DISCUSSION PAPER: DEVELOPING A RESILIENT BUILT ENVIRONMENT: POST-DISASTER RECONSTRUCTION AS A WINDOW OF OPPORTUNITY

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1. Introduction

With growing population and infrastructures, the world's exposure to hazards – of both natural and man-made origin – is predictably increasing. This unfortunate reality will inevitably require frequent reconstruction of communities, both physically and socially. At the same time, it will be vital that any attempt to reconstruct after a disaster actively considers how to protect people and their environment to ensure those communities are less vulnerable in the future. In summary, it requires reconstruction of a more resilient built environment. This discussion paper considers what is meant by a resilient built environment, why it is needed, why post-disaster reconstruction presents a window of opportunity, and how reconstruction of the built environment can contribute to broader societal resilience.

For the remainder of this discussion paper and in common with The Centre for Research on the Epidemiology of Disasters (CRED), which maintains the International Disasters Database (EM-DAT), a disaster is a "situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering". For a disaster to be entered into the database at least one of the following criteria must be fulfilled: 10 or more people reported killed; 100 people reported affected; there is declaration of a state of emergency; or, a call for international assistance.

2. A global challenge

There are wide-ranging origins and causes to the many disasters that have affected communities across the world with ever greater frequency. The term disaster is frequently associated with geo- and hydro-meteorological hazards, such as hurricanes, earthquakes and flooding. Three main categories of natural disasters account for 90% of the world's direct losses: floods, earthquakes, and tropical cyclones (Munich Re, 2010).

The degree to which such disasters can be considered 'natural' has long been challenged. In their seminal paper entitled "Taking the 'naturalness' out of natural disasters", O'Keefe et al. (1976) identified the cause of the observed increase in disasters as, "the growing vulnerability of the population to extreme physical events", not as changes in nature. However, as Kelman (2009) observes, even as early as 1756, Rousseau, in a letter to Voltaire about the earthquake and tsunami that hit Portugal a year earlier, commented that, nature did not build the houses which collapsed, and suggested that Lisbon's high population density contributed to the toll.

More recently, the links between disasters and climate change have increasingly been recognised. There are growing concerns over the threats posed by climatological hazards such as extreme temperatures, drought and wild fires, and the multi-faceted threats associated with sea level change. The scale of human contribution to climate change may still be open to debate, but there is widespread, although many would argue, insufficient concern from politicians, commentators, researchers and the public alike, over its ability to increase the number and scale of hazards, and the potential for resultant impact on communities world-wide. The World Meteorological Organisation (WMO) figures showed that 2008 was the 10th warmest year since reliable records began, meaning that the 10 warmest years on record all occurred in the past 12 years.

Alongside disasters of so called 'natural origin', many other disasters to affect populations in recent times are unquestionably of human origin. Conflict sometimes results in wars and terrorist acts that match or exceed the losses from any 'natural' disaster. Other types of disaster, often referred to as 'technical', result from equipment malfunction or human error. Although less frequent they still have the potential to cause widespread damage to people and property.

Regardless of the origins and causes, as previously noted by the authors (Haigh and Amaratunga, 2010), the consequences to human society are frequently similar: extensive loss of life, particularly among vulnerable members of a community; economic losses, hindering development goals; destruction of the built and natural environment, further increasing vulnerability; and, widespread disruption to local institutions and livelihoods, disempowering the local community.

In 2008, more than 220,000 people died in events like cyclones, earthquakes and flooding, the most since 2004, the year of the Asian tsunami (Munich Re 2010). Meanwhile, overall global losses totalled about 200 billion USD, with uninsured losses totalling 45 billion USD, about 50% more than in 2007. This makes 2008 the third most expensive year on record, after 1995 when the Kobe earthquake struck Japan, and 2005, the year of Hurricane Katrina in the US. The frequency, scale and distribution of disasters in recent years is further evidence, if any is needed, that hazards – of both natural and man-made origins – are a global problem, threatening to disrupt communities in developed, newly industrialised and developing countries. The developed world cannot afford to be complacent.

But recent disasters also highlight that developing and newly industrialised countries are most at risk: the losses to life and the economy – as a percentage of GDP – are far greater. During the last decade of the 20th Century, direct losses from natural disasters in the developing world averaged 35 billion USD annually (Munich Re 2000). Although a disturbingly high figure by itself, perhaps more worryingly, these losses are more than eight times greater than the losses suffered over the decade of the 1960's.

In part, this high risk felt by developing and newly industrialised countries can be attributed to hazard frequency, severity and exposure. The three main categories of natural disasters that account for the greatest direct losses – as identified earlier, these are floods, earthquakes, and tropical cyclones – periodically revisit the same geographic zones. Earthquake risk lies along well-defined seismic zones that incorporate a large number of developing countries. High risk areas include the West Coast of North, Central and South America, Turkey, Pakistan, Afghanistan, India, China, and Indonesia. Similarly, the pattern of hurricanes in the Caribbean and typhoons in South Asia, Southeast Asia, and the South Pacific is well established. These typically affect Algeria, Egypt, Mozambique, China, India, Bangladesh, Taiwan, Indonesia, Philippines, Korea, Afghanistan, Armenia, Georgia, Iran, Mongolia, Thailand, Argentina, Brazil, Chile, Colombia, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Venezuela. These examples illustrate that to a significant degree, developing countries are unfortunate in being located in regions that are particularly prone to natural hazards. Of course, this correlation is not entirely accidental. The large number of disasters resulting from this high level of exposure has seriously hindered the ability of these countries to emerge from poverty.

Aside from hazard frequency, severity and exposure, the other contributory factor to disaster risk is capacity. Unsurprisingly, newly industrialised and developing countries both tend to lack the capacity to deal with the threats posed by hazards. This capacity needs to be deployed before the hazard visits a community in the form of pre-disaster planning. Effective mitigation and preparedness can greatly reduce the threat posed by hazards of all types. Likewise, capacity can also be deployed following a major disruptive event. The post-disaster response can impact the loss of life, while timely reconstruction can minimise the broader economic and social damage that may otherwise result.

Although frequently represented as discrete stages, there is also recognition that the same are inter-connected, overlapping and multidimensional (see for example McEntire et al, 2002). In particular: the level and quality of pre-disaster planning will largely determine – positively or negatively – the post-disaster response; and, the effectiveness of post-disaster reconstruction will determine to what extent the community remains vulnerable to the threats posed by hazards in the future. This link between sustainable development and mitigation has been referred to by Mileti (1999) as 'sustainable hazard mitigation.'

With this in mind, although this discussion paper is focused on post-disaster reconstruction, much of what is discussed is intent on ensuring that communities are less vulnerable in the future. The emphasis on reconstruction also recognises that, unfortunately, many communities are left in a perpetual cycle of disasters, as failures in reconstruction efforts prevent them from addressing underlying risk factors.

3. Why focus upon the built environment?

As noted in the paper's title, the emphasis of this is discussion is on reconstruction of the 'built environment', but this in no way suggests that reconstruction of the built – or physical – environment should be carried out in a vacuum. Instead, as will be highlighted later, it is vitally important to link the physical requirements with broader social, natural, institutional and economic needs. However, this emphasis does recognise the growing recognition that the construction industry and built environment professions have a significant role to play in contributing to a society's improved resilience to disasters (Haigh et al, 2006; Lloyd Jones, 2006). In order to understand this role, it is necessary to understand what constitutes the 'built environment' and the nature of the stakeholders involved in its creation and maintenance.

The environments with which people interact most directly are often products of human initiated processes. In the 1980s the term built environment emerged as a way of collectively describing these products and processes of human creation. The built environment is traditionally associated with the fields of architecture, building science and building engineering, construction, landscape, surveying, urbanism. In Higher Education, Griffiths (2003) describes, 'a range of practice-oriented subjects concerned with the design, development and management of buildings, spaces and places'.

The importance of the built environment to the society it serves is best demonstrated by its characteristics, of which Bartuska (2007) identifies four that are inter-related. First, it is extensive and provides the context for all human endeavours. More specifically, it is everything humanly created, modified, or constructed, humanly made, arranged, or maintained. Second, it is the creation of human minds and the result of human purposes; it is intended to serve human needs, wants, and values. Third, much of it is created to help us deal with, and to protect us from, the overall environment, to mediate or change this environment for our comfort and well-being. Last, is that every component of the built environment is defined and shaped by context; each and all of the individual elements contribute either positively or negatively to the overall quality of environments.

As previously noted by the Editors (Haigh and Amaratunga, 2010), several important consequences for disaster risk can be identified from these characteristics. The vital role of the built environment in serving human endeavours means that when elements of it are damaged or destroyed, the ability of society to function – economically and socially – is severely disrupted. Disasters have the ability to severely interrupt economic growth and hinder a person's ability to emerge from poverty. The protective characteristics of the built environment offer an important means by which humanity can reduce the risk posed by hazards, thereby preventing a disaster. Conversely, post-disaster, the loss of critical buildings and infrastructure can greatly increase a community's vulnerability to hazards in the future. Finally, the individual and local nature of the built environment, shaped by context, restricts our ability to apply generic solutions.

4. Resilience in the built environment

The consequences outlined above serve to underline and support the growing recognition that those responsible for the built environment have a vital role to play in developing societal resilience to disasters. The notion of resilience is becoming a core concept in the social and physical sciences, and also in matters of public policy. But, what does resilience mean? What are the attributes of resilience? What is needed to create a disaster resilient built environment?

The term resilience was introduced into the English language in the early 17th Century from the Latin verb resilire, meaning to rebound or recoil. However, there is little evidence of its use until Thomas Tredgold introduced the term in the early 18th Century to describe a property of timber, and to explain why some types of wood were able to accommodate sudden and severe loads without breaking. In 1973, Holling presented the word resilience into the ecological literature as a way of helping to understand the non-linear dynamics observed in ecosystems. Ecological resilience was defined as the amount of disturbance that an ecosystem could withstand without changing self-organised processes and structures.

In subsequent decades, the term resilience has evolved from the disciplines of materials science, the ecology and environmental studies to become a concept used by policy makers, practitioners and academics. During this period, there have been a range of interpretations as to its meaning.

For some, resilience refers to a return to a stable state following a perturbation. This view advocates a single stable state of constancy, efficiency, and predictability, or, as the ability to absorb strain or change with a minimum of disruption (Horne and Orr, 1998; Sutcliffe and Vogus, 2003). For others, resilience recognises the presence of multiple stable states, and hence resilience is the property that mediates transition among these states. This requires very different attributes, as for example advocated by Douglas and Wildavsky (1982), who define resilience from the perspective of risk as, "the capacity to use change to better cope with the unknown: it is learning to bounce back" and emphasise that, "resilience stresses variability". More recently but in a similar vein, Dynes (2003) associates resilience with a sense of emergent behaviour that is improvised and adaptive, while Kendra and Wachtendorf (2003) argue that creativity is vital.

Further discrepancy can be found in the degree to which resilience should be defined in merely passive terms. Douglas and Wildavsky (1982) focus on the ability to simply 'bounce back' from a 'distinctive, discontinuous event that creates vulnerability and requires an unusual response'. Wildavsky (1988) further characterises resilience as the, 'capacity to cope with unanticipated dangers after they have become manifest' and notes that resilience is usually demonstrated after an event or crisis has occurred. Lettieri et al (2009) suggest a 'contraposition' in the literature between two concepts: resilience and resistance. Resilience they argue focuses on after-crisis activities, while resistance focuses on before-crisis activities. These all suggest a reactive approach whereby resilience is considered a 'pattern rather than a prescribed series of steps or activities' (Lengnick-Hall & Beck, 2003). Others stress a positive approach that suggests resilience is more than mere survival; it involves identifying potential risks and taking proactive steps (Longstaff, 2005). The objective is to build resilience by maximising the capacity to adapt to complex situations (Lengnick-Hall & Beck, 2005). Similarly, Paton et al (2001) write of a paradigm shift that accommodates the analysis and facilitation of growth, whereby resilience, 'describes an active process of self-righting, learned resourcefulness and growth'.

Resilience is evidently complex and open to a variety of interpretations but how can it be applied to the built environment? The relationship between disaster risk, resilience and the built environment suggests that a resilient built environment will occur when we *design, develop and manage context sensitive buildings, spaces and places that have the capacity to resist or change in order to reduce hazard vulnerability, and enable society to continue functioning, economically and socially, when subjected to a hazard event*. It is possible to elaborate on this definition by exploring specific characteristics of resilience and how they may be present in the built environment.

Firstly, resilience is seen as the ability to accommodate abnormal or periodic threats and disruptive events, be they terrorist actions, the results of climatic change, earthquakes and floods, or an industrial accident. Identifying, assessing and communicating the risk from such threats and events are therefore vital components. Individuals, communities, organisations and, indeed, nations which are prepared and ready for an abnormal event, tend to be more resilient. Consequently, those responsible for the planning, design and management of the built environment need to understand the diverse hazard threats to buildings, spaces and places and the performance of the same if a disruptive event materialises.

The next characteristic is the ability to absorb or withstand the disturbance while still retaining essentially the same function. This may mean returning to the state or condition that existed before the disturbance occurred, or returning to an improved state or condition. This absorption might be realised through the specification and use of hazard resistant methods, materials and technologies. It might also result from the construction of protective infrastructure, or the protection of critical infrastructure. Such measures may resist the threat, or at least reduce the losses experienced.

As outlined in the opening of this discussion, we live in a world which is constantly evolving, in some cases through natural processes and in other cases through the intervention of mankind. There is common agreement in the literature that systems, organisations and people who are able and willing to adapt tend to be more resilient. Creative solutions, the ability to improvise and the capacity to adapt will be essential in order to address the challenges posed by what is often seen as an unbounded threat.

The ability and willingness to learn is often linked to adaptability and being prepared. The learning may come from studying the lessons of others in a formal manner: by gathering and evaluating data, by conducting research in an objective, independent and balanced manner, and by communicating the findings, conclusions and recommendations.

The ability to absorb or withstand also requires economic and human capacity. A resilient built environment will need to be supported by a strong domestic industry and appropriately skilled professions and trades. A well-developed construction sector and supply chain, which largely comprise of micro, small and medium sized enterprises, provide a strong means to counter the economic shocks that frequently accompany other disasters, while also offering an economic stimulus and livelihood opportunity in the recovery period.

As society becomes more complex, resilient communities tend to be those which are well coordinated and share common values and beliefs. This sense of interconnectedness can be undermined by self-interest and personal gain, resulting in vulnerable societies which are less able and willing to plan for, and react to, disruptive events. Understanding the link between the physical and social environment will be vital in developing connectedness. Culturally sensitive, sustainable and socially responsible planning, design and management of the built environment, have the potential to help develop community cohesion and thus contribute to wider societal resilience.

From this discussion of its characteristics, it is evident that the concept of resilience provides a useful framework of analysis and understanding on how we can plan, design and maintain a built environment that copes in a changing world, facing many uncertainties and challenges. Sometimes change is gradual and things move forward in continuous and predictable ways; but sometimes change is sudden, disorganising and turbulent. Resilience provides better understanding on how society should respond to disruptive events and accommodate change.

5. Disasters as a window of opportunity

If this idea of a resilient built environment is appealing, how can it be achieved? A further reason for this discussion's emphasis on reconstruction is that the post-disaster period provides a window of opportunity to address many of the vulnerabilities usually encountered in a community's built environment. There are several features of this post-disaster period that can be capitalised upon. Firstly, the disaster has destroyed much of the built environment that was improperly designed and vulnerable, creating a fresh start from which to address disaster risk. Furthermore, the experience gained during the disaster typically generates new knowledge, which brings various stakeholders together around a shared awareness of the nature of risk. The mistakes of previous development policies and strategies are exposed and can be addressed. Next and perhaps even more significantly, the political will and desire to act is almost certainly stronger than usual. Any interest in disaster risk reduction that had been forgotten or side-lined before the disaster, will suddenly gain renewed prominence in the recovery period. In a similar vein, the lack of resourcing for risk reduction, any presence of corruption and otherwise weak institutional structures that allowed a vulnerable built environment to be constructed will have been highlighted. Finally, but perhaps most importantly, the post-disaster period often provides a level of resourcing, including considerable external funding, that would be otherwise unattainable. If properly utilised – something that is by no means certain – this additional resource does afford a major opportunity to reduce vulnerability.

The fact that this window of opportunity exists does not mean that the various actors involved in reconstruction will take advantage of it. Although many, if not all, of these features are usually present following a major disaster, even a cursory glance at the countless studies and evaluations of programming after disasters, provides evidence that it is frequently a missed opportunity.

There are a myriad of reasons as to why these failures occur. Humanitarian principles are primarily concerned with addressing acute human suffering. By necessity, a timely response is essential.

Anything that slows this response is likely to be a problem. Unfortunately, the well-planned reconstruction of a more resilient built environment will take time. Likewise, humanitarian principles also tend to dictate maintaining independence, neutrality and impartiality. This can dissuade actors from highlighting previous failings, which would otherwise create the necessary political will for change.

Effective reconstruction of the built environment is also competing with many other priorities. Poverty alleviation, improved health, and good governance are a few of the many goals usually mainstreamed in the post-disaster recovery period. A more resilient built environment can certainly contribute to these goals, but there will inevitably be a time-lag; other recovery programmes can sometimes appear more appealing due to their ability to deliver short term results. If the window of opportunity is to be taken advantage of, then advocates of a more resilient built environment will need to demonstrate the vital role it plays in helping society achieve much broader development goals.

A further complication is the natural tension between the need for timely reconstruction and a desire to utilise and where necessary develop local capacity. Institutions and local enterprise to plan and construct the built environment may matter, but they are often simply not there. Government, both national and local, is usually called upon to make critical long term planning decisions, and to develop and enforce appropriate building regulations. This expectation is made of institutions that have usually failed to achieve this in far less challenging periods of their electorate's history. The reality is that large scale reconstruction may have to be undertaken during a period soon after a major part of the civil service has perished, or at least been severely disrupted. At a time when even greater demands are being made of the civil service, its employees are sometimes being laid off, with the damage to the local tax base reducing available funding. At the same time, the local construction industry is suddenly called upon to increase its output to meet the needs of an unprecedented programme of reconstruction activity, while simultaneously familiarising itself with less vulnerable methods and materials. Building human resources and local capacity to address these shortfalls and support reconstruction, may take years.

The alternative, to make use of international agencies and private enterprises, understandably raises other concerns. International actors are often accused of poaching the most talented local civil servants and encroaching on a country's independence, while the private sector is accused of disaster profiteering and leaves local industry unable to 'benefit' from the economic opportunities afforded by the disaster.

In summary, there is a window of opportunity, but it is beset with challenges. A pragmatic approach to the development of a resilient built environment needs to include an understanding of these difficulties and their implications for what can actually be done, at least in the short term. While the humanitarian efforts are frequently a rushed process, effective rebuilding for resilience will require reflection, discussion and consensus building. This should not undermine the importance of starting this process early in the recovery phase; indeed, a failure to consider long term reconstruction goals early in the recovery can lead to wasted or misguided effort, as well as undermine efforts for future resilience. Instead, it recognises the importance of a judicious approach that addresses the complexity of creating resilience.

6. Asset-based reconstruction

The consequences outlined here serve to underline and support the growing recognition that those responsible for the built environment have a vital role to play in effective disaster planning. It would also appear to be highly desirable for the built environment discipline to be able to contribute to increased resilience through a strategy that is inter-disciplinary in nature. Thus far, the emphasis of this discussion has been on reconstruction of the 'built environment', but as asserted earlier, reconstruction to address a community's physical requirements must be done so in a manner that considers broader social, natural, institutional and economic needs.

The built environment industries are usually associated with a range of critical activities in post-disaster recovery, including temporary shelter and housing after the disaster, and the restoration of critical infrastructure such as hospitals, schools, water supply, power, and communications. However, in order to achieve the challenge laid out earlier – to create a more resilient built environment that can contribute to broader societal resilience – the impact of reconstruction, positively or negatively, needs to be evaluated far more carefully. Disaster planners have begun to realise the link between disaster and development – a large and well-established field relating to physical, social, natural and economic aspects of society. Although reconstruction of the built environment by itself will not eliminate the broad ranging consequences of disasters, there is increasing recognition that the reconstruction process can contribute to the development of communities beyond merely the building of their physical environment.

This potential contribution of the reconstruction process to the broader goal of a more resilient society can be viewed with the aid of the Asset-Based Community Development (ABCD) approach, developed by Kretzmann and McKnight (1993) as a methodology that seeks to uncover and highlight the strengths within communities as a means for sustainable development. The basic tenet is that a capacities-focused approach is more likely to empower a community and therefore mobilise citizens to create positive and meaningful change from within. Instead of focusing on a community's needs, deficiencies and problems, the ABCD approach helps them become stronger and more self-reliant by discovering, mapping and mobilising all their local assets. Few people realise how many assets any community has. The reconstruction process has the potential to utilise and impact, positively or negatively, a community's assets.

The construction and maintenance of a community's infrastructure and buildings, or physical assets, are the first obvious impact. These physical assets address material needs (infrastructure, water, housing, waste, energy, transport, work), social and educational needs (schools, play areas, meeting places), and, spiritual or cultural needs (places of worship). Reconstruction of the physical environment is vital to secure sustainable economic development. Further, by incorporating appropriate mitigation measures, effective reconstruction of the physical environment is also an opportunity to reduce the community's vulnerability to hazards in the future.

Of vital importance will be to secure sufficient capacity or resources to deliver all this reconstruction activity. The challenge posed by the scale of reconstruction can also be viewed as an opportunity: to develop livelihood competencies or human assets in construction related trades. This human asset development is not just required at the trade level; project management and professional skills are also vital. This opportunity can help address a problem frequently encountered following a disaster, particularly in conflict affected environment: how to develop the skills of displaced peoples and ex-combatants who, for a variety of reasons, are unable to return to their original livelihoods?

Reconstruction also enables the development of economic assets within the community through opportunities to initiate market linkages in the construction supply chain. Excessive reliance on external private enterprises can be counterproductive and hinder local economic development. Local intermediary and long term income generation opportunities provided by reconstruction activity may lay an important platform for economic development in the region. Micro, small and medium enterprises are a vital component of any economy and the construction sector is largely comprised of micro and small enterprises. Reconstruction is thus an opportunity to provide market access for these local enterprises.

A community's natural assets are frequently impacted by reconstruction. On the positive side, locally sourced and contextually appropriate materials can provide an important contribution to reconstruction while also offering market opportunities for local businesses. It is however vital to consider the community's long term sustainability and thereby ensure that its natural assets are not exploited to the detriment of the community.

Fundamental to the recovery of any disaster affected community is the idea of connectedness. There is growing evidence that collective reconstruction contributes to social cohesion and builds social assets. Reconstruction is an opportunity for cooperation and working across diverse groups, particularly useful in conflict affected environments. Engaging the community in reconstruction has the added benefit of moving them away from being passive recipients of aid, which can increase the sense of helplessness.

Finally, reconstruction can impact a community's institutional assets. The organisation and coordination of recovery is usually complex because a wide range of activities occur simultaneously with an equally wide range of needs that have to be met, including those of the most vulnerable members of the community. Reconstruction can provide members of a community with an opportunity to influence policies, decisions and interventions that affect them, including assessment, planning, construction and monitoring. Further, the community can develop links to important stakeholders.

7. Conclusion

In summary, the reconstruction process will have a far greater impact on the affected community than the physical buildings and infrastructure. An asset-based approach does not remove the need for outside resources. However it will make their use more effective. It will also go a long way to creating the type of resilient society that was put forward earlier as a goal to aspire to. Indeed many of the characteristics of resilience can be developed through an assets based approach. Asset based community development starts with what is present in the community. It concentrates on the agenda-building and problem-solving capacity of the residents and stresses local determination, investment, creativity, and control. Weak communities are places that fail to mobilise the skills, capacities and talents of their residents or members. Ignoring a community’s assets during reconstruction may inadvertently leave communities more dependent and ultimately less resilient to the threat posed by future hazards. In contrast, post-disaster reconstruction programmes where the capacities of the community are identified, valued and used, will lay the platform for a more resilient society.

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