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Integrating DRR including CCA into the delivery and management of the built environment

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1. Introduction

Recent disasters across the world have highlighted the fragility of the built environment to a range of natural hazards, including those that may be influenced by climate change. Moreover, the rapid pace of urbanisation has increased concerns about the resilience of cities in light of disaster risks including those influenced by climate change; with contemporary discussions considering how physical/protective interventions can be integrated into the built environment or, indeed, what types of interventions are most effective.

Too often Disaster Risk Reduction (DRR) and Climate Change Adaption (CCA) have been treated as separate issues. Despite a shift to more pro-active and pre-emptive approaches to managing disaster risk, DRR appears to have been overly influenced by more reactive emergency management practices (UN, 2015). At the same time, CCA activities have typically fallen within the realm of environmental sciences. As a result, there appears to be critical disconnects between policies for CCA and DRR; often centered in different departments with little or no coordination. Moreover, there is a lack of integration of these policies within building regulations; the scope of which is largely limited to rigid restrictions in height and volume and specifications of materials and technology. Most often these building regulations are focused on the mitigation of a single hazard such as earthquakes, floods or cyclones.

It is becoming clear that DRR and CCA must go hand in hand - particularly when it comes to the planning, design, construction and operation of the built environment, with the references to both areas increasingly appearing in international guidance and reports. This is hardly surprising, considering that the built environment generates significant amounts of greenhouse gas emissions and can play a major role in the vulnerability of communities. For instance, the impacts of climate change on the built environment are likely to be experienced through climate variability and extreme weather events, with both linking climate change to DRR. Ideally, urban planners, architects, builders and other decision makers who influence the delivery and management of the built environment should be increasingly asked to respond simultaneously to the challenges posed by DRR, which by definition includes CCA. Thus it is critical to enhance resilience and sustainability of the built environment through addressing multiple hazards across spatial and temporal scales.

Considering the built environment at a regional scale can help ensure that locally available natural resources are appropriately utilised so that an ecological balance can be found in light of disaster risks including those influenced by climate change. In fact, many of these lessons for DRR, including CCA, can be learnt from local knowledge in planning and building design and construction, and therefore deserve sympathetic consideration when drawing up new policies and regulations.

This chapter will discuss the above mentioned issues by highlighting the lack of integration between DRR and CCA in built environment related policies and regulations. It will highlight how policy and regulations can be used to make DRR including CCA inputs from key built environment stakeholders more proactive and thus more effective.
2. CCA, DRR and the built environment

As pointed out by Wisner et al. (2012, p.31), the “natural environment is neither a hazard nor resource until human action makes it one or the other (or both)”. Vulnerability is thus created not by the environment but by poor decision-making, practices (including construction practices) and planning. Natural hazards only become disastrous if a settlement (or any kind of a built environment) is located in a hazard-prone area, poorly constructed and/or does not have a warning system in place.

The notion of a built environment is quite recent; it is conveyed through a systems’ perspective and emphasises relationships between various built elements (Moffat and Kohler, 2008). The built environment is made up of dwellings, neighbourhoods, public spaces, waterways, and infrastructure and transport systems. Their specific characteristics, such as location, structure and density, can make their residents and assets more or less vulnerable to hazards and threats (Boyd and Juhola, 2014). The built environment is one of the largest contributors to greenhouse gas emissions worldwide (Anderson et al., 2015) and at the same time it can be extremely vulnerable to the effects of climate change. This emphasises the increasing importance of the role of the built environment in reducing its negative contributions to climate change by making the building stock more energy efficient, and in adapting to the negative impacts of climate change by increasing resilience through investment in DRR measures (Lizarralde et al., 2015). However, while the concepts of climate change and DRR are widely discussed, it is not always clear to what extent these notions are interrelated. There appear to be fundamental conflicts between perspectives dominated by eco-efficiency (minimising the use of resources) and long-term resilience (robustness of built assets) to the impacts of climate change. This however does not mean that both these perspectives cannot be addressed simultaneously as will be discussed later in this chapter.

The impacts of climate change can affect the built environment directly and indirectly. Direct impacts occur through increased frequency and intensity of extreme weather events that could lead to destruction of physical assets and property, and widespread displacement of people. Indirect impacts are the consequences of the direct impacts correlated with demographic, economic and political stressors that increase vulnerability (e.g. poverty, political instability).

Climate change and DRR are closely linked to urbanisation. Combined together, the drivers of urbanisation and the risk factors induced by climate and other hazards and threats create a diverse range of vulnerabilities unique to urban environments. Vulnerability is often discussed in the context of urbanisation, referring to the exposure of a city (and its inhabitants and systems) to disturbances, such as natural hazards, economic crises or political unrests, exacerbated by population dynamics, informal settlements and inappropriate governance and planning. According to Bene (2013), there are three main factors that multiply the risks generated by urbanisation:

- Geographical location with respect to extreme weather events and human-induced threats;
- Dependence on the complex systems that are vulnerable to various threats and hazards;
- The level of resilience and the governance of resilience.

In the ever-expanding cities, the governance capacities and state is often unable to regulate urban development or to provide the necessary infrastructure to adequately support the increase in populations, which leads to increase in vulnerabilities. Whilst there are a large number of advantages for the inhabitants of large cities (e.g. improved economic
development, easier access to basic services, a comparatively rich cultural life), with increasing social polarisation, segmentation and fragmentation, the number of people that are excluded from these benefits is growing (Butch et al. 2009).

An increasing number of international and national policy documents acknowledge climate change as a ‘risk multiplier’, although it can also diminish risks, and as a result a large number of climate change mitigation strategies aimed at reducing greenhouse gas emissions (mainly by reducing fossil fuel consumption and introducing new renewable energy technologies) have been introduced in recent decades. Being a global challenge – and which can only be addressed globally – climate change has become a distraction from other equally important concerns or ‘creeping environmental problems’ (Glantz 1994), such as resource overexploitation or inequality. As stated by Kelman and Gaillard (2010: p.32), “Climate change has been changing the characteristics of weather and climate phenomena, but did not cause the vulnerability to them”. Therefore whilst it is not appropriate to ignore climate change, it is important to bear in mind other hazards. CCA efforts should be seen as a part of the DRR agenda, with climate change being treated as one of the hazards (Kelman, 2015), although it is equally important not to overlook climate change mitigation.

The impacts of climate change on disaster risks are not only relevant to the increase in frequency and severity of a hazard, but also to encompassing vulnerabilities, as climate change rapidly affects local environments changing them in a way that local knowledge becomes less applicable (Kelman, 2015). Taking into consideration the possible effects of hazards and threats related to climate change and disasters that may affect the built environment presents a great challenge to both policymakers and built environment professionals. They have to make a choice of either taking as a basis the upper limits of uncertainties provided by the projection scenarios, or continue with current practices therefore potentially reducing the lifetime of a structure. Whilst the former is a more effective adaptation strategy, it may be less cost-effective.

A large number of cities have introduced and applied numerous mitigation measures aimed at greenhouse gas emissions and energy consumption reduction, however only a few cities have been creative and productive in the realm of adaptation (Jabareen, 2015) (for an example of an effective resilience strategy see Box 1). This suggests that built environment professionals and policy-makers do not act enough to mitigate uncertainties from climate change and other natural hazards and human-induced threats. Instead of developing strategies for coping with risks, the vulnerabilities are often increased by decisions that do not take local context into account or are not appropriately enforced (Bosher, 2014).

**BOX 1: Addressing flooding in Surat**

Surat is one of India’s most economically successful cities. However with much of the city and its surrounds being less than 10 m above mean sea level, it is also prone to fluvial and pluvial flooding. Flooding is a recurring event, bringing major disruption to the city’s economy. A vulnerability assessment has highlighted the vulnerability of households, particularly of low-income dwellers residing in riverine areas. It was therefore decided that it is important to address and decrease Surat’s vulnerabilities. The modeling, sector studies and vulnerability assessment together informed the development of the city’s resilience strategy, and highlighted the short-term, mid-term and long-term approaches for addressing the various issues. The short-term strategies included developing an end-to-end early warning system and improved information and data management. Mid-term strategies identified mapping of flood-risk areas and the regulation of construction in floodplains, while long-term strategies included the diversion of floodwaters from the Tapi River and the...
construction of a balloon barrage system. These flood-specific measures were identified alongside other sector-specific strategies that would also build resilience to flood risks, such as improving wastewater and sanitation systems to reduce health risks from flooding, as well as improving the health surveillance system. This city resilience strategy now forms part of the city’s plans for preparing for climate change impacts (Source: Bhat et al., 2013).

Regulations and policies that address how the built environment is designed, planned and operated are critical for DRR including CCA, as the ways in which land is used and buildings and infrastructure are designed and operated influence exposure to hazards and threats. Once the investment in built assets in a risk-prone location has been made, it will remain there for a long period of time; in addition, once in place it is more expensive and less effective to correct and add new DRR measures than it would have been to avoid the creation of the risk in the first place (UNISDR, 2011). It is therefore clear that building regulations and planning policies can be a primary prevention, mitigation and adaptation mechanism.

During the past 25 years, building regulations and codes have been developed for virtually every type of construction; there are also an increasing number of informal guidance documents for the construction sector. They are constantly revised and improved, and the evidence shows that in those countries where building codes have been effectively applied, there is a dramatic improvement in performance of new construction (Krimgold, 2011). The majority of the current building codes and regulations and land-use planning policies take into account various hazards and threats (e.g. floods and storms, earthquakes). However whilst these policies and regulations have shifted towards addressing the root causes of vulnerabilities to disasters such as structural integrity of a building, they do not often do so explicitly and tend to focus only on a single hazard or one part of the problem – this will be demonstrated later in this chapter. In addition, mandatory built environment policies are based on the historical trends and previous events thus neglecting future projections that are critical for effectively embedding CCA within DRR.

3. Challenges and opportunities for including CCA in DRR

DRR and climate change are addressed in separate policy arenas at international and national levels. However starting with Hyogo Framework for Action 2005-2015 and 2007 Bali Action plan, a number of efforts have been made to point out the importance of addressing DRR and CCA together (UNISDR, 2008). This has also been reemphasised in the Sendai Framework for DRR introduced in 2015, and further strengthened during the COP21 meeting in Paris in 2015. For instance, the building code reviews, which usually reflect the most recent impact of a disaster event (be that natural hazard (e.g. an earthquake) or a human-induced threat (e.g. terrorism)), will now likely be made based also on future projections of change in wind speeds or height of storm surges, as well as other climate impacts.

However, despite recent debates for integrating CCA into DRR, there is hardly any evidence about technical and institutional challenges in practice (Davies et al. 2013). Around the world, solid frameworks for CCA and DRR exist, however these frameworks are not easily included into the built environment-related regulations and policies. There is a disconnection in the way that DRR and CCA are treated: for instance both CCA and DRR are often preparedness and response oriented, thus paying less attention to prevention considerations into a country’s development and planning practices, and consequently not sufficiently mainstreaming DRR and CCA into policy-making.
Whilst the issues addressed under CCA and DRR policies relate to the built environment, the interventions are often planned and implemented by different ministries. Neither DRR nor CCA are a sector, as they require informed action across a number of sectors (from education to health to utilities). DRR is often handled by civil defence and emergency management departments, which do not have links with environmental or economic ministries that overlook national planning and climate-change related policies. In addition, DRR and CCA are not the sole responsibilities of these departments and therefore tend not to be at the top of their priority lists. This creates further challenges for the built environment when building regulations, codes, and planning policies are introduced, as often the contribution of both DRR and CCA into these policies is negligible. Moreover professional training of the built environment professionals does not mainstream DRR and CCA as these competencies are not required in order to follow the existing regulations.

Building regulations and planning policies present an excellent opportunity for incorporating CCA into DRR. However there are some challenges that can diminish the role of building regulations and codes in DRR. For instance, land use planning maybe ineffective if it is implemented at a local level but a given risk crosses legislative boundaries of that locality. In addition, planning processes are often long-winded and inconsistent with the rapid development of a city (this is particularly an issue in the middle- and low-income countries). Similarly, building codes and regulations often do not take local specifics into account, and their implementation is often hindered by a lack of required expertise and manpower within the local government to monitor and enforce the regulations (GAR, 2011). Governments are often reactive and slow in responding to the issues related to CCA and DRR, and although new improved regulations are introduced, there is often a lack of incorporation of older buildings’ and infrastructure upgrade. The lack of government initiative also drives market barriers, as often risk-averse construction professionals are reluctant to invest in new technologies and practices that could be more appropriate in terms of CCA and DRR (van Heijden, 2014). Another issue is lack of implementation of these regulations and policies. In countries like India, heavy bureaucracy also hinders effective implementation. Moreover these regulations and policies are not designed to address specific design and construction technologies as prevalent in various regions; their contextualisation thus indeed being a challenge. Another important challenge is a lack of stakeholder engagement, particularly in the private sector. DRR is often seen as a responsibility of emergency managers, however multi-stakeholder participation can increase the capacity and capability of those who take part in DRR. Involvement of various public and private stakeholders can also lead to and facilitate knowledge and experience sharing. It is essential to identify those stakeholders who can have a positive influence over DRR in the built environment at various stages of the design, construction and operation processes, including commissioning, operation and maintenance, as effective decision making requires an integrated understanding of how to avoid and mitigate the effects of disasters (Chmutina et al., 2014).

3.1 Tensions created by CCA and DRR policies

Whilst complementary, CCA and DRR policies also create some tensions when addressing the challenges faced by the built environment, due to differing interpretations of terminology, institutional responsibilities and contextual differences:

1. Specific vs. broad scope: CCA policies largely focus on what can be achieved in terms of adapting to climate change-induced threats, in particular storms and floods. DRR policies put emphasis on the capacities that are (or should be) available in order to cope with a wider range of risks and threats, both natural and human-induced often regardless of their connection to the impacts of climate change. For instance in India, the National Building Code mainly contains
administrative regulations, development control rules and general building requirements, such as fire safety requirements, stipulations regarding materials, structural design and construction (including safety), and building and plumbing services. However it has been reviewed a number of times in recent decades in order to include lessons learnt in the aftermath of a number of disasters associated with devastating earthquakes and super cyclones witnessed by the country. The salient features of the revised National Building Codes include the changes with regard to further enhancing response to meet the challenges posed by disasters and reflecting the state-of-the-art and contemporary applicable international practices. These include criteria for earthquake resistant design of structures (including guidelines and code of practice specifically for reinforced cement concrete and earthen structures), cyclone resistant structures, and fire protection. However, when it comes to CCA, the code only relates to mitigation of climate related hazards such as floods and cyclones but does not deal with adaptation challenges posed by climate change. Flood risk is emphasized in IS 13739:1993 ‘Guidelines for estimation of flood damages’. This standard lays down a detailed scientific procedure for collection of flood damages (other than loss of human life) data under various categories and also methods of translating them to monetary terms (GoI, 2008).

2. **Efficiency vs. redundancy**: The overarching climate change agenda that informs CCA policies often endorses a lean approach to development and streamlining processes that goes hand in hand with climate change mitigation, i.e. to reduce consumption and minimise environmental impacts. DRR policies are more open to the potential benefits of over-designing (i.e. using more material resources to increase robustness) in order to avoid damages and prevent disasters. Hurricane Sandy hit New York hardest right where it was most recently redeveloped: Lower Manhattan, which from a political and economic perspective should have been the least vulnerable part of the island. But it was rebuilt to be “sustainable,” not resilient: the buildings were designed to generate lower environmental impacts, but not to respond to the impacts of the environment — for example, by having redundant power systems. After the terrorist attacks of 9/11, Lower Manhattan contained the largest collection of LEED-certified, green buildings in the world. In the aftermath of Hurricane Sandy the Building Resiliency Task Force Report was issued; it provided 33 actionable proposals for making New York buildings and residents better prepared for the next extreme weather event taking into account that the weather events in the future will be more extreme due to the impacts of climate change (Urban Green Council, 2013). The Task Force provided key recommendations on how to make various types of buildings more resilient.

3. **Emphasis on standards vs. emphasis on potential**: CCA policies have been informed by, and focused on, globally accepted standards often neglecting local context. DRR policies are often driven at the local level and encourage the identification and reinforcement of local potentials and capacities of the system. For instance, whilst Barbados does not have a dedicated national policy that covers CCA, draft of the Building Code in Barbados emphasises the importance of addressing the effects of climate change on the country, and ‘takes into account the climate and geological conditions of Barbados, especially the nature of the Caribbean environment and the region’s susceptibility to hurricanes and earthquakes’ (BNSI, 2013: 23). Whilst based on international standards (Scottish Executive Technical Standard and the UK Building Regulations), it nevertheless focuses on local forms of construction such as the ‘chattel house’ (traditionally a small moveable wooden house). The Code covers (to an extent) some natural hazards: flooding receives a dedicated section (Part 2, section A-2); and hurricanes and earthquakes are mentioned in the section on Structure in the context of the installation of windows and hurricane shutters, and roof coverage (which should resist the uplift from a minimum wind speed of 208km/h), and the calculation of the earthquake loads (Chmutina and Bosher, 2015).
4. *Reactive vs. proactive:* CCA policies acknowledge that climate change will have a negative impact on the built environment and therefore suggests the ways of adapting to these impacts. DRR policies (at least on a theoretical level) acknowledge the importance of a more pro-active approach to dealing with risks. This is clearly demonstrated in UK policy. CCA policies fall under the sustainability agenda, and DRR policies fall under the resilience agenda. The National Adaptation Plan emphasises the importance of CCA for the built environment, with its main focus being on adaptation measures to flooding and heatwaves. The resilience agenda in the UK underpins the development of all DRR-related work, including plans for the protection of critical infrastructure and for the prevention of violent extremism. National policy recognises that a risk cannot be fully eliminated (and in some cases it may also provide new opportunities). Resilience on the other hand is thus seen as a way of building capacity to respond to extreme events and return to normality, notably to guarantee business continuity (Lizarralde et al., 2015).

3.2 *Main areas in which synergies could and should be created*

These tensions are important to consider, however a number of areas in which synergy can (but does not necessarily do so yet) complement both CCA and DRR is in relation to the challenges faced by the built environment.

1. **Similar goals:** CCA and DRR policies implemented at the local level essentially address the same issues. For instance, the UK National Adaptation Plan focuses on natural hazards that may have an impact on the functionality of the built environment; this goes in line with the UK National Risk Assessment, although these two documents seldom acknowledge each other.

2. Synergising CCA and DRR can provide a basis for the much needed *multi-stakeholder engagement:* currently CCA is mainly addressed by environment-related departments, whereas DRR is a responsibility of emergency managers, with the private sector and communities in many cases not being involved in decision-making at any stage. Multi-stakeholder engagement can bridge disconnected policy and practice by putting those at risk (e.g. businesses and vulnerable sections of society) to the forefront.

3. **Knowledge sharing:** Multi-stakeholder engagement will allow for the integration of scientific knowledge of the environmental professionals (and others?), local knowledge of communities that is prevalent in the DRR, and practical context-specific knowledge of the built environment professionals. In addition, CCA can draw from some of tools developed within DRR (e.g. risk monitoring).

4. Overarching DRR plans can employ a *holistic approach* by emphasising natural resource protection, land-use planning and building codes that also address reduced energy consumption.

5. **Time scales:** synergies between CCA and DRR would allow for the expansion of DRR’s efforts time horizon by utilising future projections developed as part of CCA. In doing this it could be easier to justify investment in pre-emptive risk reduction considerations for future developments.

6. **Budget allocation** will be more effective if it is aimed at both DRR and CCA thus helping to reduce doubling efforts and increasing institutional effectiveness.
However in order to create these synergies, some basic challenges need to be overcome. These include existing institutional gaps and lack of coordination between various departments/ministries linked to DRR and CCA. Also there is challenge of using commonly understood vocabulary for DRR and CCA. Another common issue is the nature of financial allocations that are made under separate budget heads for DRR, CCA and other related areas thereby making it difficult to pull the resources for integrated planning and implementation. Last but not the least is the challenge of integrating CCA into DRR policies and programmes at national, district and local levels.

The following framework for DRR including CCA can be suggested for the reduction of the vulnerabilities in the built environment (Figure 35.1). The framework suggests that DRR including CCA should be incorporated at the earliest possible stage and be based on multi-stakeholder engagement throughout the process of building and zoning regulations development. Such a framework incorporates cooperation at all levels and takes into account national priorities as well as local context-specific needs and vulnerabilities. Whilst it partially decentralises efforts for DRR including CCA, it on the other hand, helps share the financial burden of its implementation as local priorities become national and vice versa.

**FIGURE 35.1 GOES HERE**

**Figure 35.1 Framework for incorporation of DRR including CCA into built environment policies**

This framework includes regulatory interventions based on collaboration with government, businesses and civil society. It establishes direct regulatory mechanisms that help in creating enforcement approaches for new and existing buildings addressing the needs and requirements of the climate change agenda and by incorporating CCA into DRR. However such a regulatory regime allows for learning from the built environment and other professionals therefore ensuring that regulatory bodies keep up with the pace of changing construction practices.

### 3.3 CCA and DRR contributions to climate change mitigation

Deeper understanding of synergies of DRR and CCA also present an opportunity for incorporating climate change mitigation into the development of the built environment. A number of initiatives worldwide, such as offshore wind farms located in Flevoland flooded areas in the Netherlands, to protect coasts from flooding or security features that simultaneously act as sustainable urban mechanisms are becoming more and more common. Other solutions have also been summarised by Coaffee and Bosher (2008) including:

- Pavements that can act as sustainable urban drainage systems (SUDS) and harvest rainwater that can then be used for functions that do not require treated water from the mains (flushing toilets, irrigation etc.), which may contribute to water efficiency;

- Cool roofs which reflect the sunlight and therefore reduce overheating: they help keep spaces cool during heatwaves especially if there is a blackout, and simultaneously reduce indoor temperatures thus reduce air-conditioning and therefore energy consumption;

- Energy co-generation system: incorporation of off-site renewable energy technology can provide electricity during blackouts as well as contribute to an overall decrease of energy from fossil fuels;
• Use of window shutters: protects glazing from smashing during storms and hurricanes as well as protects spaces from overheating thus reducing energy consumption for air-conditioning;

The main challenge however is to recognise the importance of identifying the barriers that restrict the opportunities to integrate DRR, CCA and mitigation measures into the built environment as have been outlined within this chapter.

4. Conclusions

As demonstrated in this chapter, the contribution of the built environment to climate change and CCA is well accepted in current building policies and regulations however, the risk reduction rationale in these regulations originates mainly from the past. This sets a challenge of expanding the current existing focus of building regulations: there is a need to incorporate a wider holistic ecological approach that looks at regional impacts and vulnerabilities and is not just limited to the performance of the built environment.

CCA and DRR initiatives currently work in silos, neglecting and underestimating their commonalities and goals, or being unable to overcome political constrains. Such a lack of synergy should not be ignored as it increases the risk of unsuccessfully reducing vulnerabilities of the built environment in the long run. Whilst there is enough understanding about how to place CCA within DRR, there is a lack of appropriate governance approaches and tools. This leads to multiple negative consequences, including duplicating efforts that lead to organisational inefficiencies and ineffective use of resources as well as counter-productive efforts, in particular by reinventing older approaches (Mercer, 2010).

In order to achieve a truly sustainable and resilient built environment it is critical to achieve an effective scale of hierarchically interdependent built elements. If such hierarchy is weak, the vulnerability of a built environment increases and therefore an impact of one hazard may exacerbate the impact of another hazard, thus creating a complex/compound hazard. Vulnerability continually increases in many places because the size and complexity of the built environment is increasing, with systems and networks planned, designed, constructed and operated without appropriate attention to the potential risks. Climate change presents an additional challenge and opportunity; therefore what were previously considered reasonable margins of safety in the traditional engineering approaches may no longer be relevant or effective.

Climate change has become a part of the built environment’s political agenda nationally and internationally in many countries, and it therefore could act as a mechanism to attract attention of policy makers to DRR. This however has to be done carefully in order not to shift the agenda to climate-induced hazards only, but instead it is critical to make DRR part of the sustainability agenda. Whilst it is important to build a structure that is energy efficient and constructed using materials that have minimal impacts on the environment, it is equally important to make sure that it is not in a risk-prone area and is not going to be destroyed by the next earthquake or flood. DRR including CCA should play a bigger role in building regulations and planning policies.

Structural measures can predominate in DRR – but this is also appropriate for CCA. Incorporation of CCA into DRR in the context of the built environment can be imposed through effectively implementing, monitoring, and enforcing building regulations and codes and land use planning and zoning requirements, ensuring that responsibility for preventive, protective and mitigation actions
lies with engineering and planning professionals. It can also contribute towards climate change mitigation. Planning policies also present a unique opportunity to integrate policies of mitigation, adaptation, land use and other sustainability-related measures in one legally binding document. However, it is important to incorporate ecological perspectives through adaptable design, which increases flexibility and durability of the built environment. Better integration of CCA into DRR can promote more structured and coordinated planning, construction and operation mechanisms and simultaneously provide support for overall sustainable development.

References:


