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Organisational IS Resilience: a pilot study using Q-methodology

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Abstract

Organisational resilience has gained increasing attention in recent years. This paper focuses on an aspect of organisational resilience, i.e., on IS resilience. Given the potentially devastating implications of disruptions to organisations, understanding the dynamics of the successful adaptation of IS within organisations indicates an important avenue for future research. In this paper, we adopt Agency theory to develop a conceptual framework, focused on decision making and planning for IS resilience. Concourse theory and Q-methodology were used to develop a Q-sort questionnaire, which was refined through interviews with researchers and IS professionals. The resulting 38 statements were then sorted by eight managers. Q-sort methodology identified three types from the data, each representing distinct collective perspectives. These types are described and discussed, along with implications of findings as well as suggestions for future research.

Keywords

Information system resilience, agency theory, Q-sort methodology, decision making, disaster preparedness

INTRODUCTION

Natural disasters, pandemic disease, and terrorist attacks all pose a severe threat to the continuity of an organisation's operation. Disasters can cause challenges to organisations and it is essential that sufficient effort is directed into making them robust and resilient to withstand these uncertainties and challenges. To a large extent, most organisations are dependent on information systems in their activities. Should there be a major disruption to the information systems services, it is practically impossible for the businesses to function with snail mails and paper based accounting. Therefore, when examining the crisis resilience of organisations, one crucial aspect is to examine the continuance of stable and reliable IS services (Gibb and Buchanan 2006).

Although resilience is widely recognised in related disciplines such as, Computer Science, Crisis Management or Safety Engineering, there is very little attention paid by IS scholars to IS resilience. Today, only a limited number of resilience research exists (Muller, Koslowski and Accorsi, 2013). An IBM study reported how organizations are increasingly adopting integrated business resilience strategies in an uncertain environment and large organisations lead the way in business and IS resilience (IBM 2011). Most studies close to IS resilience have been made in the context of big business, with few attempts to study smaller businesses. However, given the specificities of SMEs as organizations, research results obtained from the study of large enterprise IS cannot necessarily be generalized and transferred to SMEs (Thong, 1999). While the broader aim for this study is to examine organisational IS resilience in SMEs, this paper focuses on the first step of developing an instrument to understand the decision priorities of owner-managers of SMEs with regard to IS resilience. Small and Medium Sized Enterprises (SMEs) make a significant contribution to employment generation and economic growth of a nation (OECD 2010; Ministry of Economic Development, 2012). SMEs in New Zealand represent 99 per cent of the business population (NZ Ministry of Economic Development, 2012). The SME sector is often referred to as the backbone of the economy of a nation. Traditionally, SMEs have several advantages over larger companies due to their flexibility in adapting to change. However, SMEs are vulnerable and very susceptible to these types of disaster.

In this paper, the emphasis is on a relatively overlooked area of research; that is the people who own and operate these firms – the entrepreneurs or owner-managers – and their efforts to make their business resilient in terms of Information Systems. Much research to date has focused on characteristics of the firm (e.g. size, sector, performance and practices, etc.), and characteristics of the entrepreneur and owner-manager in an attempt to

understand firm survival, growth and failure (Massey 2005). However, little attention has been given to the characteristics of the entrepreneur and owner-manager and how they make decisions in time of crisis to ensure resilience. This research gap is surprising, as resilience is often said to be a combination of organisational and technical qualities and, therefore, a research topic well suited for IS research (Muller, Koslowski and Accorsi, 2013). SMEs are highly dependent on the entrepreneur or owner-manager as a leader, decision maker, manager and day-to-day operator of the firm (Storey and Greene 2010).

Agency theory has demonstrated significant predictive power with respect to the decision-making of business owners and managers by its proposition of the principal-agent relationship dynamics (Jensen and Meckling, 1976; Eisenhardt, 1989; Gurbaxani and Whang, 1991; Lee and Wingreen, 2010). Specifically, agency theory proposes that the misalignment of interests between the principals (owners) of a firm and the agents (managers) is a source of costs and losses to the firm (Jensen and Meckling, 1976; Eisenhardt, 1989). In the context of SMEs, where the owner and manager is frequently either the same person, or a small, tight-knit group of people, in theory there should be either very little or no misalignment of interests, and therefore very low costs associated with "agency problems", as they are called.

The paper first reviews the literature on organisational resilience, SMEs, and agency theory. The paper then describes the research methodology, in which the methods and procedures prescribed by discourse theory are used to develop and pilot test a set of Q-sort items. Further, we present the findings of a pilot study. The paper concludes with the relevance of this research for both practitioners and academics and we propose some recommendations for further research in the area of IS resilience.

LITERATURE REVIEW

Definition of IS Resilience

The concept of resilience has been a prominent and emerging topic in various scientific fields, however, as resilience research encompasses a wide range of disciplines such as ecology, psychology or engineering, and different research contexts and topics, it is not surprising that the concept lacks an accepted common definition across disciplines (Muller, Koslowski and Accorsi, 2013). Rooted from the word *resilire*, meaning to spring back or to rebound, the term refers to "the ability to recover form and position elastically" (Muller, Koslowski and Accorsi, 2013). Against this background, resilience is defined as the ability of an organisation to not only survive but to thrive, both in good times and in the face of adversity (Seville 2009). Vargo and Stephenson (2010) proposed that for organisations to invest in resilience, the business case for resilience investments has to go beyond insurance, and must be as good as the business cases for new equipment or new staff (Vargo and Stephenson 2010).

After an extensive literature review we have not been able to find a definition of IS resilience. However, organisational resilience has been studied extensively by researchers (Vargo and Seville, 2011; Hatton, Seville, and Vargo, 2012). In order to define IS resilience we have utilised six attributes as identified by McManus (2008), namely overall situation awareness, decreased vulnerabilities and increased adaptability, risk intelligence, flexibility and agility. These terms are defined in Table 1.

Table 1. Attributes of IS resilience.

Set of Attributes	Definition
Situation awareness	It is the ability to identify and understand changes in the environment.
Management of Vulnerabilities	It is the capability to deal with the major vulnerabilities.
Adaptive Capacity	It is the capability to respond to and adapt to the changing environment.
Risk Intelligence	It is the ability to identify and anticipate risks.
Flexible	It is the ability to change.
Agile	It is the ability to produce timely responses to changing environment and conditions.

A definition of Information Systems resilience is introduced based on these characteristics for the purpose of our study, it is defined as:

Information Systems resilience is a function of an organization's overall situation awareness related to Information Systems, management of Information Systems vulnerabilities, and adaptive capacity, risk intelligence, flexibility and agility of Information Systems in a complex, dynamic, and interconnected environment.

Resilience of Organisations

Gibson and Tarrant (2010) presented the integrated functions model which suggests that organisational resilience is a goal that results from a combination of activities such as risk management and business continuity.

Gibson and Tarrant (2010) also presented the herringbone resilience model shown as Figure 1. This model suggests that resilience is enhanced by a combination of an organisation's characteristics or attributes and their activities and capabilities (Gibson and Tarrant 2010). The herringbone model incorporates many of the factors considered as possible indicators of IS resilience.

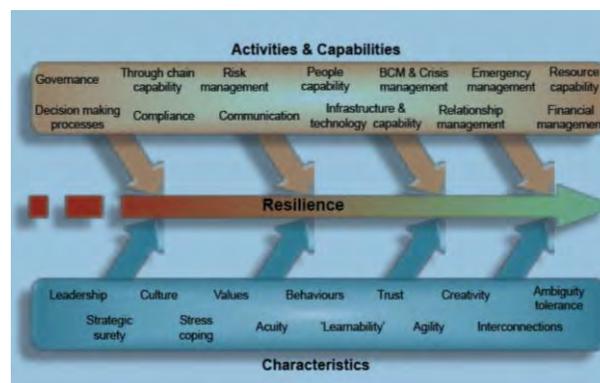


Figure 1: Herringbone Resilience Model (Gibson and Tarrant 2010)

The 'herringbone' recognises that an organisation possesses a substantial range of capabilities and undertakes a range of activities that will contribute towards improved resilience. Furthermore, the organisation also exhibits a number of characteristics that will affect the effectiveness of the capabilities and activities and help to enhance the organisation's resilience (Gibson and Tarrant 2010).

For most firms today, much business is done with vendors and customers on the Internet; they rely heavily on IT and data, and operate 24/7. For this reason, the line between business and information systems is blurred (Sayana 2005). In such cases, continued availability of information systems is a sine qua non for business. Such businesses do not have any other alternate means of recording transactions and other data, hence cannot afford to be without information systems for long. All businesses that use information systems and data in their operations have a need for business continuity and a disaster recovery plan. Most large organisations, particularly all Fortune 1000 enterprises, conduct regular IS audits to ensure confidentiality, integrity and continuous availability of information systems (Singleton 2011). Hence, continued availability of information systems is one of the major criteria for IS resilience.

However, a small enterprise that uses IT and whose business processes are reliant on IT, is also at high risk (Singleton 2011). Goodwin (2005) noted that SMEs are particularly weak in demonstrating what they had planned for business continuity of their IT systems. Goodwin (2005) predicted that SMEs will soon be under-pressure from large businesses, regulators, investors, insurers and their suppliers to demonstrate resilience. Thus, it will be hard for them to ignore business continuity in the future. Unfortunately SMEs are much less likely to carry out such planning processes than larger organisations, and, when they do, the planning is likely to be less disciplined (Berman et al. 1997). However, structured planning processes can be good for SMEs (Cragg and King 1988).

Planning and Resilience

Discussion on resilience is incomplete unless we explore planning. A central theme of resilience research are the questions of anticipation vs. resilience, and planning vs. adaptation. Anticipation involves predicting possible sources of failure or causes of crisis or disaster, so that they can be planned for, mitigated, or avoided altogether. Weick and Sutcliffe (2007) refer to this as avoiding error by design, whereby a system of controls, processes and

checks is put in place to prevent possible crises from occurring. Weick and Sutcliffe (2007) added that an anticipatory approach is more suited to environments characterised by stability and predictable outcomes.

In contrast, resilience involves being flexible in a changing environment. Weick and Sutcliffe (2007) discuss the resilience approach and note that resilient organisations recognise that it is impossible to prevent all crises and disasters all of the time. Instead they monitor their organisation as a system with inputs and outputs, the characteristics of which can provide information about the health of the whole system. Both planning and resilience involve the evaluation and prioritization of a multitude of factors, the prioritization of those factors with reference to one another, and decisions that ultimately reflect the priorities of the decision maker. Therefore it is necessary to adopt a strategy and methods that support prioritization of a multitude of decision criteria.

Optimally, businesses should find the most efficient balance, or “equilibrium” between anticipation and resilience. Comfort (2001) argues that disaster management practices are moving towards a combination of anticipation and resilience strategies. “While we agree that resilience is the key to coping, it is necessary to organise for resilience” (Comfort, 2001). Research also suggests that the anticipatory approach, including planning, is used to enable organisations to be resilient. Planning and formalising response arrangements in advance means that the organisation is free, at the time of crisis, to be much more adaptive and resilient in its response (Teoh and Zadeh 2013). Thus, instead of planning for an uninterrupted and continuous operation, a resilient organisation is able to recognise disturbances and circumvent risk with an ability to adapt and reconfigure as quickly as appropriate, either to bring the organisation to the optimal operational position, or to converge to a new optimal operating position (Teoh and Zadeh 2013).

SMEs

Research has highlighted that there is no precise definition of SMEs (Bhamra et al., 2011). As SMEs differ in size, location, business, financial performance, maturity and management style, the definition of SMEs varies from country to country.

Government bodies and official statistics most commonly define SMEs as those having fewer than 20 full time equivalent employees (NZ Ministry of Economic Development, 2012). The generalised characteristics of these firms are that they have limited access to resources, personalised management styles and little formal structure (Battisti et al. 2009). Due to lack of universally accepted definition of SME, in our research we will define SMEs as “*privately owned, have personalised management styles, little formal structures and employ less than 20 full time staff members.*”

It is well known that SMEs are different from large organisations in many respects, and organizational theories applicable to large firms may not be applicable to them (Thong, 1999). It is important to remember that a small firm is “not a little big business,” (Thong, 1999). Thus, care should be taken when studying technology issues in small firms (Thong, 1999). We will elaborate and explain some of these differences using agency theory.

Agency Theory Effects in SMEs

Agency theory applies to situations where one or more persons (the principals) engage another person or persons (the agents) to perform some service on their behalf, which includes delegating some decision making authority to the agent. “If both parties to the relationship are utility maximisers then there is good reason to believe the agent will not always act in the best interests of the principal” (Jensen and Meckling, 1976). Agency theory predicts that the agency conflict may be reduced when the owner is involved in management (Fama and Jensen, 1983; Jensen and Meckling, 1976). This theory may be more pertinent in the case of smaller organisations where it is more likely for the principal and agent to develop a close relationship, or even the principal and agent may, for practical purposes, be the same person. On the other hand, it is also true that managers in small firms may be more isolated from the market discipline due to a closer relationship with their principals. Such isolation may result in entrenchment. Entrenchment is, in turn, likely to have a negative impact on performance. Furthermore, isolation from market disciplines and entrenchment-induced inertia is likely to encourage a weak culture and weak leadership as well as a myopic strategy (Ghobadian and O'Regan, 2006).

However, in SMEs, the CEO is usually also the owner-manager. Since the CEO is the main decision maker, the managerial style and personal traits of the CEO could potentially influence the culture, leadership and strategic planning processes of an SME (Ghobadian and O'Regan, 2006). Therefore, in the case of an SME with a single CEO owner-manager, decision priorities reflect the risk tolerance or risk aversion of the owner-manager, and often do not include “agency effects” related to the misaligned interests of other decision makers.

The owner-manager’s desire for autonomy and possible disposition towards social aspects of relationships should not be ignored when trying to better understand the dynamics of power within SMEs. Implementing

change can be particularly problematic for organisations where power and authority are highly centralised (Paton, 2007). Competitor power is also of concern to SMEs, especially when buyers can at short notice switch suppliers (Saunders, 1997).

In summary, based on the arguments and predictions of agency theory, SMEs and large organisations are likely to behave differently. Moreover, agency theory predicts differences in leadership style, culture, the emphasis placed on different dimensions of the strategy making process, barriers to the implementation of strategy and performance between SMEs and large organisations. The transformational leadership style is more prevalent in SMEs, while the transactional leadership style is more prevalent in large organisations. SMEs and large organisations also differ across a number of culture constructs. Large organisations are more likely to have formal strategic plans than SMEs. The personal traits of CEOs could potentially influence the culture, leadership, and strategic planning processes of an SME.

Overall, it is evident from our literature review that the form of IS resilience in large organisations may not be directly applicable to SMEs. Whereas in large firms, a study of the firm involves the study of its network of principals and agents, their interrelationships, and decision structures intended to make them function as if they were of one mind and purpose; in SMEs we often find that the firm and the CEO owner-manager are one and the same. In other words, to study the decision priorities of SMEs is to study their CEOs, and to study CEOs of SMEs is to study their firms' decision priorities.

Research Model

A conceptual framework of determinants of IS resilience, and therefore what ought to be the decision priorities for one who is responsible for IS resilience, is presented in Figure 2.

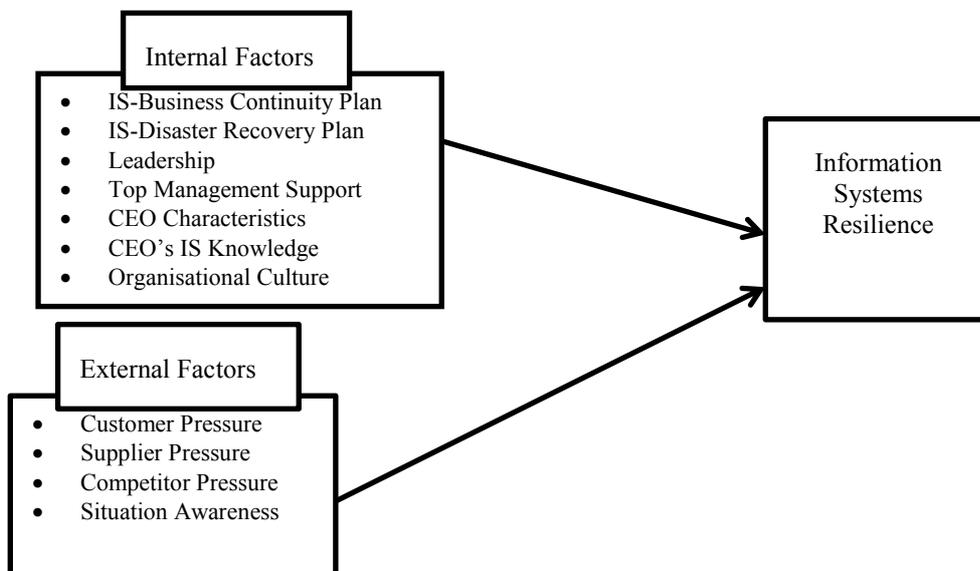


Figure 2: IS Resilience Conceptual Framework

Internal and external factors presented in the above framework of IS resilience for SMEs were derived from the literatures discussed in the previous section. In the context of this research, the model provides a guide for the development of instrumentation, and interpretation of the results.

RESEARCH METHOD

Concourse theory is a theory of communicability which proposes that people "operate" within a universe of possible thoughts, ideas, feelings, and related referential material (Brown, 1980; Stephenson, 1986a & 1986b; Klaus, Wingreen, and Blanton, 2010). The universe of possibilities for any given topic is a "concourse", and each person possesses a unique "perspective" of the concourse that is reflected by their own personal prioritization of the content of the concourse. Concourse theory prescribes Q-methodology as the principal means of operationalizing a concourse, and the perspectives of people with reference to the concourse. To operationalize the person's unique perspective of a concourse, Q-methodology proposes the Q-sort and Q-factor analysis (Stephenson, 1986 - 1988; Wingreen, Lerouge, Blanton, 2009; Wingreen et al., 2005). A Q-sort requires the person to sort through a field of statements that represent the concourse, and to classify those statements into a quasi-normal distribution, typically between "most important" and "most unimportant", or "most desirable" and "most undesirable". In doing so, the Q-sort captures the person's priorities with respect to the concourse, and operationalizes their unique perspective. Therefore, concourse theory, Q-methodology, and

the Q-sort are also appropriate to operationalize the decision priorities of CEO owner-managers in SMEs, since in their planning and decision making, they also operate within a "concourse" of criteria related to IS resilience.

Instrument Development

The Q-sort instrumentation, a set of 38 Q-sort statements, was developed according to the guidelines delineated by previous research (Brown, 1980; Stephenson, 1986a, 1986b, and 1986c). A set of Q-sort statements should represent the concourse of interest in the same way that a sample of people should represent the population in a classical correlational study. Therefore, certain prescribed guidelines are adopted in the selection of statements so as to achieve the highest probability of "representativeness" of the domain of the concourse: 1) review of the literature, 2) conversations and interviews with people who participate in the concourse, and 3) input from domain experts about the content of the sample of Q-statements (Brown, 1980; Dennis, 1988).

Furthermore, if there are areas of theoretical interest, as there are in this research, then a "structured q-set" may be developed, which balances the number of Q-statements in each theoretical category, in much the same way as experimental participants are assigned to groups for balanced experimental designs in classical experimental research (Watts and Stenner, 2012). To accomplish this, we selected statements from figures 1 and 2 to represent the various dimensions of IS resilience which should be reflected in the decision priorities of SME CEOs. These items were then coded according to whether they might be desirable for large or small firms according to agency theory, and risk tolerant or risk-averse decision makers. Therefore, the final set of 38 items was both representative of the larger concourse and well-balanced with regard to all the theoretical categories of interest in the current research.

Pilot Test

CEO owner-managers of local SMEs were recruited to assist as evaluators with the item selection phase. Following the guidelines for instrument development, feedback from the evaluators was incorporated into the Q-statement and Q-Sort instrumentation. After several iterations of the instrument development guidelines, the evaluators confirmed that the instrument is ready and should function as intended. We then approached seven CEO owner-managers of local SMEs, who provided their own Q-sorts for the purposes of testing the statistical properties of the Q-sort set and also evaluated the Q-Sort instrument. Furthermore, in order to test the theoretical structure incorporated into the Q-set, a local IT manager of a public institution was recruited to provide his own Q-sort. Agency theory predicts that the IT manager of a public institution should have very different IS resilience planning priorities than CEO owner-managers of SMEs, and these priorities should manifest themselves by the selection of Q-sort statements from different theoretical categories from the structure of the Q-sort set. The data gathered was analysed using the PQ-method software that is commonly used in Q-methodology research (Wingreen et al, 2005).

RESEARCH FINDINGS AND DISCUSSION

This section presents the findings of this research that were reached through analysis of Q-sort data. The Q-sort data was analysed using a centroid factor analysis, as suggested by prior research < removed for refereeing>. Two, three and four-factor solutions were examined at first, however, since the four-factor solution converged to a three-factor solution, there was no need to continue, and a three-factor solution was adopted.

Table 2. Z-scores and statement rankings by factor type.

Statements	Type 1		Type 2		Type 3	
	<i>z</i>	<i>rank</i>	<i>z</i>	<i>rank</i>	<i>z</i>	<i>rank</i>
1. IS DR plans informed by understanding of underlying causes of vulnerability and other factors outside organisation's control.	1.49	5	1.36	6	0	21
2. Organisation ISCP plans, developed through participatory processes, put into operation and updated periodically.	0.49	11	0	26	-0.54	29
3. Organisation's IS resilience plan shared with all suppliers.	-0.75	30	-2.04	38	-1.12	35
4. Organisation hazard/risk assessments carried out which provide comprehensive picture of all major hazards and risks faced by organisation (and potential risks).	0.3	17	0.68	12	0	21
5. On-going monitoring of hazards and risks and updating of plans.	0.24	18	1.36	6	0.78	9
6. Organisational vulnerability and capacity assessments carried out which provide comprehensive picture of vulnerabilities and capacities.	0.3	17	0.68	12	0	21
7. Resilient and accessible critical facilities (e.g. back-up systems, redundancy of data).	1.55	3	2.04	2	1.22	5
8. Top management support and commitment to IS resilience.	0.22	20	1.36	6	1.22	5

9. IS resilience can provide an organisation with an edge over its competitors	-1.24	34	0	26	-0.34	26
10. Our competitors are developing and enhancing their IS resilience capabilities	-2.29	38	0	26	-2.34	38
11. A sound IS resilience plan will help us to win more business contracts	-0.67	29	0	26	0.34	14
12. A sound IS resilience plan will help us to pay lesser insurance premium	-0.8	31	0	26	-1.9	37
13. A sound IS resilience plan will help our organisation to make more efficient use of resources	-1.68	36	0	26	0.44	12
14. Long-term IS Resilience, Business Continuity, Disaster recovery justification and planning	-0.53	27	-0.68	32	-0.34	26
15. Competitor analysis	-1.49	35	-1.36	36	-1.32	36
16. Setting up information disaster recovery system (e.g., disk redundancy, backup facility)	0.54	8	2.04	2	0	21
17. Study resilience strategies of competitors	-1.83	37	-0.68	32	-1.12	35
18. Select suppliers with robust resilience plan	0.45	13	0.68	12	1.56	3
19. Use IS network to communicate with the customers.	0.47	12	0	26	-0.34	26
20. Use IS networks to connect to supplier's databases	0.39	14	0	26	-0.88	32
21. Use cloud computing to back up organisational data	-0.1	24	-1.36	36	0.1	15
22. The level of customer involvement in preparing resilience, business continuity and disaster management plans	-1.17	32	0	26	-0.68	30
23. The extent of follow-up with customers for feedbacks	-1.22	33	0	26	-1.12	35
24. The level of supplier involvement in preparing resilience, business continuity and disaster management plans	-0.14	25	-1.36	36	-0.78	31
25. Ensuring data security.	-0.17	26	0.68	12	1.02	7
26. Providing reliable and consistent services to Suppliers.	0	22	0	26	-0.2	22
27. Providing reliable and consistent services to customers.	1.97	1	0.68	12	1.12	6
28. Capability for disaster recovery.	0.76	6	0.68	12	0	21
29. Providing the organizational units with information for 24 hours a day, 7 days a week.	0.5	10	-2.04	38	2.34	1
30. Understanding the strategic priorities of top management.	0.11	21	-0.68	32	0.34	14
31. Aligning IS strategies with the strategic plan of the organization.	0.5	10	-1.36	36	0	21
32. Adapting technology to strategic change.	-0.61	28	-0.68	32	-0.34	26
33. IS resilience plan that is well defined and structured.	0.76	7	0	26	-0.44	28
34. IS resilience plan that is flexible and adaptable.	0.3	15	-0.68	32	-0.44	28
35. Ability to identify key risks.	1.52	4	-0.68	32	0.88	8
36. Ability to align IS strategy with organizational strategy.	0.22	20	0	26	0.44	12
37. Ability to anticipate surprises and crises.	1.61	2	0	26	0.44	12
38. Committed, effective and accountable leadership of IS resilience planning and implementation.	-0.03	23	1.36	6	2	2

Table 2 reports the results of the factor analysis, which reveals three "types" of decision priorities. The z-scores are the average z-statistic for where the statement was ranked on the Q-sort distribution by those who comprise that factor. The "rank" is the average ranking of that statement by those who represent that factor. The highest and lowest rankings are highlighted so as to illustrate the decision priorities that represent each type. A type is defined by both the high and low priorities, since both distinguish any given type from others, and therefore the analysis proceeds by interpreting and defining the types based on their respective priorities. At this stage, the existence of a type means only that the type exists among those participating in the current study. A larger study will almost certainly reveal additional types. Further research with larger data sets will eventually reveal the relative proportions of these types among the population of decision-makers.

Type 1: Forward Looking and Plan oriented

Type 1 can be characterised as forward looking and plan oriented. This group clearly preferred well defined and structured plans over flexible and adaptable IS resilience plan, as exemplified by this particular highly-ranked statement: "IS resilience plan that is well defined and structured" (rank 7). Type 1 decision makers were more

concerned about anticipating events in advance, as exemplified by these two highly ranked statements: “Ability to anticipate surprises and crises” (rank 2) and “Ability to identify key risks” (rank 4). Another important characteristic of this type is that they are forward looking. This group wants to provide reliable, continuous and consistent service to their customers and also want to assure that the IS resilience plan is well integrated with their business strategy.

Type 2: Middle Manager of Public Organisation

This middle manager of a large public organisation is included as a control to see if the instrument is capable to make theoretical distinction. As predicted by agency theory, our study reveals that they have different priorities. On one hand, any type of planning is absolutely not a priority for this decision maker, as they neither consider “ability to anticipate surprises and crises” nor “Ability to identify key risks” as the top priorities. On the other hand, they are an advocate of resilient and accessible critical facilities (e.g. back-up systems, redundancy of data), setting up information disaster recovery system (e.g., disk redundancy, backup facility) and on-going monitoring of hazards and risks and updating of plans. So it is evident that though they showed some risk taking behaviour but also showed risk-averse behaviour. This middle level manager of a large public organisation is willing to engage in risk taking behaviour probably because they are not directly accountable to any of the consequences that may result due to this risk taking behaviour. Agency theory assumes that agents are motivated by self-interest, and rational actors, and are risk averse. Therefore principals can motivate agents by controlling their incentives. According to Eisenhardt (1989) an optimal solution to “The Agency Problem” can be achieved by ensuring these following mechanisms: (a) performance-based incentive plans, (b) direct intervention by shareholders, (c) the threat of firing, and (d) the threat of takeover.

In this case, the agent, who is a middle manager in a large Public organisation, does not fit at all under any of the above mentioned solution sets, thus has no motivation to make a decision in favour of the principal.

Type 3: Myopic and Process oriented

The members in Type 3 are concerned about organization and structure. “Providing the organizational units with information for 24 hours a day, 7 days a week” (rank 1), “Committed, effective and accountable leadership of IS resilience planning and implementation” (rank 2) and “Select suppliers with robust resilience plan” (rank 3) were factored as the top three most important statements. These decision makers place greater value upon resource allocation and internal efficiency of the organisation, they are more focused on keeping the operations reliable, efficient and they also want to see a responsible and reliable leadership structure in place. The comments suggest that the members in this group are interested in efficient business process and data security, as exemplified by “Providing reliable and consistent services to customers” (rank 6) and “Ensuring data security” (rank 7).

Interestingly none of the types found supplier involvement to plan for IS resilience to be critical, the reason may be that all our participants are from service industry and supplier involvement may not be very essential for them. If we include respondents from manufacturing industry then supplier involvement may emerge as an important attribute. Contrary to our expectation, however, one thing that appeared consistently from the analysis is that none of these types are interested on competitor analysis in order to prepare for IS resilience.

CONCLUSION

We have identified a gap in research related to information systems resilience in SMEs. Accordingly, we conducted an extensive literature review to identify differences between large-scale enterprises and SMEs with respect to IS resilience and undertook an empirical study using Q-sort instrumentation to analyse key issues. We used agency theory to establish the decision priority differences between SMEs and large organisations. This study contributes to the limited body of knowledge on IS resilience in SMEs in four ways. Firstly, we have developed and pilot tested an instrument to capture the decision priorities of SME CEOs. Secondly, we propose a definition of organisational IS resilience. Thirdly, our research shows that agency theory is predictive to interpret decision priorities of SME CEOs. Lastly, this is the first attempt to understand the IS resilience decision priorities of SME CEOs in lens of Agency Theory, and it appears to be valid.

The Q methodology does have some weaknesses. It is a small-sample technique, and the sample of items and participants is usually purposive, and the results lack generalizability. However, since the goals of Q-methodology are interpretive, this is usually not considered a weakness by Q-method practitioners. This study is a starting point for further research into the IS resilience in SMEs. Also, the sample was restricted to service SMEs.

There are a number of avenues of future research, including examining a greater range of organisations. Future empirical research should attempt to understand the IS resilience decision priorities and characteristics of

resilient organisations. Finally, results have implications both for researchers who are looking for theories that explain the importance of IS resilience and business managers and owners who are challenged with decisions about how to design resilient information system framework for their organisation.

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