The Silent Assassin: Business demand changes following disaster

Abstract

This paper examines the impact of business demand changes on organisational recovery within the post-disaster context. Drawing on data gathered from organisations five years after the Christchurch 2010/11 earthquakes, the paper details a number of patterns of demand for goods and services and the subsequent ability of organisations to meet such demand. It is argued that business continuity planners should not under-estimate the effects of interrupted demand chains as part of risk mapping. Proactive movement towards resilience thinking, that specifically includes engagement with the management of demand, will potentially lead to better organisational recovery outcomes.

Introduction

Previous research has shown that recovery from disaster events is a process\(^1\). Organisations move through various stages in their recovery trajectories as the economic, social and physical environment exerts uneven pressures across the business community. Outcomes vary and also depend on individual decision making and management of the impacts that arise from a given disaster event. New businesses commence and others cease or fail, though over time, most businesses rebound\(^2\) including some that are extremely hard hit\(^3\). Because of such diverse responses, the measurement of effects at a single point in time may be insufficient to capture the journey of recovery\(^4\).

The pathways that organisations take to reach recovery, will not only be affected by the level of impact and the specific characteristics of the business, but also by the changes in their environment resulting from the disaster. Whether a business experiences gains or losses, existing disaster recover studies generally agree that customers are a key environmental determinant, and play a significant role in improving organisational recovery after a disaster event. However, studies have generally not focussed directly on the demand that consumers bring. Instead, they have tended to focus on the impacts on or actions taken by affected businesses. Business Continuity planning too, has been less concerned with market changes, in favour of specific actions organisations can take to respond to threats to continuity.

This paper discusses the pivotal role of demand in business recovery processes. Demand (and capacity to meet it) changes for a variety of reasons; population shifts, changes in customer preferences or needs, accessibility to business or any mixture of the cumulative
indirect impacts of the disaster. For example, after an earthquake, road cordons that surround dangerous buildings will change foot traffic patterns, even for adjacent businesses that may have sustained no damage, while increase in repair work will also increase the numbers of trades people and supplies required. Some of these changes are outside of the control of the organisation, while others can be affected, positively and negatively, by specific business practice. Either way, demand and ability to meet it, has yet to be directly examined in conjunction with organisational and business recovery in the research literature. Accordingly, this study directly addresses this gap by highlighting the importance of considering changes in demand and capacity to meet it, in the context of business recovery journeys.

**Context**

In 2010 and 2011, the Canterbury region, part of New Zealand’s South Island, was struck by a series of damaging earthquakes that occurred along previously unidentified fault lines. The two most sizeable quakes, on September the 4th 2010 (Mw 7.1) and February 22nd 2011 (Mw 6.3), resulted in a large number of deaths (185) and injuries (over 7100), and substantial damage to buildings and infrastructure. The challenges faced by the region included extensive building damage exacerbated by ongoing aftershocks and widespread land damage due to liquefaction and landslides. Additionally, the commercial centre, cordoned for public safety, remained off limits for as long as two and half years. The Reserve Bank of New Zealand estimated the cost of the rebuild to be around $40 billion; with 18% ($7 billion) spent on infrastructure and the remaining $32 billion spread equally over the residential and commercial sectors.

**Disaster Recovery**

The scale of physical disruption has long been identified as a factor in many post-disaster business recovery studies. Direct impacts such as physical damage to buildings and contents, and disruption to lifeline services have serious consequences on business operability. Many studies have looked specifically at the scale of direct impact relative to recovery status. However, these studies and others have clearly demonstrated the presence of a number of mediating factors between level of direct damage and probability of recovery. For example, the experience of business owners after the Loma Prieta earthquakes revealed that business sector and business property ownership factored as a stronger driver to impede recovery, than building and lifeline services damage. In New Zealand, Brown et al found that “the relationship between level of impact and degree of recovery was weak”.

Factors relating to characteristics of businesses (i.e. size, sector, age) have been explored for their role in mediating the relationship between scale of impact and recovery. For example, Chang & Falit-Baiamonte found that while severity of damage was important, the extent of business loss was better explained by organisation size, sector and building tenure. Similarly, in the wake of the devastation left by Hurricane Andrew in Florida in 1992, businesses with larger numbers of employees were less likely to close, a phenomenon that was observed after the Nisqually earthquakes rocked Seattle and following Hurricane Katrina that hit New Orleans and surrounds in 2005. Size enables businesses to be
sufficiently resourced – with people, capital and planning – to respond to disaster loss, and hence significant in explaining pathways to recovery. However, size has the potential to limit adaptability and agility. Moreover, business characteristics are only one small part of the complex array of mediators.

Businesses are also impacted by indirect effects, such as consumer pattern changes, that compromise business viability, and therefore recovery. For example, six to eight months after Hurricane Katrina, the single largest indicator of business recovery related to population change. The extent to which the customer base had eroded was the strongest predictor of recovery, closely followed by retention or loss of staff. Three years on, long-term organisational performance was still strongly linked to the loss of customers.

Accordingly, understanding organisational recovery requires one to take into account the economy-wide effects of a disaster.

**Disaster-induced demand changes**

Organisations exist in partnership with individuals, communities, and other businesses. Disaster impacts on consumers, the community and other businesses have the potential to significantly affect the recovery of a business through changes in demand for goods and services. For example, after the 2010/2011 earthquakes, the University of Canterbury was able to operate. However, enrolments at the commencement of the subsequent academic year following the first earthquake, were approximately 16% lower than pre-earthquake levels, as students sought less shaky ground in other cities (University of Canterbury, 2013). Loss of customers through disruption can impact recovery through diminished transactions, restricting much needed cash flow. One personal services business on the fringe of the CBD had undamaged premises and was able to re-open. Unfortunately, they were forced to close some months later as the depopulation of the central city removed clientele. These kind of losses are frequently not covered by business interruption insurance (see Brown et al for greater detail on the intricacies of de-population and its impact on business interruption insurance claims).

Demand for goods or services can change as the community recovery progresses. The consumption of luxury goods and services is known to decrease after significant disasters that cause extensive building damage, as those affected reprioritise funds. For example, in the weeks immediately following the 2011 Christchurch earthquakes, sales of essential items such as water, batteries, baby needs and canned foods all increased while purchase of non-essentials items such as gardening hardware, greeting cards and ice-cream substantially reduced. This shift (rather than a loss) in demand is an important one to observe. Disaster relevant industries, such as those in the building and reconstruction trades, professional services related to property and the insurance, engineering and assessment sector can experience increases in demand as they work to meet short-term needs of consumers. Additionally, influx of workforce to assist in recovery efforts further stimulates demand for accommodation and restaurants, shifting the balance of demand in favour of some businesses over others.

While some businesses benefit from the work that disasters can generate, the increase in demand is generally temporary and not guaranteed. Growth in demand can trigger changes to supply with new and sometimes more powerful competitors entering the market.
place. Larger businesses may be able to outcompete for custom, lessening the demand experienced by smaller businesses. Irrespective, disaster generated demand may be short-lived and potentially followed by abrupt drops for such goods and services.

**Method**

Data for this study were gathered by survey in 2016 from organisations and businesses operating in Canterbury at the time of the 2010 earthquake. Respondents were included if they had completed one of four previous surveys undertaken by Resilient Organisations researchers, interested in the impacts of the 2010-2011 Canterbury Earthquakes. A total of 958 organisations fitting this criterion were invited by email to participate in an online survey. Where email addresses had changed or bounced, phone calls were made to invite participation. Of the original 958 participants, 52 were found to have ceased operation, and a further 25 were unable to be contacted, leaving a potential pool of respondents at 881. In total 206 valid responses were received, resulting in a 23% response rate. Despite our best efforts to canvas all potential organisations, the study has a selection bias in favour of organisations that were (a) accessible and (b) in a position to be able to or willing to engage in the study, phenomena not uncommon to post-disaster research.

While larger and older organisations are well represented in the survey data, micro, younger and charitable organisations were underrepresented in relation to the demographics of regional businesses. Distribution of responses by sector reflected the population, with the exception of Manufacturing and Art & recreation services – under represented – and Agriculture, forestry & fishing, Rental hiring and Real estate – over represented. Finally, the distribution of ownership types in the sample reflects the New Zealand wide distribution.

It is also worth noting that this study was conducted in an urban setting, in a country with sufficient social and economic safeguards in place for most citizens and many of its businesses and organisations.

The three key variables used in this study were gathered in the following ways. With respect to recovery, respondents were asked to assess their organisation on a six-point continuum from Ceased operations (1), Declining (2) Surviving (3), Recovering (4), Comfortably stable (5) and Thriving (6). Data were gathered at seven time points from immediately after, several months after, and then annually for 5 years after the earthquakes. Second, organisations were asked, to assess the level of demand they experienced, for the same seven time points and in comparison to the period prior to the 2010/11 earthquakes. Respondents were given a five-point scale option from Greatly decreased(1) through a midpoint of About the same(3) to Greatly increased(5). Third, the ability to meet demand was measured using a five-point scale ranging from Unable(1) to Completely(5) and gathered over the same seven time periods.

**Recovery**

Figure 1 provides the distribution of self-assessment of recovery for each period. As might be expected, the proportion of organisations that were comfortably stable or thriving
increased substantially within the first few years post-event. However, some organisations were still moving to comfortbly stable or thriving status at year five. The proportion of organisations that ceased immediately after the earthquake (13%) was three times the rate reporting ceasing by year 5 (4%) indicating temporary closure as part of the journey for some.

![Figure 1: Recovery over time](image)

Organisations move through various stages in their own recovery and can be affected by both external factors that arise from uncertain and changing economic, social and physical environments, as well as by the decisions they make to proactively manage the direct and indirect impacts arising from the disaster event. As demonstrated by our respondents, the time to achieve recovery varied. As a result, examining recovery for all participants at the same point in time may be insufficient to fully understand the complexities of the many organisational recovery journeys.

The data used in Figure 1 was recoded to establish a point in time for recovery for each participant based on the first instance of indicating having recovered (i.e. having reached Comfortably stable or Thriving). While a little over a third of all organisations indicated they had recovered within the first few months, even after five years, around a quarter (23.3%) indicate that they have not yet recovered. Additionally, a binary measure was created, recovered (or not), by collapsing the first three categories into a single metric of recovered at year five. Both the binary metric and the measures shown in Table 1 are used in analysis.

**Table 1: Time to recovery - Time required to reach Comfortably stable or Thriving status for organisations after the 2010/2011 Christchurch Earthquakes.**

<table>
<thead>
<tr>
<th>Time frame</th>
<th>Number</th>
<th>Percent</th>
</tr>
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<tbody>
<tr>
<td>Rapid recovery</td>
<td>Within months</td>
<td>74</td>
</tr>
</tbody>
</table>
Patterns of demand and organisational recovery

Data gathered about demand over time was examined and eight patterns of demand were identified, seven of which were found to be significantly related to recovery at year 5 ($\chi^2 = 77.707; p=.000$). Four patterns could be considered favourable i.e. demand remained the same or increased for the businesses’ goods and services and three were considered challenging as they represent either drops, sluggish recovery or volatility. Figure 2 is a conceptual diagram of the favourable patterns that were significantly related to likelihood of recovery five years after the earthquake. Around one fifth, or 20% of all organisations (n=41), experienced an initial decrease then increase above previous earthquake levels. A similar proportion of businesses (18%, n=38) indicated a steady growth in demand from pre-quake levels, without the initial loss. Two demand patterns identified reflect unchanging patterns; the first was constant demand over the five periods of observation at the same level experienced prior to the quakes (21%, n=10), and the other, Immediate and sustained increase in demand (12%, n=25) that remained throughout the five years, even immediately after the event. Notably, five years after the earthquakes in Christchurch, just on half of all participants in this study report an increase in demand, in comparison to pre-earthquake levels.

<table>
<thead>
<tr>
<th>Recovery Type</th>
<th>Recovery Timeframe</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium recovery</td>
<td>Within 1 – 3 years</td>
<td>57</td>
<td>27.7%</td>
</tr>
<tr>
<td>Slow recovery</td>
<td>Within 4 – 5 years</td>
<td>27</td>
<td>13.1%</td>
</tr>
<tr>
<td>Not yet recovered</td>
<td>Not yet recovered</td>
<td>48</td>
<td>23.3%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>206</td>
<td>100%</td>
</tr>
</tbody>
</table>

Figure 2: Favourable patterns of demand (% of respondents in brackets)
In contrast to Figure 2, the patterns of demand illustrated in Figure 3 are considered challenging as they represent either drops, sluggish recovery or volatility. Three of the four patterns represented in the Figure 3 schematic were significantly related to being not yet fully recovered five years on ($\chi^2 = 77.707; p=.000$). Around 9% ($n=18$) experienced permanent loss of demand while a smaller proportion (4%, $n=9$) reported unstable or volatile demand patterns over the five-year time period. A further 13% of organisations ($n=26$) experienced slow return to pre-quake levels. The demand pattern represented by the dotted line, contains those who experienced a temporary increase followed by a drop. It is included in the figure as it was an observable pattern in 14% of cases. However, this pattern was not found to be associated with either recovery or non-recovery five years after the disruption event. Finally, the two patterns of demand that returned to pre-earthquake levels five years after the event comprise 27% of the responding organisations.

![Figure 3: Challenging patterns of Demand (% of respondents in brackets)](image)

While healthy patterns of demand appear to foster recovery five years after a substantial interruption event, when examined by specific time to recovery, it becomes clear that some patterns of demand were more beneficial than others (Figure 4). A greater proportion of those who experienced Constant, Immediate & sustained, or Steady growth patterns reported recovering within months than others. Where an initial Decrease then increase was experienced, organisations were more likely to take within one to three years to recovery. Conversely, businesses that operated in Permanently depressed, Volatile and Slow return demand contexts were significantly more likely to have not yet recovered at year five ($\chi^2 (LR)=157.062; p=.000$). Finally, it is interesting to note that a proportion of organisations that experienced negative patterns of demand, such as slow return or permanently depressed, have still managed to recover, albeit relatively slowly, in some instances. Nonetheless, over half of all businesses operating in the context of an initial decline in
demand (*Decrease then increase* cohort), were able to recover within at least the first few years.

Figure 4: Patterns of demand and time to recovery

The above data clearly suggest that demand is an important factor in the time taken to recovery. However, on its own, demand is insufficient. Another important consideration that must also exist is the ability to meet it; to be able to operate. This covers a range of factors including ability to repair or move premises, retain or attract new staff and/or to obtain the necessary supplies and equipment.

### Ability to meet demand and organisational recovery

A total of nine patterns in organisational ability to meet demand were observed; five of these were positive and four were considered challenging. The five patterns of ability to meet demand included in Figure 5 are considered positive, as they have resulted in a complete return to being able to meet demand for goods and services by year five. Figs. 5 and 6 are conceptual representations of the patterns observed. Around 21% of organisations (n=43) experienced an *immediate & sustained* ability to meet demand. The largest proportion of respondents (31%, n=63) experienced an *early delay* characterised by only partial ability to meet demand within the first few months, before a return to complete ability. Additionally, 10% of respondents indicated moving from completely *unable to complete* ability within the first three years. These three patterns were significantly associated with the binary measure of recovery at five years ($\chi^2=43.103; p=.000$). Though present in some cases, the remaining two patterns, *Gradual return from partial* (14%, n=28) and *Extremely slow return* (2%, n=4) were not found to be significant in relation to recovery or non-recovery five years on.
Challenging patterns in ability to meet demand reflect downward trajectories (Figure 6). Perhaps the most challenging pattern was experienced by those who remained permanently decreased in their ability to meet consumer demands. Fifteen percent (n=31) reported having experienced this throughout the five years of observation. A small number of cases (n=4, 2%) reported having full ability followed by a late drop (around year 5). These two patterns were significantly associated with not having recovered by year five ($\chi^2 = 43.103; p=.000$). A small proportion of respondents (5%, n = 11) reported having early stability in meeting demand that was lost over time, while a further <1% (n=2) had erratic ability throughout the five years of observation, however neither of these last two patterns were
significant in relation to state of recovery at five years.

Fig 6: Challenging patterns of ability to meet demand (% of respondents in brackets)

Not only does sufficient business demand affect the time to recovery after a significant disaster event, but the ability of the organisation to meet such demand also has a significant relationship with it. Figure 7 reveals that faster recovery was accompanied by ability to meet demand either immediately, gradually or after an early delay only. Conversely, businesses that report that they had not yet recovered, noted that their ability to meet demand had been permanently decreased, erratic or had recently declined from having full ability ($\chi^2$(LR)=78.748; p=.000). Similarly to demand, it is again interesting to note that a proportion of organisations that experienced negative patterns of ability to meet demand, such as permanent decrease, have still managed to recover, albeit relatively slowly in some instances. Moreover, respondents that report recovering in the fastest time band in this study (i.e. within months) are represented in all but one of the patterns of ability to meet demand, opening the way for discussion around the various pathways that could be taken to business or organisational recovery.
Figure 7: Patterns of ability to meet demand and time to recovery

Discussion

The effects of a large scale disaster event on the business community are complex. There are numerous reasons organisations fail to recover, aside from the direct impacts that may arise as a consequence of the disaster event. Organisations need to regain their ability to operate in conjunction with the presence of a demand for them to do so. Organisations have the opportunity through both their pre-event and post-event actions to influence whether they are amongst the winners or losers after a disaster event. Such actions include finely balancing the investment needed to resume operations with attention to the market and spatial shifts that occur post-disaster.

Figure 8 is a conceptual model of demand and ability to meet demand for organisations before and after a disaster. Under the assumption that prior to the disaster the organisation was operating in an environment where demand and ability to meet it approximate each other, the figure highlights that post-disaster, changes are likely to occur to demand or ability to meet demand, or both. The figure illustrates three conditions of interest; (A) is the case where demand exceeds capacity to meet it. While our conceptual diagram illustrates a reduction in the ability to operate as causation, this could also be the result of a rapid increased demand, for example in the construction sector; (B) is the state of excess ability with insufficient call for goods or services. The third condition is the position of new equilibrium, where demand approximates ability to meet it, albeit at a different level to pre-disaster. This equilibrium is of course constantly shifting but represents the aspiration to which an organisation is always working towards, although it should be noted that a resilience perspective would suggest that some degree of slack between ability and demand is necessary. It is important to remember that the figure is conceptual, and the specific
shape of the curves for each organisation will undoubtedly differ.

**Figure 8: Movements in demand and ability to meet demand before and after a disaster**

**Implications for Business Continuity Planning**

Much of traditional business continuity efforts focus on avoiding falling into area ‘A’ – where demand for goods or services is greater than an organisation’s ability to meet demand. This can be caused by damage to physical or human resources, lack of infrastructure or supply chain failure – all areas traditionally managed through risk and business continuity management practices. This is also the case where an organisation alone is impacted by an event, which more often than not results in no change to demand.

The significant relationship found between demand changes and recovery after a major event point to a need to widen business continuity thinking to consider not only internal operational ability and supply chain issues, but also the ‘demand chain’. An interruption to the demand chain where ability to meet demand exceeds the level of demand experienced will result in organisations falling into area ‘B’. This may be due to population shifts, changing consumer preferences, access issues or any mixture of the cumulative indirect impacts of the disaster. This may also be caused by so called ‘slow creep disasters’ that can impact organisations that do not successfully adapt to changing customer tastes or disruptive innovation.

Despite the relative under-attention paid to interrupted demand chains (area ‘B’), there are practical means to address this condition. Risk mapping exercises should consider the impact of changed demand in either direction as part of the ‘known unknowns’. Application of standard risk management techniques that diversify the client base, for example, may increase probability of demand continuity. A move towards resilience capability
development - with its emphasis on adaptive capacity - leaves organisations more likely to rapidly recognise a need to adapt their business model to replace lost demand.

**Imagining different pathways**

It may not necessarily be critical to press to return to a pre-disaster state. The effects of disasters on organisations, staff and the people they serve, may lead businesses to adopt an altogether different stance than the pre-disaster context. For example, meeting a new lower equilibrium, and one where lower demand can be met, might serve the organisation better longer-term than attempting to remain in an environment of high demand with no capacity to meet it (area ‘A’).

Qualitative research carried out elsewhere with Canterbury organisations highlight many examples of proactive measures that would address area ‘B’. Straightforward examples include hospitality businesses in previously fixed locations who recreated themselves in mobile form; retail outlets that changed their product offerings to appeal to a new demographic in their location; and construction companies who partnered with demolition companies in recognition that new construction would temporarily be on hold. Other proactive measures centred on adjusting operational parameters. For example some organisations remained closed and did not hurry to rebuild operations, acknowledging that there would be little demand for their products in the short term. In predicting that demand for their products would rise over the longer term, other organisations reduced working hours in order to retain their valued staff. In each of these cases, organisations took proactive steps that acknowledged their ability to operate as only one part of their recovery journey.

Although our discussion has focused on demand being lesser than operational ability (area B), the converse situation where demand exceeds ability (area ‘A’) also poses significant threats to an organisation, leaving room in the market for a powerful competitor to obtain important market share that can be retained once demand reduces. Excess demand may also escalate pressure which can impact quality. A failure to maintain quality in the face of a heavy workload can diminish an organisation’s reputation over time. This situation can also lead to burn-out, diminishing the significant advantage an organisation may previously have held resulting from staff capabilities. Proactive steps that enable organisations to rapidly upscale can include building effective partnerships that can be called upon when needed for resources as well as engaging human resource strategies that enable a potential pool of labour and internal systems and processes that are able to respond in a timely manner.

**Final thoughts**

The findings from this study provide business owners, management and business continuity planners with a compelling argument for the inclusion of *business demand* in post-disaster continuity planning. The presence of stable or growing demand in a post-crisis environment is a critical part of recovery. However, it will not be sufficient to ensure recovery. Organisations need to ensure they proactively manage disruption and remain agile and creative in the solutions they engage, in order to regain operability to find equilibrium. Taking such an approach will help organisations be change ready, irrespective of the nature of such change. Though managing demand alone will not protect a business from the variety
of impacts an organisation may face in a post disaster context, it is undoubtedly true that the days of a fully operational business with little or no ongoing demand, will be numbered.

4 Alesch DJ, Holly JN, Mittler E, Nagy R. Organizations at risk: What happens when small businesses and not-for-profits encounter natural disasters.
14 Ibid.
19 Chang & Falit-Baiamonte, see 16.
20 Wasileski et al., refer 17 above.
21 Chang & Falit-Baiamonte, refer 16 above.
22 LeSage et al., refer 13 above.
Corey & Deitch, refer 15 above.


Lam NSN, Arenas, H, Pace, K, LeSage, J., Campanella, R. Predictors of business return in New Orleans after Hurricane Katrina. 2012. Available at: PLOS/One. doi:10.1371/journal.pone.0047935.s001


Alesch et al., refer 4 above.

Zhang et al., refer 25 above.


Ibid.


Alesch et al., refer 4 above.

Zhang et al. refer 25 above.

Ibid.


Marshall & Schrank. refer 1 above.

Alesch et al., refer 4 above.