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An Empirical Investigation of the Role of Information Technology in Fostering Organizational Resilience and Effectiveness

Full research paper

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Abstract

Taking inspiration from various calls by scholars to investigate the phenomenon of organizational resilience considering the COVID-19 pandemic, this study investigates the effect of information technology (IT) on resilience and organizational effectiveness. Drawing upon the rich tradition of affordance theory, we hypothesize that three IT affordances—related to collaboration, process management, and organizational memory—influence organizational resilience, which in turn promotes organizational effectiveness. To test the hypotheses, we conduct a survey of managers in public organizations in the US. The results support our hypotheses. Contributions and implications are discussed.

Keywords: Resilience, Effectiveness, Information Technology Affordance, Public Organizations

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1 Introduction and Motivation

The salience of the term “resilience” has increased manifold due to the COVID-19 pandemic. Disruptions, such as due to COVID-19, have increased the necessity of organizations to be resilient so as to sustain operations in times of widespread uncertainty (Watson et al. 2020). Resilience can be understood as adapting well in the face of challenges and disruption, allowing for dealing with shocks and keep functioning as before (Walker 2020).

The concept of resilience is of particular importance to IS scholars, given the observation that information technologies “provides firms with the infrastructure, people, and resources to accelerate transformations, and increase their resilience” (Mandviwalla et al. 2021, p. v). There is growing interest in the literature on how IT can contribute to resilience in organizations (Heeks and Ospina 2019; Ketter et al. 2020). However, much needs to be done, especially in light of the observation that the “salient role of digital technologies and innovations presents an incredible opportunity for the IS scholarly community, with its diversity of perspectives and global footprint, to contribute to the existential need of building resilience to pandemics and extreme events” (Rai 2020, p. vii).

This study partly answers this call for more investigation into how IT influences organizational resilience. The overarching research question guiding the study is as follows: ***What is the influence of IT on organizational resilience, and, in turn, on organizational effectiveness?*** To answer this research question, we propose a parsimonious set of IT-related factors that are crucial to develop organizational resilience and, in turn, promote organizational effectiveness. Building upon prior literature, we theorize that three important affordances—IT collaborative affordance, IT organizational memory affordance, and IT process management affordance (Chatterjee et al. 2015a) – play an important role in engendering organizational resilience and thus, continued effectiveness.

Affordances are a defining characteristic of a sociotechnical information system (Chatterjee et al. 2021b), and an understanding of how IT affordances contribute to resilience can be understood to be an valuable addition to the literature. Affordances capture the fundamental role of organizational IT (Chatterjee et al. 2021a), and if we can demonstrate a theoretical connection between affordances and organizational resilience, it will inform us of the crucial role of IT in fostering resilience (and ultimately, effectiveness) in organizations. We are not aware of any study that explicitly links these two theoretical concepts.

The paper proceeds as follows. In the next section, we review literature on organizational resilience, IT affordances, and organizational effectiveness. Following that, we develop our research hypotheses that links IT affordances to resilience and ultimately to organizational effectiveness. After that, we report our empirical study that tests our hypotheses, and discuss the significance of the results. We conclude with contributions and implications of the study.

2 Literature Review

2.1 Resilience in Organizations

Resilience at the organizational level is the ability of an organization “to sense and correct maladaptive tendencies and cope positively with unexpected situations” (Ortiz-de-Mandojana and Bansal 2016, p. 1615). At the organizational level, resilience is primarily a characteristic that can withstand disruptions by engaging in positive adaptations (King et al. 2016). Resilience is the ability to adapt and change, to reorganize, while coping with disturbance; it is thus a coping mechanism that ensures that the organization keeps functioning while facing challenges (Walker 2020). The interesting aspect of resilience is that resilience not only allows an organization to confront challenges due to turbulent environments and unexpected events, it actually allows them to thrive and become more successful due to facing these challenges (McManus et al. 2008).

In an integrative framework of organizational resilience, Kantur and İşeri-Say (2012) observe that organizational resilience can be engendered from antecedents such as strategic capacity and action, and resilience in turn, influences how the organization effectively evolves. Given that IT is termed as a strategic organizational resource which allows capacity for action (Chatterjee et al. 2020; Chatterjee et al. 2021a), it is logical to infer that IT should have an effect on organizational resilience. Resilience, in turn should also lead to an effective organization.

2.2 IT Affordances

Affordances are an important concept to understand the role of IT in organizations (Leonardi 2011; Volkoff and Strong 2017; Zammuto et al. 2007). Affordances can be formally defined as “what the [IT] artifact allows humans to do” and represents “the possibilities for goal-oriented action afforded to specified user groups by technical objects” (Markus and Silver 2008, p. 622). IT affordances highlight how organizational IT and the social aspects of an organization interrelate, and how the “arranging and rearranging of IT within the social environment (or vice versa) continuously create possibilities for influencing the form and function of an organization” (Chatterjee et al. 2020, p. 5).

Building upon the IT affordance literature, Chatterjee et al. (2015a) delineated a set of parsimonious IT affordances that are widely applicable to any IT-enabled organization. Drawing upon the notion that organizations are communities of practice (COPs), they argued that there are three basic aspects of robust COPs: effective collaboration, collective learning, and streamlined processes to support the COP’s operations (Chatterjee et al. 2021a). These aspects of COPs translated into three affordances: affordance for organizational memory, affordance for collaboration, and affordance for process management (Chatterjee et al. 2015a). Organizational memory affordance is the “IT-facilitated ability to create, store, transform, refine, access, mobilize, apply, and exploit organizational knowledge”; collaborative affordance is the “IT-facilitated ability to instill cooperation within an organization, both in a collocated and distributed/virtual setting, on a one-to-one or many-to-many basis”; and process management affordance is the “IT-facilitated ability to design, visualize, prioritize, and monitor work processes, as well as allocate and manage appropriate resources to enable action and decision” (Chatterjee et al. 2015a, p. 165).

Existing literature has showed the value of organizational collaboration (Orchiston et al. 2016), memory (Cotta and Salvador 2020), and processes (Burnard et al. 2018) in resilient organizations. Drawing upon such observations, it is natural to infer that the IT affordances that promote collaboration, organizational memory, and process management will be crucial in fostering organizational resilience. It is also to be noted that while IT can provide multiple affordances in an organization, these three affordances capture perhaps the most fundamental of organizational functions (as articulated before): intra-organizational collaboration (collaborative affordance), sustenance of an organization’s knowledge base (organizational memory affordance) and managing of organizational processes (process management affordance). That is why these affordances are used in this study.

2.3 Organizational Effectiveness

Organizational effectiveness is a valuable concept to critically evaluate the work of an organization (Taylor and Sumariwalla 1993). Based on early literature, effectiveness can be understood as achieving organizational purpose (Barnard 1968). Effectiveness can also be understood as an external assessment about the usefulness of the organization’s activities (Salancik and Pfeffer 1978). The concept of organizational effectiveness is grounded in the values and preferences of evaluators (Zammuto 1982).

Several conceptions of organizational effectiveness have emerged in the literature, but all conceptions point to some commonalities: the accomplishment of organizational goals, ensuring stakeholder satisfaction, achieving high quality organizational processes, and producing overall organizational flourishing (Cameron 2015). Perhaps the simplest definition of organizational effectiveness understands it in terms of “organizational productivity, net profit, the extent to which the organization accomplishes its various missions, and the success of the organization in maintaining or expanding itself” (Georgopoulos and Tannenbaum 1957, p. 2). We adopt this definition of organizational effectiveness.

3 Hypotheses development

The overall model is shown in figure 1. The model shows that the three IT affordances positively influence organizational resilience, which in turn positively influences organizational effectiveness.

3.1 Resilience and Organizational Effectiveness

One of the key characteristics of a resilient organization is that it promotes trust and positive communication (Kim 2020), especially in conditions of strife (Rangachari and Woods 2020). Through the fostering of trust and positive communication, a resilient organization counters stress and negativity (Moyle and Parkes 1999; Schaubroeck and Fink 1998), and effectively co-opts its employees in challenging situations. Especially, the trust promoted by a resilient organization is very important in fostering organizational effectiveness because it allows the producing of mutually beneficial joint outcomes—key to organizational effectiveness. (Anderson and Narus 1990; Young and Wilkinson 1989).

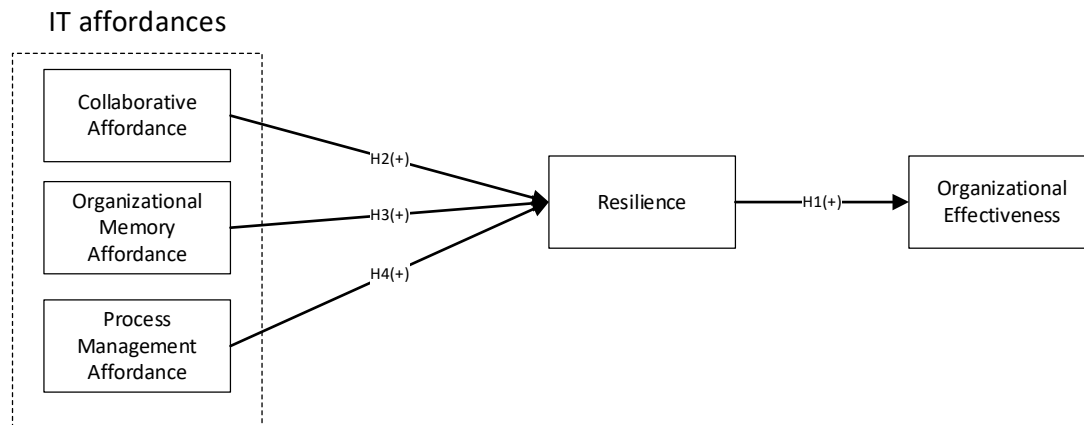


Figure 1. The Theoretical Model

Put simply, a resilient organization ensures that it fosters the mechanisms necessary to continue to be effective. These mechanisms not only include the promotion of trust and positive communication, but also other associated mechanisms such as “situation awareness, demystifying inherent threats, and reducing risk and improving organizational efficacy with recovery plans” (Karman 2020). Taken together, these mechanisms invoked by a resilient organization strengthen the relationships between an organization and its stakeholders (Frandsen and Johansen 2011) and help collective sensemaking and problem solving (Meneghel et al. 2016) when the organization faces a challenging situation. This ultimately leads to an organization performing effectively and even growing in challenging times. Based upon these arguments, we can hypothesize:

H1. Organizational resilience positively impacts organizational effectiveness.

3.2 IT Collaborative Affordance and Resilience

The collaborative affordance of IT refers to the fact that IT allows individuals within an organization to share ideas with one another and work together in a collective fashion (Zammuto et al. 2007). The collaborative affordance of IT promotes cooperative interaction in virtual settings and allows the participants to exchange ideas about problem solving and develop collective sensemaking (Seidl and Werle 2018).

This collective thinking afforded by the IT in a virtual setting “serves to socialize individuals to a set of values and norms or engender collegial and collaborative relationships” (Kirsch 2004, p. 377), and is particularly relevant to developing resilience (Robertson et al. 2021). Resilience is engendered through such IT-mediated interactive and collective processes where employees can discuss and exchange ideas about solving immediate challenges that can build the organization’s ability to quickly adapt to situations (Jung et al. 2010). Using the collaborative affordance of IT, especially if the IT affords real-time interaction, organizational stakeholders can converge on solutions and strategies to solve organizational tasks/problems (Dennis 2008) – thus improving organizational decision making. An organization that engages in purposeful and swift decision-making achieves resilience, as it can enable the organization to adapt to turbulent environments in an agile manner (Cabral et al. 2012; El Sawy et al. 2010).

In sum, the collaborative affordance of IT allows for the convergence of newly developed ideas and solutions, which is imperative in establishing resilience (Oh and Teo 2006). It allows for the integration of individual intellectual resources (Qureshi et al. 2006), breeding a collective capacity to face challenges. Therefore:

H2. Collaborative affordance of IT positively influences organizational resilience.

3.3 Organizational Memory Affordance and Resilience

Organizational memory affordance captures how IT allows an organization to acquire, retain, maintain and retrieve knowledge (Chatterjee et al. 2020). Organizational memory holds great value in today’s world; heterogeneous knowledge resources and organizational “stories” incorporated within an IT-enabled organizational repository allows for further appropriation (and actualization) of this knowledge to generate new ideas (Stein and Zwass 1995). For example, an organizational repository might have information stored about how certain challenges were met by the organization a few years back; this knowledge would likely help in the future when the organization is facing a similar challenge.

An organization can only foster resilience if they create, share, or store organizational knowledge. To make sensible decisions, employees and higher management must utilize organizational memory. When organizational memory is correctly utilized by organizational members, better decisions take place, with the organization gaining resilience as a whole (Moorman and Miner 1997). In fact, organizational leaders also leverage the learning captured in organizational memory to invoke creative solutions among its employees (Rickards and Moger 2006). Such creative ideas in times of challenge, by leveraging the IT-enabled organizational memory, arguably provide the organization with new ideas to grapple with challenges – thus building resilience. Therefore:

H3. Organizational memory affordance positive influences organizational resilience.

3.4 Process management affordance and Resilience

Process management affordance allows organizations to use IT to support, optimize, monitor, and balance work processes (Zammuto et al. 2007). This is key to identifying and averting operational problems. As we have defined before, resilience is an organization's capability to deal with oncoming problems that the organization may face. Through process management affordance, an organization builds resilience by developing the ability to identify and avert such operational problems.

Specifically, organizations can leverage the fact that IT allows organizational processes to continue seamlessly (even in challenging situations), to be more resilient to such challenges. For example, if an organization loses key employees, it could still ensure that the business processes are not unduly disrupted, because IT can perhaps automate many of the functions which the lost employees were responsible for. As a case in point, IT could help support a loan process and even approve the loan even if a bank does not have enough loan officers.

The COVID-19 pandemic situation provides another example of organizations leveraging the process management affordance of IT to be resilient. Due to the pandemic, many organizations have had to adjust to the “new-normal” of employees working remotely. While this could have been a serious disruption, the process management affordance of IT allows the same process-related functionality (e.g., same organizational workflows) for employees working from remote locations. This allows the organization to function as before, in spite of the disruption.

In sum, strong IT-enabled process management allows the organization to avoid and circumvent operational challenges which can become typical in times of strife or challenge. It is thus clear that the process management affordance of IT builds organizational resilience. Therefore:

H4. Process management affordance positively influences organizational resilience.

4 Empirical Study

4.1 Collecting data via third party firms

The method of data collection used for this paper was an online survey which was conducted through the third-party market firm, *Qualtrics*. Qualtrics is a reputable and trusted third party vendor used by the university that two of the authors are affiliated with. Qualtrics allows us to leverage the advantages of data collection using third-party market research firms (Chatterjee et al. 2021a; Lowry et al. 2016). A specific advantage of this approach includes the ability to easily access high level employees in public organizations who have previous ties with the firm. Another advantage the firm has is that it can collect data over vast geographical divides in contrast to researchers who can often only collect data locally.

4.2 Sample

This study was conducted under the umbrella of a larger study which investigated a multitude of organizational factors related to public organizations. An empirical study in public organizations is relevant in the pandemic context, as they provide essential community services and thus need to be particularly resilient and operational in the face of outside disruptions – otherwise basic community services and welfare will be severely compromised.

Data was collected from organizational managers and it was ensured that the survey respondents know about the phenomenon under investigation (Zablah et al. 2012). Due to our research focus, respondents were screened using questions which included:

- I am currently a manager in a public organization with at least 5 years of experience (Yes/No).
- I am reasonably knowledgeable about the role IT plays in my organization (Yes/No).

If the respondents answered “No” to any of the above questions, they were screened out from the potential list of respondents. The contracted sample size, from Qualtrics, for the study was 200. Overall, Qualtrics informed us that they had sent out the survey invitation to approximately 1800 managers in public organizations. The approximate survey response rate was 11.1%, which is typical of survey response rates in similar studies.

The sample size of 200 included 22 respondents for the pilot study and 178 respondents for the final study. After the pilot study, the results were analyzed to ensure that the survey instrument was valid and reliable. Following minor changes to the survey instrument, the final data collection was launched, and 178 complete surveys were received. Only the data from the final 178 respondents were utilized for the empirical analysis.

4.3 Measures and Controls

Measures for IT affordance were adopted from existing literature (Chatterjee et al. 2015a; Chatterjee et al. 2020; Chatterjee et al. 2021a). Organizational effectiveness items were adapted from Pee and Kankanhalli (2016). Resilience items were adapted from Park et al. (2015) and customized to the public organizational context. Items were measured on a standard Likert-type 7-point scale (from Strongly Agree to Strongly Disagree). A final option, “No Knowledge/Cannot Answer,” was included to identify any inappropriate respondents. No subjects selected this option. Please see table 1 for the measures.

Our study also captured control variables such as age, education level, position at organization, experience, and gender. In addition, other control variables were also collected, such as organizational size, age, sector which the organization belongs to, and the growth of the sector.

5 Results and Analysis

5.1 Measurement Model

The model was tested using Partial Least Squares (PLS). PLS is a structural equation modelling approach which is used when developing a new theory. It provides more reliable results when the sample size is fewer and the data is non-normal because it does not assume normality for data analysis (Chatterjee et al. 2015b). The tool used to analyze this data is WarpPLS7.0.

The measurement model was assessed against the recommendations by Fornell and Larcker (1981) by investigating reliability and convergent/discriminant validities. The composite reliabilities of our constructs were 0.836 (collaborative affordance), 0.884 (organizational memory affordance), 0.882 (process management affordance), 0.870 (resilience), and 0.893 (organizational effectiveness). Since these reliabilities exceed the values recommended, it helps to demonstrate that our instrument was reliable (Nunnally 1978). The convergent validity of the study was assessed by showing that “t-values of the Outer Model Loadings are above 1.96” (Gefen and Straub 2005, p. 97), and that they are significant ($p < 0.05$). Our instrument demonstrated convergent validity because all the measurement items met the criterion.

There are two steps in the process of assessing discriminant validity. The first step is to demonstrate that the loadings are higher on their constructs as contrasted with the other constructs. The second step is to establish that the square root of the average variance extracted (AVE) is higher than the correlation between any of the latent pair constructs. The loadings of all the items exceeded the benchmark of 0.7 (Nunnally 1978). The correlations between the latent variable pairs were smaller than the square root of the AVEs, which were also higher than the typical recommendation of 0.5 (Fornell and Larcker 1981). Combining reliability along with validity, it can be inferred that the instrument use by us was appropriate.

Items

IT Collaborative Affordance:

In my organization, computer technology or IT facilitates intra-organizational collaboration as follows:

Effectively implement collaboration within the organization

Effectively support collaboration

Effectively achieve real-time collaborative work

Effectively enable organizational members to work collaboratively

IT Organizational Memory Affordance:

In my organization, computer technology or IT is used to store, access, and disseminate information as follows:

Effectively capture and compile project information

Effectively capture and reuse project history (e.g., discussions, insights, work data, documents)

Effectively store, archive, retrieve, share, and reuse of project information and best practices

Effectively create knowledge communities (e.g., virtual discussion forums) focused on new ideas

IT Process Management Affordance:

In my organization, computer technology or IT helps manage organizational processes in the following ways:

Adequately visualize and monitor organizational processes

Accurately provide information to support organizational processes

Effectively streamline organizational process workflows

Support task/resource allocation, prioritization, and scheduling in order to sustain organizational processes

Organizational Resilience:

Rate how effectively your organization can adjust to uncertain changes.

My organization can handle many critical incidents at a time.

People in my organization are well prepared to respond to critical incidents.

My organization has continuity plans to handle unfamiliar situations.

My organization can recover quickly after critical incidents.

Organizational Effectiveness:

Rate how effective your organization is.

Over the past two years, the cost of providing services and/or products by our organization has reduced significantly

Over the past two years, our organization's responsiveness to requests by community stakeholders and businesses has significantly improved.

Over the past two years, the quality of our services and/or products has significantly improved.

Over the past two years, income and/or budget allocated to our organization has significantly increased.

Over the past two years, our organization's conformance to its core mission has improved significantly

Table 1. Measurement Items

5.2 Structural Model

The variance explained of the endogenous constructs was 58% (resilience) and 41% (organizational effectiveness). Against the benchmark of 10% (Falk and Miller 1992), this shows that our model had substantive predictive power. All the hypotheses were supported. The three IT affordances significantly influenced organizational resilience and organizational resilience significantly promotes the effective functioning of an organization.

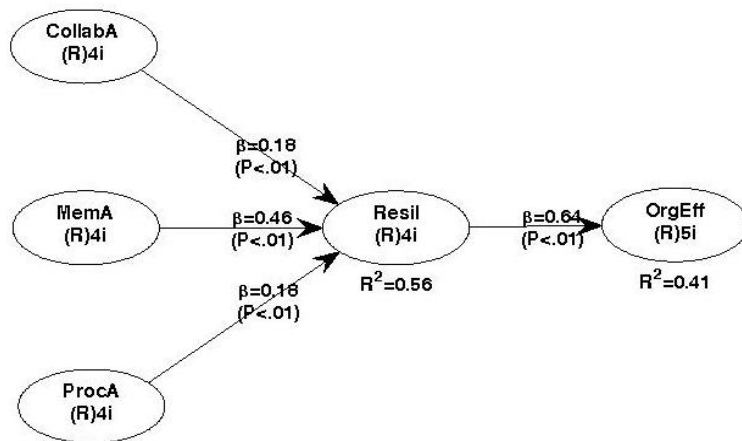


Figure 2. Structural Model

On closer scrutiny, it was also revealed that the effect of organizational memory affordance on resilience is the strongest of the three IT affordances. This is expected, because organizations often draw upon past experiences to address future disruptions (Lee et al. 2020). IT enables the organization to learn and transcribe prior knowledge (Chatterjee et al. 2015a), and the prior learning is crucial to address upcoming challenges and keep functioning (Gkeredakis et al. 2021). The effect of resilience on organizational effectiveness is not surprising, as resilience has been considered a primary attribute of a robust, functioning organization that withstands challenges and continues to operate effectively (Ivanov 2020). Overall, the results showcase the crucial role that IT plays on organizational functioning in challenging situations.

6 Discussion: Contribution and Future Implications

Our study contributes by delivering a parsimonious set of IT-related factors that promote organizational resilience and effectiveness. We believe that ours is one of the first studies that critically analyzes the role of generic IT affordances that allow an organization to be resilient.

Our study also shows that while IT affordances are crucial to resilience, the effect of organizational memory is perhaps most salient. In other words, organizational memory – which captures organizational learning over time (Foroughi et al. 2020)– should perhaps be the foremost focus of IS academics and practitioners. From an academic standpoint, more research should be devoted to an understanding of how-to better design and implement IT systems to develop and sustain organizational memory. Given the remoteness of work brought about by the COVID-19 pandemic (Chatterjee et al. 2021b), sustaining organizational memory through IT should be a primary consideration. Our study offers this valuable insight. Of course, our study also highlights that building effective collaborative systems and process management systems in this time of remote work is also crucial. Overall, we offer a parsimonious set of IT affordances that academics and practitioners interested in the phenomenon of resilience can focus on.

From a practical standpoint, the important implication is that the organizational IT we consider is not a specific set of factors that the organizations acquire when faced with a disruption; rather our study focuses on the value of IT affordances that have been built and developed over time. We forward that any organization should have these affordances built in, so that it becomes a resilient organization that can withstand challenges. In that sense, our findings highlight how organizational robustness can be improved over time using IT, and how such a robust organization is undeterred any sudden issues that may arise in the greater socioeconomic context. An organization that has built effective IT-based mechanisms for fostering collaboration, managing processes, and capturing organizational memory will be able to withstand serious disruptions.

One limitation of the study is that the data collection involved only public organizations and was conducted in the US context. Thus, there could be country-specific or organization (public vs. private) specific effects. Therefore, one immediate direction of future work is to test our model in other countries as well as in private organizations. Perhaps a comparative study could also be conducted between private and public organizations. In addition, more research is needed as to how to effectively build the IT affordances, and whether there are any other contingent organizational factors (e.g., organizational climate) that catalyze the development of resilience using IT.

7 Conclusion

To conclude, we hope that our study highlights the effective role that IT plays in the development of organizational resilience. Given the rising importance of resilience in the post COVID-19 world, we are optimistic that our findings will stimulate further interest to study the relations between and IT and resilience. We all stand to gain from continued engagement with work on IT and resilience.

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