Leadership in Sustainable Infrastructure
Leadership en Infrastructures Durables

Vancouver, Canada
May 31 – June 3, 2017/ *Mai 31 – Juin 3, 2017*

IDENTIFICATION AND CLASSIFICATION OF THE RESILIENT STRUCTURAL DIMENSIONS AND CONTINGENCY FACTORS OF PROJECT-BASED ORGANIZATIONS IN CONSTRUCTION INDUSTRY

Hosseini Naveh, Ardalan [1,3] and Heravi, Gholamreza [2]
[1] Graduate Student, School of Civil Engineering, College of Engineering, University of Tehran, Iran
[2] Associate Professor, School of Civil Engineering, College of Engineering, University of Tehran, Iran
[3] ardalan.hosseini@ut.ac.ir

Abstract: Resilience is one of the strategic and tactical aspects of organizations that help them recover from crises. A resilient organization absorbs shocks and copes positively with unexpected situations. Although the idea of resilience is becoming increasingly popular, there is only a few number of articles about resilience of organizations, particularly in the field of construction industry. Thus, resilience is an essential component of organizations in construction industry, which enables them to respond to extreme events. Observe the features that describe specific organizational design traits, is the first step for understanding resilience of organizations. Structural dimensions and contingency factors are two types of interacting features of organizations, which describe organizations in much the same way that personality and physical traits describe people. Structural dimensions describe the internal characteristics of an organization, and contingency factors describe the organizational setting that influences and shapes the structural dimensions. This paper intends to describe various types of factors affecting the resilience of the organizational structures used in the different types of construction organizations. Initially, this research employs theoretical methods such as terminology analysis, logical analysis, and synthesis to study and analyze the concept of organizations' resilience. In the next step, the resilient organizations' key features were identified and the factors affecting resilience were mentioned. This research illustrates that among major factors, which increase the resilience of construction industry organizations, are reducing bureaucracy, professionalism and technical competence, downsizing, managerial tools and techniques, environment, and organization's culture. All of the factors have been classified into structural dimensions and contingency factors. Finally, a number of factors have been split into subfactors. To achieve resilient organizations, organizational resiliency factors shall be brought into attention. It is also believed that resilience organizations, which have resilient crisis response and recovery, will boost the reliability of organizations.

1 Introduction

In recent decades, achieving disaster-resilient communities has been an important topic of concern for agencies and other groups engaged in disaster mitigation (Bruneau et al. 2003). Likewise, the management of crises and disasters for a wide variety of adverse events has become a focus of attention for both practitioners and academics (Boin and Van Eeten 2013). In the unpredictable world, which communities are increasingly confronted with emergencies and crises, organizations play a major role in planning for, responding to, and recovering from emergencies and crises by providing services and employment (Lee et al. 2013). Critical lifelines organizations (such as water and power and critical facilities) enable communities to respond, provide for the well-being of their residents, and initiate

recovery activities in emergencies, for instance, when earthquakes strike. For this reason, these organizations are assumed as the backbone of community functioning (Bruneau et al. 2003). In fact, community and organizational resilience are interconnected and interdependent (Lee et al. 2013). Therefore, if we are to attain resilient communities, we have to make organizations resilient, particularly in construction industry.

2 Literature Review

The idea of organizational resilience originates from the internal elastic characteristics, which allow systems to reform themselves dynamically. To be more precise, strengths of materials principles in engineering as well as the relationship dynamics of complex ecosystems might be the early sources of inspiration for concept of organizational resilience (Home and Orr 1997). The notion of resilience has been used in a wide variety of sciences ranging from materials science and engineering, to psychology, sociology, ecology, economics, crisis management, and organizational studies (Home and Orr 1997, Bruneau et al. 2003, Boin and Van Eeten 2013). Resilience is one of the strategic and tactical aspects of organizations that help them recover from crises. One dictionary definition defines resilience as ‘‘the ability to become strong, happy, or successful again after a difficult situation or event’’. Furthermore resilience is defined as ‘‘the ability of a substance such as rubber to return to its original shape after it has been pressed or bent’’ (Longman Dictionary of Contemporary English 2009). Regarding organizational studies, resilience has been reckoned with ‘‘a fundamental quality of individuals, groups, organizations, and systems as a whole to respond productively to significant change that disrupts the expected pattern of events without engaging in an extended period of regressive behavior’’ (Horne and Orr 1998, p. 31).

Resilience has been the center of attention for organizations in such a way that some researchers believe that it is obligatory for them. Lee et al. (2013), for instance, believe that ‘‘organizations are complex webs of people, places, and resources, and they must invest in their resilience’’. Resilient organizations are supposed to be anchored by two specific beliefs. First, the belief that absence of failure is proof of the absence of hazards partially results in brittleness. Second, resilient organizations believe that they are imperfect, but they can grow more perfect as time passes (Vogus and Sutcliffe 2007). Thus, resilience is an essential component of organizations in construction industry, which enables them to respond to extreme events.

Productive capacity is always the centre of attention for organizations and companies. In a large number of companies and organizations, productive capacity is regarded as a top priority to be ahead of their competitors. However, the other side of the coin is that the power of advanced technologies and turbulent economic environments depletes productive capacities and makes them obsolete. Therefore, organizations productive capacity will not matter unless they do the required actions to withstand these intense changes and rebound to continue to use the assets of the system in new and creative ways (Home and Orr 1997). While a conservative approach attempts to avoid error by design, resilience approach recognizes the inherent fallibility of any organizational system (Vogus and Sutcliffe 2007).

In today's uncertain and unexpected world which dramatic changes are being made without notice, construction sector organizations are to be resilient to survive and adjust under challenging conditions. Although the idea of resilience is becoming increasingly popular, there are only a limited number of articles about resilience of organizations, particularly in the field of construction industry. The underlying aim of resilient organizations might be the promise of thriving on challenging conditions, coping with unanticipated dangers, and meeting extraordinary demands by the means of adapting to existing resources, which sometimes is called bounce back ability (Boin and Van Eeten 2013). However, it is well worth noting that resilience is not restricted to adaption (Vogus and Sutcliffe 2007). The research findings show that reducing probabilities, reducing consequences from failures, and reducing time to recovery are

three central features of every resilient organization (Bruneau et al. 2003). Hence, a resilient organization absorbs shocks and copes positively with unexpected situations.

3 Method

Observe the features that describe specific organizational design traits, is the first step for understanding resilience of organizations. Thus, identification and classification of a number of factors, assists organizations to enhance their performance in relation to these attributes. This paper intends to describe various types of factors affecting the resilience of the organizational structures used in the different types of construction organizations. Initially, this research employs theoretical methods such as terminology analysis, logical analysis, and synthesis to study and analyze the concept of organizations' resilience. In the next step, the resilient organizations' key features were identified and the factors affecting resilience were mentioned. Finally, a number of factors have been split into subfactors. To achieve resilient organizations, organizational resiliency factors shall be brought into attention.

4 Identification and Classification of the Resilient Factors

According to Daft (2013), two main features of organizations, which describe their specific organizational design traits, are structural dimensions and contingency factors. Structural dimensions and contingency factors are two types of interacting features of organizations, which describe organizations in much the same way that personality and physical traits describe people. Structural dimensions describe the internal characteristics of an organization, and contingency factors describe the organizational setting that influences and shapes the structural dimensions. All of the factors have been classified into structural dimensions and contingency factors. In addition, a number of factors have been split into subfactors. Table 1 illustrates classification of the identified factors and their references.

Table 1: Classification of the identified resilient factors of organizations

Number	Factor	Pulley (1997)	Home and Orr (1997)	Mallak (1998)	McManus et al. (2008)	Sheffi (2008)	Daft (2013)	Boin and Van Eeten (2013)	Lee et al. (2013)
1	**Structural dimensions**						X		
1.1	Formalization						X		
1.1.1	Reducing bureaucracy						X		
1.2	Specialization						X		
1.2.1	Professionalism						X		
1.2.1.1	Competence		X					X	X
1.2.1.2	Knowledge based innovation and creativity								X
1.3	Centralization						X		
1.3.1	Devolved and responsive decision making								X
1.2.1.2	Knowledge based innovation and creativity								X

Table 1: Classification of the identified resilient factors of organizations (*continue*)

Number	Factor	Pulley (1997)	Horne and Orr (1997)	Mallak (1998)	McManus et al. (2008)	Sheffi (2008)	Daft (2013)	Boin and Van Eeten (2013)	Lee et al. (2013)
1.3	Centralization						X		
1.3.1	Devolved and responsive decision making								X
1.3.2	Distributed power					X			
2	**Contingency factors**						X		
2.1	Size						X		
2.1.1	Number of staff								X
2.1.2	Downsizing / smallness						X		
2.1.3	Staffing elasticity	X							
2.2	Organizational technology						X		
2.2.1	Situation awareness				X				X
2.2.1.1	Roles and responsibilities			X				X	X
2.2.1.2	Understanding of core events			X					X
2.2.1.3	Source monitoring and reliance			X					X
2.2.1.4	Connectivity awareness								X
2.2.1.5	Insurance awareness								X
2.2.1.6	Recovery priorities								X
2.2.1.7	Informed decision making								X
2.2.1.8	Devise strategies towards to avoid disastrous events								X
2.2.1.9	Organizational learning	X	X						

4.1 Structural dimensions

4.1.1 Formalization

Formalization is presumed as amount of written documentation in the organization, including procedures, job descriptions, regulations, and policy manuals. A simple measure of formalization level of an organization is the number of pages of documentation within the organization (Daft 2013). At the first glance, formalization improves organizational resilience. Formal rules and procedures both for normal

and extreme conditions enable the organization to respond changes faster. As level of formalization considerably grows, it seems that the organization gradually becomes inefficient and overly bureaucratized. Bureaucratic organizations tend to respond slowly to changes. Reducing bureaucracy makes organizations more flexible and more resilient. Often following a long period of success, organizational atrophy occurs. This phenomenon is for the reason that an organization take success for granted, becomes attached to practices and structures that worked in the past, and fails to adapt to changes in the environment (Daft 2013). To react changes immediately, fewer activities should be covered by formal procedures. Thus, it can be deduced that it is noteworthy to find a correct balance of formalization. It implies that despite formalization (including standardization) enables organizations to respond faster in face of adversity, overly bureaucratized organizations, which a large number of procedures must be followed to make any decision, cannot react rapidly enough to drastic changes.

4.1.2 Specialization

Specialization pertaining to the degree to which organizational tasks are subdivided into discrete jobs. It is perceived as the division of labor as well. To provide discrete jobs, there is a need to recruit employees with high level of proficiency. Hence, there is a strong connection between specialization and professionalism. Professionalism reflects the level of formal education and training of staff (Daft 2013). This term affects organizational resilience via two elements of competence and creativity. Competence is the ability of applying a combination of skills and knowledge to meet the demands of internal and external environments matched with inclination of individuals, groups, and teams to be effective and accountable during periods of major organizational stress (Home and Orr 1997). Information and knowledge are two elements of competence. In resilient organizations, information and knowledge accessibility is a priority. In such organizations, critical information is available in a number of different formats and locations. In addition, when unexpected problems arise in a resilient organization, people in the organization know who has the expertise to respond it (Lee et al. 2013). Therefore, high technical competence throughout the organization can be construed as a factor making organizations more resilient. An illustration of this factor is evident in NASA (National Aeronautics and Space Administration), where high concentration of PhDs among its members, and various staff units are focused on analytical competence (Boin and Van Eeten 2013). Moreover, the significant role of innovation and creativity in organizational resilience should be put into perspective. Using the assets of the system via new and creative methods is essential to withstand intense changes (Home and Orr 1997). Consequently, staff members of resilient organizations are able to use their knowledge in novel ways (Lee et al. 2013). There is an immediate prospect that erudite employees will have more bright ideas than those who are not highly educated. For this reason, recruiting very learned staff members will implicitly lead organizations to be more resilient.

4.1.3 Centralization

The term centralization is regarded as the hierarchical level that has authority to make a decision. When decision making is kept at the top level, the organization is centralized; conversely, when decisions are delegated to lower organizational levels, it is decentralized (Daft 2013). As to centralization, there are two factors, which influence organizational resilience, including devolved and responsive decision making, and distributed power. Devolved and responsive decision making means that in resilient organizations, tough decisions can be made quickly while exigencies. It indicates that in the face of adversity, someone with the authority to act is always accessible to people on the front lines (Lee et al. 2013). On the other hand, allowing all employees to take decisive action in case of a developing disruption, regardless of their rank, is a significant feature of resilient organizations. There are numerous cases, illustrating that ability of field personnel to take action quickly can limit the scope of a developing disruption. For this reason, damage will be minimized (Sheffi 2008).

4.2 Contingency factors

4.2.1 Size

Size of every organization can be simply measured by the number of employees (Daft 2013). As regards the number of staff, some researchers believe that only full time staff should be counted (Lee et al. 2013). It is noteworthy that other measures such as total assets reflect magnitude as well; however, they do not illustrate the size of the human part of the organization (Daft 2013). As for size, there are two factors, on which the organization's resilience might depend, including downsizing (or smallness) and staffing elasticity. In comparison to large-scale organizations, small-scale organizations can react to changing customer needs or shifting environmental and market conditions more quickly. Moreover, in light of the fact that in small organizations it is easier for people to feel like part of a community, these organizations often enjoy greater employee commitment (Daft 2013). A little research has been carried out into the optimum size of an organization, although case studies bear no relation to construction industry (Barrett 1941). Anthropologist Robin Dunbar, for instance, proposed that 150 is the ideal size for any group trying to meet an objective, based on studies of primitive societies, religious sects, and military organizations (Daft 2013). However, the research findings cannot be generalized to construction industry organizations. Resilient organizations tend to remain small, flat, and flexible. This is commonly known as staffing elasticity. It is a well-known fact that the cyclical pattern of hiring during times of business growth and then firing during downturns erodes employees' morale. As a result, resilient organizations avoid this pattern by using temporary workers, independent contractors, consultants, and other firms (Pulley 1997).

4.2.2 Organizational technology

Tools and techniques of production and servicing are different from tools and techniques of management. Although both of them play a pivotal role in an organization's success, only managerial skills of organizations have discussed in recent studies. These skills include situation awareness, Management of key stone vulnerabilities, adaptive capacity, and communication.

4.2.2.1 Situation awareness

If organizations are to navigate a crisis, they have to comprehend that they do not work alone, and recognize themselves as parts of a wider network. Situation awareness is defined as “a measure of an organization’s understanding and perception of its entire operating environment” (McManus et al. 2008). In other words, the organization’s situation awareness is “its ability to interpret information about its business environment and understand what that information means for the organization now and in the future” (Lee et al. 2013). This includes the ability to look forward to not only potential crises, but also opportunities. Accordingly, it includes the ability to identify crises and their consequences accurately. For this reason, understanding of the trigger factors for crises is required. In addition, there is a need for awareness of the internal and external resources, and a better understanding of minimum operating requirements (McManus et al. 2008). There are a number of factors which can influence organizations' resilience in a variety of ways, which will be discussed bellow. Main subfactors of situation awareness are roles and responsibility, understanding of core events, source monitoring and reliance, organizational learning, and capability and accessibility of internal resources.

In times of crises, roles and responsibilities are distinct in resilient organizations. Most of the staff members in such organizations have a clear picture of what their role would be in a crisis. There is “a formal structure of roles, responsibilities, and reporting relationships that can be transformed under emergency conditions into a decentralized, team-based approach to problem-solving” (Boin and Van Eeten 2013). Thus, they will be able to shift rapidly from business as usual mode to respond to crises (Lee et al. 2013). Correspondingly, roles must not be heavily dependent on people of organization. In other words, while missing key team members, the other members should be able to fill and play their role (Mallak 1998, Lee et al. 2013). It means that in resilient organizations should be substitutes for members

when needed. For this reason, grasping all team members' role and interaction of those roles is required (Mallak 1998).

Resilient organizations must use information effectively to make sense of the situation when it becomes chaotic (Mallak 1998). In other words, there is a need to a clear awareness of core events that must be precluded from happening (Boin and Van Eeten 2013). For this reason, threats and subsequent consequences should be identified and analyzed. Therefore, what is happening in the organization's industry should be proactively monitored to have an early warning of emerging issues. (Lee et al. 2013). It is noteworthy that resilient organizations rely on multiple sources of information (Mallak 1998). A resilient organization knows who would be affected if one of its larger customers or suppliers went out of business, which is regarded as connectivity awareness. Likewise, there is an insurance awareness, which ensures the organization that if it was unable to operate for several months; current level of insurance of the organization would safeguard it. In addition, priorities for what is important during and after a crisis are defined. In such organization, decisions are made on the basis of the most up to date information, and it is easy to obtain expert assistance when staff members don't know how to tackle an issue. This feature is perceived as informed decision making (Lee et al. 2013). Informed decision making should be based on one of the most valuable assets of every company, lessons learned. A quote from an article by Pulley 1997 "as individuals move in and out of organizations at a faster rate, the organizational memory often gets lost". Hence, resilient organizations use the opportunity to learn more about their inner workings as a system (Home and Orr 1997).

4.2.2.2 Management of keystone vulnerabilities

Those aspects of an organization, operational and managerial, which are required to prevent significant negative impacts on an organization is known as management of keystone vulnerabilities. This includes capability and accessibility of internal resources, and having a plan for asking employees to participate in exercises. Employees of resilient organizations can access to resources or would access resources anyway, even if not authorized, to resolve a situation (Mallak 1998). In resilient organizations, there are sufficient internal resources to operate successfully during business as usual, and absorption of small amounts of unexpected changes is possible. In such organizations in the face of adversity, internal resources become more easily available at short notice and there is less red tape to deal with issues. Moreover, there is a plan for asking employees to participate in exercises. For this reason, employees are generally able to take time off from their day-to-day roles to be involved in practicing how the organization responds in an emergency (Lee et al. 2013).

4.2.2.3 Adaptive capacity

An organization's adaptive capacity is a measure of the culture and dynamics of it, by means of which the organization is able to make snap and appropriate decisions, both in normal and extreme conditions (McManus et al. 2008). Related factors to adaptive capacity which boost organizational resilience are leadership, passion for work and the mission, to encourage employees to use innovation and creativity, staff workloads monitoring, internal connections, coordination, goal-directed solution-seeking (as a managerial skill), and outcome expectancy.

Leadership plays a significant part in resilience. Top management in a resilient organization provides good leadership when the organization struck by a real crisis, and people would accept decisions are made by management, even if they were developed with little consultation (Lee et al. 2013). Resilient organizations' leaders are keen on the success of their organization, which leads employees to go above and beyond the call of duty (Sheffi 2008). In such organizations, people are encouraged to challenge, and develop themselves through their work. In addition, they are rewarded for thinking outside of the box. Furthermore, staff workloads monitoring is following continuously; as a result, when staff workloads become excessive, managers reduce them. This leads the organization to adapt better to probable changes. Moreover, resilient organizations dedicate certain time to evaluate what it is they are trying to

achieve. This feature of resilient organizations is reckoned with outcome expectancy (Lee et al. 2013). on the other hand, connections are "characteristics and properties of relationships between persons, groups, and the system that determine the capacity and flexibility of the organization as a whole to respond under pressure. The connections demonstrate a feeling of solidarity among the entire organization. On the other hand, the timing of major and minor change efforts throughout the whole organization is vital for fulfilling a full-system alignment so that employees can gain an entire-goal perspective. Coordination refers to "the linking of our efforts together to achieve effective results" (Home and Orr 1997).

4.2.3 Environment

The environment refers to all external elements which influence an organization. It includes industry, government, customers, suppliers, the financial community, and other organizations which influence an organization more than the other ones (Daft 2013). As for environment, the factors influence the overall resilience of organization are split into two groups. The first group is those factors which are related to the organization's plan of action, and the second group consists of the factors which reflect effects of environment on the organization.

4.2.3.1 The organization's plan of action

Every resilient organization has to make a plan of action to receive appropriate response before it becomes strongly influenced by its environment. There several factors, by means of which organizations can make a better plan of action, including communications and relationships, organizational connectivity, capability and capacity of external resources, and network perspective. As to communications and relationships, resilient organizations are considered as active participants in industry and sector groups. Those who work in these organizations tend to work with whoever they need to work with to ensure that the task is done well, regardless of departmental or organizational boundaries. The relationship between these organizations and their suppliers and customers is great enough; consequently, if they cannot operate for several months, their relationships will help them to recover rapidly. In the same way, organizational connectivity is of has great importance for achieving resilience. Members of a resilient organization know how far they are connected to other organization (in the same industry or location). Both senior and junior managers actively manage those links and areas of their work that rely on other organizations. It means that they maintain contact with organizations, which they might cooperate in a crisis. This, results implicitly in ensuring the organization that external resources are capable to meet demands, both in normal and extreme conditions. A resilient organization often makes agreements with other organizations on providing resources in case of emergency. Moreover, since members of the organization have enough contacts, access to external resources is available. This factor is closely connected with network perspective. A resilient organization participates fully in industry, is able to work with other organizations during a crisis, and has a leadership role in its industry (Lee et al. 2013).

4.2.3.2 Effects of environment on the organization (External directors)

To have external directors on the organization's governing board may adversely affect the resilience of it (Lee et al. 2013). It is partly because of the fact that external directors/ trustees generally cannot be well adapted to environment changes rapidly.

4.2.4 Organization's goals and strategy

The organization's goals refers to the primary purpose of the organization, which are often written down as an enduring statement of company intent. The organization's strategy reflects distinctive competitive techniques, which the organization will meet its objectives by employing them. It includes a plan of action that describes resource allocation and activities for dealing with the environment. The scope of operations and the relationship with employees are defined by goals and strategies (Daft 2013). There are several factors related to organization's goals and strategy, which influence organizational resilience. These

factors are organization's commitment to resilience, strategic vision, to be ahead of the curve, strategic planning, and corporate mission. In a resilient organization, being able to respond to the adversities is a high priority, which is regarded as organization's commitment to resilience. Resilient organizations can find a proper balance between short- and long-term priorities. The vision or mission statement of an organization discloses organization's commitment to resilience. To be resilient, organizations should have strategic vision. It means that when the vision or mission statement of an organization is formalized in a written statement, and reveals the values to which it aspires, it exerts a positive influence on the resilience of the organization. On the other hand, top management of a resilient organization is really enthusiastic about being ahead of the curve. In other words, senior managers employ strategies, by which they become convinced that the organization is always ahead of the curve (Lee et al. 2013).

4.2.5 Organization's culture

Culture of each organization is at the root of its key values, beliefs, understandings, and norms shared by employees. Such fundamental values and norms possibly are directly related to ethical behavior, commitment to employees, efficiency, or customer service. In fact, culture is glue, by which organization members are held together. Despite culture is unwritten, it can be perceived its stories, slogans, ceremonies, dress, and office layout (Daft 2013). The dominant culture of resilient organizations includes a number of aspects, which could be influenced by several factors. Some of these factors are staff engagement and involvement, silo mentality, resilient people, partnering and strategic alliances, and conditioning for disruptions.

In resilient organizations, staff members are engaged in responding to crises. It means that all members, regardless of their level in the organization, regularly anticipate what could go wrong. Hence, they can offer possible solutions to manage those challenges. A majority of people in the organization shoulder responsibility for organization's effectiveness, and tend to resolve problems as well (Lee et al. 2013). On the other hand, some attitudes such as silo mentality are obstacles to achieve the target of building resilient organizations. Silo mentality is an attitude, which disables systems to operate with any other systems (Shaw and Frost 2015). This sort of attitude roots in avoiding sharing knowledge with the others in the same organization. Resilient organizations' employees are motivated to move between different departments or take different roles within the organization to gain experience (Lee et al. 2013). Generally, resilient people positively influence organizational resilience, but it is well worth noting, "in some cases, it may be counterproductive because strong resilient individuals may dominate and override the shared vision of others" (Home and Orr 1997). Resilient people are shape shifting. In other words, they are able to apply the same set of skills to a broad spectrum of circumstances. Furthermore, they are able to improvise due to identifying new opportunities or methods of applying skills in the current situation. As to money attachment, all have an intrinsic, subconscious attachment to money; however, resilient individuals have less attachment to money (Pulley 1997). It is noteworthy to mention that “a culture of reliability that distributes and instills the values of care and caution, respect for procedures, attentiveness and individual responsibility for the promotion of safety throughout the organization” positively affects resilience (Boin and Van Eeten 2013). As for this issue, resilient organizations are those are disrupted continuously; however, they develop expertise via continuous re-planning and rapidly getting back to normal operations (Sheffi 2008). In other words, they pass the cycle of disruption, re-planning, and recovery. In addition to these manners and attitudes, strategic alliances can promote organizational resilience. The belief that every individual has to be concerned about networked security than job security forms the basis of strategic alliances. Precisely, organizations should devise a way of creating a network of partnerships and strategic alliances (Pulley 1997).

5 Discussion and Conclusion

As mentioned before, to achieve resilient organizations, organizational resiliency factors should be taken into account. In this study, a broad spectrum of factors affecting organizational resilience have been described and classified. According to the research results, a number of these factors are more important than the other factors, and several of them are more applicable to construction organizations, which are

mentioned bellow. Distinct roles while adversity and competence exceed other factors in importance. To have a clear picture of roles and responsibilities during crises is of crucial importance in organizational resilience, particularly in construction organizations. In addition, resilient organizations must be able to apply a combination of skills and knowledge to respond to significant changes, which is considered as competence.

Situation awareness, understanding of core events, source monitoring and reliance, organizational learning, and adaptive capacity, capability and accessibility of internal and external resources, and personal commitment to resilience are of secondary importance. Understanding and perception of an organization's entire operating environment, which is known as situation awareness, includes understanding of core events. It means that probable hazards and consequences must be identified and analyzed to be well prepared for future crises. This helps better adaptation to new situations. An organization's adaptive capacity is a measure of the culture and dynamics of it, which enables the organization to make snap and right decisions. This factor includes several subfactors such as leadership, encouraging creativity, goal-directed solution seeking and so on. Furthermore, an organization has to rely on multiple sources to be resilient, both internal and external. On the other hand, organizational resilience does not merely depend on resilience of staff; however, staff attitudes such as personal commitment to resilience positively influence organizational resilience. Further work is proposed to find the relations between the identified factors with three areas of resilience (robustness, response, recovery). Other avenues worthy of further exploration include develop a robust and inclusive tool to measure and assess organizational resilience. This will test whether all the factors identified through this research are of great importance or just several of them are essential for construction sector organizations. This could be achieved through modeling, which illustrates how the factors identified work together to produce resilience.

References

Bruneau, M., Chang, S.E., Eguchi, R.T., Lee, G.C., O'Rourke, T.D., Reinhorn, A.M., Shinozuka, M., Tierney, K., Wallace, W.A. and von Winterfeldt, D., 2003. A framework to quantitatively assess and enhance the seismic resilience of communities. *Earthquake spectra*, *19*(4), pp.733-752.

Boin, A. and Van Eeten, M.J., 2013. The resilient organization. *Public Management Review*, *15*(3), pp.429-445.

Daft, R., 2013. *Organization theory and design*. 11th ed., Nelson Education, Mason, OH, USA.

Home, J.F. and Orr, J.E., 1997. Assessing behaviors that create resilient organizations. *Employment* Relations *Today*, *24*(4), pp.29-39.

McManus, S., Seville, E., Vargo, J. and Brunsdon, D., 2008. Facilitated process for improving organizational resilience. *Natural Hazards Review*, *9*(2), pp.81-90.

Mayor, M., 2009. *Longman dictionary of contemporary English*. Pearson Education India.

Mallak, L.A., 1998. Measuring resilience in health care provider organizations. *Health manpower management*, *24*(4), pp.148-152.

McManus, S., Seville, E., Vargo, J. and Brunsdon, D., 2008. Facilitated process for improving organizational resilience. *Natural Hazards Review*, *9*(2), pp.81-90.

Pulley, M.L., 1997. Leading resilient organizations. *Leadership in action*, *17*(4), pp.1-5.

Shaw, R. and Frost, N., 2015. Breaking out of the silo mentality. *Psychologist*, *28*(8), pp.638-641.

Sheffi, Y., 2008. Resilience: What it is and how to achieve it. *Retrieved October*, *1*, p.2013

Vogus, T.J. and Sutcliffe, K.M., 2007, October. Organizational resilience: towards a theory and research agenda. In *Systems, Man and Cybernetics, 2007. ISIC. IEEE International Conference on* (pp. 3418-3422). IEEE.