwaite), since it was elaborated on the analysis of the impact of disasters on people's livelihoods and of their coping capacities and associated social, economic, environmental, institutional and physical assets.

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