

Actor coordination in the disaster rebuild phase: an explorative case study of the 2010/11 Christchurch earthquakes

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Abstract

The coordination of actors has been a major focus for much of the research in the disaster relief humanitarian logistics discipline. Much of this literature focuses on the initial response phase, little has been written on the longer term recover phase. As the phases transition into long term recovery, the number and types of actors change from predominantly disaster relief NGOs to more commercial entities. We use the preliminary results from a case study of the rebuild of the civil infrastructure for Christchurch, New Zealand following a series of devastating earthquakes in 2010/11. For the rebuild phase we argue that ‘co-opetition’ is a key behaviour that allows the blending of humanitarian and commercial values to help communities rebuild to a new normal.

Keywords: Humanitarian logistics, coopetition, Christchurch earthquakes, disaster relief, SCIRT.

Topic: Humanitarian operations & crisis management

Methodology: Case study

Introduction

Rapid and effective response to a disaster event is absolutely critical. Typically, a large number and types of actors become involved in a disaster response effort such as international relief agencies, non-governmental organisations (NGOs), military, central and local government, communities and businesses. Organising such a diverse range of actors to achieve the central humanitarian objectives of alleviating human suffering is a daunting task. The problems of inter-agency coordination pre and post disaster are well known and indeed are exacerbated by their temporary nature (Balick, *et al.*, 2010). Coordination difficulties have been identified as one of the main issues for humanitarian logistics and disaster relief supply chains (Moore, Eng and Daniel, 2003; Rey, 2001; Tomasini and Van Wassenhove, 2009). Further, not only is there coordination issues at the vertical level of relief supply chain (*i.e.* from donor to disaster), but also at the horizontal level as well (two or more actors doing essentially the same things).

While most of the humanitarian literature focuses on the initial response phase (Balcik, *et al.*, 2010; Kunz and Reiner, 2012), the problems of actor co-ordination do not cease here. Indeed, humanitarian and disaster relief supply chain management go far beyond just the preparedness and early response phases. It is the long term rebuild phase that determines how successfully communities recover from an event and adapt to the 'new normal'. Indeed, reconstruction is an important stage of disaster relief for the long term sustainability of the disaster struck region for both economic and social reasons. A large-scale disaster will often substantially destroy infrastructure, such as roads, bridges and homes which means "reconstruction during the... final phase of rehabilitation could take years" (Van Wassenhove, 2006, p. 481). If reconstruction is delayed, left underfunded or uncompleted, then future mitigation and preparedness efforts will be compromised or worse, long term dissatisfaction with local leaders, authorities or NGO's at the lack of progress may translate into unrest or even violence. Hence, tight coordination of actors at both the vertical and horizontal levels is critical for the recovery phase, and certainly for the long term economic recovery of the region (Horwich, 2000).

As the disaster event evolves, the number and functions of NGOs, government and private sector actors involved in humanitarian logistics changes over time in response to the changing needs in theatre. Hence, the nature of the interorganisational coordination evolves, from command and control regimes necessary for the response phase, to a more collaborative one that we argue is more suited to the rebuild phase (Van Wassehove, 2006; Kovács and Spens, 2007). In many respects it is the quality of coordination that determines success in humanitarian logistics. Co-ordination mechanisms have been described as a set of *methods* used to manage interdependence between organisations (Xu and Beamon, 2006), yet we argue that coordination is more than just method. Rather, we focus on the nature of the *behaviour* that is used to coordinate actors. In particular, we argue that the concept of 'co-opetition' (Nalebuff and Brandenburger, 1996; Bengtsson and Kock, 2000; Kotzab and Teller, 2003; Barretta, 2008), drawn from management literature, could be an appropriate model for managing interorganisational relationships amongst humanitarian actors for the rebuild phase. Co-opetition is an amalgam of 'cooperation' and 'competition' and seeks to explain how organisations can demonstrate both behaviours simultaneously. As the rebuild phase will include growing numbers of business entities, we seek a mechanism to explain both the commercial (competition) and humanitarian (cooperation) motives. As a behavioural doctrine, co-opetition has been argued to reduce the negative externalities of competition whilst creating synergies from cooperation (Barretta, 2008). As NGO's and other humanitarian agencies often compete for scarce resources, yet are still required to cooperate within theatre, then it could be worthwhile examining co-opetition as an explanatory model for inter-agency relationships. Research on the concept of co-opetition has progressed in business (Bengtsson, Eriksson and Wincent, 2010), yet we find virtually nothing in the humanitarian logistics field.

The purpose of this paper is to offer insights from an organisational model utilised for the Christchurch (New Zealand) rebuild after a series of devastating earthquakes from 2010 to 2011. In particular, we examine the nature of the interaction found in the Stronger Christchurch Infrastructure Rebuild Team (SCIRT) who are responsible, for what is known as, the 'horizontal rebuild' (ground level and below) of the city. This paper reports some preliminary findings only from an ongoing study. We have based these insights on interviews with the CEO of the rebuild agency and also three key

managers from one of the prime contracting companies involved in the rebuild. We also include data from a wide range of public and secondary sources. The paper is organised as follows. First we discuss disaster relief phases and the nature of interorganisational relationships during the transition between phases and then focus on the little discussed long term rebuild phase. We examine the motives for coordination in the rebuild phase and then turn our attention to a preliminary case study of SCIRT, an organisational model used to coordinate a huge variety of actors involved in the rebuild of Christchurch City, New Zealand following a series of devastating earthquakes in 2010/11. We conclude with a discussion and insights to the use of co-opetition as a suitable form of cooperation for the rebuild phase where commercial agencies predominate.

Literature review

Phases of Disaster Relief

McFarlane and Norris (2006, in Norris, Stevens, Pfefferbaum, Wyche and Pfefferbaum, 2008, p. 128) define disaster as "a potentially traumatic event that is collectively experienced, has an acute onset, and is time delimited; disasters may be attributed to natural, technological or human causes". Humanitarian logistics categorizes disasters to sudden-onset and slow-onset disasters (Van Wassenhove, 2006). Sudden-onset disasters unfold with little warning such as earthquakes and weather events, whereas slow-onset disasters evolve over time such as famines and drought (Van Wassenhove, 2006). In slow-onset disasters there is seldom a single disaster event, rather the crisis builds over time. The disaster event focused view of humanitarian logistics is emphasized by Day, Melnyk, Larson, Davis and Whybark (2012, p. 24) who states that "at the heart of any humanitarian/disaster relief system is the disaster, an event that forms the focal point around which all SCM activities are organized". We note that most of the humanitarian logistics literature in this emerging discipline focuses on sudden-onset disasters.

The purpose of humanitarian logistics is to 'aid people in their survival' (Kovács and Spens, 2007), and it is concerned with the efficient management of flows of goods, information and services, to respond to the urgent needs of the affected populations under emergency conditions (Van Wassenhove, 2006; Kunz and Reiner, 2012). Humanitarian logistics literature can be divided into two mainstreams; disaster relief and continuous aid work (Kovács and Spens, 2007; Kunz and Reiner, 2012). In terms of phases of Humanitarian Disaster Relief Supply Chain Management (HDRSCM), while the terminology varies, a three phase model of disaster relief supply chains is the building block for more detailed analysis (Kovács and Spens, 2007, 2011; Altay and Green, 2006; Cozzolino, Rossi and Conforti, 2012). The basic phases are:

1. Preparedness = preparation and prevention
2. Immediate Response = emergency relief or transition
3. Reconstruction = recovery and rehabilitation

Kovács and Spens (2007, p. 200) develop this model further and offer a more realistic cyclical view of disaster relief, where the phases transition and ultimately flow back into the preparedness phase. Further, the phases of disaster relief can be labelled under pre-event and post-event categories (Tufekci and Wallace, 1998). According to this categorization, mitigation and preparation phase for a disaster takes place prior to a disaster event, whereas response and recovery are post-event phases. Table 1 below summarizes the purpose of each of the three phases, as well as some of the relevant activities within them.

Despite the intuitive logic of the three stage model, disasters are seldom discrete events and preparation is often spawned from an earlier response phase. As each country and region faces different hazards, it is logical that mitigation and preparedness efforts focus on the most likely scenarios. As Maon, Lindgreen and Joëlle (2009) point out, the different stages and activities of disaster relief may occur simultaneously, for example mitigation and reconstruction efforts should ideally be developed in parallel, though not necessarily by the same actors. Maon, *et al.*, (2009) have suggested a dual-cycle model, where the ‘prevention and planning cycle’ and ‘reaction and recovery cycle’ circle around a disaster event. However, instead of viewing the three stages as a chain, the cyclical relation of the phases is emphasized (see Figure 1 below). This approach is further supported by Pettit and Beresford (2009) and Safran (2003). Thus, ideally, rehabilitation and reconstruction includes a learning element for further disasters to come, for example the installation of tsunami warning systems. Even if the dual-cycle model helps to more realistically depict the cyclic nature of disaster relief, the widely adapted three-stage model provides a clearer way to structure the literature, as well as the aspects of, humanitarian logistics and shall be referred to in the rest of the article.

Table 1: Three phase model and activities of disaster relief

Phase:	Preparation	Immediate Response	Recovery/Mitigation
Purpose:	Preparedness is used to avoid the gravest possible consequences of a disaster (Cozzolino, <i>et al.</i> , 2012)	In the response and recovery phases the preparedness strategy is put into action, that is, temporary structures are formed and activated (Jahre, Jensen and Listou, 2009)	Recovery involves the actions taken in the long term after the immediate impact of the disaster has passed to stabilize the community and to restore some semblance of normalcy. (Altay and Green, 2006)
Examples of actions: (Altay and Green, 2006)	Planning, training, pre-positioning of supplies.	Search and rescue, restoring emergency services, situational awareness	Debris removal, making safe buildings, short term recovery transitioning into rebuild phase
Command and Control Approach:	Hierarchical Collaborative	Centralised Authoritarian	Distributed Collaborative/Competitive
Duration:	Pre-event	First 7 days (approx.)	Ongoing (multi-year)
Infrastructure:	Building in resilience	Re-establishing basic services	Repair and permanent rebuild > resilience

Source: Authors



Figure 1: The cyclical nature of disaster relief. Adapted from: Kovács and Spens (2007)

Recovery phase: actors and the new normal

The Goal of the Reconstruction Phase

The role, existence and importance of the recovery phase within disaster relief is non-debatable (Haas, Kates and Bowden, 1977). However, the recovery/rebuild phase has received little attention within the HDRSCM research. Despite the fields' rapid growth in the last few years, most of the papers still focus on the response, or preparation phases. Kunz and Reiner's (2012) review notes that only ten papers specifically address the reconstruction phase, confirming the findings of previous literature reviews that state there is a lack of studies on reconstruction phase (Altay and Green, 2006; Kovács and Spens, 2007; Overstreet, Hall, Hanna and Rainer, 2011). Indeed, most of the authors discussing the recovery phase in their articles do so in passing, only to point out its importance and draw its boundaries, in order to proceed to study the other phases of disaster relief (Maon *et al.*, 2009; Van Wassenhove, 2006).

Even if the most urgent needs of disaster-impacted population are answered in the response phase, disasters have also grave long-term consequences that need to be tackled in the recovery phase of the disaster relief. A disaster can wipe away the infrastructure, buildings, livelihoods and social stability of the impacted towns, cities and region. Beyond the personal tragedies, macroeconomic studies have found deleterious economic effects of a disaster, such as the deterioration of the country's balance of trade, fiscal balances, an increase of poverty, and over time a widening of the income gap (Ibarrarán, Ruth, Ahmad and London, 2009). While both 'rich' and 'poor' countries are equally susceptible to natural disasters, the economic impact on each varies significantly with the poor being the most vulnerable (Ibarrarán, *et al.*, 2009). It is axiomatic that the most vulnerable suffer the most and end up being the worst off after any disaster event, resulting in an increase of vulnerability and lack of resilience to future economic shocks. Hence, the aim of the recovery phase is at least stabilize the community and restore some semblance of economic normalcy (Altay and Green, 2006).

While economic recovery is important, it is not the only goal of the recovery phase. Indeed, the desired goal of the recovery phase calls for clarification. Community resilience research provides perspective on how communities function effectively and adapt successfully in the aftermath of disasters (Norris *et al.* 2008) and addresses especially the role of local people coping with the disaster. This stream of research provides many insights for disaster recovery, but the term 'resilience' itself is misleading. Originally 'resilience' was used in physics and mathematics to 'describe the capacity of a material or system to return to equilibrium after a displacement' (Norris *et al.*, 2008; Bodin and Wiman 2004; Gordon, 1978), but disaster-struck regions rarely, if ever, bounce back to their former state. Rather, regions will hence 'adapt' to the new situation with the original system irrevocably changed (Boettke, Chamlee-Wright, Gordon, Ikeda, Leeson and Sobel, 2007). Implying that after a disaster the economy does recover, but not exactly to its previous form as it grows to fill the void left by the disaster. This was also emphasized by Horwich (2000) who states that the restored economy will not be a replica of the predisaster one. Further, in supply chain network theory Hearnshaw and Wilson (2013) term this rebounding as 'adaptability' and draw a clear distinction between resilience (returning it its former state) and adaptability (a recovery to a new form). While the previous refers to the economy, the core message

holds true for the whole disaster-struck region. What emerges from the ashes is not a replica of the earlier state of affairs, rather it is a 'new normal'.

We argue then that the desired end state of the recovery phase is 'the new normal', and the ability of the disaster-struck region to reach the new normal is referred to as adaptability. Where the purpose of HDRSCM at large was to aid people in their survival (Kovács and Spens, 2007) the new normal is a state where the disaster-struck region is functioning effectively again. Clearly objectifying what the new normal looks like and when it transitions phases will be heavily case specific and relative to each region, culture and country. However, in the new normal the region is no longer strongly overshadowed by the past disaster and is able to draw the focus on mitigating and preparing for future disasters. Even if recovery and preparedness phases of disaster relief are entwined and a clear separation between the two is impossible, the new normal is the culmination or desired goal state of the recovery phase after which the preparedness phase can be seen to emerge again.

Actor Transition in the Reconstruction Phase

The logistical and supply chain actors present during the reconstruction phase have a strong impact on the success of the whole disaster recovery process, especially in terms of sustainability and long-term effectiveness (Beamon and Balcik, 2008; Besiou, Stapleton and van Wassenhove, 2011; Kovács and Spens, 2011). While most of the papers on HDRSCM are response phase centred, they also focus more on the humanitarian sector NGOs. Rightfully, NGOs play a leading role in the academic literature as they do so in reality for the response phase. However, as the phase transitions to the recovery phase, most response focused NGOs have by then fulfilled their missions and redeploy to other theatres. The control that has hitherto been centralised then devolves to local authorities, agencies, businesses and community who take the lead in shaping their own futures (Balcik, *et al.*, 2010; Dolinskaya, Shi and Smilowitz, 2011). We recognise that this sequence does not always happen as described in many post disaster theatres as power is often difficult to firstly, centralise, and then surrender. The funding of NGOs is often focused on the short-term relief hence when the media attention departs so do the NGOs before recovery/rebuild phase is even started (Gustavsson, 2003). There are legitimate reasons for this transition as philosophically the question is whether prolonged support from the humanitarian sector would help or hinder the disaster-struck region in rising back to its own feet. Further, we must ask the question if NGOs are the most appropriate actors to take the lead for the rebuild phase? We argue that they are not due to dependency issues, but that humanitarian values should remain as a part of the ethos (motives) of the actors in the rebuild phase.

Kovács and Spens (2007) argue that as the irregularities of demand and supply smooth out and the most urgent pain has been soothed, then the focus shifts to building toward the new normal. Here the purely altruistic and humanitarian motives slowly give way to more conventional business interests. Indeed, Kovács and Spens (2007) refer to the reconstruction phase as being very similar to a normal business logistics environment, though not aiming at generating profit. The skills demanded for the response phase (emergency logistics) are quite distinct from the response phases' commercial logistics (Beamon, 2004). Hence, more and more tasks are allotted to businesses and local agencies who are more skilled at managing conventional supply chains that characterise the logistics of the rebuild phase. Further, transferring tasks to

local business is also humanitarian in its own right as it helps the economic recovery and a sense of community ownership of the rebuild.

If this transition is organic and smooth at local level then outside actors such as NGOs may have little to offer. Horwich (2000, p. 523) argues that the "...destruction of physical assets is a form of accelerated depreciation" that can be managed at the local level. In fact, external actor involvement might even hinder, leading to aid dependency in the worst case (Kovács and Spens, 2011). However, if the local government and business are not able to lead the disaster-struck region towards the new normal, then this could result in social instability as people choose to leave the dysfunctional region (Ibarrarán *et al.*, 2009). In these cases the region could benefit from external actor involvement (such as central government), especially through the implementation of procedures, frameworks and funding that would fuel and stabilize the region's own recovery process. In any transition, there are four questions that need to be asked. Firstly, is the risk of aid dependency is still an issue? Secondly, will the limited resources of the NGOs be better deployed elsewhere? Thirdly, would the continued involvement of an external actor really be beneficial in this particular case? Finally, are the local organisations and business in a position to assume the lead in the rebuild? When NGOs and other external aid agencies do decide to withdrawal, a key issue is how to coordinate the transition and in what form is inter-organisational coordination going to take in the rebuild phase given the evolving power structures within the region.

Coordination for the Recovery Phase

Concepts of supply chain collaboration, cooperation, coordination and integration are used interchangeably (Jahre and Jensen, 2010; Fabbes-Costes and Jahre, 2008; van Wassenhove, 2006; Balcik *et al.*, 2010). We adopt Balcik *et al.*, (2010) use of the concept of 'coordination' to address the relationships and interactions among different actors operating within the relief environment. Whereas we see collaboration especially, but not only, as a strong intent to work together for a common cause. Hence, even if our concepts for collaboration and coordination overlap, collaboration facilitates coordination as the mentality that feeds the means. But what is the right form of coordination for the recovery phase?

While it is axiomatic that the various actors involved in disaster relief, including governmental organizations, military, humanitarian sector and private businesses should collaborate and coordinate their actions with one another, they often do not. Yet in the humanitarian field it is the disaster and the desire to relieve human suffering that should provide a higher motive (McLachlin and Larson, 2011; Tomasini and van Wassenhove, 2009). Coordination within disaster relief is seen as a means to reduce duplication of effort and to increase the effectiveness and efficiency of the disaster relief operations (McLachlin and Larson, 2011; Schulz and Blecken, 2010; Thomas and Fritz, 2006). The outcome of collaboration between a variety of organizations within HDRSCM is generally positive, whereas lack of it has been increasingly criticized for wasting resources (Pettit and Beresford, 2009; Thomas and Kopczak, 2007; van Wassenhove, 2006).

Successful collaboration and coordination comes with a price. Meetings, IT infrastructure and other means for enabling coordination and building trust consume resources. Especially in the response phase of disaster relief when time is crucial, the aid workers are overloaded and money is often scarce. (Balcik, *et al.*, 2010; Tatham, 2012). To invest themselves in the coordination efforts, the actors involved need to

believe that the benefits of coordination outweigh the costs. However, especially in the response phase the price tag does not translate to any currency, as humanitarian aspects override monetary ones (Pettit and Beresford, 2009). Furthermore, even if all actors of disaster relief aim at relieving human suffering, their mandates, ideologies and operational methods differ, causing friction (McLachlin and Larson, 2011; Balcik *et al.*, 2010). Pettit and Beresford (2009, p 461) summarise the collaboration dilemma up by saying:

"Overall, the question thus arises as to whether collaboration can ever exist in the same sense as it would in a commercial supply chain. Where supply chains are built rapidly in a crisis situation the need to develop effective collaboration is important. However, collaboration is about more than interfacing with other organizations and sharing information and resources, there is also the need to develop trust between various partners which allow the former to operate effectively. It involves establishing a relationship whereby partners have vested interest in sharing benefits and costs through process integration. "

Sudden onset disasters unravel fast without much warning and the mix of actors involved in the disaster relief, from international NGOs to local enterprises, is largely unknown prior to the event and collaboration often only occurs once a crisis is unfolding and it is then much more difficult to optimise. Indeed, Tatham and Kovács (2010) argue for the application of 'swift trust' to assist in the early generation of collaboration. The big NGOs are often the common nominator or lead agency (McLachlin and Larson, 2011) in the immediate response phase of disaster relief, and much of the coordination literature within HDRSCM has focused around; horizontal NGO-NGO relationships (Jahre and Jensen, 2010), NGO-Corporate cooperation (Binder and White, 2007), as well as NGO-Community collaboration (Patterson, Weil and Patel, 2010).

However, when the immediate response turns into recovery phase and NGOs fade to the background or leave and the role of the military and national governments decreases, it is the local institutions and private sector that must take the lead on the way to the new normal. The milieu of the actors present in the recovery phase is presented in the Figure 2 and it is likely to bear a high resemblance to the milieu before the disaster, being specific to each area or region (Horwich, 2000). The recovery phase should not be run solely by the commercial laws of supply and demand. The disasters tend to have the gravest impact on the lives of those worst off before the disaster (Ibarrarán, *et al.*, 2000) and humanitarian considerations should be present in the recovery phase to correct the balance on the way to the new normal. As an example, if construction companies would focus on bidding against each other for restoring the wealthiest neighbourhoods and leave the worst hit, poor neighbourhoods for themselves, this would not only be non-humanitarian, but also undermine the social stability of the region.

Institutions, such as the local government, play a substantial role in steering the disaster-struck region to the new normal along humanitarian principles and facilitating cooperation among the actors in the recovery phase (Boettke *et al.*, 2007; Izadkhah and Hosseini, 2010). However, they must now rely on commercial entities rather than NGOs' to deliver the rebuild. Most of the literature on private sector's involvement in HDRSCM revolves around NGOs and the response phase where companies engage with NGOs for both commercial and philanthropic relationships (Balcik *et al.*, 2010). In the recovery phase motivations to cooperate change somewhat shifting from the humanitarian to the commercial. Nevertheless, the reality is that motivations to

cooperate are always difficult to untangle from the surrounding context, being a mix of humanitarianism, corporate social responsibility, commercial return, and legitimacy seeking. Whatever the reason, high levels of tight coordination around rebuild activities is essential, especially given the greater level of public scrutiny such relationships are subjected to in a stabilised region. Finally, if cooperation is essential, and private sector businesses are at the heart of the rebuild phase, how best do we organise to generate the right incentives for cooperation to flourish organically?

Case study: co-opetition and the rebuild

Christchurch Earthquakes 2010/11: The Research Context

This research was conducted in Christchurch, New Zealand after the city, with a pre-earthquake population of 330,000, suffered a series of devastating earthquakes between 2010 and 2011. Christchurch would be considered a modern 'first world' city with a good public services and governance, a strong regulatory environment and sound building practices and codes. The first 7.1 magnitude earthquake struck at a shallow depth of 10 kilometres on 4th September 2010 within 40 kilometres of the city causing significant damage but no direct casualties. However, another 6.3 magnitude earthquake¹ struck directly under the city on the 22 February 2011 at a very shallow depth of 5.3km resulting in violent shaking and a maximum peak ground acceleration (PGA) of 2.2g (*i.e.* 2.2 times the acceleration of gravity) being one of the highest ever ground accelerations recorded in the world. This earthquake struck at 12.51pm, lunch time on a busy working day killing 185 people and causing significant damage to the city and the eastern suburbs, especially the central business district (CBD) where 80-90% of the buildings have had to since be demolished. The damage was exacerbated by the buildings and infrastructure being already weakened from the initial 7.1 magnitude earthquake five months prior. With large parts of the city being built on silt loam and sandy soils, liquefaction was a significant problem and over 510,000 tonnes of sand/silt had to be removed from the city (Christchurch City Council, Dec 2011). The liquefaction caused significant ground movement and underground pipes became positively buoyant. Hence, the damage to the city's infrastructure was exceptional with 80% of the city's water and sewerage system being destroyed (Clifton, 2011). The cost to insurers was initially estimated to be NZD15 billion (Murdoch and Fraser, 2011), but has since been revised to NZD40 billion making it one of the costliest earthquakes in human history (3 News, April 2013). Four months later the city experienced 6.3 and 5.7 magnitude earthquakes on the 13th June 2011, and also a 5.8 and 5.3 set striking on the 23rd December 2011 each causing more damage, injuries and liquefaction. To date, the city and region has experienced well over 14,000 aftershocks (Nicholls, 2014). Since most of the damage and all the 185 lives were lost in the 22nd February earthquake, we will focus on this event as the crisis trigger. However, the ongoing significant earthquake swarms lasting over the next 18 months have caused considerably more damage and disruption to response and rebuild efforts.

The response phase after the 22nd February magnitude 6.3 earthquake lasted a little over seven days and then the attention switched to the recovery/rebuild phase. While, the early response phase is a rich research area in itself, it is outside the scope of this paper. Early in the recovery phase, there was a dawning realisation that the rebuild would be massive and well beyond the capabilities and resources of any one

¹ Technically an aftershock from the 4th September 2010 earthquake.

organisation or business. The damage to the horizontal infrastructure (ground level and below) was unprecedented and totalled 300 kilometres of sewer pipes, 124 kilometres of water mains, 895 kilometres of road (52% of the total), and in addition over 50,000 individual road faults (for example cracks, bridge support displacements) (Christchurch City Council, Dec 2011, p. 11). It was clear that the asset owners and local authorities had to prioritise their effort and develop a detailed programme to rebuild the city's infrastructure. Not long after, a broad outline plan was developed by the Christchurch City Council and this sat alongside other works streams, but the question was who was going to coordinate this massive task of rebuilding the horizontal infrastructure?

We have previously noted the rich research environment of these earthquake and the relevance of the phases of disaster relief operations. However, we narrow our focus to the horizontal infrastructure rebuild (all city services ground level and below), and in particular to the organisation that has evolved to coordinate the recovery/rebuild phase of this disaster. Hence, the structure, function and performance metrics of Stronger Christchurch Infrastructure Rebuild Team (SCIRT) and how that is translated into inter-organisation cooperation is what is of interest for this paper. Our focus and space constraints preclude the development of a full case study methodology just yet. As such, we base our study on a number of interviews with key informants within SCIRT, the CEO, one of the five key contractors, an analysis of a number of key documents, agreements, contracts and also material available in the public arena. We start by outlining briefly the history of SCIRT and examine this for humanitarian motivations and also the development cooperation amongst the actors in the rebuild phase. We believe that the structure of inter and intra organisational cooperation that has developed between SCIRT and its five prime contractors is an example that could potentially inform cooperation for the rebuild phase of humanitarian logistics.

A Model for Rebuilds: The Stronger Christchurch Infrastructure Rebuild Team (SCIRT)
After the first earthquake in September 2010 the infrastructure response and recovery phases were managed locally by Christchurch City Council who set up their own Infrastructure Rebuild Management Office (IRMO). The IRMO was staffed by the Council personnel and was tasked with assessing and planning the rebuild of the city's horizontal infrastructure. The intent was to contract the work to CCCs own City Care Department, and in addition, to the four major commercial construction companies of Fulton Hogan, Downer, McConnell Dowell and Fletcher Construction. These contractors were still held at arms-length typical of local government procurement methodologies pre-earthquakes. Some remedial and rebuild progress was made, however the second major earthquake in February 2011 caused much greater damage as previously described. Those involved with the IRMO realised that the task was now significantly more complex and beyond their capabilities. A key question was how best to structure and organise all the various actors involved in the rebuild phase that included, government, military, NGOs, councils, communities and businesses? This is a classic challenge for all humanitarian efforts.

Realising the scale of the rebuild phase, and how politically vital it was that it be seen to be managed effectively and at pace², the National Government created the Canterbury Earthquake Recovery Authority (CERA) on the 29th March 2011 by an Act of Parliament (CER Act, 2011). CERA would be the agency that would lead the

² There was a general election in 2011 (actually held on the 26th November 2011) that returned the National Government, some say on the basis of their handling of the Christchurch Earthquakes.

earthquake recovery and was tasked with cooperating with the central government, the local councils, businesses and residents. The powerful agency was anticipated to last five years and its mandate was to include all aspects of the rebuild including the horizontal infrastructure. The Government has also agreed to subsidise the cost of this infrastructure rebuild up to NZD1.8 billion, 60% of all the valid costs of fresh water system and also 83% of all roading costs (through the New Zealand Transport Authority - NZTA) (CERA, Jun 2013). CERA is effectively the governing authority for the rebuild with powers to set aside any law or regulation and works closely with the Christchurch City Council (CCC). Other agencies such as SCIRT are responsible for the design and operational aspect of the rebuild. The structure of the relationship between the Government (Crown), Christchurch City Council, CERA and its operational partners is illustrated in Figure 2 below. Of interest is the deliberate establishment of a buyer/seller relationship between CERA and the operational agencies of SCIRT and the Christchurch City Council. The intent of this structure was to ensure the best service delivery of the rebuild and a “need to transition to a value-for-money environment” (CERA, June 2013, p. 9). A key part of the agreement is that cooperation be explicit in all relationships by using such clauses as “1.1.1. Open, frank, honest, prompt, fair and consistent in all dealings with each other” (p. 2). While ostensibly an arms-length buyer/seller arrangement, operationally it works as a form of alliance between CERA, CCC, NZTA, SCIRT and the five major construction companies seconded to SCIRT.

The Origins of SCIRT – Humanitarian and Commercial Motivations

In the case of horizontal infrastructure rebuild, something unusual happened. As the initial damage assessments were made it was clear that the rebuild would become the biggest civil construction project in the history of New Zealand (Steeman, Oct 2013). SCIRT did not exist before the earthquakes, nor did it evolve from any other existing organisation. The entire organisation was constructed from scratch and in an incredibly short time period May – August 2011. In fact its genesis emerged, not with the local or central authorities, but rather in the minds of the CEO’s and Managing Directors of four of the major constructions companies. These key actors quickly perceived that the scale of this rebuild would be way beyond any of these firms individually, and that only a cooperative approach would provide the capacity and capability of the scale required to bring relief quickly to the people of Christchurch. However, designing an effective organisation quickly from nothing is a difficult task, yet it also provides a unique opportunity to set in place the desired organisational culture and ethos from the outset. Staff inductions emphasised the need for high levels of cooperation, cross-functional integration and any leaving behind any previous company loyalty (Interview data). One manager reports that the culture revolves around "everybody's in this together" emphasising that, no matter your parent company background, everyone must do their best for the rebuild (Steeman, 2013; Personal Interview Communication 2013). The mission statement developed for SCIRT is as follows:

“Creating resilient infrastructure that give people security and confidence in the future of Christchurch”

The humanitarian need to work hard for the devastated city and its people where key motivational factors (Steeman, 2013). This lead to a general understanding of the need for high levels of cooperation yet set in a commercial environment where services were being contracted to competing construction companies.

About 2 weeks after the February 2011 earthquakes, the New Zealand Transport Agency was charged with being the lead agency to coordinate the horizontal rebuild. There was also a flurry of high level calls between the CEO's and Directors of the five major construction companies, the Christchurch City Council, NZTA, CERA and the Government about how best to coordinate the recover. The case study interviews indicate a strong empathy toward the suffering of the people of Christchurch and the humanitarian desire was strong. Indeed, strong enough in the initial stages at least to overcome any form of commercial motive. Prior to the earthquakes these five construction companies were arch competitors. That they have put aside this natural competition to cooperate on the rebuild is remarkable and, we argue, would not have happened without humanitarian values and some empathy toward human suffering. The rebuild situation was assessed as (SCIRT Presentation, March 2014):

- Biggest rebuild/construction programme in New Zealand history
- Damage and scope not fully known
- Very high levels of uncertainty and risk
- Urgent need to respond and start the rebuild effort
- Logistics of daunting complexity
- Need to deliver and demonstrate commercial value over the longer term
- Need to adopt 'whole of government' approach and absorb existing relief efforts

Hence, an 'alliance' approach was developed and central coordinating agency charged with implementing the programme of works for the horizontal infrastructure rebuild was formed. An interim Alliance Agreement was signed on the 4th May 2011. Later the Stronger Christchurch Infrastructure Rebuild Team (SCIRT) assumed full responsibility from Council's IRMO on 31st August 2011. The above ground rebuild of commercial and residential buildings and council facilities were incorporated into another stream of work and is outside the scope of SCIRT remit.

Structure and Function

SCIRT currently functions under the governance oversight of the Horizontal Infrastructure Governance Group, chaired by a Government representative (as noted in Figure 2 below). This Governance group is made up of representative of the three key funding agencies, CERA, Christchurch City Council and the New Zealand Transport Authority (NZTA). SCIRT, being the organisation that is relevant to our study, sits under this governance group as a 'supplier' of services to these agencies. SCIRT operates under its own board that comprises three representatives from the funding agencies, and five representatives from each of the five lead construction companies, City Care, Fulton Hogan, Downer, McConnell Dowell and Fletcher Construction. While the relationships are based on a buyer/seller arrangement, this level of inter-agency representation at board level is significant for the development of cooperation (Stewart, Kolluru and Smith, 2009). The SCIRT board oversees the delivery of the rebuild services to the Horizontal Infrastructure Governance Group and liaises with the three funding agencies.

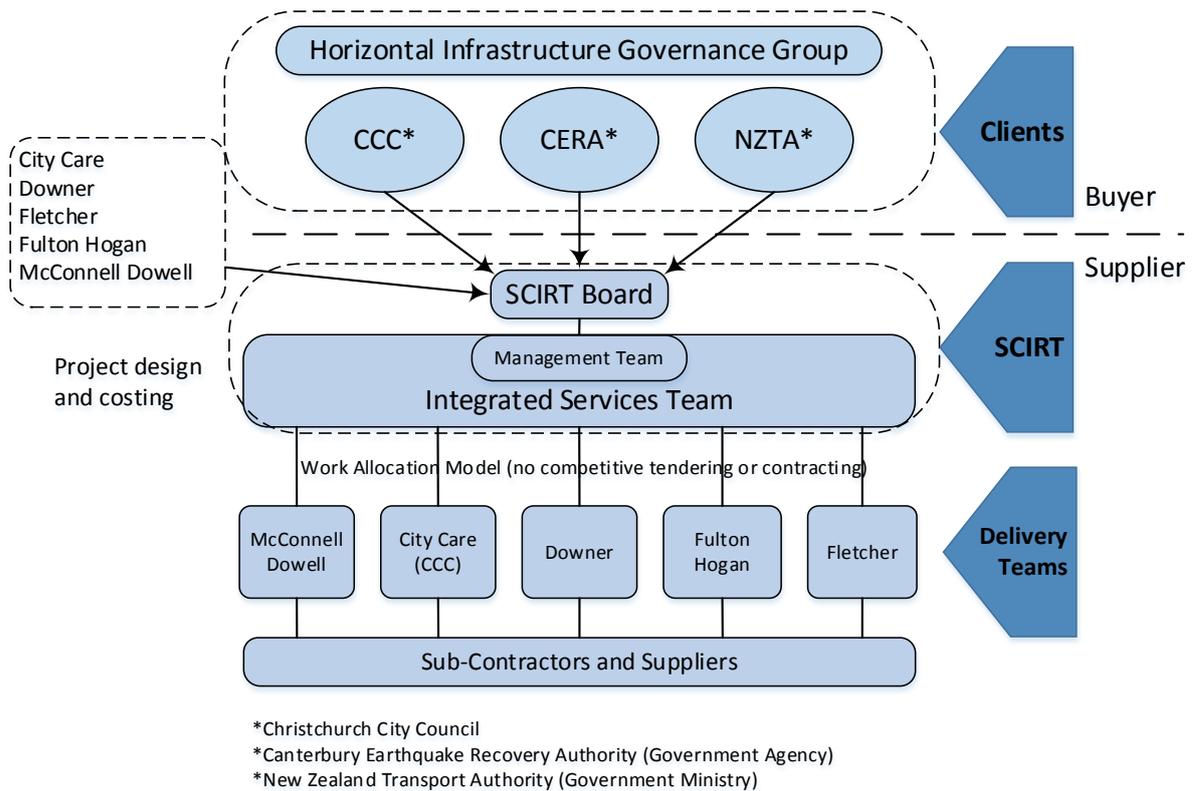


Figure 2: Organisational Structure and Functions of SCIRT in the Rebuild Phase
 Adapted from: CERA/CCC Cost Sharing Agreement (2013), p. 9; SCIRT Presentation, Beneath The Hood: How SCIRT Works, March 2014.

SCIRT itself is headed by a CEO and a senior management team called the Horizontal Infrastructure Management Team comprised of representatives of the three major client agencies and also high level representation from the five construction companies.

The heart of SCIRT is the Integrated Services TEAM (IST) that employs 300 staff from 21 different consulting and engineering companies bringing together a wide variety of construction disciplines. Interestingly for our study, SCIRT does not directly employ anyone (Alchimie, March 2014), rather all staff are on secondment (employed, contracted) from their parent organisation. They come from the funding agencies of CERA, Christchurch City Council and New Zealand Land Transport agencies, as well as the five prime contracting firms and other discipline experts as required. This high level of inter-company cross discipline integration has been instrumental in creating a culture of innovation and cooperation, especially driven by the need to do well for the community.

The role of the IST is to design the rebuild projects, develop cost estimates (audited), monitor the standards of engineering compliance, design and build work, manage the environmental and community impacts of each project and report to key stakeholders. The IST designs discrete projects or parcels of work and cost estimates and then allocates (no tendering) these projects to the five prime contractors (Steeman, 2013). The five construction companies are guaranteed work and the removal of the tendering process greatly facilitates the formation of cooperation. These five contracting companies are responsible for delivering their allocated projects on time and within the

estimated costs (Targeted Outturn Costs, TOC). The agreement with SCIRT stipulates that a minimum of 40% of the contracted work allotted to each of the five be subcontracted out. Currently, over 60% of the work is subcontracted (Steeman, 2013), meaning that revenue is shared out to local businesses thus supporting the recovering economy. One major difficulty is that many of the specific project costs are impossible to know prior to the commencement of the task due to the complex geology underlying the city and that the scale of the damage is often unknown.

Performance Metrics and Incentive Clauses

Critical to the development of cooperation in what is a competitive environment of the rebuild are the incentives that are established through the Key Performance Indicators (KPI's) and the pain/gain payment model. The right incentives promote the desired behaviour and SCIRT have devolved a series of incentives linked directly to their performance metrics. These KPI's have evolved as the rebuild progresses but focus mainly bringing projects in under budget, within time frames, whilst ensuring quality and safety. As a project is scoped, designed and costed by SCIRT a 'targeted outturn cost' (TOC) is established, being the estimated cost of repair plus a fixed margin for the contracting construction companies profit and overheads. All five contracting companies have the same margins agreed under the alliance agreement with SCIRT. Actual payment is made to the five contracting companies using a three step (limb) process outlined in Table 2 below. The starting figure is the estimated Targeted outturn costs (TOC) worked out by the IST prior to allocating to the five construction companies.

Table 2: Payment Model – Three 'Limbs'

Limb	Payment Component	Explanation
Limbl:	Actual Outturn Cost (AOC)	Actual cost of delivering the project (at each milestone and end of project)
	Plus	
Limbl2:	Profit and Corporate Overhead (margin)	Agreed percentage margin as per alliance agreement (same for all five contractors)
	Plus	
Limbl3:	Gainshare/Painshare	The difference between total TOC and total AOC for all projects is split between the client SCIRT and all five contractors, usually 50/50.
Total:	Plus/Minus payment to all contractors	

Source: Adapted from SCIRT Presentation, (SCIRT, March, 2014).

It is interesting to see how these Limb payments establish incentives for the desired inter-organisational behaviour. For the contractors, they are guaranteed to be reimbursed for their actual project costs and also their fixed margin and overhead expenses. What is variable is the gainshare/painshare of the equation. Here the actual costs (AOC) are compared to the targeted costs (TOC) and if the project comes in under budget, then the client (SCIRT) all five contractors share the windfall, while any cost overruns are also all shared between the client and contractors. These payments are progressive and are made during the course of the project comparing what has been spent to date with what the TOC says should have been spent.

There is much more detail around how each Limb is calculated but this is outside the scope of our research at present. What is critical for the development of co-opetition is the commercial incentives established through the gain/pain sharing agreement inherent in the Limb3 payments or deductions. Assuming that Limb3 costs/surplus are split 50/50 between the client SCIRT and the five contractors, there are modifications to this split based on other non-cost KPIs. The Limb3 payments are pooled and if one company's share of the work falls due to poor performance, then its share of the pool falls proportionally. For example, if the KPI's around health and safety injuries is poor for one contractor then the split is weighted against the offender decreasing their returns and the total pool for the others. Hence, if one contractor overruns the budget the total pool available for distribution for all contractors shrinks as well. One outcome is that this incentive structure could generate animosity between the five contractors with the other four applying undue pressure on the non-performer. However, it is reported that there have not been any serious disputes so far that have necessitated the intervention of the SCIRT Board (Alchimie, March 2014). Nevertheless, what has actually emerged is a strong incentive for all parties, including the client, to collaborate and share their ideas, innovations and resources to increase the total pool to be shared. This high level of collaboration within the SCIRT project has emerged between, what were traditionally, fierce rivals prior to the earthquakes. Hence, while competitors, they have now become more overtly collaborators in a hybrid behaviour we argue is a form of co-opetition. How this co-opetitive behaviour manifests itself will be a fascinating study, but again will be the subject of ongoing future research.

Discussion and implications for humanitarian logistics

Co-opetition in the Recovery Phase

Returning to our original research question, we asked in what form should cooperation take in the recovery phase of a disaster? As the phases of disaster relief transition from the response to the recovery phase we have noted that the mix of actors also changes (Balick, *et al.*, 2010). As the recovery phase gathers pace many of the tasks are now undertaken by commercial entities whose motives may differ somewhat from a disaster relief NGO's. Indeed, most humanitarian organisations use the terms coordination and collaboration interchangeably. As the goal of the recovery phase is to achieve a 'new normal' as fast as possible without wasting scarce resources, cooperation amongst actors is still as important as the response phase. Indeed, we have observed that cooperation in business is no different to cooperation in humanitarian logistics. What changes is the motivation to cooperate moving from philanthropic to commercial (Balcik, *et al.*, 2010). It can be argued that as the response phase actors are predominantly disaster relief organisations they are strongly motivated by humanitarian

values. When the recovery phase tasks are increasingly undertaken by commercial organisations, then commercial values will predominate and humanitarian logistics needs models that permit these. While humanitarian values are still important in the recovery phase, the behaviour morphs into a form of cooperation and competition enacted simultaneously by the same actors. In an attempt to explain this behaviour we borrow from management literature a term coined ‘co-opetition’ as a amalgam of cooperation and completion (Nalebuff and Brandenburger, 1996; Bengtsson and Kock, 2000; Kotzab and Teller, 2003; Barretta, 2006). Figure 3 below illustrates these changing motivations.

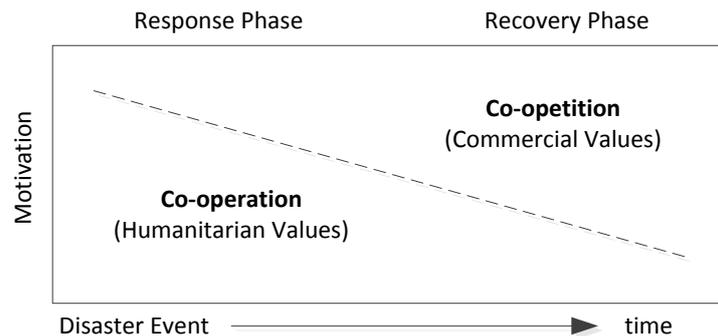


Figure 3: Forms of Co-operation in Phases of Disaster Relief (Source: Authors)

At its broadest, co-opetition can be understood as the simultaneous cooperation and competition among actors within a similar context (Kock, Nisuls and Söderqvist, 2010). As the relationships between actors can exist on the vertical and horizontal planes at several levels at once, opportunities for both competition and cooperation are bound to exist. It is amongst the myriad of these relationships that both cooperation and competition manifest. With its roots in Game theory (Nalebuff and Brandenburger, 1996), co-opetition captures the paradoxical behaviours of competitors sharing information and resources with others with whom they compete against. Co-opetition has been studied in a number of areas, for example; developing international opportunities for SME's (Kock, *et al.*, 2010), logistics service providers (Schmoltzi and Wallenburg, 2012), research and development networks (Schiavone and Simoni, 2011) and also in the Toyota automotive supplier networks (Wilhelm and Kohlbacher, 2011).

Co-opetition is generally understood to manifest amongst actors at the same horizontal level within a network (Scholtzi and Wallenburg, 2012). The rationale for co-opetition is not to compete to divide up the market, but rather to cooperate to increase the size of the current market or create new markets so that all actors benefit. In humanitarian supply chains co-opetition could be understood as the desire to eliminate wastes and duplications and to make the scarce resources go further for the effected region. Yet, despite Nalebuff and Brandenburger's (1996) high claims for the relevance of co-opetition, it is rarely applied in practice. Further, there are virtually no references to co-opetition as a form of coordination mentioned in humanitarian logistics literature. Rather, efforts focus on either centralised or decentralised coordination (Dolinskaya, *et al.*, 2011), coordination by either command, consensus or default (Donini, 1996) and coordinating mechanisms such as procurement alliances (Wild and Zhou, 2011; Balcik, *et al.*, 2010).

Indeed, humanitarian logistics literature is bereft of any form of organisational model that nurtures cooperation beyond the universal imperative to for actors to collaborate. As a rebuild phase progresses commercial incentives emerge as well as humanitarian ones as the number and type of actors involved change. The infrastructure rebuild is one of the biggest tasks and perhaps one of the most important of recovery phase a natural disaster. Certainly, quickly re-establishing sanitation, fresh water and clean food supply chains can greatly mitigate famine or the outbreak to diseases. But beyond that is the longer term recovery of the community and economy. As we have argued earlier, the adaptability of a disaster struck region has an impact on what approach is most effective for dealing with the aftermath of a disaster to achieve the new normal optimally rather than sliding into aid dependency. During the rebuild phase local autonomy and ‘by-in’ from the local community and business is very important for a sense of ‘ownership; and wellbeing derived from active participation. Hence, deploying an organisational model such as has been developed by SCIRT is important to meld what where *ex ante* competitors into an *ex post* cohesive group of collaborators to deliver the massive task of infrastructure rebuild.

Clearly, authoritative command and control forms of directed actor cooperation, while suitable in emergencies, will be untenable for the rebuild. Instead, actors in the rebuild phase engage for both humanitarian and commercial reasons. Indeed, philanthropic relationships occur when private sector companies support or collaboration with relief organizations in ways that do not include profit making. Thus, supporting Haigh and Sutton’s (2012) contention that private enterprises engage to meet humanitarian stakeholder expectations. In the case of the Christchurch earthquakes, and the evolution of the alliance relationships that underpin the SCIRT model, we see a form of cooperation and also competition mixed in the same relationship. We have drawn from management literature the concept of co-opertition to explain the relationship observed in this model. The collaborative culture formed through the colocation of contracted personal throughout SCIRT and also the incentive structure established by the KPI’s and Limb payments strongly foster collaborative actions that award the whole rather than the individual company self-interest. We argue that SCIRT offers a model that would be suitable to foster the right sort of co-opetitive behaviour for the rebuild phase. However, we also acknowledge that this model, while working well for a well-developed democratic economy, may not be suitable in other contexts or countries. Our initial research, while pointing to some promising insights, will need more data gathering and analysis to confirm these early results, hence we advise caution in interpretation. We also argue that the recovery/rebuild phase of the disaster relief needs considerable more research and hope that our paper offers an addition to the thin literature base at present. Finally, while the recovery phase is not yet the new normal, for long term balance it makes sense to integrate humanitarian values into the commercial participation during the rebuild phase of disaster relief supply chains. We offer co-opetition as the most suitable form of cooperation to achieve this.

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