POTENTIAL KEY INDICATORS OF ORGANISATIONAL RESILIENCE FOR THE CONSTRUCTION INDUSTRY

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ABSTRACT

Construction organisations play key roles within our society pre-disaster and post-disaster. All buildings and engineering infrastructure have been planned, designed, built, operated and maintained by organisations involved in the construction industry. Post-disaster, construction organizations are critical to the recovery and reconstruction programmes. In reconstruction programmes, communities rely on services provided by construction organisations to enable them to recover from emergencies and crises. Therefore, in order to ensure that the disaster recovery and reconstruction programs are successfully implemented, it is necessary for construction organisations to be resilient and able to respond, and recover from an event. Improving the resilience of the construction sector demands an in-depth understanding of the expertise and knowledge needed to avoid and mitigate the effects of disasters. The purpose of this paper is to present a review of the literature to identify potential key indicators of organisational resilience in the construction sector. These indicators can be used in setting a benchmark for measuring the resilience of construction organizations and, hence, enhance their capability to increase their resilience in order to survive a crisis and thrive in a world of uncertainty.

Keywords: Key Indicators, Construction Organisations, Post-disaster Reconstruction, Organisational Resilience

INTRODUCTION

Various small businesses or Small and Medium-scale Enterprises (SMEs) in New Zealand are exposed to varying scales of natural hazards both geological and climatic in nature. Most construction organisations are SMEs, 98\% in the New Zealand construction sector, and are often affected by such events (Hatton et al., 2012). In New Zealand, the Government appointed the largest local construction firm, Fletchers Construction Ltd, to coordinate the rebuilt for all residential housing, with SMEs involved as sub-contractors. These organisations play an important
role in reconstruction post-disaster in assisting communities to respond and recover from disasters and crises, and further, planning following a disaster to 'making a safer city'. However, Chang et al. (2010) reported that in post-earthquake reconstruction in Christchurch, the development of new subdivisions in affected regions has been short of building expertise and materials, leading to project failure, rework such as project suspension, quality defects, cost overruns and delivery delay. Chang-Richards et al. (2013) further discuss that skills training, recruitment and skilled workers are becoming crucial for construction companies to meet demand and complete effectively. Chang et al. (2011) also emphasised that limited capacity of the construction industry and the resources shortage in post-disaster reconstruction and recovery in Christchurch affected constructing organisations in terms of construction delay.

As far as construction organisations are concerned, being resilient might well decide the survival or the failure of affected organisations, resulting in economic and community consequences. Seville et al., (2006) highlight that organisations deal with uncertainties and unexpected events all the time, and managing these present both opportunities and risks for the organisation. An organisational resilience perspective would provide an answer to why some construction organisations dissolve in the face of high levels of on-going strain while some organisations are capable of maintaining function and structure in the face of major disruption. Communities rely on services provided by construction organisations in major restoration and reconstruction activities and improving resilience of construction organisations to the effects of disaster has thus become an important issue, with the increasing threat of disaster. To be resilient, construction organisations need strong leadership, an awareness and understanding of their operating environment, their ability to manage vulnerabilities, and their ability to adapt in response to change. These attributes need to be captured in organisational resilience indicators. This paper presents the initial literature review of a doctoral research study undertaken to address the issue of resilience in the New Zealand construction sector, and discusses key indicators of organisational resilience within the industry.

THE NEW ZEALAND CONSTRUCTION ORGANISATIONS

In recent years, there has been increasing emphasis on creating more resilient communities and organisations to disaster. Lee at al. (2013) sees organisational and community resilience as two sides of the same coin and states that if organisations are not prepared to respond to emergencies and crisis, communities also are not prepared. The ability of organisations to continue to operate and to provide services and employment is critical to the ability of communities to be resilient. McManus et al. (2008) argue that the resilience of organisations directly contributes to the speed and success of community recovery. Without
Critical services provided by construction organisations in restoration and reconstruction of lifelines, building and infrastructure, it is difficult for communities to respond or recover. In New Zealand, construction is the fifth largest sector employing over 157,000 full-time equivalents (FTEs) or 8% of the total economy. The 8% of national employment generates only 4% of national GDP, but accounts for 10% of all business and is the highest contributor to investment in fixed assets (gross fixed capital formation, or GFCF), which represents 45% of all investment in New Zealand (PwC-PricewaterhouseCoopers, 2011). PwC (2011) reported that the Christchurch rebuild, earthquake-strengthening and the remedial work on leaky buildings raised the prospect of the largest construction-led boom in New Zealand history. These statistics and statements illustrate the significance of construction organisations in the New Zealand construction sector and their significant contribution to the national economy and communities. The construction sector is not only a key component of the nation’s economy, it is also a primary factor in the quality of communities’ lives and the ability of the government to achieve their policies (Bosher et al., 2007).

Recent studies show that 98.4% of construction organisations in New Zealand are characterised as small businesses or SMEs (PwC, 2011; Hatton et al., 2012), and participation of these organisations is critical for the successful operation of the construction industry. These organisations therefore, have the potential to create disruption to the construction and rebuild activities, not only in the construction sector but also to the supply chains of other industries and economies. Thus, it is argued that the resilience of construction organisations against disasters is of significant importance to the construction organisation’s themselves, the construction sector as whole and other reliant industries.

RESILIENCE OF CONSTRUCTION ORGANISATIONS

Construction organisations have a significant role to play in contributing to a community’s improved resilience (Haigh et al., 2006; Bosher, 2008; Haigh and Amaratunga, 2010). Communities rely on services provided by construction organisations in pre-disaster and post-disaster to improve their resilience. To improve community resilience, construction organisations must first be resilient and able to respond to, and recover from, a disaster and to make links between resilience and organisations (Lee et al., 2013). Dalziell (2005) suggests the ability of organisations to be resilient and continuously functioning during a disaster or crises will have a large influence on the ability of the community to recover from such events. Organisational resilience is a continuous operation during business as usual and crisis situations (Lee et al., 2013). Servile et al. (2006) highlight that a resilient organisation has the ability to face major crises, reduce vulnerability and improve the ability and speed of the
organisation to manage crises effectively. McManus (2008) defines organisational resilience as a function of vulnerability, situation awareness and adaptive capacity of an organisation in a complex, dynamic and interdependent system. Although a review of the literature in relation to organisational resilience uncovered numerous definitions of the term, this research adopts the organisational resilience definition suggest by Stephenson et al. (2010) as ‘the ability of an organisation to survive a crisis, and potentially even thrive in an environment of change and uncertainty’.

ORGANISATIONAL RESILIENCE FRAMEWORK

Researchers in this area have come up with different definitions for resilience as well as what factors contribute to resilience. The definitions are dynamic and change with different perspectives, such as spatial, social, and scale or unit of analysis (Renschler et al., 2010), and according to the context in which it is being applied (Haigh and Amaratunga, 2010). Researchers also often meet difficulties in gathering data on resilience indicators for input into their models or frameworks (Cutter et al., 2008). Table 1 shows some of the models and frameworks developed by researchers to represent resilience from different perspectives.

Table 1 Resilience Models and Frameworks

<table>
<thead>
<tr>
<th>Source</th>
<th>Context</th>
<th>Dimension of Resilience</th>
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<tbody>
<tr>
<td>Bruneau et al. (2003)</td>
<td>MCEER Community, Infrastructure systems</td>
<td>Robustness, redundancy, resourcefulness, rapidity</td>
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<td>Paton (2007)</td>
<td>CDEM Societal resilience</td>
<td>Personal: Critical awareness, self-efficacy, action coping, outcome expectancy, resources Community: Collective efficacy, participation, commitment, information exchange, social support, decision making, resources Institutional: Empowerment, trust, resources, mechanisms for assisting community, problem solving</td>
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<tr>
<td>McManus et al. (2007)</td>
<td>Organisational Resilience</td>
<td>Situation awareness, management of vulnerabilities, adaptive capacity</td>
</tr>
<tr>
<td>Cutter et al. (2008) DROP</td>
<td>Community, Country resilience</td>
<td>Social, Technical, Economic, Organisational</td>
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</table>
**Joseph Mayunga (2009)**  
**CDRF - HRRC**  
Regional, Country resilience  
Human capital, social capital, economic capital, physical capital

**Omer et al. (2009), COMPASS**  
Infrastructure networks resilience  
Vulnerability of network systems

**Stephenson et al. (2010), ResOrgs**  
Organisational Resilience  
Adaptive capacity, planning

**Miles and Chang (2011)**  
ResilUS – MCEER  
Community resilience  
Community/Neighbourhood, businesses, households, lifelines

**Ainuddin and Routray (2012)**  
Community Resilience  
Social, economic, institutional, physical

**Lee et al. (2013)**  
ResOrgs  
Organisational Resilience  
Leadership & culture, networks, ready change

In New Zealand, there is an increasing emphasis on creating more resilient communities by creating a link between the resilience of communities and the resilience of organizations. The New Zealand Government has entrusted a group of researchers known as The Resilient Organisations Research Group (ResOrgs) to conduct public good research programmes to review and increase the resilience of organisations within New Zealand. ResOrgs is a collaboration between top New Zealand research universities and key industry players, and represents a synthesis of engineering disciplines and business leadership, aimed at transforming New Zealand organizations into those that both survive major events and thrive in the aftermath (Stevenson et al., 2011).

**THEORETICAL FRAMEWORK FOR MEASURING ORGANISATIONAL RESILIENCE**

The literature on resilience indicators is vast, contains many methodological approaches, and highlights the need for a process of construction and validation indicators that requires a number of specific steps (Freudenberg, 2003; Cutter et al., 2010). Cutter et al. (2010) suggest the stages involve the development of a theoretical framework to provide the basis for variable selection, data weighting and aggregation, and validation. This paper utilizes the organisational resilience model; Relative Overall Resilience (ROR) developed by McManus (2008) as its conceptual basis for discussion. Initially, McManus (2007) developed a framework using a quantitative approach to assess and analyse organisational resilience involving 15 key resilience indicators, grouped under three main interrelated categories; situation awareness, management of keystone vulnerabilities, and adaptive capacity. After a series of workshops in 2008, McManus added a further category;
resilience ethos and extended another 8 indicators to access an organisation’s resilience (McManus, 2007; Seville, 2008). Based on McManus’s (2008) ROR model, Stephenson (2010) utilized a qualitative method, presented 13 indicators of organisational resilience, and grouped them into 2 dimensions; planning and adaptive capacity.

The dimensions and indicators were formed as a starting point for the development of a resilience measurement tool. A literature review was conducted to investigate the indicators and to provide more information on how each of them might be related to resilience. A workshop between academia and industry was used as a medium to review the proposed indicators and highlight any gaps or potential conflicts between indicators. As a result, a further amendment was made to the dimensions and indicators towards the development of a resilience measurement model. The resilience measurement tool was constructed based on on-line survey tools in the survey hosting web site. A pilot study was conducted to test the tool for usability and validity involving 68 organisations in Auckland. After considering the work of McManus (2008) and Stephenson (2010), ResOrgs identified 13 key indicators of organizational resilience which have been used in the Resilience Benchmark Tools and are being implemented by ResOrgs for benchmarking the resilience of organizations in New Zealand. These 13 indicators are divided into 3 groups; leadership and culture, networks, and change ready, to help measure the resilience of organizations, to monitor processes over time, and to compare resilience strengths and weaknesses against other organizations (ResOrgs, 2012).

Finally in 2013, ResOrgs introduced the ‘Resilience Benchmark Tool’ for improving organisations’ understanding of resilience and its impact on organizational performance. It provides organizations with a tool for evaluating their resilience strengths and weaknesses for each of these indicators, and for benchmarking how they compare to other organizations of a similar size or in a similar sector. Table 2 captures the development of indicators of organisational resilience from a New Zealand perspective. This measurement tool has been developed through a comprehensive process which consists of: propose and develop initial resilience indicators; review and validate the indicators; develop the measurement model; pre-test; and further test and validate using 68 organisations in Auckland. This framework and assessment tool is perhaps one of the most comprehensive frameworks in terms of organisational resilience. Key organisational resilience indicators introduced by Lee et al. (2013) of ResOrgs, will be used in this study to validate their applicability in the construction sector, modify or add to as appropriate, and to assess the resilience of construction organisations in New Zealand. It is intended that these indicators will be used in setting a benchmark for measuring the resilience of construction organizations.
Table 2 Dimension and indicators of organisational resilience

<table>
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<tr>
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<th>Dimension and indicators</th>
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<tr>
<td>McManus et al. (2007)</td>
<td><strong>Situation awareness</strong>: Roles &amp; responsibilities, Understanding &amp; analysis of hazards &amp; consequences, Connectivity awareness, Insurance awareness, Recovery priorities; <strong>Management of vulnerabilities</strong>: Planning &amp; strategies, Participation in exercises, Capability &amp; capacity of internal resources, Capability &amp; capacity of external resources, Organisational connectivity; <strong>Adaptive capacity</strong>: Roles &amp; responsibilities, Silo mentality, Communication &amp; relationship, Strategic vision &amp; outcome expectancy, Leadership, management &amp; governance structure</td>
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<tr>
<td>McManus (2008)</td>
<td><strong>Resilience ethos</strong>: Commitment to resilience, Network perspective</td>
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<td></td>
<td><strong>Situation awareness</strong>: Roles &amp; responsibilities, Understanding &amp; analysis of hazards &amp; consequences, Connectivity awareness, insurance awareness, Recovery priorities, Internal &amp; external situation monitoring &amp; reporting, Informed decision making; <strong>Management of vulnerabilities</strong>: Planning &amp; strategies, Participation in exercises, Capability &amp; capacity of internal resources, Capability &amp; capacity of external resources, Organisational connectivity, Robust processes for identifying &amp; analysis vulnerabilities, Staff engagement &amp; involvement; <strong>Adaptive capacity</strong>: Roles &amp; responsibilities, Silo mentality, Communication &amp; relationship, Strategic vision &amp; outcome expectancy, Leadership, management &amp; governance structure, Innovation &amp; creativity, Devolved &amp; responsive decision making</td>
</tr>
<tr>
<td>Stephenson et al. (2010)</td>
<td><strong>Adaptive capacity</strong>: Minimisation of silo mentality, Capability &amp; capacity of internal resources, Staff engagement &amp; involvement, Information &amp; knowledge, Leadership, management &amp; governance structure, Innovation &amp; creativity, Devolved &amp; responsive decision making, Internal &amp; external situation monitoring &amp; reporting; <strong>Planning</strong>: Planning strategies, Participation &amp; exercise, Proactive posture, Capability &amp; capacity of external resources, Recovery priorities</td>
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<tr>
<td>Lee et al. (2013)</td>
<td><strong>Leadership &amp; culture</strong>: Leadership, Staff engagement, Situation awareness, Decision making, Innovation &amp; creativity; <strong>Networks</strong>: Effective partnership, Leverage knowledge, Breaking silos, Internal resources; <strong>Change Ready</strong>: Unity of purpose, Proactive posture, Planning strategies, Stress testing plan</td>
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**CONCLUSION**

The Canterbury rebuild is presenting a test for the New Zealand construction industry. Building the resilience of construction organisations should be considered a key part of any overall resilience policy due to their role in successful restoration and reconstruction project delivery post-disaster. Most construction organisations are SMEs, and are increasingly affected by disasters leading to negative impacts to other organisations. Improving the resilience of construction organisations will not only minimise the negative consequences to their organisation, but also help to improve community resilience. Thus, a resilience measurement tool, a framework of resilience management strategies on
how to improve construction organisations and an assessment tool for measuring the resilience of construction organizations would benefit the construction industry. This paper identified 13 potential key resilience indicators introduced by ResOrgs and Lee et al. (2013), to review organisational resilience in the construction sector. Further research will investigate these resilience indicators to determine which ones best describe the resilience of organisations within the construction sector. Other relevant indicators will also be explored. In addition, a separate indicators and assessment tool specifically for measuring the resilience of construction organisations is needed due to the nature of the industry comprising of various organisations in the phase of planning, design, procurement, construction, operation, maintenance and refurbishment. Such a test will allow the construction organisations to benchmark their resilience practices in order to survive a crisis and thrive in a world of uncertainty, and further support other businesses to continue their operation.

REFERENCES


Seville, E. (2008), ‘Resilience: Great Concept…but what does it mean?.’ Council on Competitiveness - Risk Intelligence and Resilience Workshop, Wilmington, USA.


