Developing a Tool to Measure and Compare Organizations' Resilience

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Abstract: Organizational and community resilience are interrelated and interdependent. As a result, organizational resilience is a critical component of communities' ability to plan for, respond to, and recover from emergencies and crises. Organizational resilience can also be a source of competitiveness and a driver of cultural adaptive capacity. To invest in resilience, organizations need to understand their resilience strengths and weaknesses and must be able to evaluate the effectiveness of resilience strategies. This paper develops a survey tool that organizations can use to identify their strengths and weaknesses and to develop and evaluate the effectiveness of their resilience strategies and investments.
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Introduction

Communities are increasingly confronted with emergencies and crises that challenge their social and economic stability. They rely on services and employment provided by organizations to enable them to plan for, respond to, and recover from emergencies and crises. However, organizational and community resilience are two sides of the same coin; if organizations are not prepared to respond to emergencies and crises, communities also are not prepared.

In addition to the link between resilient communities and resilient organizations, there is also a link between being resilient and being competitive. To be resilient, organizations rely on strong leadership, an awareness and understanding of their operating environment, their ability to manage vulnerabilities, and their ability to adapt in response to rapid change. These characteristics run parallel to a competitive organization whose leaders are able to leverage its strengths to adapt, ahead of its competitors, to rapid changes in their market or industry sector.

Despite the potential community and business rewards of becoming more resilient, organizations struggle to prioritize resilience and to link resilience to emergencies and crises with the ability to operate effectively, efficiently, and competitively during business as usual. Many organizational leaders agree with the need to improve organizations' resilience; however, they lack the time or resources to address the problem. There always seems to be something more vital or important to address. It is also very difficult to attract board-level buy-in or support for investments that have no measurable return or quantifiable benefit. This is especially true where resilience activities are competing against more traditional projects for the same funds. To improve community resilience, it is important for organizations to make the link between resilience and organizational competitiveness and to invest in resilience. However, for organizations to invest in their resilience, they must be able to demonstrate the business case.

What Is Organizational Resilience and Why Is It Important?

The study of organizations from a disaster perspective includes an array of literature examining why they fail, which is mainly drawn from the analysis of major accidents (Choo 2008; Paté-Cornell 1993; Reason 2000; Sheaffer et al. 1998), as well as several studies proposing models of crisis causation and management (Hwang and Lichtenthal 2000; Pearson and Mitroff 1993; Pearson and Clair 1998; Shrivastava et al. 1988; Smith 1990; Turner 1976). Less attention is given to what makes organizations succeed despite disaster. However, organizational resilience literature is beginning to fill this gap and to focus on the characteristics of organizations that survive and thrive (Corey and Deitch 2011; Kendra and Wachtendorf 2003; Seville et al. 2008). Concepts have also emerged that provide a sociotechnical systems view of organizations such as high reliability organization (HRO) theory (Bierly and Spender 1995; Bourrier 2011; Roberts 1990), and normal accident theory (Perrow 1984, 1999), which also explore elements linked to resilience.

Resilience is a multidimensional, sociotechnical phenomenon that addresses how people, as individuals or groups, manage uncertainty. Organizations respond to uncertainty in many ways; they centralize internal controls (Pfeffer 1978), they learn (Carroll 1998; Weick et al. 2005), they are creative (Kendra and Wachtendorf 2003), and they adapt (Vogus and Sutcliffe 2008). Discussions about resilience characterize it using notions of bouncing back (Hale and Heijer 2006), robustness (Tierney 2003), absorption (Berkes 2007), and surviving and thriving (Seville 2009). Hollnagel et al. (2008) go further and identify a set of four abilities that they argue define the

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quality of resilience: the ability to respond to various disturbances and to regular and irregular threats, the ability to flexibly monitor what is going on, the ability to anticipate disruptions, and the ability to learn from experience.

Organizational resilience is a continuously moving target that contributes to performance during business as usual and crisis situations (Mitroff 2005). It requires organizations to adapt and to be highly reliable (Weick and Sutcliffe 2007) and enables them to manage disruptive challenges (Durodie 2003). Seville et al. (2008; p. 18) discuss organizational resilience as an organization's ". . .ability to survive, and potentially even thrive, in times of crisis."

In particular, organizations' ability to adapt has received a lot of attention, and researchers have questioned whether all adaptation is resilience. From the resilience engineering perspective, Woods (2006) argues that resilience is more than an ability to adapt. From this, Woods and Wreathall (2008) and Vogus and Sutcliffe (2008) distinguish two types of adaptive capacity. First-order adaptive capacity is displayed when organizations respond or bounce back using existing predetermined planning and capabilities. In practice, this is shown through disciplines such as business continuity and risk management. In contrast, second-order adaptive capacity emerges when organizations develop new capabilities to respond dynamically to situations that are outside of their design (Woods and Wreathall 2008). Woods (2006) also introduces the idea that the resilience of a system at one scale influences its resilience at other scales. Hale and Heijer (2006) discuss what a resilient organization would look like and ask whether an organization that has a good safety record and experiences very few accidents can be labeled as resilient. However, they conclude that organizations can achieve high levels of safety without being resilient.

Another key theme within resilience engineering is the need to detect the drift toward failure (Dekker 2006; Marcus and Nichols 1999) or weak signals (Choo 2008; Sheaffer et al. 1998), which often precede disaster. Dekker (2006) from the resilience engineering perspective and Weick and Sutcliffe (2007) from the high reliability perspective both identify the organizations' preoccupation with failure as a key element of resilience, arguing that resilient organizations continuously question assumptions about their environment.

Reason (2000; p. 769) argues, "High reliability organisations. . .offer important models for what constitutes a resilient system." The similarities or crossover between HRO and resilience theory is further emphasized by Weick and Sutcliffe (2007), who use HRO theory as a basis for their organizational resilience audits that measure organizational resilience and ask to what extent organizations display HRO characteristics. A review of these audits, which formed part of this research but is too lengthy to include here, can be found in Stephenson (2011).

Organizational resilience is important for two key reasons: first because community resilience and organizational resilience are interdependent (Dalziell and McManus 2004) and second because being resilient can provide organizations with competitive advantage (Parsons 2007). McManus et al. (2008) argue that the resilience of organizations directly contributes to the speed and success of community recovery. Without critical services provided by organizations such as power, water, sanitation, transport, healthcare, etc., communities cannot respond or recover. Buckle (2006) reflects this when he discusses organizations as a level of social resilience.

The purpose of this paper is to develop a survey tool to measure and compare organizations' resilience. The benchmark resilience tool can be used to identify resilience strengths and weaknesses and help organizations to understand how resilient they are now so that they can develop strategies to improve. The tool is tested on a random sample of Auckland organizations, and factor analysis is used to develop the instrument. As part of the development, a suite of indicators and a model of organizational resilience are proposed. The results are primarily intended to help translate a complex multidimensional sociotechnical phenomenon into something more tangible for organizations and to provide organizations with a starting point for addressing their resilience. The results are not intended to replace more qualitative-rich studies that organizations can use to delve deeper into the implications and meaning of their quantitative results.

Why Measure Organizational Resilience and What Are the Challenges?

Metrics for measuring and evaluating organizational resilience can contribute to four key organizational needs:

- The need to demonstrate progress toward becoming more resilient;
- The need for leading, as opposed to lagging, indicators of resilience;
- The need to link improvements in organizational resilience with competitiveness; and
- The need to demonstrate a business case for resilience investments.

Organizations can struggle to prioritize and allocate resources to building resilience, given the difficulty of demonstrating progress or success (Stephenson et al. 2010). This is partly because emergency management and business continuity programs have to compete for resources against profit-driven activities for which there are metrics for evaluating whether they have produced financial growth or not (Kay 2010). Resilience, however, focuses on more social and cultural factors within organizations that are more difficult to measure and to link to financial outcomes. One example would be the difficulty of quantifying how the cost of running an emergency exercise affects an organization's resilience and their bottom line. Organizations must be able to demonstrate progress toward becoming more resilient by quantifying improvements in their resilience and tracking changes in that measurement over time.

Flin et al. (2000) review scales developed to measure safety climate in high reliability industries and note that in recent years, operating companies and regulators have moved away from lagging indicators toward leading indicators of safety. Lagging indicators are based on retrospective data and, in the context of resilience, would measure how resilient an organization has been. An example of this would be looking at an organization's experience of crises to describe its resilience over the last 10 years and then using that as a predictor of its future resilience. Leading indicators measure observable processes, actions, and practices that are thought to contribute to the organization's resilience. An example of this would be measuring an organization's ability to communicate across organizational, social, and cultural boundaries as an indicator that contributes toward their resilience. Flin et al. (2000; p. 178) argue that leading indicators ". . .may reduce the need to wait for the system to fail in order to identify weaknesses and to take remedial actions."

In the context of resilience this is very important because leading indicators can provide organizations with information on their resilience strengths and weaknesses before a crisis happens.

In a competitive environment, an organization that is aware of its resilience strengths is more equipped to find opportunities out of a crisis situation (Knight and Pretty 1997). Resilient organizations can also be more competitive during business as usual. Vargo and Seville (2010) discuss competitive excellence and provide Table 1 to

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illustrate the similarities and links between organizational resilience and competitive excellence. The comparison shows that elements of resilience and competitive excellence share many of the same features. For example, the organization's situation awareness, or its ability to interpret information about its business environment and understand what that information means for the organization now and in the future, is very similar to its ability to know its competition and environment.

The link between crisis management and competitiveness or profitability is also emphasized by Mitroff (2005; p. 376) who argues "Smart organizations practice crisis management equally in good and bad times. As a result, they experience substantially fewer crises and are substantially more profitable."

For organizations to invest in resilience, the business case for resilience investments has to go beyond insurance and must be as good as the case for new equipment or new staff (Vargo and Stephenson 2010).

Mendonça (2008) discusses the need to measure resilience and identifies several challenges including whether resilience exists a priori or only emerges during a crisis response, a lack of longitudinal data on preevent conditions to enable comparison, and the difficulty of a positivist approach where there is no widely accepted definition or proven set of factors. This paper tries to address some of these challenges but in identifying indicators of organizational resilience also highlights the challenge of understanding the causal relationships between indicators to enable a fuller discussion of overall resilience.

Factors of Organizational Resilience

Mallak (1998) surveyed nursing executives in the acute healthcare industry to measure organizational resilience. To enable this, he operationalized three concepts introduced by Weick (1993): bricolage, attitude of wisdom, and virtual role system. With responses from 128 nursing executives, Mallak (1998) used confirmatory factor analysis to develop six factors as metrics of resilience: goal-directed solution seeking, avoidance or skepticism, critical understanding, role dependence, source resilience, and access to resources.

Somers (2009) extended Mallak's (1998) research and applied it to 142 public works organizations. He used Mallak's six factors to measure resilience potential or latent resilience, defined as ". . .resilience that is not presently evident or realised" (Somers 2007; p. 13). Through his research, Somers (2009) uses data from a nonprobability sample, which does not involve a random selection, to develop the organizational resilience potential scale (ORPS). In addition to Mallak's six factors, Somers (2009) also includes measures of decision structure and centralization, connectivity, continuity planning, and agency accreditation in the ORPS. While both studies of Mallak (1998) and Somers (2009) represent significant theoretical contributions, neither was developed using a random sample and therefore cannot be used as the sole basis for a robust resilience measurement tool.

McManus (2008) used grounded theory to explore organizational resilience in New Zealand. She conducted a qualitative study using semistructured interviews with 10 case study organizations to assess their resilience qualities. From these case studies, McManus et al. (2008; p. 82) proposed a definition of organizational resilience as ". . .a function of an organization's overall situation awareness, management of keystone vulnerabilities and adaptive capacity in a complex, dynamic and interconnected environment."

Through this definition, she hypothesized a model where relative overall resilience (ROR) is composed of three factors (situation awareness, management of keystone vulnerabilities, and adaptive capacity) and also proposed 15 indictors of organizational resilience (five for each factor) (McManus 2008). The ROR model has been chosen as the starting point for this paper because it presents a rare operationalized definition of organizational resilience that has been developed through research with New Zealand organizations and therefore provides a good context for this study. The indicators proposed in the ROR model within each of the three factors can be seen in Table 2. Each of the three dimensions are discussed; however, a detailed discussion of each indicator including relevant literature and a review of its contribution to overall resilience can be found in Stephenson (2011).

Situation Awareness

The term situation awareness was first used in connection with the military, where pilots are required to understand, assimilate, and act on large volumes of information to perform their roles (Endsley 1995). Endsley et al. (2003; p. 13) define situation awareness as ". . .being aware of what is happening around you and understanding what that information means to you now and in the future."

Table 1. Organizational Resilience and Competitive Excellence (Reprinted with Permission from Vargo and Stephenson 2010)

Feature of resilience	Features of competitive excellence
20/20 Situation awareness and effective vulnerability management	Knowing your competition and environment
Agile adaptive capacity	Being quick to respond when things change
World class organizational leadership and culture	Having outstanding leadership
20/20 Situation awareness and effective vulnerability management	A robust capital structure
World class organizational leadership and culture	A commitment to your customer that is extraordinary
World class organizational leadership and culture	A cohesive culture of quality, responsibility and service

Table 2. McManus's Factors and Indicators of Relative Overall Resilience (Reprinted with Permission from McManus 2008)

Situation awareness	Management of keystone vulnerabilities	Adaptive capacity
Roles and responsibilities	Planning strategies	Silo mentality
Understanding and analysis of hazards and consequences	Participation in exercises	Communications and relationships
Connectivity awareness	Capability and capacity of internal resources	Strategic vision and outcome expectancy
Insurance awareness	Capability and capacity of external resources	Information and knowledge
Recovery priorities	Organizational connectivity	Leadership, management, and governance structures

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They go on to note that the term is usually applied to operational situations. One example of this is the application by Masys (2005) to airline operation and safety, which suggests that situation awareness is distributed across teams, groups, and organizations, as well as human and machine agents. Masys (2005; p. 548) draws on Stout and Salas (1998) and argues that situation awareness "...should be regarded as an essential requirement for competent performance in dynamic environments, with inaccurate and incomplete situation awareness often leading to dangerous and life-threatening consequences."

Crichton et al. (2005) echo this when they discuss incident command skills in the oil industry. They argue that situation awareness is a vital command skill in a crisis because the first step in decision making is to evaluate the situation. Roth et al. (2006) discuss the importance of shared situation awareness as an informal cooperative strategy between railroad workers, which "...facilitates work, and contributes to the overall efficiency, safety, and resilience...of railroad operations" (Roth et al. 2006; p. 967). This informal cooperative strategy, which occurs within the organization's culture, is the mechanism through which the organization shares or communicates their situation awareness.

Management of Keystone Vulnerabilities

Turner (1978) made the first theoretical analysis of organizational vulnerability to technological disasters, emphasizing the role of organizational norms and values. Several authors have also focused on identifying organizational vulnerabilities that have contributed to organizational losses or failure during and after disasters using case study and survey research. Kroll et al. (1990) identify organizational size as a vulnerability when they discuss how small businesses suffered more severe losses during and after the Loma Prieta earthquake. Durkin (1984) and Alesch and Holly (1998) identify predisaster economic health as a vulnerability during and after the 1984 Coalinga earthquake and the 1994 Northridge earthquake. Alesch and Holly (1998) also identify the owners' entrepreneurial skills, or lack of, and the effect of the disaster on demand for the organization's products or services as vulnerabilities. Chang and Falit-Baiamonte (2003) review research conducted at the University of Delaware Disaster Research Center using large-scale survey research and highlight a number of vulnerabilities observed during and after floods, hurricanes, and earthquakes. These vulnerabilities include disruption to infrastructure, difficulties with supplies and shipments, drops in demand, and predisaster economic health (Chang and Falit-Baiamonte 2003; p. 60).

McManus et al. (2008) discuss what qualifies a particular vulnerability as a keystone vulnerability and note other uses of the term keystone: ecological and architectural. They go on to define keystone vulnerabilities as "...components in the organizational system, which by their loss or impairment have the potential to cause exceptional effects throughout the system" (McManus et al. 2008; p. 83). This is also addressed within the field of business continuity management where organizations aim to identify and assess potential single points of failure, such as a single source supplier or resource, through business impact analyses [British Standards Institute (BSI) 2006].

Adaptive Capacity

An organization's ability to adapt is at the heart of its ability to display resilient characteristics. Kendra and Wachtendorf (2001) argue that the idea of resilience as adaptive behavior is increasingly being applied to the business environment to help explain how organizations manage the balance between stability and change. Starr et al. (2003) discuss the importance of adaptation and suggest that adaptive capacity is also linked to an organization's competitiveness.

Kendra and Wachtendorf (2003) discuss resilience in response to the September 11th terrorist attacks and note that organizations displayed "...adaptive behaviour that was not dependent on either specific physical facilities or specific technological systems." Here they describe how organizations drew on their culture and the capabilities of their staff, as opposed to their structures and technology, to develop adaptive responses to emerging situations. An organization's adaptive capacity then, is their ability to continuously design and develop solutions to match or exceed the needs of their environment as changes in that environment emerge.

Reviewing McManus's Relative Overall Resilience Model

Before developing a survey tool to measure organizations' resilience based on McManus's ROR model, it is important to assess whether the model is applicable to a wider population of organizations. McManus's case study organizations were selected to represent a range of organization types and sizes. However, McManus (2008) notes that the indicators identified through her research are limited to the case study organizations. The measurement instrument should initially include all possible indicators of organizational resilience. It can then be refined during the analysis to find the most parsimonious model of organizational resilience, and the tool can be developed so that it is applicable to as many organizations as possible.

The factors and indicators of organizational resilience of McManus (2008) were reviewed through a literature review and workshop to identify any possible gaps and update the model if necessary. The literature review highlighted a number of concepts that should be included such as creativity, deference to expertise, commitment, and staff engagement. At the workshop, participants discussed the three factors identified by McManus (situation awareness, management of keystone vulnerabilities, and adaptive capacity) and were asked to identify indicators for each. Following the workshop, the suggested indicators were compared with the ones proposed by McManus, and any gaps were identified. This process, as well as the literature review, resulted in a second proposed suite of indicators of organizational resilience, which can be seen in Table 3. The resilience ethos factor and the eight indicators that were added to the model as a result of the literature review and workshop are indicated in the table.

Methodology

McManus's (2008) original ROR model with three factors and 15 indicators and the adjusted model proposed in this paper with four factors and 23 indicators were both tested through this research. Items were developed for each of the indicators within the two models using the deductive method suggested by Hinkin (1998), whereby each indicator is defined and then each component of each definition is used to develop an item. Each item was then operationalized using a four-point Likert scale ranging from strongly agree to strongly disagree.

Once the survey tool was drafted, a pilot study was conducted using four of McManus's (2008) original case study organizations. The purpose of the pilot study was to check the usability of the survey tool and to check face validity of the items. Senior managers and staff from each organization completed the survey and were then interviewed to give feedback. As a result of the pilot study, changes

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Table 3. Adjusted Version of McManus's Indicators of Relative Overall Resilience (Adapted from McManus 2008)

Resilience ethos[a]		
Commitment to resilience[a] Network perspective[a]		
Situation awareness	Management of keystone vulnerabilities	Adaptive capacity
Roles and responsibilities	Planning strategies	Silo mentality
Understanding and analysis of hazards and consequences	Participation in exercises	Communications and relationships
Connectivity awareness	Capability and capacity of internal resources	Strategic vision and outcome expectancy
Insurance awareness	Capability and capacity of external resources	Information and knowledge
Recovery priorities	Organizational connectivity	Leadership, management, and governance structures
Internal and external situation monitoring and reporting[a]	Robust processes for identifying and analyzing vulnerabilities[a]	Innovation and creativity[a]
Informed decision making[a]	Staff engagement and involvement[a]	Devolved and responsive decision making[a]

[a]Indicators proposed as additions to the McManus model of relative overall resilience.

were made to the language of the items and the survey introduction and instructions.

A sample of 1,009 organizations from the Auckland region of New Zealand was randomly selected from a credit reference database to test the tool. Compared with the industry sector profile of the Auckland region (Statistics New Zealand 2009), the sample was found to represent all but two industry sectors: mining and other services.

The tool developed through this research was developed and tested using survey responses from as many people as possible within each organization; there are two key reasons for this. First, any measurement that is used to inform investment decisions, strategies, and organizations' responses to crises and emergencies must be as robust as possible. Many measurement tools used by organizations rely on information from only one organizational member, often a specialist or the manager responsible for that area of work. This produces results based on a single experience, often with a vested interest in the scores or results achieved. It is critical that any measurement of resilience represents the knowledge and experience of people from all levels and functions of the organization. Second, a measurement based on a single person's response would only tell us what the organization was talking about doing, whereas a measurement based on multiple responses is more likely to indicate what the organization is actually doing and whether their plans, procedures, and strategies have been embedded into the organization's culture.

Between March and November 2009, one senior manager and as many staff as possible from each organization were asked to complete the survey by following a link in an e-mail invitation. Senior managers completed a version of the survey that included the resilience items, as well as an extra section of financial and management items. These items were included as a check based on the hypothesis that more resilient organizations would also achieve higher scores for financial and management items. Other staff members completed a version of the survey that included only the resilience items. The majority of participants took part using the online survey; however, paper copies of the survey were also made available to those who did not have regular access to a computer or the internet. The items used, including the financial and management items, are shown in Appendix I.

In total 249 individuals from 68 organizations took part in the research. This included organizations from 13 industry sectors. As suggested by Pallant (2007), the Kaiser-Meyer-Olkin (KMO) coefficient was used to check the suitability of the data for factor analysis. The KMO suggests that data are suitable if the coefficient is 0.6 or greater; in this research, a KMO of 0.888 indicated that the data were suitable for use in factor analysis. Principal axis factor analysis with a varimax rotation was used to test McManus's (2007) original model of ROR and the adjusted model proposed in this paper. Items were retained with a factor loading of 0.4 or greater as suggested by Hinkin (1998). Items with factor loading of less than 0.4 were reviewed against the literature, and if no strong case could be found for retaining them despite their low loading, they were dropped from the model.

Results

McManus's Relative Overall Resilience Model

McManus's (2008) ROR model suggested that organizational resilience is comprised of three factors: situation awareness, management of keystone vulnerabilities, and adaptive capacity. In turn, each of the three factors was comprised of five indicators; this model is shown in Table 2 and was operationalized as 49 items in the survey tool. In the Appendix, these items are those related to McManus's 15 original indicators.

Based on McManus's (2008) ROR model, a three-factor solution was extracted using principal axis factor analysis with a varimax rotation. This resulted in a solution where 37 of the items used to measure McManus's indicators were retained, and 12 items were dropped because of poor loadings. The solution had two substantial factors and a third factor that was weak, with only four items (one of which was double loaded). This demonstrates that, using the sample and scales developed through this research, the three-factor ROR model of McManus (2008) is not supported.

Adjusted Model of Organizational Resilience

The model of adjusted ROR is an adjusted version of McManus's (2008) ROR model, which is proposed in this paper (Table 3). This model suggests that organizational resilience is comprised of four factors; resilience ethos, situation awareness, management of keystone vulnerabilities, and adaptive capacity. In this model, the resilience ethos factor is measured using two indicators, and the other three factors are measured using seven indicators each. This model was operationalized as 73 items in the survey tool (Appendix I).

On the basis of the adjusted model, a four-factor solution was extracted using principal axis factor analysis with a varimax rotation. This resulted in a solution where 57 of the items used to measure the indicators were retained, and 16 items were dropped because of poor loadings. The solution had two substantial factors

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and two factors that were weak, with only eight items in one and four items in the other. This demonstrates that, using the sample and survey tool developed through this paper, the four-factor model of adjusted ROR is not supported.

New Model of Organizational Resilience

Given that neither McManus's (2008) original ROR model nor the adjusted model was supported by the data, principal axis factor analysis with a varimax rotation was used to explore the factor structure of the data to identify a model of organizational resilience that could be supported.

A two-factor solution (Appendix II) was extracted based on all 73 items shown in Appendix I. This resulted in a very clean two-factor structure, where 53 items were retained to measure organizational resilience and 20 items were dropped because of poor loadings (<0.4, as previously discussed). Dropped items were reviewed in relation to the literature, and it was found that most were covered by other items; they are shown in Appendix I, and an explanation of why each of these items was dropped can be found in Stephenson (2011). In hindsight, this was because of the language of the items and reflects how interrelated the concept of resilience is. Despite this, the purpose of the factor analysis was to reduce the number of items and seek a parsimonious solution, and this was achieved. The two-factor solution forms the basis for the new model of organizational resilience and the benchmark resilience tool developed in this paper.

Table 4 shows the new model of organizational resilience that was developed by this research and includes a definition of each indicator. Based on this new model, organizational resilience is comprised of two factors, planning and adaptive capacity, and is measured using 13 indicators (53 items).

At this point, it is useful to discuss the links between the two-factor model proposed here and McManus's (2008) three-factor model, which was developed from richer qualitative data. Four of the indicators shown in Table 4 are as they were proposed in the adjusted model in Table 3. These include capability and capacity of internal resources, innovation and creativity, devolved and responsive decision making, and participation in exercises. The other indicators were either added to (four indicators), only partially retained (five indicators), or were created out of various items grouped together according to their content. Within this model,

Table 4. New Model of Organizational Resilience

Factors	Indicator	Definition
Adaptive capacity	Minimization of silos	Minimization of divisive social, cultural, and behavioral barriers, which are most often manifested as communication barriers creating disjointed, disconnected, and detrimental ways of working.
	Internal resources	The management and mobilization of the organization's resources to ensure its ability to operate during business-as-usual, as well as being able to provide the extra capacity required during a crisis.
	Staff engagement and involvement	The engagement and involvement of staff who understand the link between their own work, the organization's resilience, and its long-term success. Staff are empowered and use their skills to solve problems.
	Information and knowledge	Critical information is stored in a number of formats and locations and staff have access to expert opinions when needed. Roles are shared and staff are trained so that someone will always be able to fill key roles.
	Leadership	Strong crisis leadership to provide good management and decision making during times of crisis, as well as continuous evaluation of strategies and work programs against organizational goals.
	Innovation and creativity	Staff are encouraged and rewarded for using their knowledge in novel ways to solve new and existing problems and for utilizing innovative and creative approaches to developing solutions.
	Decision making	Staff have the appropriate authority to make decisions related to their work and authority is clearly delegated to enable a crisis response. Highly skilled staff are involved, or are able to make, decisions where their specific knowledge adds significant value, or where their involvement will aid implementation.
	Situation monitoring and reporting	Staff are encouraged to be vigilant about the organization, its performance and potential problems. Staff are rewarded for sharing good and bad news about the organization including early warning signals and these are quickly reported to organizational leaders.
Planning	Planning strategies	The development and evaluation of plans and strategies to manage vulnerabilities in relation to the business environment and its stakeholders.
	Participation in exercises	The participation of staff in simulations or scenarios designed to practice response arrangements and validate plans.
	Proactive posture	A strategic and behavioral readiness to respond to early warning signals of change in the organization's internal and external environment before they escalate into crisis.
	External resources	An understanding of the relationships and resources the organization might need to access from other organizations during a crisis, and planning and management to ensure this access.
	Recovery priorities	An organization wide awareness of what the organization's priorities would be following a crisis, clearly defined at the organization level, as well as an understanding of the organization's minimum operating requirements.

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McManus's (2008) indicators and the additional indicators proposed in this paper were not dropped from the model altogether; instead, they were reorganized and incorporated into the two-factor structure. This suggests that McManus' (2008) proposed indicators were valid but were not organized into a structure that could be supported by the data. A detailed discussion of each indicator in Table 4, its internal consistency, item reliability, and how it came from the three-factor model to the two-factor model presented in this paper is described in Stephenson (2011).

Given the nature of the items within each factor, Factor 1 was named adaptive capacity and Factor 2 was named planning. Although the two-factor structure that was identified is simpler than was expected, it is not surprising that the two factors are adaptive capacity and planning. This reflects a central theme within crisis management and resilience literature: anticipation versus resilience, planning versus adaptation (Comfort et al. 2001; Valle 1999; Wildavsky 1998).

Cronbach's α is a coefficient of an instrument's internal consistency that measures whether several items that purport to measure the same concept produce similar scores and can be said to measure the same thing. This is particularly important where scores for items are combined to measure a whole and where an instrument uses Likert-type items (Yaffee 2003), as in the benchmark resilience tool. Cronbach's α is commonly used to validate survey instruments in scale development research (Gliem and Gliem 2003), postdisaster stress (Elklit et al. 2001; Joseph et al. 1993), medicine (Bland and Altman 1997), organizational failure (Gaskill et al. 1993), culture (Buchanan 1974), and crisis research (Leiser et al. 2010).

Appendix III shows the Cronbach's α coefficient of each indicator and of the survey instrument as a whole. All but one of the indicators achieved an α of 0.7 or greater, which suggests strong internal consistency (Hinkin 1998). This is a very good result, indicating the reliability of the tool and means that the items vary in relation to each other and all appear to be measuring the same concepts. However, the planning strategies indicator of the planning factor achieved an α of 0.677, which is just below the suggested level. Despite this, the planning strategies indicator has been retained within the model and the survey tool because the literature strongly suggests that planning plays a key role in organizations' crisis management (Hurley-Hanson 2006) and resilience (Carthey et al. 2001; Christopher and Peck 2004). In this instance, it is most likely that, although the items used to measure planning strategies constitute a unique indicator, the items are not as closely related (Bunderson et al. 2000). In future research, it will be important to try to strengthen this indicator and to investigate whether further items could increase its reliability. The strengths of the indicators and the instrument as a whole will also be significantly improved through examining the internal structure of the indicators and whether some are more influential on an organization's resilience than others. An understanding of the causal relationships, if any, between the indicators is critical to understand how resilience emerges and to further explore the business as usual benefits of resilience.

Conclusions

The ability of organizations to continue to operate and to provide goods, services, and employment is critical to the ability of communities to be resilient. Organizations are complex webs of people, places, and resources, and they must invest in their resilience. However, given the recurring financial crises and rapidly changing political and business environments, this presents a number of challenges. Challenges include the difficulty of understanding an organization's resilience before they are tested through crisis and gaps in understanding of the links between organizational resilience and business as usual profitability and competitiveness.

This paper developed a survey tool that organizations can use to measure their resilience. This provides organizations with information on their resilience strengths and weaknesses so that they can answer questions including how resilient are we, does our level of resilience meet our expectations and those of our stakeholders, and what could we do to improve? The new model of organizational resilience developed through this research operationalized resilience as a function of two factors: adaptive capacity and planning. Given this two-pronged approach, organizations can identify which approach they inherently favor and leverage those strengths while also addressing potential weaknesses.

The survey and the new model of organizational resilience are the first iteration, and more work is needed to develop a robust and inclusive tool. In particular, the planning strategies indicator should be strengthened, and the survey tool should be retested using a larger random or random stratified sample using confirmatory factor analysis. This will test whether the structure identified through the new model is unique to the Auckland sample or is applicable to organizations in general. New Zealand is also fortunate to have a very adaptive and positive culture; however, other cultures are more conservative, formal, and centralized. A cross-cultural study should be conducted so that we can better understand any possible cultural bias within the tool. In addition, an understanding of exactly how the indicators identified work together to produce resilience and whether some are more influential than others would greatly improve our understanding of the way resilience works. This could be achieved through regression and structural equation modeling.

Appendix I. Benchmark Resilience Items

The following tables show the items that were used to test and develop the benchmark resilience tool. The benchmark resilience questions are copyright of the Resilient Organisations Research Programme at the University of Canterbury in New Zealand and are used with permission. The questions are continually reviewed and updated as part of ongoing research; to access the current version, please go to www.resorgs.org.nz.

Resilience Measurement Questions: Resilience Ethos

Indicator	Item
Commitment to resilience	Our organization is focused on being able to respond to the unexpected.
	In our organization, there is an appropriate balance between short- and long-term priorities.[a]
	Our organization has a culture where it is important to make sure that we learn from our mistakes and problems.
Network perspective	Our organization actively participates in industry or sector groups.[a]
	Our organization is able to collaborate with others in our industry to manage unexpected challenges.
	Management sees our organization as having a leadership role in our industry.[a]

[a]Items dropped as a result of low factor loadings.

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Resilience Measurement Questions: Situation Awareness

Indicator	Item
Roles and responsibilities	Most people in our organization have a clear picture of what their role would be in a crisis.[a]
	Our organization is able to shift rapidly from business as usual mode to respond to crises.
	If key people were unavailable, there are always others who could fill their role.
Understanding and analysis of hazards and consequences	During an average day, people interact often enough to know what's going on in our organization.
	Managers actively listen for problems in our organization because it helps them to prepare a better response.
	Tick list format: Think of the highest risk facing your organization; which of the categories provided does it fit into? (please tick one): natural hazard, financial crisis, major accident or fire, pandemic, loss of critical services, e.g., electricity, reputation damage, fraud, regulatory issues, staffing issues, failure of a key supplier or customer, other.[a]
	Our organization fully understands the impact that this risk would have on us.[a]
	What would be the maximum amount of time that your organization could stop operating for and yet still be able to recover? (a range scored 1–6)[a]
Connectivity awareness	In our organization we are aware of how dependent the success of one area is on the success of another.
	Our organization has a good understanding of how quickly we would be affected if one of our larger customers or suppliers went out of business.[a]
	Our organization is conscious of how a crisis in our organization would impact other organizations.
Insurance awareness	If our organization was unable to operate for 3 months, I believe that our current level of insurance would safeguard the organization.[a]
	If our organization sustained significant physical damage, we would have sufficient funds to restart operations until our insurance claim was settled.[a]
Recovery priorities	Our organization has clearly defined priorities for what is important during and after a crisis.
	I believe that our organization's priorities for recovery from a crisis would be sufficient to provide direction for staff.
	Our organization understands the minimum level of resources it needs to operate successfully.
Internal and external situation monitoring and reporting	Whenever our organization suffers a close call we use it as a trigger for self evaluation rather than confirmation of our success.
	Our organization proactively monitors what is happening in its industry to have an early warning of emerging issues.
	Our organization is successful at learning lessons from past projects and making sure these lessons are carried through to future projects.
Informed decision making	Our organization is prepared to invest to ensure that decisions are made on the basis of the most up to date information.[a]
	In our organization, it is generally easy to obtain expert assistance when something comes up that we don't know how to handle.
	If something is not working well, I believe staff from any part of our organization would feel able to raise the issue with senior management.

[a]Items dropped as a result of low factor loadings.

Management of Keystone Vulnerabilities

Indicator	Item
Planning strategies	Given our level of importance to our stakeholders I believe that the way we plan for the unexpected is appropriate.
	Tick list format: Our organization prepares for crisis through (please tick one): planning, insurance, a combination of planning and insurance, don't know.[a]
	Tick list format: Our organization currently employs people in the following areas (tick all that apply): risk management, crisis management, emergency management, business continuity management.
	Tick list format: Does your organization have a formal written crisis/emergency or business continuity plan?: yes, no, don't know.
	Tick list format: Is your organization's formal written crisis/emergency or business continuity plan of a sufficient standard to be useful in an emergency?: yes, no, don't know.
	Tick list format: Has your organization done any formal planning for a specific hazard or risk? (please tick one): yes, no, don't know.
	Tick list format: Which of the following hazards or risks have your organization planned for? (tick all that apply): natural hazard, financial crisis, major accident or fire, pandemic, loss of critical services, e.g., electricity, reputation damage, fraud, regulatory issues, staffing issues, failure of a key supplier or customer, other.
	Tick list format: Has your organization done any planning for a possible flu pandemic?: yes, no, don't know.
	Tick list format: In response to the threat of flu pandemic, our organization has (please tick the option closest to the planning that your organization has completed): discussed how a flu pandemic would be managed with key staff, put formal plans in place to manage a flu pandemic if it happened, engaged in formal planning with other organizations to manage the impact of a flu pandemic on our sector.
Participation in exercises	Our organization understands that having a plan for emergencies is not enough and that the plan must be practiced and tested to be effective.
	People are generally able to take time off from their day-to-day roles to be involved in practicing how we respond in an emergency.
	I believe our organization invests sufficient resources in being ready to respond to an emergency of any kind.

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Capability and capacity of internal resources	I believe that our organization has sufficient internal resources to operate successfully during business-as-usual.
	During business as usual resources are managed so that we are always able to absorb a small amount of unexpected change.
	When a problem occurs in our organization, internal resources become more easily available at short notice and there is less red tape to deal with.
Capability and capacity of external resources	I am confident that our staff have enough contacts that we would be able to access external resources at short notice if we needed to.[a]
	Our organization has agreements with other organizations to provide resources in an emergency.
	Our organization has thought about and planned for support that it could provide to the community during an emergency.
Organizational connectivity	People in our organization actively manage areas of their work that rely on other organizations.[a]
	Our organization keeps in contact with organizations that it might have to work with in a crisis.
	Our organization understands how it is connected to other organizations in the same industry or location, and actively manages those links.
Robust processes for identifying and analyzing vulnerabilities	People in our organization understand how quickly we could be affected by unexpected and potentially negative events.
	People in our organization report significant mistakes even if others do not notice that a mistake is made.[a]
	People in our organization are always rewarded if they spot potential trouble spots.[a]
Staff engagement and involvement	People at all levels of the organization often think about what could go wrong so that they can create ways to manage those challenges.[a]
	Most people in our organization feel responsible for the organizations effectiveness.
	People in our organization typically own a problem until it is resolved.

[a]Items dropped as a result of low factor loadings.

Resilience Measurement Questions: Adaptive Capacity

Indicator	Item
Silo mentality	People are encouraged to move between different departments or try different roles within our organization to gain experience.
	There is an excellent sense of teamwork and camaraderie in our organization.
	In our organization, it is important that there are no barriers which stop us from working well with each other and with other organizations.
Communications and relationships	Our organization is regarded as an active participant in industry and sector groups.
	People in our organization work with whoever they need to work with to get the job done well, regardless of departmental or organizational boundaries.
	If our organization was unable to operate for 3 months, the relationship we have with our suppliers and customers would help us to recover rapidly.[a]
Strategic vision and outcome expectancy	Our organization has a vision or mission and it is formalized in a written statement.[a]
	When I read my organizations vision or mission statement I recognize it as reflecting the values that we aspire to.[a]
	In our organization we regularly take time from our day-to-day work to reevaluate what it is we are trying to achieve.
Information and knowledge	In our organization, it is a priority that people have the information and knowledge they need to respond to unexpected problems that arise.
	In our organization, if something out of the ordinary happens, people know who has the expertise to respond.
	In our organization, we make a conscious effort to ensure that critical information (e.g., staff contact details) is available in a number of different formats and locations.
Leadership, management, and governance structures	I am confident that management would provide good leadership if our organization was struck by a real crisis.
	I believe people would accept decisions made by management about how our organization should manage a crisis, even if they were developed with little consultation.
	Managers constantly monitor staff workloads and reduce them when they become excessive.
	Top management think and act strategically to ensure that our organization is always ahead of the curve.
	Top management in our organization are good examples of professionals that we can aspire to learn from.
Innovation and creativity	Our organization actively encourages people to challenge and develop themselves through their work.
	People in our organization are known for their ability to use their knowledge in novel ways.
	People in our organization are rewarded for thinking outside of the box.
Devolved and responsive decision making	Should problems occur, someone with the authority to act is always accessible to people on the front lines.
	When we need to, our organization can make tough decisions quickly.
	In this organization, the people most qualified to make decisions make them regardless or seniority.

[a]Items dropped as a result of low factor loadings.

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Reflective Business Performance Questions

Organization type	Indicator	Item
All	External directors	Tick list format: Does your organization have external directors/ trustees on its governing board?: yes, no, don't know.
	Number of staff	Tick list format: How many full time people work for your organization? (please tick one): 1–5, 6–10, 11–50, 51–250, 251–500, 501–2,000, 2,001+.
	Locations	Open format: How many locations or sites does your organization have?
	Staff turnover	Tick list format: What is your organization's average annual staff turnover over the last 5 years?: 0–5%, 6–10%, 11–20%, 21–40%, 41%+.
	Backup IT	Tick list format: Does your organization have backup IT facilities?: yes, no, don't know
	Relocation	If your building or work area was inaccessible because of a physical damage or a hazard, where would you relocate to? (please tick one): A temporary building or office that we would arrange when needed, a temporary building or office that we have already arranged, we have plans (that have already been tested) for our staff to work from home, we would arrange for our staff to work from home, although we have not planned or practiced this, we would not relocate, don't know, other (please specify).
	Cash flow	Tick list format: How would you rate your organization's cash flow?: excellent, good, satisfactory, poor, very poor, don't know.
	Staff satisfaction	Tick list format: Has your organization used a staff satisfaction survey or assessment in the last 2 years?: yes, no Open format: Please describe your score from the most recent staff satisfaction survey that your organization took part in.
	Skip logic question: for-profit/not-for-profit organizations were separated from this point	Tick list format: Which of the following best describes your organization?: for profit, not for profit.
For profit	Sales growth rate	Tick list format: What is your organization's average annual sales growth rate over the last 5 years? For each year, this is calculated as your organization's annual increase in sales divided by the previous year's sales: less than 0%, 1–10%, 11–30%, 31–100%, 101%+, don't know.
	Profit to sales ratio	Tick list format: What is your organization's average annual profit to sales ratio over the last 5 years? For each year, this is calculated as your organization's net profit before tax divided by the total sales: less than 0%, 0–5%, 6–10%, 11–20%, 21%+, don't know.
	Return on investment	Tick List Format: What is your organization's average annual return on investment (ROI) over the last 5 years? For each year, this is calculated as your organization's profit after tax, divided by its assets minus its liabilities: less than 0, 0–5, 6–10, 11–20, 21+, don't know.
	Debt	Tick list format: What is your organization's debt-to-equity ratio? This is calculated by dividing your organization's total debt by its stockholders' equity: 0–0.4, 0.5–0.9, 1–1.4, 1.5–1.9, 2–2.4, 2.5–2.9, 3–3.4, don't know (if don't know, then subjective debt question is shown).
	Subjective debt	Tick list format: How do you feel about your organization's level of debt?: very positive, positive, negative, very negative.
Not for profit	Income budget increase	Tick list format: By how much, on average, has your organization's income budget increased each year, over the last 5 years?: less than 0%, 1–10%, 11–30%, 31–100%, 101%+, don't know.
	Operating surplus	Tick list format: What is your organization's average operating surplus as a percentage of its total income over the last 5 years?: 0–5%, 6–10%, 11–20%, 21–40%, 41%+, don't know.

Note: Only one senior manager from each organization was asked to complete the reflective questions.

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Appendix II. Rotated Factor Analysis Results

Items	Factors: 1 (adaptive capacity)	Factors: 2 (planning)
SA2.2	0.685	
AC1.2	0.676	
AC6.1	0.672	
AC6.3	0.662	
AC2.2	0.643	
AC5.4	0.635	
SA6.3	0.617	
AC1.3	0.616	
AC5.5	0.614	
AC7.1	0.601	
AC5.1	0.597	
AC5.3	0.589	
AC4.2	0.587	
AC5.2	0.583	
SA7.3	0.579	
AC6.2	0.575	
AC4.1	0.542	0.421
AC7.2	0.535	
RE1.3	0.532	
KV7.2	0.526	
AC7.3	0.524	
SA3.1	0.515	
SA6.2	0.498	
SA1.3	0.493	
SA2.1	0.489	
AC4.3	0.483	
AC3.3	0.483	
KV3.2	0.481	
KV7.3	0.456	
AC1.1	0.446	
KV3.1	0.436	
SA7.2	0.416	
KV3.3	0.415	
KV6.3		
RE1.2		
SA1.1		
KV7.1		

Appendix II. (*Continued.*)

Items	Factors: 1 (adaptive capacity)	Factors: 2 (planning)
KV5.1		
KV4.1		
SA3.2		
KV6.2		
SA2.3.1		
KV2.1		0.711
SA5.1		0.694
SA5.2		0.676
KV4.3		0.609
KV1.1		0.592
KV1.3		0.572
SA1.2		0.558
KV2.3		0.552
SA3.3		0.549
SA5.3		0.547
KV6.1		0.534
KV2.2		0.505
KV1.4.1		0.490
KV4.2		0.482
KV5.2		0.478
RE1.1		0.475
SA6.1		0.462
KV5.3		0.456
AC2.1		0.438
RE2.2		0.415
KV1.2		
SA7.1		
RE2.3		
AC3.1		
SA2.3.2		
AC3.2		
AC2.3		
RE2.1		
SA4.2		
SA2.4		
SA4.1		

Note: Items shown with no factor loading achieved a factor loading of less than 0.4 and therefore were dropped from the analysis after further literature review.

Appendix III. Cronbach's α Coefficients for Each Indicator

Factor	Indicator	Cronbach's α	Cronbach's α based on standardized items	No of items
	Organizational resilience measurement tool	0.950	0.954	53
Adaptive capacity	Silo mentality	0.761	0.774	4
	Capability and capacity of internal resources	0.719	0.752	3
	Staff engagement and involvement	0.707	0.707	2
	Information and knowledge	0.749	0.754	5
	Leadership, management, and governance structures	0.832	0.831	6
	Innovation and creativity	0.724	0.733	3
	Devolved and responsive decision making	0.727	0.735	3
	Internal and external situation monitoring and reporting	0.821	0.824	7
	Overall adaptive capacity	0.945	0.907	33
Planning	Planning strategies	0.677	0.681	4
	Participation in exercises	0.791	0.794	3
	Proactive posture	0.703	0.705	5
	Capability and capacity of external resources	0.739	0.739	4
	Recovery priorities	0.819	0.817	4
	Overall planning	0.903	0.907	10

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