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An Exploration of the Construction Industry's Role in Disaster Preparedness, Response and Recovery

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The construction industry's role in reconstruction activities following disasters such as the Indian Ocean Tsunami, is well documented. In particular, post-disaster reconstruction has been the subject of a significant body of research, with particular emphasis on developing countries that are less able to deal with the causes and impacts of disasters. There is, however, growing recognition that the construction industry has a much broader role to anticipate, assess, prevent, prepare, respond and recover from disruptive challenges. Advocates suggest construction professionals have a key role to play because they are involved in the construction of the infrastructure, and therefore should also be involved when an event destroys that infrastructure. They also suggest that the construction professions are in the best position to frame the discussion of the cost-benefit trade-offs that occur in the risk management process; for example, the need for risk avoidance against the cost of implementing safety strategies.

This exploratory paper considers the need for a more expansive view of the life cycle of infrastructure projects: one that extends beyond the traditional cycle of feasibility analysis, planning, design, construction, operation, maintenance and divestiture. This revised life cycle considers the construction professional's ability to anticipate and respond to events, such as the Indian Ocean Tsunami, which damage or destroy an infrastructure project and reflects the construction industry's ongoing responsibility toward an infrastructure's users.

Keywords: disaster management, enhanced life cycle, disruptive challenge, resilience, reconstruction.

BACKGROUND

The new millennium has seen a series of events – including the Bam Earthquake in Iran (2003), the Indian Ocean Tsunami (2004), and the terrorist events in America (2001), Madrid (2004) and London (2005) – that have increased the degree of uncertainty faced by policy makers, challenged emergency arrangements and raised issues regarding their appropriateness. In light of these events, the terms *resilience* and *disruptive challenges* have been adopted by many policy makers in an attempt to describe the way in which they would like to reduce a nation's susceptibility to major incidents of all kinds by reducing their probability of occurring and their likely effects, and by building institutions and structures in such a way as to minimise any possible effects of disruption upon them (Coles, 2004; Civil Contingencies Secretariat, 2004).

The concept of resilience has arisen from an amalgamation of historic developments in the disaster planning process. It has a focus on disaster and addresses the ability of the community to recover following the impact of a disastrous event (Fox, 2002).

Douglas and Wildavsky (1982) 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 which is improvised and adaptive, while Kendra and Wachtendorf (2003) draw parallels with the creative actions of organisations in the aftermath of disasters. Creativity, they argue, is a vital element in emergency response and emphasis should be placed on better preparation and training employees to enhance creativity at all levels of responding organisations.

NATIONAL POLICY IN RESILIENCE AND RECOVERY

Resilience and recovery requires a concerted approach that will support the foundations of community sustainability and capacity building and which will eventually reduce risks and vulnerabilities to future disasters (Rotimi *et al.*, 2006). The rational starting point is the setting up of an institutional infrastructure for emergency management, which will formulate public policies for preparedness, response and recovery. These recovery policies should then be integrated into other emergency management areas as well as policies of sustainability and community capacity building (Coghlan, 2004).

In the UK, the resilience policy agenda is being driven by the Civil Contingencies Secretariat (CCS), which was set up to improve the UK's resilience against disruptive challenges through working with others to anticipate, assess, prevent, prepare, respond and recover. The CCS has a two-stranded approach focusing on a Capabilities Programme (Cabinet Office, 2003) and the Civil Contingencies Bill 2004. *Capability* is a military term which is intended to be inclusive of personnel, equipment and training and such matters as plans, doctrine and the concept of operations (Coles, 2004). Capabilities are embedded in systems, routines, mechanisms and practices, and can only be improved by making such features more responsive to new needs. Capability is a forward-looking view: it predicts the outcome before a process has taken place. In contrast, performance is backward-looking and consists of the results achieved after completion, thus providing historic data (Haigh, 2003). The Capabilities Programme is an audit of current infrastructure and resources extending to the full range of contingencies likely to face the UK in the first decade of the 21st century. The aim is to ensure that a robust infrastructure of response is in place to deal rapidly, effectively and flexibly with the consequences of civil devastation and widespread disaster inflicted as a result of conventional or non-conventional disruptive activity (Civil Contingencies Secretariat, 2004).

The CCS stresses the need for an integrated planning perspective in order to achieve resilience. Specifically, any planning system should include all levels of government as well as the public, private and voluntary sectors. They define resilience as including a planning process based on partnerships and the sharing of best practice and systems that are developed and tested to cover the full range of potential, disruptive hazards. This type of multi-disciplinary approach is widely supported (Fox, 2002; Tobin and Whiteford, 2002). However, Coles (2004) notes the complex and confusing picture of departmental domains and responsibilities of the Capabilities Programme, and argues that it is, “a clear example of how to further extend complexity in what is already a complex, tightly coupled system of interactions and interdependencies.” This complexity also appears to be at odds with improvisation and creativity of resilience, which Dynes (2003) contrasts with the emergency response organisations' command and control structure that destroys flexibility and innovation.

In a similar vein, the Ministry of Civil Defence and Emergency Management (MCDEM) in New Zealand encourages a holistic approach to the issue of recovery planning and believes this will be most effective if it is integrated with reduction, readiness and response. The definition of recovery encapsulates the expectations of recovery as “the coordinated efforts and processes to effect the immediate, medium and long-term holistic regeneration of a community following a disaster” (MCDEM, 2005). Recovery is delivered through a continuum of central, regional, community and personal structures. The MCDEM, together with cluster groups of agencies, coordinate planning at the central level. Regional and territorial authorities are encouraged to produce group plans that will suit peculiar conditions of their local areas. Other discussion documents produced at the national level, such as *Focus on Recovery: A Holistic Framework for Recovery* and *Recovery Planning*, both released in 2004, give context to recovery planning, while the Civil Defence and Emergency Management Act (CDEMA) 2002 provides the legislation and the foundations for the New Zealand Civil Defence and Emergency Management (CDEM) environment (Rotimi *et al.*, 2006).

Elsewhere, particularly in developing countries, recovery planning appears less defined and when tested, is often found to be insufficient or ineffective. Jigyasu (2004) describes an increase in the vulnerability of local communities after the Latur 1993 earthquake in India, where sustainable recovery interventions were poorly planned and implemented. The national and international humanitarian response to the Tsunami varied in each of the countries given differences in the area covered, political context, impact as percentage of economy, culture, existing relationships to the donor nations and access to resources. In India and Sri Lanka, Rex (2006) found they naturally differed in all of the above, although recognised that within both countries there was not one homogenous culture but numerous, with often confusing and contentious sub-cultures to be dealt with. In Sri Lanka, Rex found this to be more obvious due to awareness brought by the civil war, but in India it came as a surprise that there was so much variation due to combinations of geography, religion, caste, livelihood and language. In general however, Rex found that relief and reconstruction efforts in all locations were affected by

sudden availability of great quantities of money with minimal systems for spending; increased visibility and focus on corruption; wide geographical spread of relief operations making logistics and communications difficult; and, competition for resources (2006).

THE CONSTRUCTION INDUSTRY'S ROLE IN RESILIENCE AND RECOVERY

The construction industry's role in recovery activities following disruptive challenges, both natural and human-caused, is well documented. In particular, post-disaster reconstruction has been the subject of a significant body of research (for examples see: Karim, 2004; Lizarralde and Boucher, 2004; Nikhileswarananda, 2004; Young, 2004; Jigyasu, 2002), with particular emphasis on developing countries that are less able to deal with the causes and impacts of disasters. The importance of improving the construction industries of developing nations is widely recognised, highlighting a need to equip them to manage the post-disaster scenario (Ofori, 2002). Construction is typically engaged in a range of critical activities: temporary shelter before and after the disaster; restoration of public services such as hospitals, schools, water supply, power, communications, environmental infrastructure and state administration; and securing income earning opportunities for vulnerable people in the affected areas (World Bank, 2001). Similarly, disaster planners have begun to realise the link between disaster and

development (Fox, 2002). Development is a large and well-established subject area and in its broadest context relates to social, economic and, significantly from a construction perspective, physical aspects of society.

Although more robust construction in and of itself will not eliminate the consequences of disruptive events, there is widespread recognition that the engineering community has a valuable role to play in finding and promoting rational, balanced solutions to what remains an unbounded threat (Sevin and Little, 1998). There has been considerable research aimed at developing knowledge that will enable the construction of a generation of buildings that are more robust and safer; for example, through reduction of injury inducing blast debris, the development of glazing materials that do not contribute to the explosion-induced projectile hazards and have enhanced security application, as well as the integration of site and structure in a manner that minimises the opportunity for attackers to approach or enter a building (Levy and Salvadori, 1992; Mallonee *et al.*, 1996; National Research Council, 1995; The President's Commission on Critical Infrastructure Protection, 1997).

A MORE EXPANSIVE CONSTRUCTION LIFE CYCLE

There is however growing recognition that the construction industry has a much broader role to anticipate, assess, prevent, prepare, respond and recover from disruptive challenges. Peña-Mora (2005) suggests construction managers have a key role to play because they are involved in the construction of the infrastructure, and therefore should also be involved when an event destroys that infrastructure. He highlights that construction managers' skill in getting equipment, scheduling a set of activities to accomplish a task and knowing how to manage those activities can be very valuable when an extreme event occurs. Moreover, he emphasises that construction engineers possess valuable information about their projects – information that can be critical in disaster preparedness as well as response and recovery. The information they possess, he argues, may be the difference between life and death. Similarly, Lloyd Jones (2006) concluded that chartered surveyors, with appropriate training, have key roles to play during all disaster phases, from preparedness to immediate relief, traditional recovery and long-term reconstruction.

Sevin and Little (1998) suggest that computerized building plans, structural analysis programs, and damage assessment models may all facilitate rapid rescue and recovery of victims in the aftermath of an event, and that these all require the active involvement of the construction professions. They also suggest that the construction professions are in the best position to frame the discussion of the cost-benefit trade-offs that occur in the risk management process, for example the need for risk avoidance against the cost of implementing safety strategies.

The multi-disciplinary and integrated planning approach that is being adopted by the CCS and MCDEM would suggest a clear role for the construction industry in contributing to a nation's resilience agenda. At present however, the full extent of the potential for construction to contribute to such initiatives is unclear, beyond traditional design and reconstruction activities.

In developing countries, construction's role is equally important but also different. In major post-disaster, such as the 2004 Tsunami, both human and material resources were over-demanded which slows progress and drives up prices. The internal difference in resources derives from the situation that in a typical development programme, the construction is very basic and in developing countries very little expertise is required at the scale a programme operates. However, when they must increase their capacity in quantity and speed, more experienced and skilled resources

are required to actually manage the projects. In addition to construction expertise, possibly large-scale, basic project management experience was also essential. For both of these skill-sets, smaller developing countries may not have people with this large-scale time-critical management experience, and ex-patriots with these skills frequently do not have the experience to understand the environment adequately (Rex, 2006).

ENHANCING THE CONSTRUCTION KNOWLEDGEBASE IN RESILIENCE AND RECOVERY

Pena Mora (2005) suggests the need for a more expansive view of the life cycle of infrastructure projects: one that extends beyond the traditional cycle of feasibility analysis, planning, design, construction, operation, maintenance and divestiture. This revised life cycle should encompass the construction professional's ability to anticipate and respond to unexpected events that damage or destroy an infrastructure project – from earthquakes to terrorist attacks – and reflect the construction industry's ongoing responsibility toward an infrastructure's users. He refers to this concept as the *enhanced management and sustainability cycle for infrastructure with uncertain life span or enhanced life cycle*.

Designing policy for future events crucially depends upon the degree of certainty or uncertainty faced by the architects of such policy. It is evident that the disruptive challenges of recent years have served as a 'wake-up call' for governments and have increased the degree of uncertainty faced by policy makers. A resilience agenda suggests a need for creativity, improvisation and adaptation, but it is unclear what role construction professionals will have in the "complex and confusing picture of departmental domains and responsibilities" that national recovery programmes frequently offer (Coles, 2004). Creativity has been identified as a key component of resilience and therefore the full extent of construction's potential contribution is likely to be best identified by construction professionals themselves, who can identify a more expansive view of the life cycle of infrastructure projects that encompass the construction professional's ability to anticipate and respond to unexpected events that damage or destroy an infrastructure project. Knowledge and awareness among construction researchers and practitioners will identify those aspects of resilience that will benefit from the involvement of construction professionals and where appropriate, stimulate ideas for further research. Lloyd-Jones (2006) concludes that the built environment's professional bodies, such as RICS and CIOB, should work together to promote the development of a worldwide network of trained professionals ready to join recovery and reconstruction teams working with local people.

At present however, this body of knowledge appears fragmented and poorly integrated with resilience and recovery policies. Eighteen months on, most of the affected counties have yet to recover from the devastation caused by the Indian Ocean Tsunami of December 2004, Sri Lanka being no exception. Overall, the Tsunami affected two thirds of the coastline of Sri Lanka. It also resulted in the destruction of more than 100,000 houses (UNEP, 2005). The destruction of houses also resulted in the discontinuance of several livelihoods such as fishing, farming, tourism and handicrafts-related activities. The UNEP report highlights the context in which the current post-Tsunami rehabilitation is operating. Among the most important factors is the pre-existence of very high densities of unplanned settlements in the southern part of Sri Lanka, with the majority of construction failing to observe some of the critical building standards. Furthermore, the post-Tsunami rehabilitation operation has been affected due to weak local government institutions with poor response capacities to address the needs of such a magnitude. This is mainly because, before the Tsunami,

Sri Lanka was known to be a safe haven where outrages of nature scarcely occurred except for occasional floods and landslides during the rainy seasons.

In addition to commercial and non-commercial property damage, the number of deaths apportioned to the Indian Ocean Tsunami is estimated to be in excess of 250,000, with at least 40,000 of those in Sri Lanka (BBC, 2005). A lack of awareness has been identified as a major reason behind the huge loss of life (Banerjee, 2005). Indeed, the term 'Tsunami' was heard by most of the ordinary Sri Lankans only after this devastation. Many of the direct victims were affected at the scene as they were curiously observing the pre-warnings of the Tsunami, without knowing the nature or the scale of the disaster to come. Both awareness and preventive steps are needed to prevent such huge loss of human life again. For prevention in the future, the first and foremost step is to sensitise people at large and create awareness through different media and text on various natural hazards, including the Tsunami, and the preventive measures to be adopted (Banerjee, 2005). The problem continues beyond the pre-disaster stage into recovery, where Sri Lanka has again demonstrated the need for proper information and knowledge dissemination, as this has often been highlighted as the reason behind unsuccessful post-Tsunami recovery activities. A lack of prior knowledge and proper point of references have made most of the recovery plans guessing games, eventually failing without adding appropriate values to the recovery attempts (Banerjee, 2005).

CONCLUSION

It is clear that much work has been done and is ongoing, relating to disaster management and construction's role specifically. Despite this, knowledge appears fragmented, although there are undoubtedly many successful practices and lessons to be learnt, most significantly from major disasters such as the 2004 Tsunami. A lack of effective information and knowledge dissemination can be identified as one of the major reasons behind the unsatisfactory performance levels of current disaster management practices.

Future research must aim at increasing the effectiveness of disaster management by facilitating the sharing of appropriate knowledge and good practices in land, property and construction. Such research must explore the wide range of perspectives from which the construction industry is able to contribute towards improved resilience. It must define a more expansive view of the construction life cycle of infrastructure projects that encompasses the need to anticipate, assess, prevent, prepare, respond and recover from disruptive challenges. In doing so it must look to enhance knowledge and raise awareness among practitioners and researchers of the linkage between good planning, design, construction and operation, and disaster prevention and resilience.

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