

Organizational Resilience

A summary of academic evidence, business insights and new thinking
by BSI and Cranfield School of Management

bsi.



Organizational Resilience

A summary of academic evidence, business insights and new thinking

Professor David Denyer

Cranfield School of Management

Cranfield University

To cite this report: Denyer, D. (2017). Organizational Resilience: A summary of academic evidence, business insights and new thinking. BSI and Cranfield School of Management.

Acknowledgements: Deepak Padaki, Elaine Dickson, Michael Wiedemann, Neil Pollock, Mark Stevens for supporting the case studies. Professor Kim Turnbull James, Professor Graham Braithwaite, Dr Colin Pilbeam, Dr Elmar Kutsch, Dr Joanne Murphy, John Merrell, Lester Coupland and Geraint Evans for intensive discussions and ideas that contributed to this report.

Enquiries should be sent to: organizational-resilience@bsigroup.com or david.denyer@cranfield.ac.uk

© BSI and Cranfield University 2017

First published 2017

Snapshot

BSI teamed up with Cranfield School of Management to pull together the best available research evidence on Organizational Resilience. The evidence assessment, covering 181 academic articles, was supplemented with five case studies.

The Organizational Resilience tension quadrant

- Organizational Resilience is the ability of an organization to anticipate, prepare for, respond and adapt to incremental change and sudden disruptions in order to survive and prosper.
- The thinking on Organizational Resilience has evolved over time and has been split by two core drivers: **defensive** (stopping bad things happen) and **progressive** (making good things happen), as well as a division between approaches that call for consistency and those that are based on flexibility.
- We identify four ways of thinking about Organizational Resilience: **preventative control** (defensive consistency), **mindful action** (defensive flexibility), **performance optimization** (progressive consistency) and **adaptive innovation** (progressive flexibility).

Organizational Resilience – finding fit, managing tensions and avoiding erosion

- **Fit:** Organizational Resilience needs to be fit for purpose. There is no single recipe and leaders need to find a balance between *preventative control*, *mindful action*, *performance optimization* and *adaptive innovation* that is appropriate to their mission and sector.
- **Tensions:** Leaders have to manage the tensions between the need to be both *defensive* AND *progressive* and also *consistent* AND *flexible*. Paradoxical thinking helps leaders shift beyond 'either/or' toward 'both/and' outcomes.
- **Erosion:** Organizational Resilience requires constant effort. If neglected, *preventative control*, *mindful action*, *performance optimization* and *adaptive innovation* will erode over time and can result in organizations sleepwalking into disaster.

Introducing the 4Sight methodology

- A new 4Sight methodology can help those in leadership roles throughout the organization introduce and sustain Organizational Resilience by developing four key practices: foresight, insight, oversight and hindsight.
- The 4Sight methodology complements the established Plan-Do-Check-Act (PDCA) methodology. Whilst PDCA provides consistency, 4Sight provides the flexibility to deal with the complex issues that abound in modern business.
- This report provides guidance on how these practices can be developed and illustrates how world-leading organizations have achieved Organizational Resilience.

“Organizational Resilience is the ability of an organization to anticipate, prepare for, respond and adapt to incremental change and sudden disruptions in order to survive and prosper”

Foreword

Howard Kerr, Chief Executive, BSI

In 2014, BSI produced guidance on anticipating, preparing for, responding and adapting to today's volatile business climate. It represents collective best practice thinking, created by industry for industry, the world's first standard on Organizational Resilience, BS 65000.

Little did we suspect how valuable such work would become to a global business community that continues to experience unprecedented economic and political uncertainty, and senior executives were keen for further detail on this subject.

We independently assessed their attitudes in 2015 with a global study of business leader opinion, which found that almost nine in ten saw resilience as a priority for their business, while eight in ten believed it to be indispensable for long-term growth.

This original study, carried out in partnership with the Economist Intelligence Unit, revealed that just a third of CEOs were confident their organization possessed the resilience to survive long term.

With this new report, we have commissioned one of the world's foremost management schools to address that capability gap, consolidating 50 years of management theory into a single report.

Striving for excellence requires business leaders to challenge complacency, promote vigilance and embrace the need for continual improvement. This report reveals that many organizations are instead sleepwalking to disaster through complacency of processes and practice.

This report highlights that 'waiting out a storm' is no longer an option. Rather, leaders must face the paradox of embracing risk if they are to succeed. Doing so requires them to prepare their businesses to react to threats as opportunities, adapting to survive and prosper.

For those of us at BSI, this is the true meaning of Organizational Resilience. That a resilient organization is one that not merely survives over the long term, but flourishes. We believe that mastering Organizational Resilience offers the best opportunity to pass the test of time, unlocking future prosperity and securing longevity. Those that learn to spring forward and not back, reap dividends for their company, employees, investors, customers and society in general.

My hope is that this paper provides leaders with the insight to recognize the need to lead their organization in taking measured risks and in doing so master Organizational Resilience.

Howard Kerr, 2017

“Nine in ten saw resilience as a priority for their business, while eight in ten believed it to be indispensable for long-term growth.”

Contents

Introduction	8
The evolution of thinking on Organizational Resilience	9
The Organizational Resilience ‘Tension Quadrant’	10
Preventative Control	
Mindful Action	
Performance Optimization	
Adaptive Innovation	
Organizational Resilience – finding fit, managing tensions and avoiding erosion	16
Finding Fit	
Managing Tensions	
Avoiding Erosion	
Introducing the 4Sight methodology	20
Foresight	
Insight	
Oversight	
Hindsight	
Combining PDCA and 4Sight	23
Conclusion	25
Appendix 1: Approach	26
Appendix 2: Case studies	27
Infosys (India)	
Baiada (Australia)	
NxtraData (India)	
SAP (Germany)	
Ciena (USA)	
References	43
Appendix 3: Tables of the articles included in the rapid evidence assessment	46

Introduction

Why are some organizations more successful in coping with, and responding to, the complexity, volatility and uncertainty of the current business environment? Why do some organizations facing adversity focus on the negative, whilst others successfully seize the opportunity to adapt and change? As a leader, what more could you do to ensure Organizational Resilience for your business?

This report provides insight into how organizations can “anticipate, prepare for, respond and adapt to incremental change and sudden disruptions in order to survive and prosper” (BS 65000, BSI, 2014). Understanding the dynamics of resilience has assumed greater urgency in the face of challenges such as natural disasters, terrorism, economic recession, mass migration, cyber threats, long-term healthcare issues such as obesity, and a host of other socio-political and economic trends. New technologies, such as integrated systems with artificial intelligence, the ‘Internet of Things’, and the ‘circular economy’ also present both new opportunities and potential threats. In addition, many industries have become globalized, with the progressive international dispersion of their products and services, and the disaggregation of their supply chains, making it increasingly difficult to ensure that quality, safety, and labour standards are maintained. In response to these challenges, business leaders are increasingly aware that Organizational Resilience will help them grow their businesses and protect their continuing performance.

“Senior executives need to both ‘insure’ against bad events, while at the same time adapt and change before the cost of not doing so becomes too great”

Resilience is required for businesses to respond to disruptions as well as positively adapt in the face of challenging conditions, leveraging opportunities and delivering sustainable performance improvement. Simply put, senior executives need to both ‘insure’ against bad events (Stephenson, 2010), while at the same time adapt and change before the cost of not doing so becomes too great. Identifying best practice in Organizational Resilience is a significant challenge, not least because of the conflicting guidance found across a variety of information sources. To address this issue, BSI teamed up with Cranfield School of Management to assemble the best available research on Organizational Resilience and to explore how it has evolved as a principle, and to better understand the best practice of world-leading firms.

Our approach (see Appendix 1) included a rapid evidence assessment (REA), which identified 181 academic studies, as well as a wealth of books and reports on Organizational Resilience. We supplemented the REA with case studies of organizations that had been identified as exhibiting best practice in Organizational Resilience:

- **Infosys** (India)
- **Baiada** (Australia)
- **NxtraData** (India)
- **SAP** (Germany)
- **Ciena** (USA)

The evolution of thinking on Organizational Resilience

Research and thought leadership on Organizational Resilience has developed over the last 40 years in several different fields (see Figure 1). We identify five distinct phases, with five contrasting perspectives. A defensive perspective that focused on loss avoidance and value preservation drove the first two phases:

- 1. Preventative control.** Organizational Resilience is achieved by means of risk management, physical barriers, redundancy (spare capacity), systems back-ups and standardized procedures, which protect the organization from threats and allow it to 'bounce back' from disruptions to restore a stable state. i.e. defensive + consistent.
- 2. Mindful action.** Organizational Resilience is produced by people, who notice and react to threats and respond effectively to unfamiliar or challenging situations. i.e. defensive + flexible.

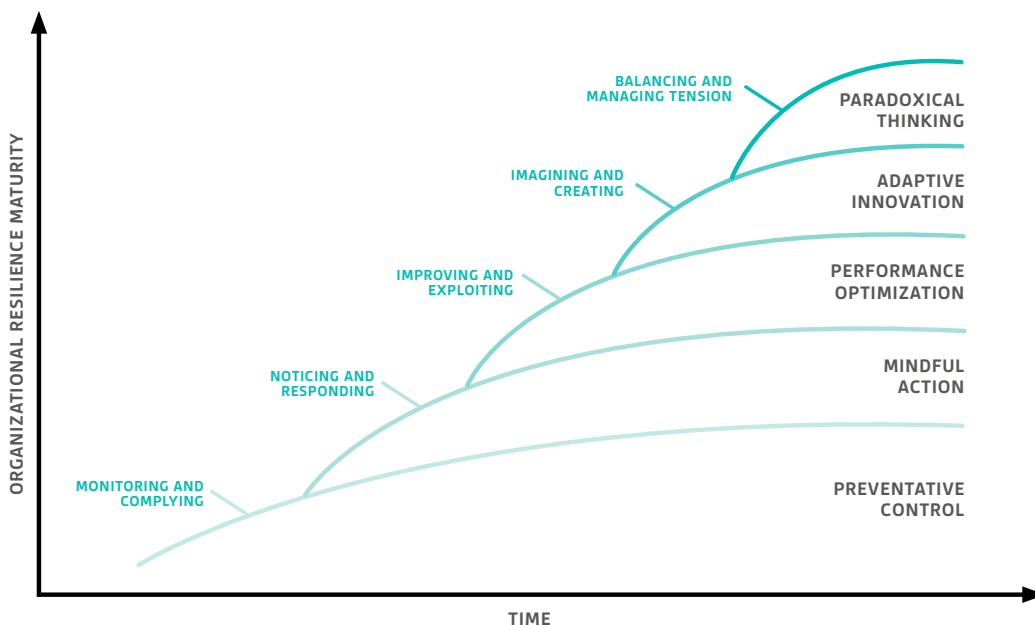


Figure 1: The evolution of Organizational Resilience thinking over time

It soon became recognized that Organizational Resilience was not only about learning to bounce back (Wildavsky, 1988), but also the ability to 'bounce forward' (Manyena, O'Brien, O'Keefe and Rose, 2011) to grow and prosper in the future (Reich, 2006). Again, there were two further phases and perspectives on how this could be achieved:

- 3. Performance optimization.** Organizational Resilience is formed by continually improving, refining and extending existing competencies, enhancing ways of working and exploiting current technologies to serve present customers and markets i.e. **progressive + consistent**.
- 4. Adaptive innovation.** Organizational Resilience is created through creating, inventing and exploring unknown markets and new technologies. Organizations can be the disruption in their environment i.e. **progressive + flexible**.

The Organizational Resilience ‘Tension Quadrant’

5. Thinking on Organizational Resilience has been split between behaviours that are **defensive** (stopping bad things happen) and those that are **progressive** (making good things happen), as well as between behaviours that are **consistent** and those that are **flexible**. These four viewpoints form an integral part of a framework, which we have termed the Organizational Resilience ‘Tension Quadrant’ (Figure 2).

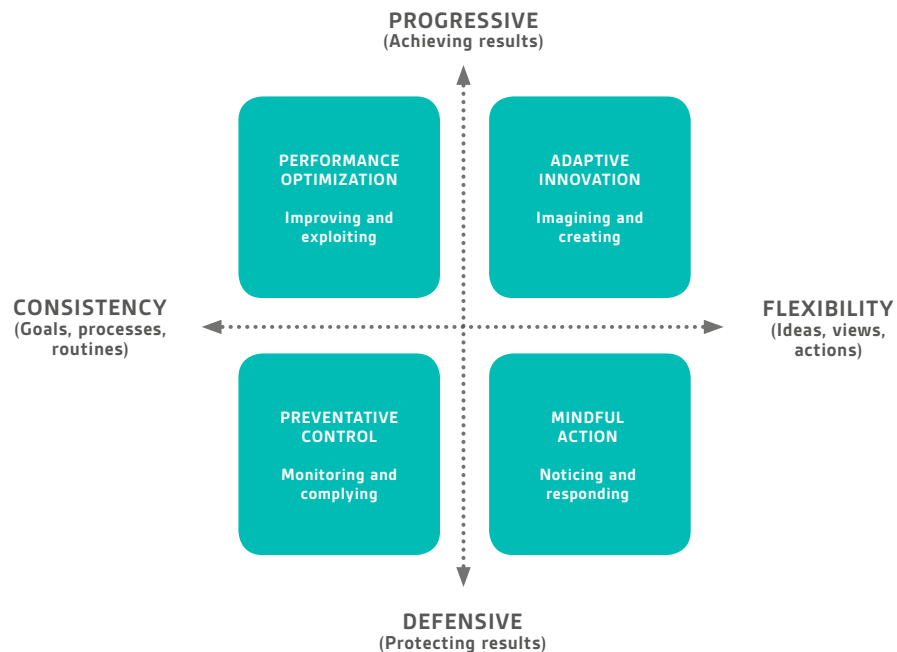


Figure 2: The Organizational Resilience ‘Tension Quadrant’

The differences between these perspectives and behaviours have been the source of much disagreement and misunderstanding. It is hardly surprising that leaders seeking to enhance Organizational Resilience receive conflicting guidance. More recently, a new, fifth strand of thinking on Organizational Resilience has emerged that integrates, balances and seeks fit (fitness for purpose). Put simply, senior leaders must manage the tensions between the four approaches if organizations are to be truly resilient – and this requires paradoxical thinking.

6. Paradoxical thinking. Organizational Resilience is achieved by balancing preventative control, mindful action, performance optimization and adaptive innovation, and managing the tensions inherent in these distinct perspectives.

The different perspectives and behaviours are discussed in more detail in the following sections.

Preventative control: defensive and consistent

Society expects organizations and critical infrastructures to be safe, secure and dependable, and that industry, government, regulators and service-deliverers have appropriate and continually improving capabilities to ensure this. Major disruptive events rarely occur spontaneously (Perrow, 1984). Small problems and errors, which



Key learning point:

There are two core drivers of Organizational Resilience – defensive and progressive – and there are two core perspectives on how resilience can be achieved – consistency and flexibility. Where these have not yet been integrated into a holistic framework, integration, balance and fit (for purpose) are essential. This requires paradoxical thinking.

are not rectified at source, can cascade into more significant events. As damage propagates, it may induce component failure and eventually system failure (Perrow, 1984). Regulating the system involves protecting it from threat by promoting constancy and predictability. The ultimate goal of regulation is to produce fail-safe system designs. Defences, barriers, safeguards and back-ups occupy a key position in this approach. Systems have multiple defensive layers: some are engineered, others rely on people, and yet others depend on procedures and administrative controls (Reason, 1990; 2000). Many companies have instigated performance improvement programmes that focused on conformity to industry standards, equipment design and maintenance and inspection. Reliability engineering and management have been used to design 'demonstrably resilient' systems. The focus has been on excellence in operating procedures, certification and competence and the assessment and management of risk. "A resilient organization must manage its information – physical, digital and intellectual property – throughout its lifecycle, from source to destruction" (BSI, 2014). To safeguard sensitive information, mechanisms must also be in place to safeguard a company's data and protect the company against unauthorized and unintended uses of the IS/IT systems (Ignatiadis and Nandhakumar, 2007)¹. See the Infosys, NxtraData, SAP and Ciena case studies for examples of how such 'Information Resilience' can be achieved (Appendix 2).

Resilient organizations take precautionary measures in the face of potential problems. These actions include arrangements such as business continuity plans and training for emergency responses. See the Baiada case study for examples of such action (Appendix 2). Studies of ecological challenges (Holling, 1973) have emphasized the need for organizations not only to guard against failure but also to absorb and recover from the disruptions (Timmerman, 1981). In one of the earliest studies of Organizational Resilience, Meyer (1982) studied how hospitals responded to an unexpected doctors' strike and used the term 'resiliency' (p520) to refer to an organization's ability to respond to the disruption and restore prior order. From this perspective, Organizational Resilience is the "intrinsic ability of an organization (system) to maintain or regain a dynamically stable state, which allows it to continue operations after a major mishap and/or in the presence of a continuous stress" (Woods and Hollnagel, 2006).

Research suggests that resilient organizations deploy rather than restrict resources when facing threat. For example, Gittell, Cameron, Lim and Rivas (2006) found that firms which engaged in layoffs as a response to the terrorist attacks of September 11, 2001 compromised their established relationships with suppliers and customers and were less able to regain profitability. The organizations that laid off employees also compromised their ability to respond effectively to subsequent disruptions. This study found that firms with the greatest financial reserves, and that had avoided high levels of debt (e.g. Southwest Airlines) prior to the event, were able to return to and surpass previous levels of performance without resorting to layoffs.

Reserve capacity (slack resources) allows systems to cope with unexpected circumstances (Rochlin, LaPorte and Roberts, 1987; Leveson, Dulac, Marais and Carroll, 2009). Time is also regarded as an important resource and slack is added to the decision-making process, enabling actors to assess the effects of their decisions first, without affecting the overall system (Lawson, 2001). Organizations need a viable

"A resilient organization must manage its information – physical, digital and intellectual property – throughout its lifecycle, from source to destruction"

1. It should be noted that IT/IS is rarely mentioned in the literature on Organizational Resilience. There is, however, a growing literature on cyber security and the importance of this threat should be appreciated.

business model that allows financial reserves (or slack resources) to be built up, so that these resources can be used to provide a strong commitment to employees during times of crises, and sustain relationships that act as enabling conditions for organizations to return quickly to full performance (Gittell et al., 2006).

In the last decade the requirement to respond to external threats has extended into supply chain disruption research (Chopra and Sodhi, 2004; Kleindorfer and Saad, 2005; Craighead, Blackhurst, Rungtusanatham and Handfield, 2007; Stecke and Kumar, 2009). Interdependencies that exist in the supply network (Rice and Caniato, 2003), the reliance on critical nodes (Craighead et al., 2007) and the pursuit of efficiency gain and over-optimization have resulted in networks that are often extremely fragile and vulnerable to disruptions (Hendricks and Singhal, 2003; Christopher and Peck, 2004; Tang, 2006). In contrast, resilient supply chains² are flexible and agile and contain redundancy through modular design and diversification (Rice and Caniato, 2003; Christopher and Peck, 2004; Sheffi and Rice, 2005; Sheffi, 2007). Juettner and Maklan (2011) examined supply chain resilience in the global financial crisis and concluded that four resilience capabilities (flexibility, reaction speed/velocity, access to timely information, and collaborations among supply chain members) can avoid or limit the impacts of adverse events on revenue, cost and lead time/availability targets.



Key learning point:

Organizational Resilience requires control (multiple independent, and redundant, layers of protection for all critical assets e.g. people, product, property, information etc.) and compliance (standard operating procedures, processes and training).

Preventative control: at its best and signs of weakness

At its best	Signs of weakness
Known problems are solved using proven techniques	Systems and people are impractical and rigid – ‘go by the book’
Standard ways to do things are perfected by fine tuning	Local practice has taken over from written procedure and has become ‘normal’
Redundancy through design and diversification has a stabilising effect	Inefficient and complex systems and processes; analysis paralysis
Disturbances are quickly counteracted by planned responses	Prearranged corrective actions are unclear or impracticable

Mindful action: defensive and flexible

To be resilient is to be prepared for adversity, which requires “improvement in overall capability, i.e. a generalized capacity to investigate, to learn, and to act, without knowing in advance what one will be called to act upon” (Wildavsky, 1988). Rather than relying on static controls and reactive responses, Organizational Resilience also requires resources that can be activated, combined, and recombined in new situations, as challenges arise (Sutcliffe and Vogus, 2003). An important contribution of this stream of work is that people are not regarded purely as sources of error, but provide a positive contribution towards resilience (Hollnagel, Woods and Leveson, 2006). For example, it has been suggested that the operator’s role is to make up for holes in the designer’s work (Rasmussen, 1986). Thus, the focus of resilience thinking shifted to the need for a culture that facilitated noticing and containing problems (Sutcliffe and Vogus, 2003).

Some organizations, despite operating in complex and dynamic environments, face many opportunities for failure in their daily operations but almost never experience

2. It should be noted that the supply chain disruption literature is extensive. An ongoing systematic review conducted by colleagues at Cranfield School of Management Anurag Tewari identified 118 academic studies.

an operating failure or disruption. Management experts have labelled these ‘high reliability organizations’ (HROs). HROs have been urged to include organizations such as some nuclear facilities, nuclear aircraft carriers, oil and gas companies, commercial airlines and more latterly some hospitals, schools and public utilities (La Porte, 1996; La Porte and Consolini, 1991; Weick and Roberts, 1993; Weick, Sutcliffe and Obstfeld, 2005). The HRO literature draws attention to the teamworking and cognitive processes that contribute to the avoidance, trapping or mitigation of incidents (Weick et al., 1993; Weick et al., 2005; Weick and Sutcliffe, 2007).

A central feature of high reliability organizations is the idea of mindful organizing, which is considered to involve five interrelated mechanisms:

- 1. Preoccupation with failure:** HROs prioritize reliability (Leveson et al., 2009) and are said to have “healthy uneasiness” about what might go wrong, which enables them to remain sensitive to all possible threats (Hollnagel et al., 2006; Weick and Sutcliffe, 2007).
- 2. Reluctance to simplify interpretations:** HROs make deliberate attempts to create a very complete picture of the work and the work environment, as well as encouraging diversity of opinion, so that teams can express different ideas. Alternative voices and perspectives are encouraged; they search for disconfirming evidence and challenge the assumptions people are making.
- 3. Sensitivity to operations:** Leaders and staff in HROs are constantly aware of how their decisions and actions affect the organization (Weick and Sutcliffe, 2007). It also involves closing loopholes in processes and maintaining situational awareness (Klein, 2008).
- 4. Commitment to resilience:** There is a recognition that things will go wrong that can’t be predicted, but they can be identified and responded to quickly to minimize the harm.
- 5. Deference to expertise:** (Weick and Sutcliffe, 2007). HROs exhibit an adaptive, flexible or ‘organic’ nature (Weick et al., 2005), which enables them to be hierarchical and rule-based during normal operations but decentralized and responsive in high tempo and emergency modes (Weick and Roberts, 1993; Leveson et al., 2009). This means recognizing that those closest to the frontline are the experts and empowering them to make decisions when a critical issue arises, resulting in quicker mitigation of harm. In HROs, senior leaders conduct frequent walk-rounds to reinforce expected behaviours and to help find and fix critical issues. HROs have daily operational briefs where they look back to learn from problems and look forward to predict and lessen risk or harm, thereby maximizing the learning from incidents and near misses (Leveson et al., 2009).

Alternative voices and perspectives are encouraged; they search for disconfirming evidence and challenge the assumptions people are making.

Individual training, experience, and the development of specialized knowledge enhance Organizational Resilience (Coutu, 2002). Organizational Resilience is improved when employees possess psychological capital consisting of four synergistic factors: self-efficacy, optimism, hope and resiliency (Sutcliffe and Vogus, 2003; Youssef, Luthans and Youssef, 2007). As individuals gain control over key task behaviours and exercise discretion in performing those actions, they develop a sense of efficacy and competence (Sutcliffe and Vogus, 2003). As a sense of competence increases, individuals are better able to respond effectively in unfamiliar or challenging situations and persevere in the face of failures and challenges (Masten and Reed, 2002). These people can “respond quickly and

effectively to change while enduring minimal stress” (Mallak, 1998) and “rebound from adversity strengthened and more resourceful”. When employees have experiences that add to their growth, competence/expertize, and efficacy they are more likely to exercise behaviours such as judgement, discretion and imagination (Luthar, Cicchetti and Becker, 2000), which enhances their ability to cope with unfamiliar events.



Key learning point:

Organizational Resilience requires proactive management and a culture that is focused on noticing and responding to threats and opportunities.

Mindful action: at its best and signs of weakness

At its best	Signs of weakness
People are wary about what could go wrong	People being too certain about how things are
Opportunities and problems are noticed, understood and addressed quickly	Signs of problems are missed; people who raise issues are ignored; people don't report errors
People exercise judgement, discretion, and imagination when faced with challenges	People diffuse responsibility for resolving problems and defer decision making and action to others
People are empowered to act when they recognize a problem	People are blamed quickly if they make errors or fail to follow procedures

Performance optimization: progressive and consistent

Driven by globalization, the need for downward pressure on costs and the aim of improvements in shareholder value, many organizations have focused on the need to plan, organize for and realize efficiency gain and increase productivity (Judge, Piccolo and Ilies, 2004). Performance optimization involves learning to do existing things better, delivering goals and meeting the needs of the public, the media, regulators and the government, who all demand that products and services be delivered that ‘work right this time, next time and every time’. Typically, optimizing involves process enhancement, including the refinement, extension and exploitation of existing assets and competencies, technologies, and paradigms (March, 1991). For an organization this means “identifying operational improvements across its products/services and processes in order to meet the needs of its customers over time, through to how it governs itself” (BSI, 2014).

Optimization often involves formalized structures for authority and decision-making, a focus on internal integration through planning and coordination of operations, resource allocation and structuring of tasks (Marion and Uhl-Bien, 2002; Uhl-Bien, Marion, and McKelvey, 2007; 2008). Leadership is a critical aspect of optimization, often achieved by helping followers understand role and task requirements (Bass, 1985), providing answers (Grint, 2005) (Osborn and Hunt, 2007), creating and using rewards as reinforcement and intervening when best practice is not met (Burns, 1978). When **change occurs** it is often controlled and planned, involving sequential steps (Kotter, 1996) for altering organizational and individual behaviour. Leadership can shield people from threat, keep order and reduce conflict (Grint, 2005). Building consensus and commitment is critical for eliminating discord and misunderstanding. Just as manufacturers routinely target zero defects, resilient organizations should aim for ‘zero trauma’ (Hamel and Valikangas, 2003). In a resilient organization following an optimization agenda change happens “with no calamitous surprises, no convulsive reorganizations, no colossal write-offs and no indiscriminate, across-the-board layoffs” (Hamel and Valikangas, 2003).

Performance optimization: at its best and signs of weakness

At its best	Signs of weakness
Performance improvement – ‘do what we do better’	Lack of novel ideas on how to ‘do better things’
Known solutions are implemented quickly – even by edict	Overconfidence in “best” practice; viewpoints of non-experts are excluded;
A clear sense of direction, goals, roles and responsibilities	People’s individual identities and motives are at odds with the organizational goals
A strong individual leader who people can relate to	Lack of leadership at all levels; lack of devolved ownership and responsibility



Key learning point:

Organizational Resilience involves the improvement, refinement, extension and exploitation of existing assets and competencies, technologies, and paradigms

Adaptive innovation: progressive and flexible

“It is not the most intellectual of the species that survives; it is not the strongest that survives; but the species that survives is the one that is able to adapt to and to adjust best to the changing environment in which it finds itself” (Megginson, 1964).

The famous quote, often attributed to Charles Darwin, highlights the importance of adaptation. In today’s business environment the rapid production of knowledge and innovation is critical to organizational survival (Uhl Bien et al., 2008). Innovation involves creative problem-solving, innovation and learning, which have become critical to competitive advantage (Santos and Eisenhardt, 1989). In response to these challenges, organizations can no longer engage in technical change by applying known solutions and current know-how that can be implemented by experts, rather they need to engage in adaptive change that “requires going beyond any authoritative expertise to mobilize discovery, shedding certain entrenched ways, tolerating losses and generating the new capacity to thrive anew” (Heifetz, 1994; Heifetz and Laurie, 1997; Heifetz and Linsky, 2002). This requires experiments, new discoveries and invention from numerous places in the organization or community.

A fundamental premise of innovation is that the future is not an extrapolation of the past. There are different pathways, differing start points and differing trajectories. Responsiveness involves systems thinking, looking for patterns and connections, examining knock-on effects and shifting the focus between individual parts of the system and the system as a whole. Leadership is required to help identify the adaptive challenge (Heifetz, 1994; Plowman, Silansky, Beck, Baker, Kulkarni and Travis., 2007) but also to disrupt conventional thinking about solutions by challenging the commonly accepted understanding of the underlying problem. To stop people becoming complacent leadership may be required to conflict, create controversy and foster discomfort (Lichtenstein and Plowman, 2009; Heifetz, 1994). Leadership can also help to create an atmosphere that tolerates dissent and divergent perspectives on problems (Heifetz and Laurie, 1997; Uhl-Bien et al., 2007). Innovation requires people to experience and observe the situation from multiple viewpoints, listen to dissident voices and encourage divergent perspectives on problems (Heifetz and Laurie, 1997).



Key learning point:

Organizational Resilience involves changing before the cost of not changing becomes too great. This requires learning to do new things by changing underlying values and assumptions, creative problem solving, innovation and learning.

Adaptive innovation: at its best and signs of weakness

At its best	Signs of weakness
Productive tension disrupts existing patterns and generates a search for new possibilities	Entrenched thinking; People often resist even acknowledging adaptive challenges
Creative thinking and problem solving by people drawing on multiple perspectives and taking risks in a safe environment	Lack of diversity of people and outlooks; nonconforming voices are ignored; people are too frightened to try something new
Collective strategic action with rich interactions coalition formation, negotiation and compromise	Silos; people refer to “them” and “us”; resources or ideas aren’t shared
Systems-wide changes across borders and boundaries; multidimensional and fundamental changes	Quick fixes; local changes; reinventing the wheel; change is resource intensive and slow - the search for solutions goes on

Organizational Resilience – finding fit, managing tensions and avoiding erosion

Senior leaders need to manage the tensions between these four approaches if organizations are to be truly resilient. We suggest that the shape of the Organizational Resilience Tension Quadrant (Figure 3) will depend on the nature of organization, its operations, and the industry, particularly level of uncertainty and industry clock speed (rate of technological, regulatory and market change). We tend to find, for example, that organizations with high potential for accidents, such as energy production, transport, mining, and construction, are often weighted toward the preventative control (defensive consistent) quadrant. It should be noted that a preoccupation with one particular dimension could create blind spots that can impair Organizational Resilience.

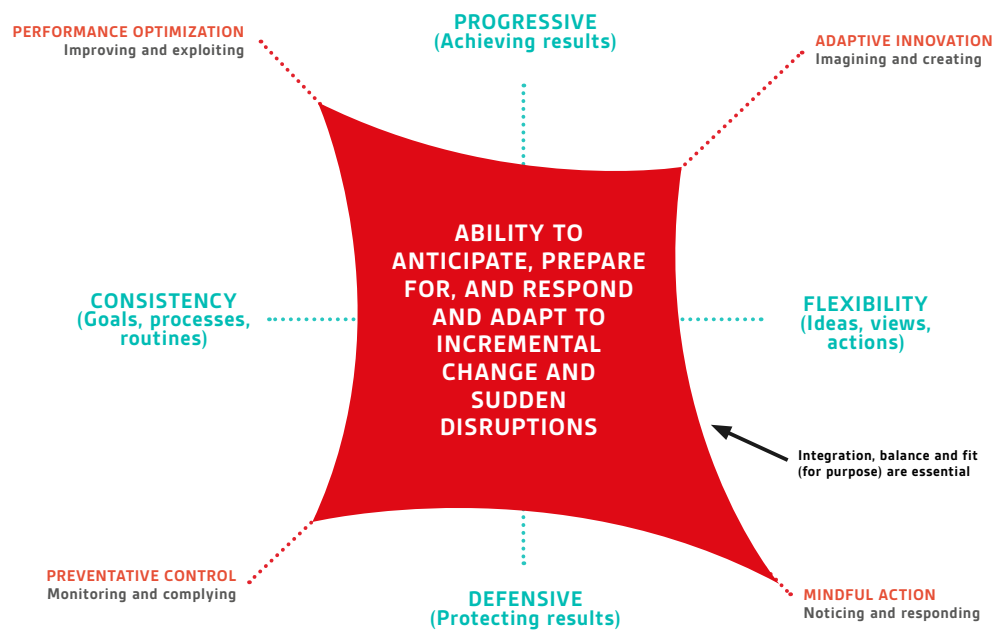


Figure 3: Organizational Resilience Tension Quadrant: blending defensive and progressive thinking

Managing tensions

Leaders need to manage the tensions between defensive and progressive views of Organizational Resilience. This has also been termed a tension between production and prevention (Reason, 1990; Leveson et al., 2009), or thoroughness and efficiency (Woods and Hollnagel, 2006). An overemphasis on the defensive agenda impedes resilience because the organization becomes inflexible and unproductive. An overemphasis on the progressive agenda impedes Organizational Resilience because a unitary emphasis on achieving more from less can result in excessive cost cutting. Resilient organizations are said to be both “highly adaptable to external market shifts” yet also “focused on and aligned behind a coherent business strategy” (Neilson, Pasternack and Van Nuys, 2005).

Senior leaders also need to manage the tension between consistency and flexibility. This has been expressed variously in studies as exploitation or exploration (March, 1991), administration or adaptation (Uhl-Bien et al., 2007) predictability or possibility (Holling, 1973), controlling risk or taking risk, compliance or judgement (Woods and Hollnagel, 2006), unity or diversity (Hamel and Valikangas, 2003).

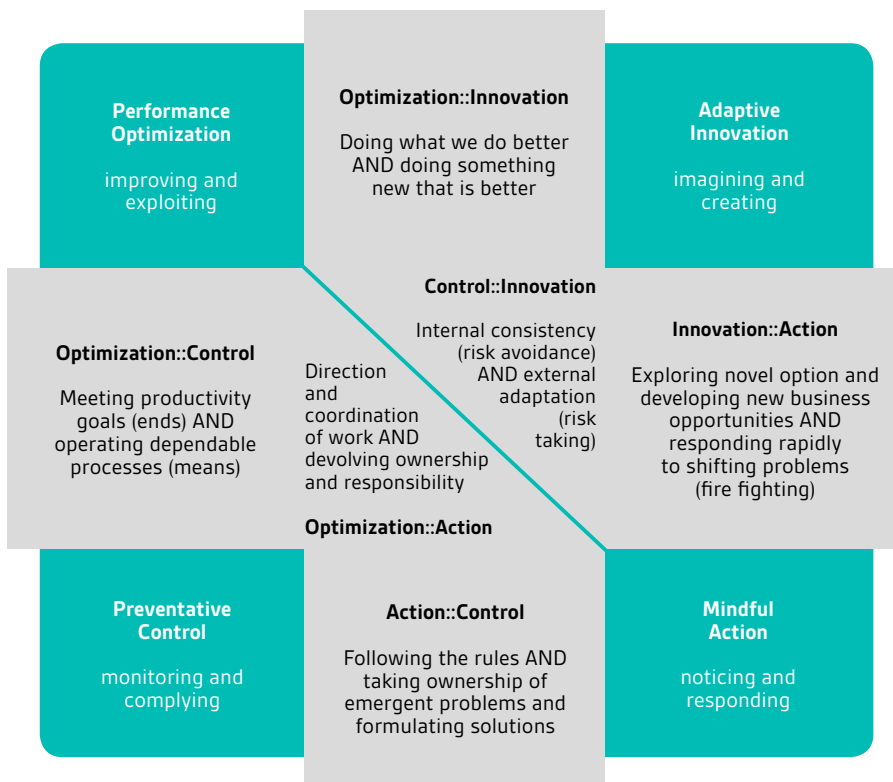


Figure 4: Managing the Organizational Resilience Tensions

These tensions (see Figure 4) are often seen as separate opposites (Lewis and Smith, 2014), with an ‘either/or’ choice. However, accepting and engaging with these tensions enables people to live and thrive with paradox (Lewis and Smith, 2014). Tensions can create conflicts and inconsistencies that motivate a search for new possibilities (Festinger, 1957) and can inspire learning, discovery, and creativity. Building on the idea of hybridity, the term ‘ambidextrous’ suggests “firms needed to shift structures to initiate and, in turn, execute innovation”. (Duncan, 1976). Tushman and O’Reilly (2007) identify three ambidexterity mechanisms: ‘sequential’ i.e. changing structures over time, ‘simultaneous or structural’, i.e. separate groups



Key learning point:

Organizational Resilience requires preventative control, mindful action, performance optimization and adaptive innovation. Paradoxical thinking helps leaders shift beyond 'either/or' towards 'both/and' outcomes.

within the organization for the two separate strategies, and thirdly 'contextual' i.e. people make their own judgements about how to divide their time between conflicting demands for alignment and adaptability (Gibson and Birkinshaw, 2004). Contextual ambidexterity is achieved when people feel discipline, stretch, support, and trust (Ghoshal and Bartlett, 1994). Leadership can exacerbate or ameliorate the tensions in Organizational Resilience (Uhl-Bien, Marion and McKelvey, 2007). Effective leadership can enable "reinforcing, virtuous cycles" (Lewis and Smith, 2014). Leveraging these tensions by employing 'both/and' thinking (Farjoun, 2010) is a critical aspect of Organizational Resilience.

Avoiding erosion

Numerous high profile failures in retail, manufacturing, energy production, healthcare, public services and banking and other sectors have shown that failures tend to occur when preventative control, mindful action, performance optimization and adaptive innovation are eroded over time. Figure 5 shows the typical pattern of a failure.

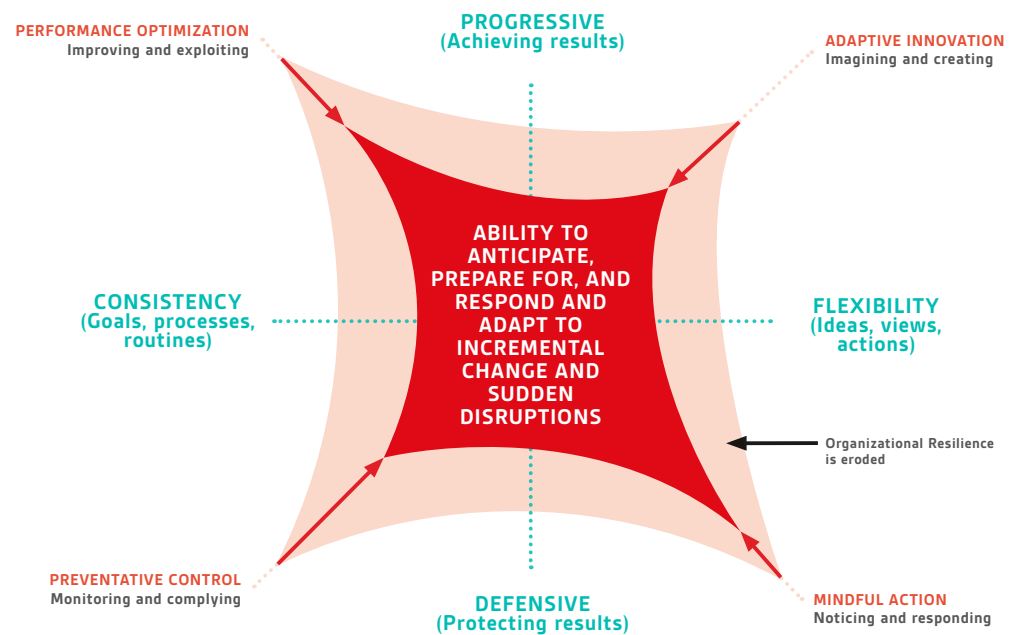


Figure 5: The erosion of Organizational Resilience: sleepwalking into disaster

Performance optimization is eroded when organizations enjoy a long period of success resulting in the dismissal of the possibility of future failure (Hollnagel et al., 2006). A singular focus on short-term productivity gain has also proved detrimental to medium-term mission and sustainable performance as the primary goal. Over time organizations create the illusion that "failure can't happen here" (Woods and Cook, 2002).

Adaptive innovation is inhibited when the organization feels the threat of impending crisis. Organizations tend to control expenditure and resources and focus on the one thing they do well (e.g. their core product or service), known as a threat-rigidity effect (Staw, Sanderlands and Dutton, 1981). By implication, the range of options open to the organization narrows and it becomes progressively more difficult to

reverse decisions, and the organization can become 'path dependent' getting locked, it loses its capability to adopt better alternatives (Sydow, Schreyogg and Koch, 2009).

Preventative control is diminished over time. Reason (1990) argued that each defensive layer is like a slice of Swiss cheese, having many holes. The holes in the defences arise because of latent problems (Reason, 1990), such as defective maintenance, poor training, when local practice takes over from written procedure (Snook, 2000) and 'deviant acts' become normalized (Vaughan, 1996). When the holes in many layers momentarily line up, an incident can occur.

Mindful action is weakened when organizations stop investing in the competence of their people, maintaining efficacy and encouraging growth (Sutcliffe and Vogus, 2003), as well as the structures and practices people become inattentive (Simons and Chabris, 1999), become mindless (Langer, 1989) and lose situational awareness (Klein, 2008). In hierarchical organizations those with expertise who are closest to the problem are not empowered to act (Weick and Sutcliff, 2007) and people diffuse responsibility for taking action (Latané and Darley, 1970).

Organizational Resilience can be undermined as these factors can combine to create blind drift and organizations can sleepwalk into disaster. Once failure does occur most organizations respond by bolstering preventative control by adding new safeguards, reinforcing barriers and redoubling training efforts but rarely engage in fundamental changes to the adaptive innovation or mindful action aspects of resilience (Denyer and Pilbeam, 2015)

In hierarchical organizations those with expertise who are closest to the problem are not empowered to act

Introducing the 4Sight methodology

The final section of the report will explore more specific requirements of Organizational Resilience using a new methodology, '4Sight', which provides a leadership agenda for Organizational Resilience. 4Sight is particularly useful for dealing with complex problems such as designing a new software application, developing a new technology, planning a new infrastructure system, implementing a major change programme or dealing with a crisis. Such challenges are difficult to resolve because of incomplete or contradictory knowledge, the number of stakeholders and opinions involved, the financial risk, and the interconnected nature of these problems with other issues. Problems that involve changing behaviour, values and priorities, or that are indeterminate in scope and scale, are particularly "wicked" (Rittel and Weber, 1973). Mobilizing people to meet these challenges and problems is at the heart of Organizational Resilience. 4Sight describes a repeatable process employing creative thinking. It involves four core processes (see Figure 5).

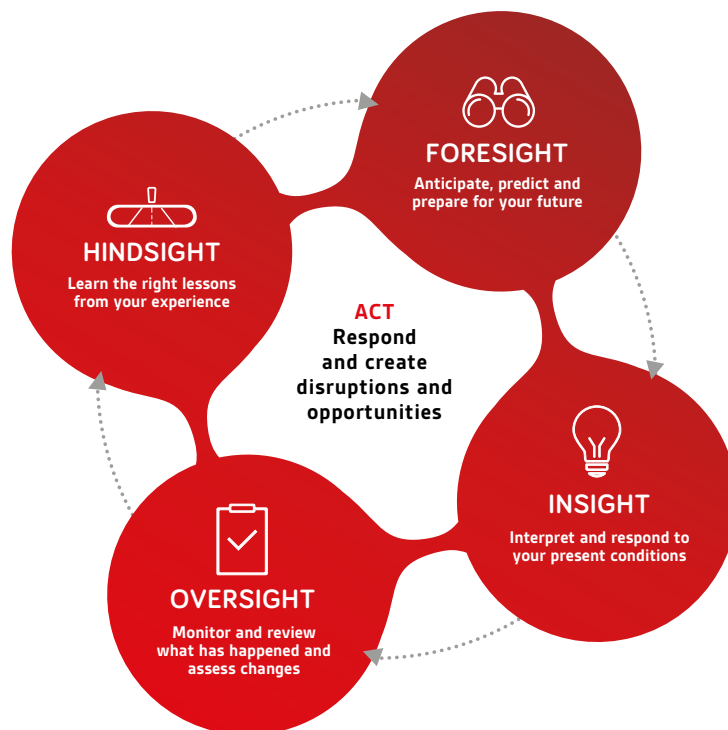


Figure 6: The 4Sight model of Organizational Resilience

Foresight

Anticipate, predict and prepare for your future.

The worst kind of uncertainty is being unaware of what you don't know. Therefore, scan for the stimuli to which the organization must respond if it is to survive and grow. This will require constant surveillance for possible opportunities and potential threats to the organization. Systematically explore possible, plausible, probable and preferred futures. This foresight will help people in your organization to be mentally prepared for uncertainty and change. **Foresight** also needs an inward focus to help your people anticipate and notice problems, errors and issues within the organization that could grow into significant incidents. Encourage people to heed the warning signs and attend to 'weak signals' on impending problems. Just as with evolution, the secret of resilience is variation, which, in organizational terms, comes

from multiple perspectives and diversity. Embrace multiple viewpoints and listen to diverse voices.

Insight

Interpret and respond to your present conditions.

Bring people together to pause, step back and see the big picture, helping them consider the interactions between the various parts of the organization. Examine knock-on effects and shift your focus between individual parts of the organization and the organization as a whole. Try to bring clarity and focus to the challenges you confront and frame them in ways that helps people create shared understanding and shared commitment. Look for patterns and connections in your environment and develop multiple hypotheses about what is really going on. This involves systematically gathering information and evidence from diverse sources including first hand observation of customers in the field or frontline staff to continually refine and update your understanding of the status of ongoing operations and the environment you face. In short, build situational awareness. Search relentlessly for latent problems and errors. Encourage people to report anomalies, mistakes and concerns, however minor, without fear of retribution, and provide confidence that people's concerns will be addressed.

Avoid becoming detached from what users and frontline employees do, say, think and feel. Spend time observing, engaging and empathizing with people to understand their experiences and motivations, as well as immersing yourself in the physical environment to have a deeper personal understanding of the issues involved. Some of the most powerful realizations come from noticing disconnects between what someone says and what they do. Elicit stories from the people you talk to, and always ask "Why?" to uncover deeper meaning. Sometimes it is important to reframe or disrupt conventional thinking about solutions by challenging the commonly accepted understanding of the underlying problem. Enable people to explore the contradictory aspects of a problem and encourage novel solutions, which might shift people's mindsets from seeing only 'either/or' choices to seeing 'both/and' solutions.

Spend time observing, engaging and empathizing with people to understand their experiences and motivations

Oversight

Monitor and review what has happened and assess changes.

Put in place a robust process for identifying, prioritizing, sourcing, managing and monitoring the organization's critical risks and ensure that process is continually improved as the business environment changes. Balance performance and compliance by ensuring that management's actions are consistent with corporate strategy, reflect the culture of the business, and are in line with the organization's risk profile. Understand the risks inherent in your business model, including the key assumptions underlying the continued viability of the mission, and agree with executive management on the company's risk appetite and tolerance of failure. Recognize your organization's fallibility and monitor how closely the system is operating relative to its performance limits, and manage any deviations as quickly as possible once they emerge. To achieve this, the organization must monitor its own performance and track how things are going. Because performance is always easier

to measure by assessing whether your goals were achieved, most organizations employ lagging indicators that are backward-focused or 'trailing'. However, also use leading indicators that are focused on future performance and continuous improvement. These measures are proactive in nature and report what employees are doing on a regular basis to ensure resilience. Importantly, complement prescriptive, compliance-based oversight with performance-based oversight, shifting the focus on the achievement of objectives rather than on the method followed to achieve them – i.e. don't simply ask, "Do we have a system or process?" but "How effective is it?"

Hindsight

Learn the right lessons from your experience.

Invest time in learning from experience and past events. Future performance can only be enhanced if your organization is willing and able to change behaviour as a result of experience. Learning goes beyond compiling statistics about events, because metrics rarely promote learning by themselves. Hindsight bias is a psychological effect that can limit learning and create a blame culture. After the fact, the past, and particularly the actions of individuals, seems incredible because knowledge of outcome biases our judgement about the processes that led up to that outcome. It is very easy to be trapped into oversimplifying the situation and the uncertainties involved. Therefore, resist playing the classic blame game by asking "Who screwed up?" or "Who's fault was it?", but instead ask questions like "Why did it make sense for that person to act the way that they did at that time?" or "Could someone with similar knowledge and skills act the same way if they faced a similar situation?". This will help uncover the situational and organizational factors that led to the event. Contemporary thinking around resilience places a high emphasis on the advantages of learning from success, as well as failure. In high reliability organizations, failures are rare and success is the normal state. If learning is derived mainly from the former, then the opportunities to improve are limited. Instead, a better understanding of what works well, including those situations where a good outcome was achieved despite threats or failures in the system, provides many more opportunities for learning.

Contemporary thinking around resilience places a high emphasis on the advantages of learning from success, as well as failure

The four processes of the 4Sight model enable an organization to **respond to and create disruptions and opportunities**. Creative responses to emerging threats and opportunities can only be achieved by stimulating innovative ideas and new ways of working, drawing on multiple perspectives and interdisciplinary teams, or co-creating with customers and consumers. The model involves generating and refining ideas and developing designs and prototypes. Be aware that best practices can never be imitated but require translation to fit your particular circumstances. To enable the four processes, leaders in the organization need to create safe 'problem spaces' that allow people to experiment without fear of failure. They also need to recognize that, whilst some changes will be successful, others may fail immediately or could lose their value, so they know when to abandon ideas, products or practices that no longer work.

Combining PDCA and 4Sight

The 4Sight methodology complements the established Plan-Do-Check-Act (PDCA) methodology (Demming, 1986). Whilst PDCA provides consistency (see Figure 7) and works well for continuous improvement of existing systems and processes, 4Sight provides the flexibility to deal with the big, complex issues that abound in modern business. Figure 7 summarizes the differences between PDCA and 4Sight.

PDCA	4Sight
Approach	Approach
Plan (defining your policy, objectives and targets)	Foresight (Anticipate, predict and prepare your future)
Do (Implement your plans within a structured management framework)	Insight (Interpret and respond to your present conditions)
Check (Measure and monitor your actual results against your planned objectives)	Oversight (Monitor and review what has happened and assess changes) Hindsight (Learn the right lessons from your experience)
Act (Correct and improve your plans to meet and exceed your planned results)	Act (Respond to and create disruptions and opportunities)
Works well when the challenge:	Works well when the challenge:
Is easy to identify and define	Is difficult to agree; easy to deny
Is resolvable using current expertise and known solutions	Requires new ways of thinking, beliefs, roles, relationships and approaches to work
Has a definite stopping point – when the solution is reached and can be judged as right or wrong	Has no stopping rule – how much is enough? No right or wrong, just better or worse outcomes
Leader’s role:	Leader’s role:
Agree goals, build commitment, provide answers	Identify the problem, connect people’s interests to the work of solving it and ask searching questions
Clarify roles and responsibilities	Empower people to act
Keep emotions out – “we can solve this”	Let people experience threat – within a productive range of distress
Fit solutions around current ways of working (culture, practices)	Challenge norms—“we could be very different”
Seek consensus and reduce conflict	Embrace diversity of opinion and scepticism
Focus on “making what we do better”	Focus on “doing better things”

Figure 7. Comparing PDCA and 4Sight for Organizational Resilience

“If I had an hour to solve a problem, I’d spend 55 minutes thinking about the problem and 5 minutes thinking about solutions.”

Albert Einstein

A core function of leadership involves helping people understand the nature of the challenges confronting the organization and selecting appropriate responses. Einstein is reputed to have said, “If I had an hour to solve a problem, I’d spend 55 minutes thinking about the problem and 5 minutes thinking about solutions.” Yet many organizations struggle with identifying the nature of the real problems they confront and jump straight into solutions. Many organizations fall into the trap of solving a problem the same way every time, particularly when successful results have been produced in the past and time is short. For example, a product

“Organizations fail more often because they solve the wrong problem than because they get the wrong solution to the right problem”

Ackoff, 1974

manufacturer preoccupied with the problem of increasing sales may become locked into relentless subtle aesthetic or feature changes, whilst neglecting the real problem of changing consumer needs that will soon make the product obsolete i.e. they get locked into a consistency spiral without embracing flexibility (see Figure 8).

Many problems cannot easily be resolved through technical change processes because the problem definition and our understanding of it evolve as new possible solutions are invented and implemented. Conventional, technical change processes do not lend themselves to rule-breaking, game-changing, paradigm-shifting breakthroughs. As Ackoff (1974) states, organizations fail more often because they solve the wrong problem than because they get the wrong solution to the right problem. Heifetz (1994) also notes that “the single most common source of leadership failure they have been able to identify in politics, community life, business, or the non-profit sector... is that people, especially those in positions of authority, treat adaptive challenges like technical problems.”

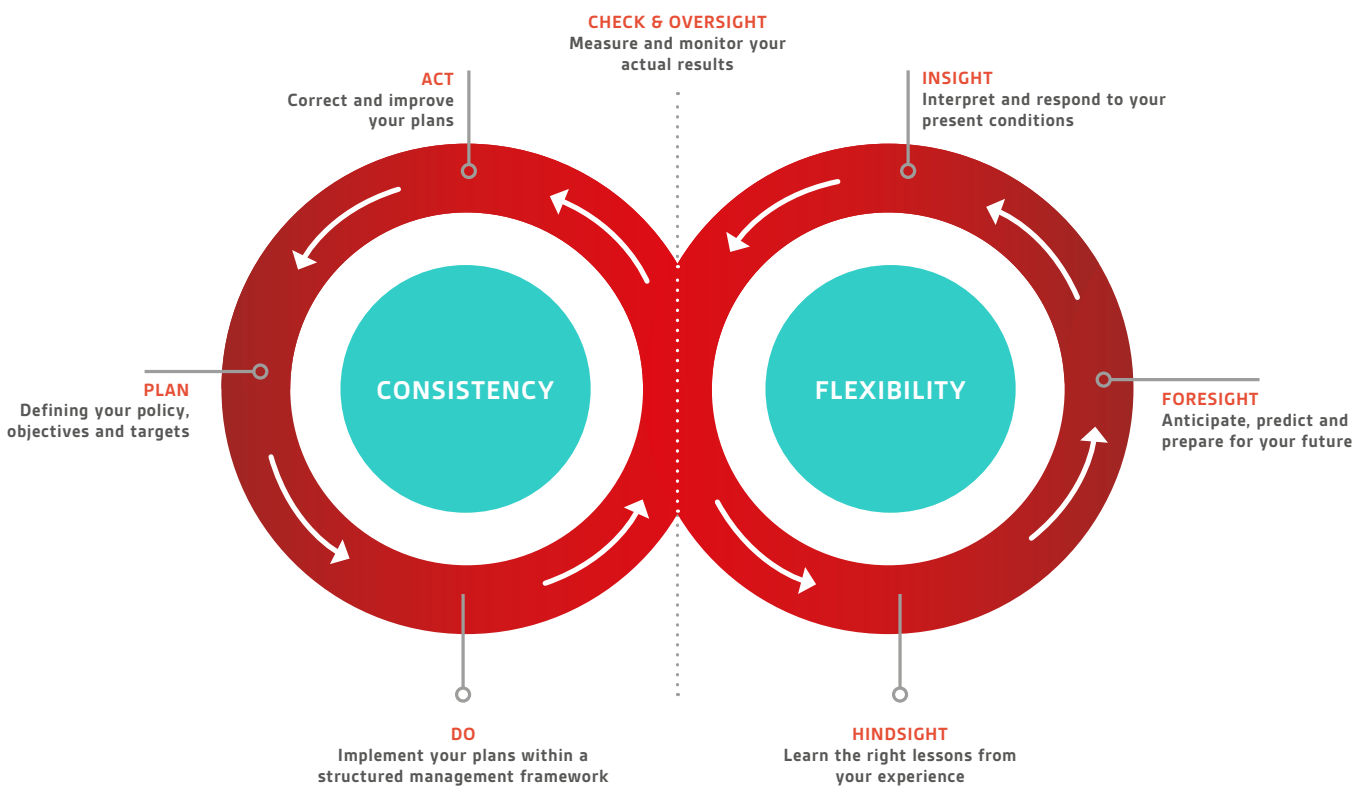


Figure 8: Blending PDCA and 4Sight for Organizational Resilience

The challenges encountered by organizations rarely occur in isolation, so leaders often deal with multiple interconnected issues and problems. Thus, in complex environments, organizations might need to improve existing processes at the same time as embrace innovation, change and transformation (Uhl-Bien, Marion and McKelvey, 2007). Therefore, PDCA and 4Sight may be better regarded as complementary rather than conflicting. These two approaches can be mutually enabling. Together, PDCA and 4Sight offer a structured framework for understanding and pursuing both continual improvement and innovation in ways that add real value to stakeholders and mitigate the impact of disruptions (See figure 8).

Conclusion

To summarize, the key points raised in this report:

- Organizational Resilience is the ability of an organization to anticipate, prepare for, respond and adapt to incremental change and sudden disruptions in order to survive and prosper.
- To date, there has been a preoccupation with **defensive** resilience behaviours and not enough focus on resilience to adapt to opportunity to deal with the big, complex issues that abound in modern business.
- Organizational Resilience requires a holistic approach and an appropriate balance between preventative control, mindful action, performance optimization and adaptive innovation.
- Managing the inherent tensions between these distinct perspectives requires **paradoxical thinking** – moving beyond ‘either/or’ towards ‘both/and’ outcomes.
- Organizational Resilience can be difficult to recognize, implement and sustain – many organizations are sleepwalking into disaster or irrelevance.
- Organizational Resilience requires effective leadership and a shift in mindset – leaders and colleagues can use the 4Sight methodology.
- The emphasis on PDCA or 4Sight is dependent on the nature of the challenges faced by the organization. Getting this wrong reduces Organizational Resilience.
- Whether you are the chief executive setting the direction of the business, or an individual focusing on a specific task, the 4Sight methodology will help you achieve Organizational Resilience.
- Those getting it right have prospered – as can be seen at Infosys, Baiada, NextraData, SAP, and Ciena (see Appendix 2).

None of this is easy—and all of it takes skilled leadership and effort, as illustrated by the case studies in this report (see Appendix 2). In an increasingly complex and dynamic world, Organizational Resilience calls for leaders to be able to direct and coordinate change, but to do so without specifying solutions, or creating ‘top down’ visions and targets that might alienate the very people who can develop solutions to emerging challenges.

Paradoxically, therefore, executives have to manage and master the tension between the strong supportive leadership that people want to see during times of change, and the more demanding collaborative leadership that will sustain the organization. In leadership, as in Organizational Resilience as a whole, an increasingly volatile, uncertain, complex and ambiguous world calls for an appropriate balance between defence and progression, consistency and flexibility.

Whether you are the chief executive setting the direction of the business, or an individual focusing on a specific task, the 4Sight methodology will help you achieve Organizational Resilience

Appendix 1: Approach

This report summarizes the findings of a rapid evidence assessment (REA) and case studies of Organizational Resilience. First popularized in evidenced-based medicine, Rapid Evidence Assessments (REAs) are used to identify and evaluate claims about what works and provide an evidence-informed basis for managerial action. An REA is a tool for getting on top of the available research evidence within a relatively short timeframe. The review began through extensive electronic searches of the Thomson Reuters Web of Science platform (Indexes=SCI-EXPANDED, SSCI, AandHCI, CPCI-S, CPCI-SSH, ESCI). The database has global reach. A search was conducted for publications with the term 'resilien*' in the title, abstracts or keywords. The asterisk (*) included as a wildcard symbol to search for variations of the term resilience (such as resilient or resiliency). To ensure that the search was not too broad and remained focused on business and management research, it was limited to publications classified as belonging to the areas of 'business' or 'management'.

The search covered the time span 1970 to 2017. 643 articles were identified. Papers on resilience were excluded when they related solely to themes deemed irrelevant³. As a result, 264 articles were discarded. The REA was limited to the more highly cited publications to focus on those that were influential in business and management research on organizational resilience (as evidenced through their citation count). 178 records in the data set had fewer than 5 citations and were rejected. 33 of the remaining articles were deemed low quality. 145 studies remained. Cross-referencing and additional author searches based on the included articles revealed another 36 relevant studies, which were added. The total number of academic articles identified was 181³. The searches of academic literature were then supplemented by manual searches of Google Scholar and Google to ensure the incorporation of grey literature and books. A search for Organizational Resilience on Google yielded about 841,000 results in 0.25 seconds, demonstrating the popularity of the subject and growth in available information.

Given the vast and fragmented information on Organizational Resilience, the final inclusion of sources in this REA was necessarily selective.

Findings from the search were originally grouped into 7 research streams (see Appendix 3):

- (1) Response to external threats
- (2) Preparedness and organizational reliability
- (3) Coping with occupational and job demands
- (4) Renewal and strategic agility and crisis as opportunity
- (5) Supply chain vulnerabilities and disruptions
- (6) Ensuring IT/IS/cyber stability
- (7) Defining and conceptualizing resilience

3. Topics deemed outside the scope of this review include: careers; military (e.g. of recruits); infrastructure and build environment; natural environment and ecosystems; entrepreneurship (e.g. entrepreneurs resilience to set backs); capitalism; health care provision; the economy; urban systems / cities; individual resilience – e.g. to sleep deprivation; marketing and advertising e.g. brands; students; poverty reduction; communities; life cycle effects, financial resilience .

³ It is important to note that each of these stands could contain other articles that contribute to our understanding for OR, but they do not explicitly refer to OR in the title or abstract. For example, the field of ensuring IT/IS/Cyber stability is clearly larger than the eight articles reported below. However, within the scope of a REA it is not possible to run additional searches in each of the research streams, as one might in a full blown systematic review.

Articles from each stream were then reviewed to identify important ideas and cross cutting themes.

The review was supplemented with case studies of organizations that had been identified as exhibiting best practice in at least one aspect of organizational resilience. Interviews were conducted with leadership and senior managers responsible for ensuring organizational resilience. The aim is to reveal to other organizations some of the best practices that create Organizational Resilience.

Appendix 2: Case studies

- **Infosys** (India)
- **Baiada** (Australia)
- **NxtraData** (India)
- **SAP** (Germany)
- **Ciena** (USA)

Combining the functions of strategy and risk at Infosys

An interview with **Deepak Padaki**, Executive Vice President - Corporate Strategy and Chief Risk Officer, Infosys

Infosys is a global leader providing technology services and consulting to Fortune 500 companies, enabling clients to create and execute strategies for their digital transformation. Infosys employs a team of 199,000+ innovators across the globe.

In the fast-moving world of technology services, Infosys has to stay current and up to date on new technology. Organizational Resilience is critical to success, “at a time like this when there is high disruption, a lot of change, a lot of unknowns”.

Infosys has 32 risks that it tracks at an organization level. The 32 risks encompass four core areas: strategy, strategy execution, operations, and external risks. Technology is “disrupting our own business”, especially when you look at things like automation technologies, which “are fast disrupting the services-oriented model that we’ve had for over 30 years now”. Infosys recognized the need to change the business model, and the failure to change the business model was one of the biggest risks to shareholder value: “you always have risks like business continuity, operational risks, fraud and compliance, but we felt the biggest risk to longer-term shareholder value was strategy and the successful execution of strategy.”

Infosys saw the need to change its business model back in 2008 because it “was more paranoid than some of our peers regarding the eventual effects of commoditization”, but at that time it “probably overestimated the market’s readiness for what we were trying to do.” However, in the last two years, it has become even more obvious that “the old model won’t be sustainable as it is for too long.” Infosys is now moving from a pure services model to a “software plus services” model to gain a better profit contribution and margin by means of investing in intellectual property. It recognizes that this change is not unproblematic, “There is a gravity of the whole traditional core business that lends itself to inertia. As that’s making you money, you are weighed down by it and it takes effort to gain escape velocity, so you don’t really focus on the new stuff.”

The new strategy emphasizes innovation, which was a distinct shift from what had been Infosys’ philosophy for the previous 20-25 years. In the past it “was running a services model with factory-like efficiencies, with a high amount of standardization, homogeneity, and high productivity.” It was recruiting 25,000 new employees from undergraduate colleges every year, who were trained so that they fitted into the process quickly and correctly. The systems in the company “were geared for scale and transactions, over agility, innovation, creativity and fast failure”. Now Infosys is moving from that to an environment where it is saying “everybody needs to come up with something new, and they need to innovate.” To bring greater alignment to operations and decision-making in the company, and lower risk to the strategies that it has adopted, Infosys has combined the functions of strategy and risk. Deepak is now “both the chief risk officer of the company looking at enterprise risk and also the head of strategy, because we felt that these are two sides of the same coin.” A core function involves monitoring “what is happening with the competition, what is

happening with the industry environment and with technologies, to make sure that the strategic choice risk itself is being mitigated correctly.” The company has shifted from a focus on “how you minimize risk to how you enable the business to take risks, because in this unknown environment you need to take some risks to get the return.”

Managing “the two-sided coin of strategy and risk” works by asking strategic questions and discussing risk mitigation measures. For example, there was a discussion about what needed to be changed in the business model. Infosys needed to create new software platforms, so new product teams were formed, and they created new software. Then the question became, ‘What are the risks that new software will not gain in sales momentum?’ So it mitigated that risk by engaging the existing sales teams to sell the new software. The next question was, ‘What is the risk that the sales team does not have the competencies to do this?’ This provoked a conversation about whether the company should just retrain its existing salespeople or bring in new salespeople. The final mitigation was to “catalyze the existing sales team with of some of the salespeople who were specialized in software sales, including those obtained in an acquisition”.

To ensure excellence in strategy execution, Infosys has developed a corporate scorecard, which gives it a roadmap for the next three to five years. Various parameters including market penetration, operations, innovation, automation, people, culture, and values are captured in the scorecard. The key issue is being satisfied that the “new software-based services and the renewed traditional services are providing a platform for consistent profitable growth”. Infosys also focuses on system strength and process rigour, with a strong focus on safeguards in its contracts and business continuity. With a large number of employees, Infosys has “a lot of labour risks, safety risks, facilities risks, immigration risks and all kinds of employee-related risks”. There is also, of course, fraud and cyber security, which are traditional issues that Infosys addresses along with legal compliance. In the past, resilience at Infosys relied on “policies, procedures, enforcement and accountability”, but now it is seeing a move towards more analytics and agility.

One of the first things that employees came back and said was, “If you want me to come up with new stuff I need to be able to access the Internet freely.” In the past, access to the Internet was curtailed because it was thought to reduce productivity and increase cyber risk. However, “now we are saying of course you need to go and see what other people are doing, you need to part of forums outside, you need to have access to information on the Internet because you need to be innovative and collaborate.” But this change raised risk because the more open the network was to the outside world, the greater the cyber security threat. Infosys “struggled with this issue for quite some time, and finally we came up with an ‘open Internet’ policy, where we could safeguard some of the critical risk”. The day it opened up its Internet for most people to access most sites “we got a record number of cyber security hits on our network – it was unprecedented, but luckily none of them came through the firewall.” Importantly, Infosys recognized that this was going to happen and prepared for it. To date, Infosys thinks productivity hasn’t been adversely affected but innovation has improved. The open access Internet policy also “has a more intangible cultural benefit, which is that people just feel they’ve got more freedom and more empowerment to do things.”

The open Internet policy was just one of a series of employee-friendly measures that Infosys took. Another 'mindful action' was "reaching out across the company to every one of our employees to make them aware of the changes that are happening in the company. I think the first thing we need to do is make every single individual aware that there is change in the air." One successful programme was called the 'Zero Distance' programme. Infosys realized that in a people-based business a major risk would be employees leaving if they did not appear to be part of the change, so the company "very consciously engaged with all the 200,000 people to try to get the change from within... to make everybody a change agent." The Zero Distance programme sets out to challenge every single individual to do something different and project successes are celebrated at 'town hall' meetings. This approach has also benefitted from extremely high commitment from the CEO: "he is the one who is actually running these town halls. So people feel a sense of energy and awareness of the change that is happening." The approach "has really brought our attrition rate down quite a bit, people feel engaged with the company, and so I think resilience starts there, with awareness."

Infosys is also focused on external shocks, which could be natural disasters or macro-economic issues. "It could be US elections, it could be Brexit" or others things that are not under its control. For Infosys "it is not so much about mitigation but more about preparedness" to ensure that the organization is prepared for the unknown. It has teams that do research on macro trends, on client industries, and on specific clients that are aligned for them and could be potentially at risk. There is also research on "what's happening to supply chain models, what's happening to workforces, is there a rise in marketplace and democratization of supply." Infosys has "actually spawned departments that are experimenting on some of these new ideas. So, for instance there are labs experimenting with virtual reality and Internet of Things technologies. It has also created an innovation fund "where we can invest money all over the world into start-ups that are on the fringes of what we do." These groups are "giving us a lot of pointers and indicators of what's happening with business models and technologies at the fringes." These groups help Infosys "anticipate what's coming next."

If crisis does hit, "the most important thing is to get the cow out of the ditch." For example, Infosys has a large facility with a large number of employees in Chennai, and "last December it was hit with unprecedented floods. Pretty much the whole city was down, all our centres had to be closed, we had to evacuate people, and we had to get them home, even though public infrastructure was in a mess and communication lines were down." Critically, "every project, every account that's running there, has a back-up plan, they have alternate centres, they have data networks that can pick up the work somewhere else and so on." The whole incident was managed to "minimize the loss of life, the business disruption and the loss of revenue." But in the post-mortem of what happened Infosys examined what it could have done better. One of the scenarios it had not imagined was that it could lose complete mobile communication in the city, meaning that it couldn't fulfil the company objective of calling every employee to make sure they were safe. The company is now experimenting with various technologies to find a way of monitoring the whereabouts of employees during a disaster.

Resilience for Infosys is about "built-in preparedness" to cope with events that it could not have predicted. Central to this is having "leadership capability that can

“Infosys is now moving from a pure services model to a software plus services”

step in within 15 minutes and contingency budgets that you can give this person, which they are free to distribute, because you can't wait for headquarters to give approval.” Interestingly, sometimes these are not the obvious leaders of these departments, because in an emergency situation “the established leader may not be the right person.” Infosys takes the same approach with strategy and innovation. If something is not working it asks ‘How quickly can we change KPIs? How quickly can we change leadership and structures without disrupting the momentum of the flow of operations?’ Most companies measure the performance of units and employees on an annual basis. But “who can predict what’s going to happen 12 months from now?” Goals are set for “how the world is today, but if something changes we need to be able to change the goals of 200,000 employees quickly, and realign the whole organization. That is the nirvana state if we can get there – change KPIs in say, a fortnight!” According to Deepak, Infosys “still has a way to go in that, but this is the way we are thinking.”

From Beyond compliance, balancing safety and efficiency at Baiada

An interview with **Elaine Dickson**, Chief Risk Officer, Baiada

Baiada is a privately-owned Australian company, which provides premium quality poultry products throughout Australia and is one of the largest chicken producers in the southern hemisphere. Its business operations include meat chicken growing and breeder farms, hatcheries, processing plants, feed milling and protein recovery. Products include sales of live poultry, processed chicken products and pet food. As such, core concerns include protecting the health of the animals and biosecurity, particularly preventive measures designed to reduce the risk of transmission of infectious diseases. Ensuring the quality, welfare and safety of its livestock and reducing the likelihood of potential food safety incidences is paramount.

Baiada has focused on systems strength in terms of quality, workplace health and safety systems, financial risks, environmental systems, IT risks, business continuity plans and contingency planning.

Baiada has reduced the level of burden generally associated with existing rules required to enforce compliance by implementing strategies in a way that is targeted, proportionate and informed, using a comprehensive assessment of risk. “You need to have good systems, but not be overburdened with red tape; make your documentation and your monitoring capture what is not only necessary but also streamlined. The aim is to balance operational efficiencies and resources. What this means is not throwing unnecessary or additional resources into the business, especially in our industry where the margins can be so tight that you need to have systems that are efficient as well as robust.”

The evolution of processes and systems often lags behind developments in technology, business models and consumer trends, making them less and less fit for purpose. Specifically, the Baiada board recognized the need to address emerging risks and the need to take a “step beyond compliance.” Compliance was only one element of how Baiada manages risk. The board decided that it “needed to take this to another level and it needed someone to look at risk management systems and also the broader challenges faced by the business over and above compliance.”

Baiada recently appointed Elaine as Chief Risk Officer as well as recruiting a new Head of Compliance to look at the business and produce a holistic risk management strategy and to be proactive across all current and emerging risks to the business, “prevention rather than reaction.” Safety management had to evolve to remain relevant, effective and deliver the required safety outcomes. The focus has been on taking the business “on a journey to be more predictive to avoid the sudden disruptions.” The traditional prescriptive system has also matured into a performance-based system. This shifts the focus from asking whether or not a particular procedure is being followed to asking how effective it is and having an open discussion about potential problems. “Compliance meetings have now become a discussion based on the questions: ‘What are your concerns?’ and ‘What has happened over the last week that you need to bring to this meeting?’, so that we can be proactive in our approach”

“Infosys has developed a corporate scorecard, which gives it a roadmap for the next three to five years”

Baiada consistently gathers and analyzes safety risk information about all parts of its operations. For example, it is currently examining “the factors that influence the understanding and behaviours of people throughout the food chain, from our agricultural operations, through to distribution, retail and finally consumption.” The data gathered will be used to develop a programme to enhance understanding among stakeholders, right through the entire food safety chain and enhance the safety of the poultry products. The company also engages with experts and consultants to “help identify and plug gaps in our systems”.

“For Infosys, it is not so much about mitigation but more about preparedness”

Baiada is also changing the way it carries out its governance responsibilities, particularly in relation to legal and regulatory compliance. Now that this has been more formalized, it leads to achieving results in a more structured and systematic manner.” This includes development of an effective corporate risk register, risk reviews and testing the effectiveness of those controls. The system will be based on the risk management standards, which it is hoping to achieve in 2017.

One of the core features of Baiada’s approach is assessing the performance of each part of the business, helping the different groups manage their safety risks and agreeing with the board the actions that are needed to uphold standards and further enhance resilience. Baiada discusses, “on a very regular basis, in structured and formal meetings with all key players, the need for the business to be resilient, the need for various managers and staff in different areas to make other areas aware of the issues that they’re facing, so that we can adapt to any possible risk or change that may affect another area.”

Baiada is continuing to make more informed decisions about the safety outcomes that “we and the industry should aim to deliver to better manage the risks across the sector.” It monitors “what the industry is doing in Australia, how we are performing within that industry, what’s occurring to the other players, what the market is doing, and adjusting the strategy... as well as learning from what happens within other organizations. For example, “there was a recent incident in a competitor’s processing plant in another state, so we immediately sent out a directive to all our relevant people to ask them to check the same system that caused the competitor’s issue. We were looking at the overall system anyway, but the extra checks highlighted a few other areas where we can make improvements.”

Elaine says that the key to Organizational Resilience is “getting the right people in the right roles. I think that’s just such a key to any organization’s success.” She continues, “I just know that our people are the key to the success of this business, right from our executive management down to the senior management and the people on the shopfloor.” The key is, “start them off right, train them properly, reward them appropriately and hold them accountable”. She suggests that one of the keys to success at Baiada was the ability to grow and “remain big, but still keep that small business feel that we’ve always had.”

Minimizing the impact of disruption to the customer at NxtraData

An interview with **Neil Pollock**, CEO, NxtraData

NxtraData is a cloud and IT services company. It is the largest Indian-owned and Indian-operated data centre managed services company. “We provide IT infrastructure to enable businesses to conduct business, to serve their own customers.”

Nxtra Data offers an integrated portfolio of data centre managed services, including both domestic and international network connectivity. It has three core product lines: Co-location, Managed Services, and Cloud, and within these lines it offers a number of different products and services. NxtraData serves around 240 customers, which span different sectors, including government agencies, telecommunications, ecommerce, IT, and manufacturing firms. “We’ve got the full gamut of size and scale, as well as industries”.

Resilience is critical to NxtraData because, “when you decide to take a service or a product from us, you’re entrusting your IT operations to us.” NxtraData manages the infrastructure that’s running its clients’ business, “the billing engine, the customer relationship management engine, ERP, the order book, whatever.” The worst-case scenario is a data centre that becomes ‘blacked out’ and clients are unable to access their own infrastructure.

The company is very clear that at “the foundation of everything we do is the customer” and it has developed processes to ensure that across the organization “we ensure every possible mitigation for things that can disrupt our business and our customers’ business.” Therefore, at NxtraData “resilience is geared around minimizing the impact of disruption to our customer.”

“From something as simple as a battery failing to take up the load during a power outage, through to an earthquake crushing a building, we’ve got to have a plan, a policy or a way of doing business that caters for all levels of disruption. There is an absolute process that we follow in order to address a disruption in the business, and so our business resilience is entirely built on the processes that we have in place to address the disruptions as and when they occur.” Fundamentally, “if resilience is not in your blood then you won’t be in this business.”

Whilst many organizations might see being based in India as a challenge to resilience, NxtraData sees it as an opportunity. “There’s not one day that goes past where we don’t have a disruption”. This means that it constantly sharpens its systems and processes and it ensures that resilience is a core priority at all times. “Every time we think we’ve reached a comfort zone, every time that we think that 100% uptime is just part of the norm and the way we do business, the good Lord sends something our way to make sure that we realize that He’s actually in control of things, not us.”

NxtraData “systematically stress tests” its systems, “which means that every quarter or every month, or whenever it’s required, we undertake activity to simulate disruptions in our business... it becomes part of our everyday routine.” NxtraData

simulates low probability events, even those with “less than 0.01%” chance of occurring, “just to make sure that the disruptions we meet every day, don’t become the only things that we worry about”.

Because NextraData deals with disruptions every day, it is “able to dream up disruptions that we haven’t seen or heard of, and think through what we would do if that happened.” The ability to anticipate problems and adapt to issues is also enhanced through diversity, which has three aspects: diversity of age, diversity of background and the open culture. It’s “a fantastic mix of people from completely diverse backgrounds, IT and telco. They’re technology-oriented but they’ve got very, very different ways of thinking and their brains are synapsed in very, very different ways.” There are also people “fresh out of school” and more experienced employees in their 40s. A key cultural strength is the ability “to tell anyone what you’re thinking or if you have a concern or a worry.” Neil states, “I don’t care what level you’re at in the organization or how far away you think you are removed from me, if you have something that you think is important then you come and tell me. If you’re not being listened to, then it’s okay for you to come and tell me.”

Organizational Resilience is “in the DNA” of NextraData: “Our employees know that everything they do on a daily basis determines their safety, the welfare of their family, the welfare of our customers and our brand. Whilst, “there is no excuse for not following a process... what I have discovered over many, many years of working in business and in the military is that it is very rarely the individual who we can “blame” for something; it is invariably a gap in the process – invariably.”

Systems and process resilience at SAP

An interview with **Michael Wiedemann**, Vice President Data Protection Operations, SAP

SAP is a world leader in enterprise applications in terms of software and software-related services. It offers interface and cloud options in addition to traditional, on-premises services. As an IT company, which is responsible for running systems for more than 300,000 customers worldwide, data security is a major threat to organizational resilience at SAP. “Our worst nightmare, one I have almost every second night, is a headline stating that we somehow compromised data of our customers.”

This is not only due to penalties imposed by the authorities, but more importantly “we would lose the trust of our customers.” The majority of SAP’s customers have their own IT systems and given SAP access for remote support, “they open the door and we can see almost everything.” It’s “a huge responsibility” as customers “trust us entirely with what could be incredibly sensitive information”. When you log onto a customer’s system “you have to know what are the do’s and the don’ts? What data aren’t you allowed to change on a customer’s system? If you have to do it, how would you do it?”

To help safeguard data, SAP was an early adopter of management systems in the late 80’s, specifically ISO 9001 on quality and ISO 27001 for security. Consequently, SAP added a management system for data protection – based on BS 10012 – to its certification landscape in 2010. All these management systems “have one thing in common, which is the cycle of the management system, it’s plan, do, check, act, four easy points.” These management systems are essential for a company with more than 80,000 employees because, “the weakest factor in the security and data protection chain is always the human element”. Central to the SAP approach is the need for employees to follow guidelines so that everybody knows the procedure. However, with regard to training “if you wait, say, two weeks and then ask them... 80% is already forgotten and 20% is not really clear.” The critical task is to keep data protection on the agenda, “you have to raise the awareness and you have to keep it high, and the only way to do that is to constantly show up and do something about it.”

It is not possible for every employee to know all the legislation, “so you have to translate it and you have to simplify it, and that’s what we did.” SAP produces work instructions - one-page summaries of “key do’s and don’ts”. These are written specifically for different functions such as marketers, developers or support people because these groups have different challenges and different learning styles. The work instructions are the “only thing they need to know. If they follow these guidelines they are good.” With sales staff, who are regularly on the road, SAP changed their training and made critical information available on mobile devices, “so they could use it whenever they wanted, whenever they had the time.” One specific challenge is installing the same standards with the staff of partners and acquired firms. Therefore, organizational resilience is an important consideration for the post-merger integration (PMI) team. When the PMI process starts, “first of all we want to learn what is their security standard, then we compare it with our security

standard... we have to ensure that their standard is at least as high as the SAP standard, otherwise we cannot keep our promise to our customers.”

Data protection representatives are responsible for keeping awareness high during the year, not only once a year when they participate in ‘town hall’ meetings. They have to have a project plan at the beginning of the year outlining what they want to do during the year until the end of the year. Recruitment of the right people to be representatives is a critical priority, “we go to the top management, say we need to fill in a position... then they come back with names, and then we go over the names and we jointly decide on the best candidate”. Representatives have a variety of backgrounds, from managers to lawyers to technicians. But, critically, they all have the social skills to keep organizational resilience on the agenda.

Procedure control is a legal requirement for data protection in Europe, and will be heightened with the General Data Protection Regulation (GDPR) in May 2018. Whenever “you want to set up a new process where personal data are processed, or touched at least, or made visible or used, whenever you do that, then you have to ensure that this process follows certain guidelines”. At SAP, “everyone has brilliant ideas every day, and these ideas have to have a data protection check.” This is where innovation can conflict with compliance. It could “take us ages – weeks, months, to check each tiny new process, to really look at the detail and find out whether or not this is compliant.” This kind of process control doesn’t work because the checks would “slow down the company”.

The way SAP overcame this problem was with a procedure enrolment tool (PET) introduced to help make users responsible for doing their business. Now, “if somebody comes up with a new idea, we let them know, we train them, we have all the information at hand and say, okay, these are the do’s and the don’ts. That’s what you can do and that’s what you cannot do.” The tool “provides critical information and asks important question and ensures that decisions are documented.” So what “you have to do, and it’s not that complicated, you have to train the people. You have to explain what they have to look at whenever they design something new, and what they have is experience. This way the central team can focus on second level support, and can use their expert skills for really complex issues, but the day-to-day business, the day-to-day questions can be judged by the business.”

SAP performs about 150 to 200 internal audits every year as well as external audits. Sometimes it’s a pure data protection audit, sometimes it’s a combined audit, “if we work together with other management systems like security or quality and they do audits maybe for quality, then we add just our data protection piece to those audits, but most of the audits are done purely on data protection”. When “we go into the different locations, we ask the people, have you understood what is important about data protection and security?” The audits are compliance based, because we have to be compliant with all the legal requirements around the world. It’s made easier for the employees that we have these work instructions, and so what we check on is the compliance to the work instruction. It’s data protection behaviour.

The SAP management systems undergo constant improvement. Whenever “we do an audit we always – I would say always – have findings. We see there are things that need to be improved.” SAP also constantly monitors mitigation strategies. Next, it looks for any particular trends and patterns across findings from across the organization and has regular meetings with board members to report those findings.

SAP “has to look actively for disruptive events: what could happen, what could endanger your business, the way you do business? Then you have to adapt.”

Despite a focus on internal processes, SAP also has to keep abreast of big changes, which are often driven by customer demands, “we have to watch the customer market, we have to watch what the customer needs, and then we have to react to that.”

Another good example of changing early has been in relation to data protection regulations. Specifically, SAP customers were becoming increasingly concerned about the data protection policies in so-called ‘not secure countries’. In these jurisdictions, SAP could rely on local law and legal requirements to ensure the security of personal data. In response, SAP invested in building a specific European support organization for its European customers who wanted to make sure that their data didn’t leave European borders. They also redeveloped clauses with their business partners in ‘not secure countries’ to ensure they did everything that is required to protect the data. “We reacted much earlier than everybody else because we were listening to our customers, we were observing the market and we were able to proactively change the way we offered support to our customers.”

SAP is now ahead of the game with regards to the General Data Protection Regulation of the EU, which will come into force in May 2018. The regulation will require every company in Europe to have something like a data protection management system: “Many of them follow what we had in the past, so it’s minor changes for many of those requirements, but some of the requirements are pretty new, and now we all have to come up with new ideas.”

Engaging with customers, with velocity and integrated systems at Ciena

An interview with **Mark Stevens**, Corporate Social Responsibility Director, Ciena

Ciena Corporation is a network strategy and technology company known for its commitment to customer success. With nearly 25 years of industry leadership, supporting more than 1,300 of the world's largest, most reliable networks, Ciena's technology success is complemented by a high-touch consultative approach to business.

Ciena is committed to developing and applying technologies that facilitate openness, virtualization, automation, collaboration, and a common experience. Technologies that offer the greatest degree of choice deliver the most rewarding customer experiences and business outcomes. Ciena's inspiration to innovate comes directly from the dynamics of each customer's business and network. Ciena engineers have received over 2,000 patents, representing a diverse range of inventions and contributing to customers' continued success.

Ciena's deep expertise in packet and optical networking and distributed software automation helps it to deliver solutions for next-generation networks. The company enables high-scale, programmable networks that can be controlled and adapted by network-level applications, and provides open interfaces to co-ordinate computing, storage, and network resources in a unified, virtualized environment.

Ciena employs approximately 5,500 people globally and is a leader in many of the markets it serves.

Ciena's corporate social responsibility director describes Organizational Resilience as an insurance policy that takes away, "as much of the risk as you can, but doing it in a way that is actually pragmatic and cost-effective." It's about "taking steps to ensure that you don't actually have the issue or the risk being realized in reality". It is important to acknowledge that "we can never totally remove risk, that's reality, but you can plan around minimizing that risk." This requires varying degrees of proactive work and preparatory risk assessment. Whilst "management review, audit protocol and testing are the mechanics of Organizational Resilience", the most important aspect is the empowerment of people. "We have a fantastic response to our customers, we will work together to make them successful, and proactively make adjustments if there's something that doesn't work."

Ciena has a common set of goals and five core values: customer first, velocity, innovation, outstanding people and integrity. Customer first is fundamental because "we're only here for one reason, customers value." The values enable employees to have a shared understanding across cultural differences and different countries. There is zero tolerance or variation from the core values, because it's the "DNA of Ciena". The values are embedded in the performance appraisal process, which are partly objectives based and partly focused on "how you lived up to the values". Ciena also takes measures to ensure that their supply chain "supports and shares our own values and ethical behaviours", thereby ensuring that "we actually do things in the right way at the right time to ensure our customers view us correctly".

The expression Ciena-time sums up the company's focus on velocity and the need to move quickly and efficiently to meet customer needs. It means "expeditiously implementing improvements in the way we do things basically, and responding quickly to address issues as they arise." The cultural aspect of resilience is enhanced because "anybody can go and talk to the CEO of the company, there are no barriers. This means that "...if somebody has an issue or a concern, they can bring that concern straight to the top if needed." At Ciena "It's all about the people. We make sure our people feel that there are making an impact and that they are recognized for their accomplishments."

Ciena believes in transparency and building customer intimacy with its clients.

Every year the company opens up its R&D facilities and hosts around 1,500 customer representatives over a four or five week period. The approach "is literally opening the kimono." The customers can see demonstrations in Ciena's labs of not only of the existing products but they also can discuss new leading edge, and in some cases 'bleeding edge', innovations still in development. They also have the opportunity to meet with senior Ciena leaders and engineers during their visit.

Ciena manages to find a balance between progressive and defensive concerns. The key is its robust management systems and integrated processes, "in essence the whole thing's done the same way." Certification to standards is just recognition that we are doing the right thing. The key success factor is "being focused, planning and responding... but keep it real because going over the top unnecessarily creates a burden which you will take a long while to recover from at a later point." That is, "just make the system appropriate to what you're doing and make it work for you.... make it effective and pragmatic." Having a certification partner that adds value is important, someone who "prompts you and asks those teasing and challenging questions". Transparency to the outside world is also critical and, as such, Ciena will publish a corporate CSR report for the first time this year.

Ciena manages systems and processes at both a regional and a corporate level. Regional Environmental Health and Safety (EHS) committees are empowered to deal with issues and make decisions at the local level as needed. Naturally, employee representatives sit on the committees because Ciena "wants to make sure that however good we think our management system approach may be, we've got to make sure that it's grounded in reality, and believe me, the best way to ground something in reality is to include the employees as part of that process." The regional committees have a coordinator to ensure that processes are consistent and robust. They also have a strong audit regime, steering groups and annual review.

The company also uses risk-profiling tools to help understand geographical or geopolitical risk. A third party is leveraged to help monitor Ciena's regulations from an EHS point of view all around the world. Supply chain risk is a particular area of focus, given that Ciena has a totally outsourced supply chain. The greatest exposure is when there's a single supplier, so the company looks to second or multisourcing. Sometimes unexpected events impact the supplier base, which is located in many different countries around the world, sometimes in areas prone to natural disasters. When unexpected events arise Ciena reacts quickly. For example, when disaster hit the Philippines, Ciena flew out a quickly assembled response team to support the relief effort. It recognized that getting the telecom network working was critical to the rescue effort.

Additionally, the company has a structured internal corrective action process, which is driven by audit findings (internal and external) and 'hot events'. That is, "things which cause you to take stock, the real surprise situations". Despite having effective processes and governance regime, unexpected events do happen. "When those things occur it tends to be multiple events happening at the same time. But thankfully they are very rare and few and far between." When these events do occur there's a structured checklist Ciena goes through to see "what could have been done differently, if anything, to actually protect us in the future."

References

- Ackoff, R.L. (1974). *Redesigning the Future, A Systems Approach to Societal Problems*. John Wiley & Sons, Inc.
- Bass, B.M. (1985). *Leadership and performance beyond expectations*. New York, Free Press.
- BSI (2014). BS 65000:2014, *Guidance on Organizational Resilience*, British Standards Institute.
- Burns, J. M. (1978). *Leadership*. New York, Harper and Row.
- Chopra, S. and Sodhi, M.S. (2004). Managing risk to avoid supply-chain breakdown, *MIT Sloan Management Review*, 46(1), pp. 53-62.
- Christopher, M. and Peck, H. (2004). Building the resilient supply chain. *International Journal of Logistics Management*, 15, pp. 1-14.
- Coutu, D. L. (2002). How resilience works. *Harvard Business Review*, 80(5), pp. 46.
- Craighead, C.W., Blackhurst, J., Rungtusanatham, M.J. and Handfield, R.B. (2007). The severity of supply chain disruptions: design characteristics and mitigation capabilities, *Decision Sciences*, 38(1), pp. 131-156.
- Deming, W. Edwards (1986). *Out of the Crisis*. MIT Center for Advanced Engineering Study.
- Denyer, D. and Pilbeam, P. (2015). *Managing Change in Extreme Contexts (Routledge Studies in Organizational Change and Development)*. Routledge.
- Duncan, R. (1976). The ambidextrous organization: Designing dual structures for innovation in Kilman, R. Pondy, L. and Slevin, D. (eds) *The Management of Organizations*. North Holland, New York.
- Farjoun, M. (2010). Beyond dualism: Stability and change as a duality. *Academy of Management Review*, 35(2), pp. 202-225.
- Festinger, L. (1957). *A Theory of Cognitive Dissonance*. Stanford, Stanford University Press.
- Ghoshal, S. and Bartlett, C. A. (1994). Linking organizational context and managerial action: The dimensions of quality management. *Strategic Management Journal*, 15, pp. 91-112.
- Gibson, C. B. and Birkinshaw, J. (2004). The antecedents, consequences and mediating role of organizational ambidexterity. *Academy of Management Journal*, 47, pp. 209-226.
- Gittell, J.H., Cameron, K., Lim, S. and Rivas, V. (2006). Relationships, layoffs, and organizational resilience: airline industry responses to September 11. *Journal of Applied Behavioral Science*, 42, pp. 300-329.
- Grint, K. (2005). Problems, problems, problems: The social construction of 'leadership'. *Human Relations*, 58, pp. 1467-1494.
- Hamel, G. and Valikangas, L. (2003). The quest for resilience. *Harvard Business Review*, 81(9), pp. 52-63.
- Heifetz, R.A. (1994). *Leadership without easy answers*, Harvard University Press.
- Heifetz, R.A. and Laurie, D.L. (1997). The work of leadership. *Harvard Business Review*, 75, pp. 124-134.
- Heifetz, R.A. and Linsky, M. (2002). *Leadership on the line: Staying alive through the dangers of leading*. Harvard Business Press, Vol. 465.
- Hendricks, K.B. and Singhal, V.R. (2003). The effect of supply chain glitches on shareholder wealth. *Journal of Operation Management* 21(5), pp. 501-523.
- Holling, C.S. (1973). Resilience and Stability of Ecological Systems. *Annual Review of Ecology and Systematics*, 4(1), pp. 1-23.
- Hollnagel, E., Woods, D.D. and Leveson, N. (2006). *Resilience Engineering – Concepts and Precepts*. Ashgate Publishing.
- Ignatiadis, I. and Nandhakumar, J. (2007). The impact of enterprise systems on organizational resilience. *Journal of Information Technology*, 22(1), pp. 36-43.
- Juettner, U. and Maklan, S. (2011). Supply chain resilience in the global financial crisis: an empirical study. *Supply Chain Management. An International Journal*, 16, pp. 246-259.
- Judge, T.A., Piccolo, R.F. and Ilies, R. (2004). The forgotten ones? The validity of consideration and initiating structure in leadership research. *Journal of Applied Psychology*, 89(1), pp. 36-51.
- Klein, G. (2008). Naturalistic Decision Making, *Human Factors. The Journal of the Human Factors and Ergonomics Society*, 50(3), pp. 456-460.
- Kleindorfer, P.R. and Saad, G.H. (2005). Managing disruption risks in supply chains. *Production and Operations Management*, 14(1), pp. 53-68.
- Kotter, J.P. (1996). *Leading change*. Cambridge, MA, Harvard Business School Press.
- La Porte, T. (1996). High reliability organizations: unlikely demanding, and at risk. *Journal of Contingencies and Crisis Management*, 4(2), pp. 60-71.
- La Porte, T. and Consolini, P. (1991). Working in practice but not in theory: theoretical challenges of 'high

- reliability organizations'. *Journal of Public Administration Research and Theory*, 1(1), pp. 19-48.
- Langer, E.J. (1989). *Mindfulness*. Reading, MA, Addison-Wesley.
- Latané, B. and Darley, J.M. (1970). *The Unresponsive Bystander: Why Doesn't He Help?* New York: Appleton-Century Croft.
- Lawson, M. (2001). In praise of slack: time is of the essence. *The Academy of Management Executive*, 15(3), pp.125-135.
- Leveson, N., Dulac, N., Marais, K. and Carroll, J. (2009). Moving Beyond Normal Accidents and High Reliability Organizations: A Systems Approach to Safety in Complex Systems. *Organization Studies*, 30(2-3), pp. 227-249.
- Lewis, M.W., and Smith, W.K. (2014). Paradox as a Metatheoretical Perspective: Sharpening the Focus and Widening the Scope. *The Journal of Applied Behavioral Science*, 50(2), pp. 127-149.
- Lichtenstein, B.B. and Plowman, D.A. (2009). The leadership of emergence: A complex systems leadership theory of emergence at successive organizational levels. *The Leadership Quarterly*, 20(4), pp. 617-630.
- Luthar, S.S., Cicchetti, D. and Becker, B. (2000). The construct of resilience: a critical evaluation and guidelines for future work. *Child Development*, 71(3), pp. 543-562.
- Mallak, L. (1998). Putting Organizational Resilience to Work. *Industrial Management*, 40(6). pp. 8-13.
- March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2(1), pp. 71-87.
- Marion, R. and Uhl-Bien, M. (2002). Leadership in complex organizations. *The Leadership Quarterly*, 12(4) (2001), pp. 389-418.
- Masten, A.S. and Reed, M.J. (2002). Resilience in development. In C. R. Snyder and S. Lopez (Eds.). *Handbook of positive psychology* (pp. 74-88). Oxford UK: Oxford University Press.
- Manyena, S. B., O'Brien, G., O'Keefe, P. and Rose, J. (2011). Disaster resilience: a bounce back or bounce forward ability? *Local Environment*, 16(5), pp. 417-424.
- Meggison, L.C. (1964). Key to Competition is Management. *Petroleum Management*, 36(1), pp. 91-95.
- Meyer, A.D. (1982). Adapting to Environmental Jolts. *Administrative Science Quarterly*, 27(4), pp. 515-537.
- Neilson, G.L., Pasternack, B.A. and Van Nuys, K.E. (2005). *The Passive-Aggressive Organization*. Harvard Business Review, pp. 83-92.
- Osborn, R.N. and Hunt, J. (2007). Leadership and the choice of order: Complexity and hierarchical perspectives near the edge of chaos. *The Leadership Quarterly*, 18, pp. 319-340.
- Perrow, C. (1984). *Normal Accidents: Living with High Risk Technologies*. New York, Basic Books, Inc.
- Plowman, D. A., Silansky, S., Beck, T., Baker, L., Kulkarni, M. and Travis, D. (2007). The role of leadership in emergent, self-organization. *The Leadership Quarterly*, 18, pp. 341-356.
- Rasmussen J. (1986). *Information Processing and Human-Machine Interaction*. Amsterdam, North-Holland.
- Reason, J. (1990). *Human Error*, The Press Syndicate of the University of Cambridge, New York.
- Reason, J. (2000). *Human Error, Models and Management*. *British Medical Journal*. 320(7237), pp. 768-770.
- Reich, J.W. (2006). Three psychological principles of resilience in natural disasters. *Disaster Prevention and Management*, 15(5), 793-798.
- Rice, J.B.J. and Caniato, F., (2003). *Supply Chain Response to Terrorism: Creating Resilient and Secure Supply Chains*, Supply Chain Response to Terrorism Project: Interim Report of Progress and Learnings. MIT Center for Transportation and Logistics (CTL) and Politecnico di Milano for the Supply Chain.
- Rittel, H.W.J. and Webber, M.M. (1973). Dilemmas in a General Theory of Planning 4, pp. 155-169.
- Rochlin, G. I., LaPorte, T. R. and Roberts, K. H. (1987). The self-designing high-reliability organization: Aircraft carrier flight operations at sea. *Naval War Col. Rev.* 40, pp. 76-90.
- Santos, F. and Eisenhardt, K. (2009). Constructing markets and shaping boundaries: Entrepreneurial power in nascent fields. *Academy of Management Journal*, 52(4), pp. 643-671.
- Simons, D. J. and Chabris, C. F. (1999). Gorillas in our midst: sustained inattention blindness for dynamic events. *Perception*, 28(9), pp. 1059-1074.
- Sheffi, Y. and Rice, J.B. (2005). A supply chain view of the resilient enterprise. *Sloan Management Review* 47, pp. 41-48.
- Sheffi, Y. (2007). *The Resilient Enterprise: Overcoming Vulnerability for Competitive Advantage*, 1st ed. MIT Press, Cambridge, MA.
- Snook, S. A. (2000). *Friendly Fire: The Accidental Shoot Down of U.S. Black Hawks over Northern Iraq*. Princeton, NJ: Princeton University Press.
- Staw, B.M., Sandelands, L.E. and Dutton, J.E. (1981). Threat Rigidity Effects in Organizational Behavior: A Multilevel Analysis. *Administrative Science Quarterly*, 26(4), pp. 501-524.

- Stecke, K. and Kumar, S. (2009). Sources of Supply Chain Disruptions, Factors That Breed Vulnerability, and Mitigating Strategies *Journal of Marketing Channels*, 16 (3), pp. 193-226.
- Stephenson, A. (2010). *Benchmarking the Resilience of Organizations*. Unpublished PhD Thesis, Civil and Natural Resources Engineering Department, University of Canterbury.
- Sutcliffe, K.M. and Vogus, T. J. (2003). 'Organizing for Resilience' in K. S. Cameron, J. E. Dutton and R. E. Quinn (eds) *Positive Organizational Scholarship* pp. 94-110, San Francisco, CA: Berrett-Koehler Publishers.
- Sydow, J., Schreyogg, G. and Koch, J. (2009). Organizational path dependence: opening the black box. *Academy of Management Review*, 34, pp. 689-709.
- Tang, C. (2006). Robust strategies for mitigating supply chain disruption. *International Journal of Logistics Research and Application* 9, pp. 33-45.
- Timmerman, P. (1981). *Vulnerability, Resilience and the Collapse of Society: A Review of Models and Possible Climatic Application*, Institute for Environmental Studies, University of Toronto, Toronto.
- Tushman, M. L. and O'Reilly, C. A., III. (2007). Research and relevance: Implications of Pasteur's quadrant for doctoral programs and faculty development. *Academy of Management Journal*, 50, pp. 769-774.
- Uhl-Bien (2009)
- Uhl-Bien, M., Marion, R. and McKelvey, B. (2007). Complexity leadership theory: Shifting leadership from the industrial age to the knowledge era. *The Leadership Quarterly*, 18(4), pp. 298-318.
- Uhl-Bien, M., Marion, R. and McKelvey, B. (2008). Complexity leadership theory: An interaction perspective. *Complexity Leadership*, 8(4), pp. 2-12.
- Vaughan, D. (1996). *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA*. Chicago, University of Chicago Press.
- Weick, K. E. (1993). The Collapse of Sensemaking in Organizations: The Mann Gulch Disaster. *Administrative Science Quarterly*, 38(4), pp. 628-652.
- Weick, K. and Roberts, K. (1993). Collective mind in organizations: Heedful interrelating on flight decks. *Administrative Science Quarterly*, 38(3), pp. 357-381.
- Weick, K.E. Sutcliffe, K.M. and Obstfeld, D. (2005). Organizing and the Process of Sensemaking. *Organization Science*, 16(4), pp. 409-421.
- Weick, K.E. and Sutcliffe, K.M. (2007). *Managing the unexpected: Resilient performance in and age of uncertainty*, second edition. San Francisco, CA, Jossey-Bass.
- Wildavsky, A. (1988). *Searching for Safety*. New Brunswick, NJ, Transaction Press.
- Woods, D. D. and Cook, R. I. (2002). Nine Steps to Move Forward from Error. *Cognition, Technology and Work*, 4(2), pp. 137-144.
- Woods, D. D. and Hollnagel, E. (2006). *Joint Cognitive Systems: Patterns in Cognitive Systems Engineering*, Boca Raton, FL, Taylor and Francis.
- Youssef, C. M., Luthans, F. and Youssef, C. M. (2007). Emerging Positive Organizational Behavior. *Journal of Management*, 33(3), pp. 321-349.

Appendix 3: Tables of the articles included in the REA

Response to external threats

Title	Year	Authors	Journal	Citations
Integrated business continuity and disaster recovery planning: Towards organizational resilience	2015	Sahebjamnia, N.; Torabi, S. A.; Mansouri, S. A.	<i>European Journal Of Operational Research</i>	11
Framing disaster resilience The implications of the diverse conceptualisations of bouncing back	2014	Aldunce, Paulina; Beilin, Ruth; Handmer, John; Howden, Mark	<i>Disaster Prevention And Management</i>	8
Project System Vulnerability to Political Risks in International Construction Projects: The Case of Chinese Contractors	2014	Deng, Xiaopeng; Pheng, Low Sui; Zhao, Xianbo	<i>Project Management Journal</i>	6
Self-Preservation vs. Collective Resilience as Consumer Responses to National Disasters: A Study on Radioactive Product Contamination	2014	Frank, Bjoern; Schvaneveldt, Shane J.	<i>Journal Of Contingencies And Crisis Management</i>	5
Organizational Crises And The Disturbance Of Relational Systems	2013	Kahn, William A.; Barton, Michelle A.; Fellows, Steven	<i>Academy Of Management Review</i>	10
The role of positive affectivity in team effectiveness during crises	2013	Kaplan, Seth; Laport, Kate; Waller, Mary J.	<i>Journal Of Organizational Behavior</i>	10
The ethics of disaster management	2012	Geale, Sara Kathleen	<i>Disaster Prevention And Management</i>	5
Multi-agency community engagement during disaster recovery Lessons from two New Zealand earthquake events	2012	Johnston, David; Becker, Julia; Paton, Douglas	<i>Disaster Prevention And Management</i>	6
Extreme Weather Events and the Critical Importance of Anticipatory Adaptation and Organizational Resilience in Responding to Impacts	2012	Linnenluecke, Martina K.; Griffiths, Andrew; Winn, Monika	<i>Business Strategy And The Environment</i>	29
Small business responses to a major economic downturn: Empirical perspectives from New Zealand and the United Kingdom	2012	Smallbone, David; Deakins, David; Battisti, Martina; Kitching, John	<i>International Small Business Journal</i>	10
Resilience and adaptation of small and medium-sized enterprises to flood risk	2012	Wedawatta, Gayan; Ingirige, Bingunath	<i>Disaster Prevention And Management</i>	6
Group decision-making in an unconventional emergency situation using agile Delphi approach	2012	Xie, Kefan; Liu, Jia; Chen, Gang; Wang, Pan; Chaudhry, Sohail S.	<i>Information Technology And Management</i>	10
Another day, another dollar: Enterprise resilience under terrorism in developing countries	2010	Branzei, Oana; Abdelnour, Samer	<i>Journal Of International Business Studies</i>	11
Beyond Adaptation: Resilience for Business in Light of Climate Change and Weather Extremes	2010	Linnenluecke, Martina; Griffiths, Andrew	<i>Business And Society</i>	41
Vulnerability and Resilience in Natural Disasters: A Marketing and Public Policy Perspective	2009	Baker, Stacey Menzel	<i>Journal Of Public Policy And Marketing</i>	26
Attaining improved resilience to floods: a proactive multi-stakeholder approach	2009	Bosher, Lee; Dainty, Andrew; Carrillo, Patricia; Glass, Jacqueline; Price, Andrew	<i>Disaster Prevention And Management</i>	11
Leveraging public-private partnerships to improve community resilience in times of disaster	2009	Stewart, Geoffrey T.; Kolluru, Ramesh; Smith, Mark	<i>International Journal Of Physical Distribution And Logistics Management</i>	31
Enhancing disaster resilience through local environment management Case of Mumbai, India	2009	Surjan, Akhilesh; Shaw, Rajib	<i>Disaster Prevention And Management</i>	6
Tending Wounds Elements of the Organizational Healing Process	2008	Powley, Edward H.; Piderit, Sandy Kristin	<i>Journal Of Applied Behavioral Science</i>	15
Hazard or disaster: Tourism management for the inevitable in Northeast Victoria	2007	Cioccio, Leah; Michael, Ewen J.	<i>Tourism Management</i>	50
Defending critical infrastructure	2006	Brown, Gerald; Carlyle, Matthew; Salmeron, Javier; Wood, Kevin	<i>Interfaces</i>	148

Adaptive fit versus robust transformation: How organizations respond to environmental change	2005	Lengnick-Hall, CA; Beck, TE	<i>Journal Of Management</i>	51
Disaster dynamics: Understanding the role of quantity in organizational collapse	2002	Rudolph, JW; Repenning, NP	<i>Administrative Science Quarterly</i>	103
On the edge: Heeding the warnings of unusual events	1999	Marcus, AA; Nichols, ML	<i>Organization Science</i>	72

Articles located through additional searching

Manyena, S. B., and Gordon, S. (2015). Bridging the concepts of resilience, fragility and stabilisation. *Disaster Prevention and Management: An International Journal*, 24(1), 38–52. doi:10.1108/DPM-04-2014-0075

Comfort, L. K. (2012). Designing Disaster Resilience and Public Policy: Comparative Perspectives part 2. *Journal of Comparative Policy Analysis: Research and Practice*, 14(2), 109–113. doi:10.1080/13876988.2012.664709

Linnenluecke, M. K., and Griffiths, a. (2013). The 2009 Victorian Bushfires: A Multilevel Perspective on Organizational Risk and Resilience. *Organization and Environment*, 26(4), 386–411. doi:10.1177/1086026613508126

Linnenluecke, M., and Griffiths, a. (2010). Beyond Adaptation: Resilience for Business in Light of Climate Change and Weather Extremes. *Business and Society*, 49(3), 477–511. doi:10.1177/0007650310368814

Preparedness and organizational reliability

Title	Year	Authors	Journal	Citations
The Resilience Architecture Framework: Four organizational archetypes	2014	Limnios, Elena Alexandra Mamouni; Mazzarol, Tim; Ghadouani, Anas; Schilizzi, Steven G. M.	<i>European Management Journal</i>	7
The Resilient Organization A critical appraisal	2013	Boin, Arjen; van Eeten, Michel J. G.	<i>Public Management Review</i>	11
A Complex Adaptive Systems View of Resilience in a Project Team	2012	Edson, Mary C.	<i>Systems Research And Behavioral Science</i>	5
Preparedness: the state of the art and future prospects	2012	Hemond, Yannick; Robert, Benoit	<i>Disaster Prevention And Management</i>	6
Organizational resilience: A conceptual integrative framework	2012	Kantur, Deniz; Iseri-Say, Arzu	<i>Journal Of Management And Organization</i>	6
Managerial Autism: Threat-Rigidity and Rigidity's Threat	2012	Muurlink, Olav; Wilkinson, Adrian; Peetz, David; Townsend, Keith	<i>British Journal Of Management</i>	5
The unlearning dimension of organizational learning in construction projects	2012	Wong, Peter S. P.; Cheung, Sai On; Yiu, Regina L. Y.; Hardie, Mary	<i>International Journal Of Project Management</i>	8
Organizational errors: Directions for future research	2011	Goodman, Paul S.; Ramanujam, Rangaraj; Carroll, John S.; Edmondson, Amy C.; Hofmann, David A.; Sutcliffe, Kathleen M.	<i>Research In Organizational Behavior: An Annual Series Of Analytical Essays And Critical Reviews, Vol 31</i>	14
Developing a capacity for organizational resilience through strategic human resource management	2011	Lengnick-Hall, Cynthia A.; Beck, Tammy E.; Lengnick-Hall, Mark L.	<i>Human Resource Management Review</i>	50
Understanding and reducing vulnerability: from the approach of liabilities and capabilities	2011	McEntire, David	<i>Disaster Prevention And Management</i>	5
Organizing for Transient Reliability: The Production of Dynamic Non-Events	2011	Weick, Karl E.	<i>Journal Of Contingencies And Crisis Management</i>	12
ECOLOGICAL SENSEMAKING	2011	Whiteman, Gail; Cooper, William H.	<i>Academy Of Management Journal</i>	45
Policy and Practice: Recursive Learning From Crisis	2010	Elliott, Dominic; Macpherson, Allan	<i>Group And Organization Management</i>	12
Reclaiming resilience and safety: Resilience activation in the critical period of crisis	2009	Powley, Edward H.	<i>Human Relations</i>	35

Managing the Threat of Terrorism in British Travel and Leisure Organizations	2009	Sullivan-Taylor, Bridgette; Wilson, David C.	<i>Organization Studies</i>	10
A strategic marketing intelligence and multi-organisational resilience framework	2008	Trim, Peter R. J.; Lee, Yang-Im	<i>European Journal Of Marketing</i>	10
Understanding and managing complexity risk	2007	Bonabeau, Eric	<i>Mit Sloan Management Review</i>	11
Reliability, mindfulness, and information systems	2006	Butler, BS; Gray, PH	<i>Mis Quarterly</i>	59
Shared situation awareness as a contributor to high reliability performance in railroad operations	2006	Roth, Emilie M.; Multer, Jordan; Raslear, Thomas	<i>Organization Studies</i>	33
The link between diversity and resilience	2005	Reinmoeller, P; van Baardwijk, N	<i>Mit Sloan Management Review</i>	29
Paradox of coordination and control	2000	Gittell, JH	<i>California Management Review</i>	12
On a wing and a prayer? Exploring the human components of technological failure	2000	Smith, D	<i>Systems Research And Behavioral Science</i>	6
Organizing for high reliability: Processes of collective mindfulness	1999	Weick, KE; Sutcliffe, KM; Obstfeld, D	<i>Research In Organizational Behavior, Vol. 21, 1999</i>	506
Organizational learning activities in high-hazard industries: The logics underlying self-analysis	1998	Carroll, JS	<i>Journal Of Management Studies</i>	95
The Collapse Of Sensemaking In Organizations - The Mann Gulch Disaster	1993	Weick, KE	<i>Administrative Science Quarterly</i>	1009
Collective Mind In Organizations - Heedful Interrelating On Flight Decks	1993	Weick, KE; Roberts, KH	<i>Administrative Science Quarterly</i>	1261
Learning Through Failure - The Strategy Of Small Losses	1992	Sitkin, Sb	<i>Research In Organizational Behavior</i>	334
Adapting To Environmental Jolts	1982	Meyer, Ad	<i>Administrative Science Quarterly</i>	523
Threat-Rigidity Effects In Organizational-Behavior - A Multilevel Analysis	1981	Staw, BM; Sandelands, LE; Dutton, JE	<i>Administrative Science Quarterly</i>	1126

Articles located through additional searching

Holling, C. S. (1973). Resilience and Stability of Ecological Systems. *Annual Review of Ecology and Systematics*, 4(1), 1–23. doi:10.1146/annurev.es.04.110173.000245

Holling, C. S. (2001). Understanding the Complexity of Economic, Ecological, and Social Systems. *Ecosystems*, 4(5), 390–405. doi:10.1007/s10021-00

Goodman, P. S., Ramanujam, R., Carroll, J. S., Edmondson, A. C., Hofmann, D. A., and Sutcliffe, K. M. (2011). Organizational errors: Directions for future research. In Staw, BM and Brief, AP (Ed.), *Research in Organizational Behavior* (Vol. 31, pp. 151–176). doi:10.1016/j.riob.2011.09.003

Vogus, T. J., and Sutcliffe, K. M. (2007). Organizational resilience: Towards a theory and research agenda. In 2007 IEEE INTERNATIONAL CONFERENCE ON SYSTEMS, MAN AND CYBERNETICS, VOLS 1-8 (pp. 3476–3480).

Dekker, S., Hollnagel, E., Woods, D. D., and Cook, R. (2008). Resilience Engineering : New directions for measuring and maintaining safety in complex systems. Lund University School of Aviation, (Final report), 1–67.

Starbuck, B. (2002). Creating Foresight : Lessons for Enhancing Resilience from Columbia David Woods Cognitive Systems Engineering Laboratory Institute for Ergonomics The Ohio State University. Knowledge Creation Diffusion Utilization.

Roe, E., and Schulman, P. R. (2012). Toward a Comparative Framework for Measuring Resilience in Critical Infrastructure Systems. *Journal of Comparative Policy Analysis: Research and Practice*, 14(2), 114–125. doi:10.1080/13876988.2012.664687

Vaughan, D. (1999). The dark side of organizations: Mistake, misconduct, and disaster. *Annual Review of Sociology*. Retrieved from <http://arjournals.annualreviews.org/doi/abs/10.1146/annurev.soc.25.1.271>

Vogus, T. J., and Welbourne, T. M. (2003). Structuring for high reliability: HR practices and mindful processes in reliability-seeking organizations. *Journal of Organizational Behavior*, 24(7), 877–903.

Meshkati, N., and Khashe, Y. (2015). Operators' Improvisation in Complex Technological Systems: Successfully Tackling Ambiguity, Enhancing Resiliency and the Last Resort to Averting Disaster. *Journal of Contingencies and Crisis Management*, 23(2), 90–96. doi:10.1111/1468-5973.12078

Powley, E. H. (2009). Reclaiming resilience and safety: Resilience activation in the critical period of crisis. *Human Relations*, 62(9), 1289–1326. doi:10.1177/0018726709334881

Vaughan, D. (2002). SIGNALS AND INTERPRETIVE WORK: THE ROLE OF CULTURE IN A THEORY OF PRACTICAL ACTION. *Culture in Mind: Toward a Sociology of Culture and ...*, 28–54.

Barton, M. A., Sutcliffe, K. M., Vogus, T. J., and DeWitt, T. (2015). Performing Under Uncertainty: Contextualized Engagement in Wildland Firefighting. *Journal of Contingencies and Crisis Management*, 23(2), 74–83. doi:10.1111/1468-5973.12076

Termeer, C. J. a. M., and van den Brink, M. a. (2012). Organizational Conditions for Dealing with The Unknown Unknown. *Public Management Review*, 15(February 2015), 1–20. doi:10.1080/14719037.2012.664014

Cooke, D., and Rohleder, T. (2006). Learning from incidents: from normal accidents to high reliability. *System Dynamics Review*, 22(3), 213–239. doi:10.1002/sdr

Roberto, M., Bohmer, R., and Edmondson, A. (2006). Facing ambiguous threats. *Harvard Business Review*. Retrieved from http://i.bnet.com/pdf/174953-Facing_?Ambiguous?_Threats.pdf

Tucker, A., and Edmondson, A. (2003). Why hospitals don't learn from failures. *California Management Review*, (1). Retrieved from <http://www.kpsacmcme.com/CME/PSU/WhyHospDontLearnFromFailures.pdf>

Skertich, R. L. ., Johnson, D. E. A. ., and Comfort, L. K. . (2013). A Bad Time for Disaster: Economic Stress and Disaster Resilience. *Administration and Society*, 45(2), 145–166. doi:10.1177/0095399712451884

Denyer, D., Kutsch, E., Lee-Kelley, E. (Liz), and Hall, M. (2011). Exploring reliability in information systems programmes. *International Journal of Project Management*, 29(4), 442–454. doi:10.1016/j.ijproman.2011.02.002

Coping with occupational and job demands

Title	Year	Authors	Journal	Citations
Why Entrepreneurs Often Experience Low, Not High, Levels of Stress: The Joint Effects of Selection and Psychological Capital	2016	Baron, Robert A.; Franklin, Rebecca J.; Hmieleski, Keith M.	<i>Journal Of Management</i>	11
Resilience training in the workplace from 2003 to 2014: A systematic review	2015	Robertson, Ivan T.; Cooper, Cary L.; Sarkar, Mustafa; Curran, Thomas	<i>Journal Of Occupational And Organizational Psychology</i>	5
Danger Zone Entrepreneurs: The Importance of Resilience and Self-Efficacy for Entrepreneurial Intentions	2014	Bullough, Amanda; Renko, Maija; Myatt, Tamara	<i>Entrepreneurship Theory And Practice</i>	8
Compassion satisfaction, compassion fatigue, anxiety, depression and stress in registered nurses in Australia: Phase 2 results	2014	Drury, Vicki; Craigie, Mark; Francis, Karen; Aoun, Samar; Hegney, Desley G.	<i>Journal Of Nursing Management</i>	10
Resilience in nurses: an integrative review	2014	Hart, Patricia L.; Brannane, Jane D.; De Chesnay, Mary	<i>Journal Of Nursing Management</i>	8
Compassion satisfaction, compassion fatigue, anxiety, depression and stress in registered nurses in Australia: study 1 results	2014	Hegney, Desley G.; Craigie, Mark; Hemsworth, David; Osseiran-Moisson, Rebecca; Aoun, Samar; Francis, Karen; Drury, Vicki	<i>Journal Of Nursing Management</i>	10
The Role of Psychological Capital in Perception of Safety Climate Among Air Traffic Controllers	2013	Bergheim, Kjersti; Eid, Jarle; Hystad, Sigurd William; Nielsen, Morten Birkeland; Mearns, Kathryn; Larsson, Gerry; Luthans, Brett	<i>Journal Of Leadership And Organizational Studies</i>	5
Entrepreneurial resilience during challenging times	2013	Bullough, Amanda; Renko, Maija	<i>Business Horizons</i>	6
Meeting the Leadership Challenge of Employee Well-Being Through Relationship PsyCap and Health PsyCap	2013	Luthans, Fred; Youssef, Carolyn M.; Sweetman, David S.; Harms, Peter D.	<i>Journal Of Leadership And Organizational Studies</i>	10
The added value of the positive: A literature review of positive psychology interventions in organizations	2013	Meyers, M. Christina; van Woerkom, Marianne; Bakker, Arnold B.	<i>European Journal Of Work And Organizational Psychology</i>	15
Relationship Quality and Virtuousness: Emotional Carrying Capacity as a Source of Individual and Team Resilience	2013	Stephens, John Paul; Heaphy, Emily D.; Carmeli, Abraham; Spreitzer, Gretchen M.; Dutton, Jane E.	<i>Journal Of Applied Behavioral Science</i>	13
A multi-level study of emergent group leadership: Effects of emotional stability and group conflict	2012	Li, Yan; Chun, Hui; Ashkanasy, Neal M.; Ahlstrom, David	<i>Asia Pacific Journal Of Management</i>	9

We Need a Hero! Toward a Validation of the Healthy and Resilient Organization (HERO) Model	2012	Salanova, Marisa; Llorens, Susana; Cifre, Eva; Martinez, Isabel M.	<i>Group And Organization Management</i>	14
RESOURCES FOR CHANGE: THE RELATIONSHIPS OF ORGANIZATIONAL INDUCEMENTS AND PSYCHOLOGICAL RESILIENCE TO EMPLOYEES' ATTITUDES AND BEHAVIORS TOWARD ORGANIZATIONAL CHANGE	2012	Shin, Jiseon; Taylor, M. Susan; Seo, Myeong-Gu	<i>Academy Of Management Journal</i>	27
Experimentally analyzing the impact of leader positivity on follower positivity and performance	2011	Avey, James B.; Avolio, Bruce J.; Luthans, Fred	<i>Leadership Quarterly</i>	26
Meta-Analysis of the Impact of Positive Psychological Capital on Employee Attitudes, Behaviors, and Performance	2011	Avey, James B.; Reichard, Rebecca J.; Luthans, Fred; Mhatre, Ketan H.	<i>Human Resource Development Quarterly</i>	114
Emotions in uniform: How nurses regulate emotion at work via emotional boundaries	2011	Hayward, Renae Maree; Tuckey, Michelle Rae	<i>Human Relations</i>	22
Organizational Socialization and Positive Organizational Behaviour: Implications for Theory, Research, and Practice	2011	Saks, Alan M.; Gruman, Jamie A.	<i>Canadian Journal Of Administrative Sciences-Revue Canadienne Des Sciences De L Administration</i>	9
Building Resilience	2011	Seligman, Martin E. P.	<i>Harvard Business Review</i>	18
Relationship between Positive Psychological Capital and Creative Performance	2011	Sweetman, David; Luthans, Fred; Avey, James B.; Luthans, Brett C.	<i>Canadian Journal Of Administrative Sciences-Revue Canadienne Des Sciences De L Administration</i>	19
Storm Clouds and Silver Linings: Responding to Disruptive Innovations Through Cognitive Resilience	2010	Dewald, Jim; Bowen, Frances	<i>Entrepreneurship Theory And Practice</i>	18
The Development and Resulting Performance Impact of Positive Psychological Capital	2010	Luthans, Fred; Avey, James B.; Avolio, Bruce J.; Peterson, Suzanne J.	<i>Human Resource Development Quarterly</i>	99
Contributions of work-life and resilience initiatives to the individual/organization relationship	2010	Ollier-Malaterre, Ariane	<i>Human Relations</i>	16
When respect deteriorates: incivility as a moderator of the stressor-strain relationship among hospital workers	2010	Oore, Debra Gilin; Leblanc, Diane; Day, Arla; Leiter, Michael P.; Laschinger, Heather K. Spence; Price, Sheri L.; Latimer, Margot	<i>Journal Of Nursing Management</i>	8
PSYCHOLOGICAL CAPITAL: A POSITIVE RESOURCE FOR COMBATING EMPLOYEE STRESS AND TURNOVER	2009	Avey, James B.; Luthans, Fred; Jensen, Susan M.	<i>Human Resource Management</i>	105
Can Positive Employees Help Positive Organizational Change? Impact of Psychological Capital and Emotions on Relevant Attitudes and Behaviors	2008	Avey, James B.; Wernsing, Tara S.; Luthans, Fred	<i>Journal Of Applied Behavioral Science</i>	117
Relationships and Resilience Care Provider Responses to Pressures From Managed Care	2008	Gittell, Jody Hoffer	<i>Journal Of Applied Behavioral Science</i>	0
The mediating role of psychological capital in the supportive organizational climate - employee performance relationship	2008	Luthans, Fred; Norman, Steven M.; Avolio, Bruce J.; Avey, James B.	<i>Journal Of Organizational Behavior</i>	145
Neuroscientific Implications of Psychological Capital: Are the Brains of Optimistic, Hopeful, Confident, and Resilient Leaders Different?	2008	Peterson, Suzanne J.; Balthazard, Pierre A.; Waldman, David A.; Thatcher, Robert W.	<i>Organizational Dynamics</i>	20
Positive psychological capital: Measurement and relationship with performance and satisfaction	2007	Luthans, Fred; Avolio, Bruce J.; Avey, James B.; Norman, Steven M.	<i>Personnel Psychology</i>	376
Emerging positive organizational behavior	2007	Luthans, Fred; Youssef, Carolyn A.	<i>Journal Of Management</i>	0
Emotion as mediators of the relations between perceived supervisor support and psychological hardiness on employee cynicism	2006	Cole, MS; Bruch, H; Vogel, B	<i>Journal Of Organizational Behavior</i>	43
Psychological capital development: toward a micro-intervention	2006	Luthans, F; Avey, JB; Avolio, BJ; Norman, SM; Combs, GM	<i>Journal Of Organizational Behavior</i>	167
Unleashing individual potential: Performance gains through positive organizational behavior and authentic leadership	2004	Gardner, WL; Schermerhorn, JR	<i>Organizational Dynamics</i>	49

The role of positive psychology in enhancing satisfaction, motivation, and productivity in the workplace	2004	Martin, AJ	<i>Journal Of Organizational Behavior Management</i>	9
How resilience works	2002	Coutu, DL	<i>Harvard Business Review</i>	136
The need for and meaning of positive organizational behavior	2002	Luthans, F	<i>Journal Of Organizational Behavior</i>	392

Articles located through additional searching

Kossek, E. E., and Perrigino, M. B. (2016). Resilience: A Review Using a Grounded Integrated Occupational Approach. *Academy of Management Annals*, 10(1), 1–69. doi:10.1080/19416520.2016.1159878

Robertson, I. T., Cooper, C. L., Sarkar, M., and Curran, T. (2015). Resilience training in the workplace from 2003 to 2014: A systematic review. *Journal of Occupational and Organizational Psychology*, 88(3), 533–562. doi:10.1111/joop.12120

Kish-Gephart, J. J., Detert, J. R., Treviño, L. K., and Edmondson, A. C. (2009). Silenced by fear: The nature, sources, and consequences of fear at work. *Research in Organizational Behavior*, 29, 163–193. doi:10.1016/j.riob.2009.07.002

Robertson, I. T., Cooper, C. L., Sarkar, M., and Curran, T. (2015). Resilience training in the workplace from 2003 to 2014: A systematic review. *Journal of Occupational and Organizational Psychology*, 88(3), 533–562. doi:10.1111/joop.12120

Renewal and strategic agility and crisis as opportunity

Title	Year	Authors	Journal	Citations
What You Can Learn From Family Business	2012	Kachaner, Nicolas; Stalk, George; Bloch, Alain	<i>Harvard Business Review</i>	6
Super-Flexibility For Real-Time Adaptation: Perspectives From Silicon Valley	2011	Bahrami, Homa; Evans, Stuart	<i>California Management Review</i>	8
Capture, Governance, And Resilience: Strategy Implications From The History Of Rome	2011	Carmeli, Abraham; Markman, Gideon D.	<i>Strategic Management Journal</i>	16
Key Issues For It Executives 2011: Cautious Optimism In Uncertain Economic Times	2011	Luftman, Jerry; Ben-Zvi, Tal	<i>Mis Quarterly Executive</i>	19
Why learning from failure isn't easy (and what to do about it): Innovation trauma at Sun Microsystems	2009	Valikangas, Liisa; Hoegl, Martin; Gibbert, Michael	<i>European Management Journal</i>	9
If at first you don't succeed: globalized production and organizational learning at the Hyundai Motor Company	2009	Wright, Christopher; Suh, Chung-Sok; Leggett, Christopher	<i>Asia Pacific Business Review</i>	5
Toward an Understanding of When Executives See Crisis as Opportunity	2008	Brockner, Joel; James, Erika Hayes	<i>Journal Of Applied Behavioral Science</i>	20
Dialectics of resilience: a multi-level analysis of a telehealth innovation	2007	Cho, Sunyoung; Mathiassen, Lars; Robey, Daniel	<i>Journal Of Information Technology</i>	22
The rise of the phoenix: methodological innovation as a discourse of renewal	2007	Wastell, David G.; McMaster, Tom; Kawalek, Peter	<i>Journal Of Information Technology</i>	9
The quest for resilience	2003	Hamel, G; Valikangas, L	<i>Harvard Business Review</i>	134

Articles located through additional searching

Teixeira, E. de O., and Werther, W. B. (2013). Resilience: Continuous renewal of competitive advantages. *Business Horizons*, 56(3), 333–342. doi:10.1016/j.bushor.2013.01.009

Sutcliffe, K. M. M. (1994). What executives notice: accurate perceptions in top management teams. *Academy of Management Journal*, 37(5), 1360–1378. doi:10.2307/256677

Supply chain vulnerabilities and disruptions

Title	Year	Authors	Journal	Citations
Supply network disruption and resilience: A network structural perspective	2015	Kim, Yusoon; Chen, Yi-Su; Linderman, Kevin	<i>Journal Of Operations Management</i>	7
A Contingent Resource-Based Perspective Of Supply Chain Resilience And Robustness	2014	Brandon-Jones, Emma; Squire, Brian; Autry, Chad W.; Petersen, Kenneth J.	<i>Journal Of Supply Chain Management</i>	14
Reducing the Risk of Supply Chain Disruptions	2014	Chopra, Sunil; Sodhi, Manmohan S.	<i>Mit Sloan Management Review</i>	15
Mitigation processes - antecedents for building supply chain resilience	2014	Scholten, Kirstin; Scott, Pamela Sharkey; Fynes, Brian	<i>Supply Chain Management-An International Journal</i>	11
The resilience of energy supply chains: a multiple case study approach on oil and gas supply chains to Europe	2014	Urciuoli, Luca; Mohanty, Sangeeta; Hintsä, Juha; Boekesteijn, Else Gerine	<i>Supply Chain Management-An International Journal</i>	5
Supply chains and supply networks: distinctions and overlaps	2013	Braziotis, Christos; Bourlakis, Michael; Rogers, Helen; Tannock, James	<i>Supply Chain Management-An International Journal</i>	6
Does firm innovativeness enable effective responses to supply chain disruptions? An empirical study	2013	Golgeci, Ismail; Ponomarov, Serhiy Y.	<i>Supply Chain Management-An International Journal</i>	5
A complex network approach to supply chain network theory	2013	Hearnshaw, Edward J. S.; Wilson, Mark M. J.	<i>International Journal Of Operations And Production Management</i>	22
Control and system-theoretic identification of the supply chain dynamics domain for planning, analysis and adaptation of performance under uncertainty	2013	Ivanov, Dmitry; Sokolov, Boris	<i>European Journal Of Operational Research</i>	23
Exploring the role of social capital in facilitating supply chain resilience	2013	Johnson, Noel; Elliott, Dominic; Drake, Paul	<i>Supply Chain Management-An International Journal</i>	10
Risk and resilience in agri-food supply chains: the case of the ASDA PorkLink supply chain in Scotland	2013	Leat, Philip; Revoredo-Giha, Cesar	<i>Supply Chain Management-An International Journal</i>	14
Ensuring Supply Chain Resilience: Development and Implementation of an Assessment Tool	2013	Pettit, Timothy J.; Croxton, Keely L.; Fiksel, Joseph	<i>Journal Of Business Logistics</i>	19
Selection of resilient supply portfolio under disruption risks	2013	Sawik, Tadeusz	<i>Omega-International Journal Of Management Science</i>	44
The influence of relational competencies on supply chain resilience: a relational view	2013	Wieland, Andreas; Wallenburg, Carl Marcus	<i>International Journal Of Physical Distribution And Logistics Management</i>	23
Supply Chain Risk Management: An Agent-Based Simulation to Study the Impact of Retail Stockouts	2013	Wu, Teresa; Huang, Simin; Blackhurst, Jennifer; Zhang, Xiaoling; Wang, Shanshan	<i>Ieee Transactions On Engineering Management</i>	8
The impact of supply network characteristics on reliability	2012	Adenso-Diaz, Belarmino; Mena, Carlos; Garcia-Carbajal, Santiago; Liechty, Merrill	<i>Supply Chain Management-An International Journal</i>	6
Scenario-based Supply Chain Network risk modeling	2012	Klibi, Walid; Martel, Alain	<i>European Journal Of Operational Research</i>	21
Optimizing system resilience: A facility protection model with recovery time	2012	Losada, Chaya; Scaparra, M. Paola; O'Hanley, Jesse R.	<i>European Journal Of Operational Research</i>	23
An Empirically Derived Framework of Global Supply Resiliency	2011	Blackhurst, Jennifer; Dunn, Kaitlin S.; Craighead, Christopher W.	<i>Journal Of Business Logistics</i>	41
A simulation-based framework to evaluate strategies for managing global inbound supply risk	2011	Colicchia, Claudia; Dallari, Fabrizio; Melacini, Marco	<i>International Journal Of Logistics-Research And Applications</i>	5
Supply chain resilience in the global financial crisis: an empirical study	2011	Juettner, Uta; Maklan, Stan	<i>Supply Chain Management-An International Journal</i>	40
Optimizing efficiency-robustness trade-offs in supply chain design under uncertainty due to disruptions	2011	Shukla, Aviral; Lalit, Vishal Agarwal; Venkatasubramanian, Venkat	<i>International Journal Of Physical Distribution And Logistics Management</i>	11

Impacts from Climate Change on Organizations: a Conceptual Foundation	2011	Winn, Monika I.; Kirchgorg, Manfred; Griffiths, Andrew; Linnenluecke, Martina K.; Guenther, Elmar	<i>Business Strategy And The Environment</i>	34
Risk Uncertainty and Supply Chain Decisions: A Real Options Perspective	2010	Hult, G. Tomas M.; Craighead, Christopher W.; Ketchen, David J., Jr.	<i>Decision Sciences</i>	42
The design of robust value-creating supply chain networks: A critical review	2010	Klibi, Walid; Martel, Alain; Guitouni, Adel	<i>European Journal Of Operational Research</i>	142
Do Perceptions Become Reality? The Moderating Role Of Supply Chain Resiliency On Disruption Occurrence	2010	Zsidisin, George A.; Wagner, Stephan M.	<i>Journal Of Business Logistics</i>	40
Understanding the concept of supply chain resilience	2009	Ponomarov, Serhiy Y.; Holcomb, Mary C.	<i>International Journal Of Logistics Management</i>	102
Supply chain security culture: measure development and validation	2009	Williams, Zachary; Ponder, Nicole; Autry, Chad W.	<i>International Journal Of Logistics Management</i>	14
Supply chain optimization of petroleum organization under uncertainty in market demands and prices	2008	Al-Othman, Wafa B. E.; Lababidi, Haitham M. S.; Alatiqi, Imad M.; Al-Shayji, Khawla	<i>European Journal Of Operational Research</i>	28
Competition and diversification effects in supply chains with supplier default risk	2007	Babich, Volodymyr; Burnetas, Apostolos N.; Ritchken, Peter H.	<i>Mandsom-Manufacturing And Service Operations Management</i>	111
The severity of supply chain disruptions: Design characteristics and mitigation capabilities	2007	Craighead, Christopher W.; Blackhurst, Jennifer; Rungtusanatham, M. Johnny; Handfield, Robert B.	<i>Decision Sciences</i>	0
Designing survivable resilient networks: A stochastic hybrid genetic algorithm approach	2007	Konak, Abdullah; Bartolacci, Michael R.	<i>Omega-International Journal Of Management Science</i>	18
Broken ties: The impact of organizational restructuring on the stability of information-processing networks	2007	Kwon, Dowan; Oh, Wonseok; Jeon, Sangyong	<i>Journal Of Management Information Systems</i>	10
Security and the global supply chain	2006	Sarathy, Ravi	<i>Transportation Journal</i>	27
Managing disruption risks in supply chains	2005	Kleindorfer, PR; Saad, GH	<i>Production And Operations Management</i>	423
Sustainable operations management	2005	Kleindorfer, PR; Singhal, K; Van Wassenhove, LN	<i>Production And Operations Management</i>	321
A supply chain view of the resilient enterprise	2005	Sheffi, Y; Rice, JB	<i>Mit Sloan Management Review</i>	192

Articles located through additional searching

Not conducted

Ensuring IT/IS/Cyber stability

Title	Year	Authors	Journal	Citations
Institutional pressures and mindful IT management: The case of a container terminal in China	2009	Wong, Christina W. Y.; Lai, Kee-hung; Teo, Thompson S. H.	<i>Information And Management</i>	16
The impact of enterprise systems on organizational resilience	2007	Ignatiadis, Ioannis; Nandhakumar, Joe	<i>Journal Of Information Technology</i>	16
Resilience as a source of survival strategy for high-technology firms experiencing megacompetition	2004	Watanabe, C; Kishioka, M; Nagarnatsu, A	<i>Technovation</i>	5
Information system organizational resilience	2003	Riolfi, L; Savicki, V	<i>Omega-International Journal Of Management Science</i>	27
Institutional pressures and mindful IT management: The case of a container terminal in China	2009	Wong, Christina W. Y.; Lai, Kee-hung; Teo, Thompson S. H.	<i>Information And Management</i>	16
The impact of enterprise systems on organizational resilience	2007	Ignatiadis, Ioannis; Nandhakumar, Joe	<i>Journal Of Information Technology</i>	16

Resilience as a source of survival strategy for high-technology firms experiencing megacompetition	2004	Watanabe, C; Kishioka, M; Nagarnatsu, A	<i>Technovation</i>	5
Information system organizational resilience	2003	Rioli, L; Savicki, V	<i>Omega-International Journal Of Management Science</i>	27

Articles located through additional searching

Not conducted

Defining and conceptualizing resilience

Articles located through additional searching

Hémond, Y., and Robert, B. (2012). Preparedness: the state of the art and future prospects. *Disaster Prevention and Management*, 21(4), 404–417. doi:10.1108/09653561211256125

Sawalha, I. H. S. (2015). Managing adversity: understanding some dimensions of organizational resilience. *Management Research Review*, 38(4), 346–366. doi:10.1108/MRR-01-2014-0010

Aldunce, P., Beilin, R., Handmer, J., and Howden, M. (2014). Framing disaster resilience: The implications of the diverse conceptualisations of “bouncing back.” *Disaster Prevention and Management*, 23(3), 252–270. doi:10.1108/DPM-07-2013-0130

Sudmeier-Rieux, K. I. (2014). Resilience – an emerging paradigm of danger or of hope? *Disaster Prevention and Management*, 23(1), 67–80. doi:10.1108/DPM-12-2012-0143

Mamouni Limnios, E. A., Mazzarol, T., Ghadouani, A., and Schilizzi, S. G. M. (2014). The resilience architecture framework: Four organizational archetypes. *European Management Journal*, 32(1), 104–116. doi:10.1016/j.emj.2012.11.007

Linnenluecke, M. K. (2015). Resilience in Business and Management Research: A Review of Influential Publications and a Research Agenda. *International Journal of Management Reviews*, 00, 1–27. doi:10.1111/ijmr.12076

Seville, E. (2008). Resilience: Great Concept but What Does it Mean? Paper Presented at the US Council of Competitiveness Workshop, Risk and Resilience. Wilmington, USA. November 2008., (November), 10. Retrieved from <http://ir.canterbury.ac.nz/handle/10092/2966>

bsi.

