Think before you act: organizing structures of action in technology-induced change

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Abstract

Purpose – The purpose of this paper is to explore the influence of technology on organizational change during an electronic government implementation in a public organization in East Malaysia. It also examines the interpretation and enactment of technology as affecting organizational performance.
Design/methodology/approach – The research utilized a case study approach involving semi-structured interviewing with 18 employees representing department heads, middle managers, and technical officers. The data were triangulated by unobtrusive observations of meetings and work processes as well as archival records.
Findings – Technology could either constrain or enable change based on the interplay of intended and unintended use. The way actors interpret the role of technology during change also affects their enactment of technology, leading to both innovation and disruption in work practices. In turn, their enactment patterns shape organizational structure, strategy, and performance.
Research limitations/implications – The paper contributes to the organizational change literature by exploring how individual-level change has led to organizational outcomes as a result of technology. It extends the technology enactment and sociomateriality literature by considering technology use as an organizing process to facilitate change in order to understand the interplay of the social and material aspect of technology.
Practical implications – Employees should be made aware of and accountable for the consequences of unintended use or avoidance of technology in order to enable positive change. Collective sensemaking of technology-induced change should be encouraged to transform work practices so as to shape organizational structure, strategy, and performance.
Originality/value – Unlike similar research, this study extends the structuration perspective of technology in work organizations by exploring how technology enables and constrains organizational change through intended and unintended use. It further illuminates the power of human agency to innovate and organize structures of action that modify social relations and organizational strategy influencing organizational performance.

Keywords Case study, Organizational change, Technology use, E-government implementation, Human agency

Paper type Research paper

Introduction

Electronic or e-government initiatives have long been the focus of public sector transformation as governments introduce information technology (IT) into work practices to improve service delivery to citizens (Von Haldenwang, 2004), regulate public

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service networks (Jaeger and Thompson, 2003), and extend global reach (West, 2004). "E-government" has been conceptualized as an IT-related approach to facilitating organizational change (Irani *et al.*, 2007; Nasim and Sushil, 2010), increasing work efficiency and effectiveness (Akman *et al.*, 2005; Deng, 2008), establishing governance, and maintaining a civil society (Beynon-Davies, 2005; Steyaert, 2004). In view of the different definitions, we offer an integrated perspective which suggests that e-government implementation is the utilization of technology to create structural and symbolic changes in organizational actors' cognition and behavior thereby affecting organizational outcomes.

Examples of e-government implementation cover a variety of organizational objectives and functions. For instance, e-government applications have been used to improve the performance of research and development in the USA (West, 2004) and enhance the transparency, compliance, and performance of the World Bank's corporate and borrowers' procurement operations (World Bank Report, 2004). In addition, similar applications have been found to be useful in the UK Inland Revenue Department to increase their efficiency in customer service (Beynon-Davies, 2005), and in Singapore to link private and public organizations to generate business collaborations (Tung and Rieck, 2005). More comprehensively, United Nations has used e-government systems to expand and monitor the healthcare developments in various countries (UNDESA, 2007).

Malaysia is no exception as e-government was introduced as an initiative to transform the mindset of public servants and develop a culture of excellence in 1996 as part of a work-culture movement (Abdul Karim and Mohd Khalid, 2003). The objective of the movement is threefold. First, it is to create a civil service which is efficient, effective, dynamic, and innovative. Second, it is to create a civil service with a high level of discipline and a high standard of integrity. Third, it is to create a civil service with a focus on prompt decision making and effective customer service (Sarji, 1993). A year following the announcement, East Malaysia adopted the e-government movement by transforming their public sector into a technology-enabled workforce (Yeo and Ajam, 2010).

This study focusses on East Malaysia as it provides an interesting context from which to explore how technology is introduced as a tool for organizational change given the digital divide between those who have access to technology and those who do not. As with most developing countries, East Malaysia had neither the technical support nor the infrastructure to expedite the advancement of technologies during the initial phase of e-government implementation (Chen *et al.*, 2007). Further, it lacked the necessary resources and reach to ensure that technology platforms such as IT systems and e-portals would be optimally utilized (Yeo and Ajam, 2010). Still, e-government services have been introduced to improve service delivery through the creation of web sites to facilitate the electronic retrieval of documents and submission of applications. Examples of such services include e-Gazette, e-forms, e-enquiries, and e-employment. One public organization in particular, INFunity (a pseudonym), has been instrumental in exploiting the use of technology in support of East Malaysia's e-government initiative. INFunity has introduced a range of e-government services for both their own employees and customers including online course registration, job application, account services, maintenance, and technical support.

In this paper, we explore the use of technology as associated with e-government implementation in INFunity. This organization was chosen as they introduced technology as a critical enabler of change. Further, technology led the organization into several major phases of change, affecting the way individual perceive and use technology in their work practices. This study therefore explores how technology enables or constrains

change affecting technology interpretation and enactment. This perspective offers a deeper understanding of the relationship between human agency and sociomateriality in technology-induced change (Boudreau and Robey, 2005; Orlikowski and Scott, 2008). The paper therefore addresses the following questions:

How does the introduction of technology influence organizational change during an e-government implementation?

How does organizational actors' interpretation and enactment of technology influence organizational performance?

The paper contributes to the organizational change literature by exploring how individual-level change has led to organizational outcomes as a result of technology introduction during an e-government implementation of a public organization. Most studies on e-government have focussed on how it could help improve work and service efficiency and effectiveness (Jaeger and Thompson, 2003), develop wider networks with governments and industries (Akman *et al.*, 2005), and facilitate public sector reform (Chen *et al.*, 2007). The role of technology, as both an enabler and a constraint of organizational change, has not been extensively explored from the perspective of e-government implementation (Cordella and Iannacci, 2010). This study therefore extends the conversation around change processes as affected by the intended and unintended use of technology (Balogun and Johnson, 2005). Particularly, the interplay of technology enablers and constraints in a context like INFunity offers an alternative perspective of the structuration of change (Orlikowski, 1996). The introduction of technology has further unraveled the dialectic between disruption and innovation of work practices arising from technology-induced change (cf. Robey *et al.*, 2002). The reciprocal relationship between the role of technology and the structure of human action at INFunity offers a different perspective of how innovation in work practices through e-government implementation helps create, modify, and maintain social interaction in an otherwise bureaucratic organizational setting (cf. Boudreau and Robey, 2005). Providing a change perspective to the understanding of technology enactment (Fountain, 2001) and the duality of technology (Orlikowski, 1991) allows us to explore technology use as an organizing process to gain further insight into the interplay of the social and material aspect of technology (Orlikowski, 2007; Vaast and Walsham, 2005).

Preliminary conceptual framework

The relationship between technology use and organizational change particularly in an e-government context has not been sufficiently explored in the literature (e.g. Deng, 2008; Nasim and Sushil, 2010; Steyaert, 2004). In addition, it would be useful to understand how technology use could shape organizational change and consequently influence e-government implementation (e.g. Jaeger and Thompson, 2003; Tung and Rieck, 2005; Von Haldenwang, 2004). Some studies have found that an abrupt introduction of technology could vastly affect institutional arrangements such as formal organizational processes including human actions and social relations (Fountain, 2001; Liker *et al.*, 1999). In particular, how technology is enacted could also influence the subsequent configuration of hardware, software, and social networks, modifying organizational forms such as formalization, centralization, and communication channels (Orlikowski, 2007). In e-government implementation, the relationship between the way technology is designed, selected, implemented, and used becomes of importance. This perspective echoes Orlikowski's (1991, 2007) reference to technology as both objective and interpretive tool which she termed the duality of technology and subsequently sociomateriality, the latter suggesting that when technology is socialized through human "inter-action",

it loses its objective characteristics leading to unintended consequences (Boudreau and Robey, 2005). This is supported by the structuration view where technology is situated in both organizing and organization, suggesting that human action could structure technology (organizing) by creating regularized patterns of technology enactment (organization) (Orlikowski, 1991, 2000).

The social and material aspect of technology could be further explored to understand how they influence change at different levels within an organization (e.g. Leonardi and Barley, 2008; Orlikowski and Scott, 2008). We have developed a preliminary conceptual framework (see Figure 1) which illustrates how the introduction of technology has affected change in institutional properties (e.g. organizational strategies), organizational forms (e.g. organizational structures), and organizational actors (e.g. individual roles). The intersection of these three variables, marked "X", suggests a performance outcome as a result of individual and organizational-level change. The framework further implies that the introduction of technology could affect power, politics, and control within an organization contributing to emergent change (Leonardi and Barley, 2008). Implicit in the framework is the perspective that technology has caused individuals to engage in collective sensemaking in order to develop concertive actions where single actions are integrated into broader actions when responding to change (Orlikowski, 2000; Weick, 1995).

Institutional properties

Institutional properties are formalized processes that are driven by organizational strategies (Fountain, 1995). Such processes could give rise to adaptive and generative strategies that seek change and improvement (Jansen, 2004). These strategies are driven by two approaches. The "soft" approach is where change is associated with organizational culture, continuous improvement, and empowerment while the "hard" approach involves structural change, radical transformation, and strong leadership (Beck *et al.*, 2007). Taken together, these approaches give rise to institutional properties that enable the motivation and formalization of change as catalyzed by technology use (Amis and Aïssaoui, 2013).

Organizational forms

Organizational forms such as formalization, centralization, span of control, and networking affect how activities are socialized, shaping the schemas of cognition and structures of

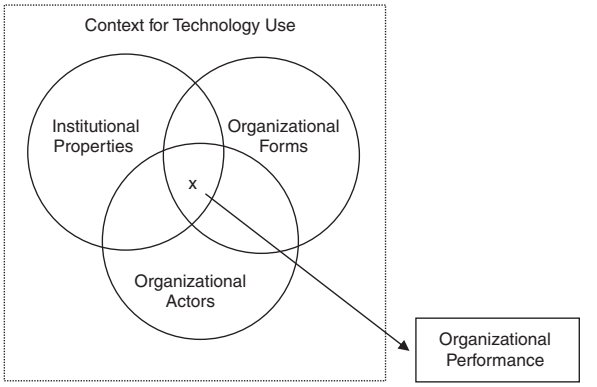


Figure 1.
A preliminary framework of technology-induced change

action (Fountain, 2001; Weick, 1995). For example, infiltration of technology in the form of automated operations through distributed channels could eliminate bureaucracy as decisions are made more spontaneously following the reduction of repetitive manual tasks (Luna-Reyes and Gil-Garcia, 2011). Simply put, the use of technology develops informal structures based on modification of social interaction and work practice. In other words, technology has allowed meanings and actions to be socially constructed as collaborative networks increase leading to different levels of task interdependence (Orlikowski, 2007).

Organizational actors

Organizational actors function as carriers and recipients of change affecting occurring at the individual and organizational level. Resistance to change is one of the major obstacles in any change interventions caused by personal characteristics such as self-talked uncertainty, identification with previous routines, and firmly held ideologies (Beck *et al.*, 2007). As actors engage in complex processes of change in ambivalent environments, they learn to make sense of, act upon, and even influence others to change (Thomas *et al.*, 2011; Weick and Roberts, 1993). Consequently, actors assume different roles where they learn to enact change through the use of technology based on their capacity to absorb and respond to various forces of change (Orlikowski, 1996). With an understanding of their capacity to organize and manage change, actors become more proactive in implementing, facilitating, and adapting to change (Tsoukas and Chia, 2002). Most importantly, given the right motivation, not only will they overcome barriers to change but they will also be proactive agents of change.

Organizational performance

Organizational performance in relation to change is not limited to financial outcome but rather the wider interpretation of organizational effectiveness. This includes the specification of goals, strategic positioning of people and processes, and capitalization of culture to mobilize change (Boumgarden *et al.*, 2012; Smith, 1993). Performance also considers intangible attributes such as attitude, commitment, and knowledge acquisition that help promote and sustain organizational growth (Yeo and Ajam, 2010). The intangible aspect of performance is relevant to public sector management as service delivery is largely associated with personal attention, information accuracy, and prompt response to enquiries (Halloway *et al.*, 1999). Further, technology has been found to improve public service through centralized systems in support of information management, contributing towards work consistency and output reliability (Nasim and Sushil, 2010). In addition, technology has proven to increase the level of innovation in work practices in the public sector through the development of new services that enable timely problem solving and decision making (Yoo *et al.*, 2012).

Methods

Research context

In the past 15 years, INFunity has undergone three major phases of change. In the first five years (1997-2002), technology was introduced to phase out a third of manual work through the installation and development of new IT systems to increase the efficiency of work processes. In the subsequent five years (2003-2007), more advanced technologies were introduced to phase out another half of manual work. During this period, the surge in technological gadgets such as smart phones and laptops increased the readiness of their employees to create and handle new e-government applications.

In the most recent five years (2008-2012), their employees' level of readiness to experiment the use of technology increased significantly alongside the organization's investment in even more sophisticated IT systems. Although these phases of change were largely planned, the ongoing process of change was emergent at INFunity, fueled by the interplay of intended and unintended consequences of technology use.

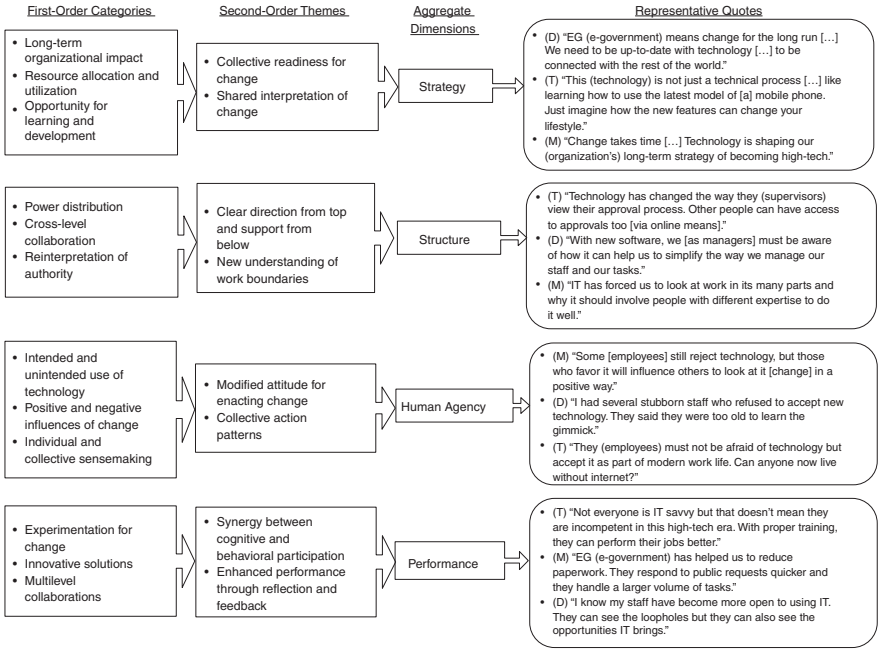
Research execution

We adopted a case study approach by gathering data from different sources to gain a deeper understanding of our preliminary conceptual framework (see Figure 1) (Yin, 2003). Primarily, we conducted interviews with employees at INFunity who had the direct experience in at least two phases of e-government-related change. Secondarily, we conducted unobtrusive observations in meetings and workplace activities to determine the types of change that were going on. We also referred to archival records to have an idea of their e-government implementation. The research was conducted at the end of the third phase where we saw how change was affected by the introduction of more advanced IT systems. Prior to this study, no formal research was conducted at INFunity to explore the influence of technology on their change processes. As such, our involvement proved to be timely as INFunity was open to being used as a case study on technology-induced change (Eisenhardt, 1989; Yin, 2003).

We embarked on a convenience sampling plan through a contact person at INFunity who was highly supportive of our research. This senior management staff helped us gain access to the interviewees as well as the meetings and work units we could observe during our two visits. He was instrumental in ensuring that the interviewees were varied in terms of backgrounds, functions, and roles as associated with the change process at INFunity (Sekaran, 2000). The sample comprised three groups of six informants each, representing department heads (coded D1-D6), middle managers (coded M1-M6), and technical officers (coded T1-T6). Where required, the informants were asked to provide some evidence in support of their views on technology use or the change process.

We developed the interview protocol based on the two research questions and piloted the initial questions on a small group of informants, resulting in some major rephrasing of the questions. The pilot interviews also prompted us to use probes to elicit deeper responses (Hussey and Hussey, 1997). The interviews were conducted in English as we, the researchers, do not have mastery over Malay, the national language of Malaysia. Each interview lasted about 50 minutes and all interviews were tape-recorded and transcribed based on the stories told. Where interesting quotes were detected, we paused the tape to transcribe them verbatim. The face-to-face interviews were supplemented by 11 telephone calls to obtain further information. For triangulation, we attended 19 meetings and walked around nine different work units at INFunity to observe daily activities paying particular attention to their employees' interaction patterns (Yin, 2003). We also relied on minutes of meetings, progress reports, e-mails, and intranet information to help us understand the context of change better.

For data analysis, we embarked on both a manual and software approach to help us make sense of the data. We first coded the data based on recurrences of words used, guided by probes, and keywords (see Figure 2) (Sekaran, 2000). Pattern matching and recurring themes were finalized using Nvivo nodes (Lee and Kim, 2007). We examined first-order themes based on broad categories and then second-order themes that emerged from the data. The third stage was to group these thematic patterns into meaningful concepts or aggregate dimensions (Krippendorff, 1980). In the process, we



Notes: D, department heads; M, middle managers; T, technical officers

Figure 2.
Coding scheme

depended on our preliminary conceptual framework (see Figure 1) and research questions to guide us in the analytic procedure to achieve pattern matching (Miles and Huberman, 1994). This process enabled us to understand more about the relationship between the concepts and empirical data, as illustrated in Figure 2 (Eisenhardt, 1989).

Analysis of findings

Findings indicate that individual interpretations of technology affected the subsequent use which in turn affected how change processes ultimately played out. These processes were enacted through the interplay of disruption and innovation of technology use when individuals combined stabilized patterns of enactment (technology acceptance as sustaining work practice) with emerging patterns of enactment (technology improvisation as facilitating change). Such enactment patterns further influenced organizational structure, strategy, and performance.

Influence of technology on organizational change

Our findings suggest that the role of technology influenced the cognitive and behavioral involvement of individuals in such a way that their interpretations of technology could lead to action patterns that ultimately shaped the strategic and structural orientation of the organization. Most informants adopted an inside-out approach to viewing technology, particularly how it could affect their work rather than the impact it would have on service delivery. However, they also realized that "by incorporating electronic features into 'the government', we should not be inward looking but […] adopt a global outlook" (D4). The underlying tension of "seeing the bigger picture" (D2) and "focusing on day-to-day work" (T3) led to occurrences of intended and unintended technology use (see Table I).

Technology use	Examples	Interpretations of technology
Intended	Processing of online enquiries and applications from citizens	Bridging government and citizens
	Intranet portal in support of internal work efficiency	Faster speed in capturing and transferring data
	Formal and informal communication channel to employees and citizens	Restructuring relationship between service provider and customers
Unintended	Use of network login record to monitor classified information	A feature revealing workflow transparency
	Decision makers' reliance on IT-savvy employees to input data into systems exposing confidential information	Complexity as a tool exposing users' incompetence in technology use
	Informal sharing of electronically transmitted data among colleagues resulting in confusion of responsibility for action	Ease of data transfer affecting employees' responsiveness for action due to unclear role boundaries

Table I.
Intended and unintended use of technology

Strategy. Findings indicate that the introduction of technology changed the strategic orientation of INFunity as their leaders began asking questions about how it could help increase their presence in the Malaysian Federal Government and the global context. Unlike the private sector, strategy reflects "the long-term positioning of the Government to stay connected with the outside world" (D5) rather than overcoming competitive forces. Over the years, technology did affect INFunity's task structures by increasing task interdependencies that involve both technology and manual work. Because of the volume of information exchange as a result of integrated IT platforms that connect different public organizations in Malaysia virtually, individuals ended up with information overload. While integrated IT platforms helped facilitate efficient exchange of information internally and cross-organizationally between governmental bodies, some employees found themselves releasing classified information to each other. This is an example of an unintended consequence of technology use which led to a different course of action in order to salvage the release of sensitive information (Balogun and Johnson, 2005), as apparent in the following quote:

> IT in some ways has changed the way we look at our work […] Those [electronic] applications disrupt our familiar workflow but also give us more control over our work […] like the database, the tracking and so on […] Downside is, people can misuse the info [M6].

As found, the unintended use of technology provided individuals the common ground for collective sensemaking as they began to help one another organize meanings surrounding technology use and the change it brought to their work practices (Leonardi and Barley, 2008).

The informants also reflected that they had to manage ongoing tensions arising from centralized systems and fragmented work practices. However, in trying to make sense of standardized (common platforms for e-government services) and more emergent structures of action (offline solutions as a result of IT discrepancies), employees at INFunity developed the courage to experiment alternative ways of accomplishing their tasks and accepting any unforeseen errors as part of adapting to the change process. While experimentation was quite prevalent at INFunity, some employees were seen approaching emergent tasks in entrenched ways, creating undue work disruptions

and hindering the accomplishment of interdependent tasks. Based on our unobtrusive observations, some employees were more reactive to disruptions (employees were anxious to provide immediate solutions to problems during ongoing operations) than the learning opportunities these disruptions could potentially offer (employees showed little reflection and feedback on emerging issues), as commented by the following informants:

> Technical problems do two things to people: Turn them away and they will go back to old habits or change their behavior [for the better] (T2).

> When we get stuck [in IT] […] people like to focus on the problem and forget about the bigger picture! [M1].

In the above examples, the role technology appears to have diminished as it serves INFunity's short-term rather than long-term objectives (cf. Schultze and Orlikowski, 2004).

The use of technology at INFunity was found to be related to individuals' perception of task complexity in how tasks are related to each other via IT platforms. If tasks were perceived as highly complex, employees would be less willing to stretch the inscribed features of technology, particularly so when "technology is running too fast for us to catch up!" (D3) This is an example of technology avoidance that not only impeded the change process but also affected social cognition in that individuals could influence one another, particularly those in the same workgroup, in the way they made sense of the role of technology in their work practices (Kane and Labianca, 2011). However, informants also reflected that sensemaking at the group level could help shape each other's interpretation of how they could engage in more of technology, as suggested in the following quote:

> We are not used to working with IT […] we are afraid of what could go wrong […] we often run to our colleagues who face similar issues to talk it over. We realized we are all in the same boat and then we somehow see the big picture together. We always think of our customers first (D6).

In the above example, individuals responded to IT challenges by adopting an outside-in perspective to view their work from their customers' perspective (Lee and Kim, 2007). This allowed them to see the wider context of their work practices which in turn helped INFunity shape their long-term e-government strategies (Cordella and Iannacci, 2010).

Structure. Findings suggest that technology use affected organizational forms by developing distributed decision making and empowerment among INFunity's employees. Professional roles shifted from defined, inflexible, and hierarchical structures to more spontaneous and fluid role structures making coordination easier (Vaast and Walsham, 2005). The infiltration of technology "literally chipped off the pyramid structure" (D4), a characteristic of bureaucratic organizations in the public sector (Smith, 1993). The gradual but dramatic shift in organizational structure at INFunity provided new interactional dynamics that connected "those at the top to those in the bottom" (M6) through the socialization of technology. Flexible communication channels such as intranet and common IT platforms offered the growing space for information exchange, closing the gap between decision makers and subordinates to a large extent. Although new structural forms of interaction brought "the company closer to one another" (T4), the increased transparency of information sharing also led to some challenges, the following of which is an illustrative quote:

> I am not good at using IT. Once I got stuck with the Performance Appraisal System and asked one of my staff good at IT for help. He spent the evening rectifying the problem but also walked away with some sensitive information (D1).

The above is an example of an unintended consequence of technology use which led to a leak in sensitive information. This is a typical scenario of how organizational leaders, in their eagerness to solve a particular IT problem, lost sight of their accountability of data and critical information. In another example, the misuse of confidential information by an employee led to a twist in individual roles. This employee used the privileged information he had access to as a threat to ask for personal favors from his manager (cf. Yeo and Ajam, 2010). The reversal of power relations in this scenario further gave rise to the unexpected restructuring of social relations (Orlikowski and Scott, 2008). As a consequence, the unintended use of technology altered expectations in norms, privileges, and individual rights that affected decision making related to work practices (Liker *et al.*, 1999).

The need for constant technology use at INFunity further created an opportunity for individuals to exercise implicit empowerment in managing their tasks. To a large extent, individuals viewed the objectivity of technology as a means of externalizing their influence in organizing and managing change. For instance, the innovative use of e-mails through the creation of subgroups and the circulation of incontrollable information extended technology's objectivity to redefine social relationships and responsibilities (Robey *et al.*, 2002). Anything captured in "black and white [in e-mail] could be a record to assign a task for someone to complete by a certain time […] and this ensures transparency and it's a lot easier to communicate between parties" (M6). Indirectly, the unintended use of technology in this example led to supervisors exploiting e-mails as a channel to redirect their own complex tasks to others by abdicating their responsibility. This practice inadvertently led to different expectations in trust, integrity, and work ethic, as suggested in the following quote:

> My boss sometimes emails me to do something outside my job area and I am tempted not to do it for him as he will take it as his own work. But if I don't do it, I'm afraid he will evaluate me poorly in my [performance] appraisal (T5).

In this case, the underlying tension caused by the unintended use of technology created a different social structure that redefined work boundaries and mutual expectations albeit against ethical work practices (Balogun and Johnson, 2005).

Although employees at INFunity exercised some level of self-empowerment, not many of them were actually comfortable with the given autonomy due to ambivalent task boundaries. The reason is that some employees feared being reprimanded for not carrying out their superiors' instructions while others were unwilling to take technology risks for fear of undesirable consequences. For these passive technology users, "IT is quite just a means to an end […] to get work done" (D1). In the public sector, "mistakes [caused by IT] could be regarded as political crimes and the stakes are high" (M2). Such a risk-adverse mindset in turn affected social cognition arising from spillover effects where resistance breeds further resistance to change (Thomas *et al.*, 2011). On the one hand, the unintended consequences of technology use at INFunity undermined the change process. On the other hand, the decrease in manual tasks gradually convinced individuals of the immediate need to use technology with the increase in e-government services. In trying to allay the fears of employees, INFunity conducted regular dialogue sessions to allow them to voice out their concerns and fears about technology use and prepare them for further change (Tsoukas and Chia, 2002). However, the downside of unintended technology use actually led to an upside to changing things around as regular dialogue and feedback did help individuals make better sense of technology's role in their work practices (Weick, 1995).

Human agency. The study reveals that the tensions created between technology use and organizational change led employees at INFunity to perceive their individual roles differently. While some of them were perturbed by the change caused by technology, some others perceived themselves as carriers of change, as indicated by an informant:

> You can't have only one car on the roads […] IT is the same. People must "drive" [their cars] together to enjoy the highway of activities. It's the same for fostering change around you. You need to get people moving! (T6).

Not only did the employees have to deal with a higher level of task interdependence interfaced by IT, they also had to unlearn old ways of doing things by focussing on challenges as opportunities for change. At the individual level, technology introduced at INFunity reflected individuals' readiness for change, their resilience to change, and their proactiveness towards change. A shift in attitude and behavior was necessary for most employees to overcome the complexity of technology use, as reflected by another informant:

> Our challenge was to get everyone to respond to change positively. In our case, we adopted a top-down approach to use IT in our daily job. Many of them are old-timers, been here for a long […] time. Some even needed a lot of push to complete the [IT] training (M5).

At the group level, employees at INFunity had to learn to build trust between each other as most IT applications required collaborative efforts to create and modify particularly when there was a system breakdown requiring urgent technical intervention (Jasperson *et al.*, 2002). At the organizational level, leadership played a critical role in planning for and developing more advanced e-government services. In particular, leaders at INFunity had to create the context for individuals to take risks as well as assess task urgency and complexity to meet the increasing needs of customers, as exemplified in the following quote:

> People are afraid to lose their job because they think technology will replace them […] so they resist change. We (supervisors) did quite a lot of handholding. The staff are now encountering real-time change because pressure is coming from our customers to improve our services (D2).

Our observations and informal conversations with employees at INFunity reveal that extreme improvisations of IT features not only contributed to many unexpected technical problems but also led to the corruption and loss of data, a risk that held some employees back in performing further workarounds. However, we also observed in several meetings that the resolution of technical problems often involved a diverse mix of employees including IT specialists and leaders. Trying to figure the problems motivated some meaningful conversations that helped individuals make sense of how human agency could "make IT serve you rather than you serve IT" (T4). The unintended use of technology also led to a heightened awareness of how IT could be constantly reconfigured to prevent potential misappropriation giving rise to technology-in-construction (Orlikowski, 2000).

More importantly, the study reveals the power of human agents as carriers of positive and negative change. Work disruptions and environmental ambivalence resulting from IT intrusion were perceived as either a positive or negative force of change. Some employees viewed disruptions as an opportunity to reconsider their work processes while others were more pessimistic resulting in resistance to change. The fear of not being able to accomplish their daily tasks due to the incompetent use of

technology and the lack of technical support intensified their resistance to incorporate technology into their work practices. A more pressing issue was that leaders at INFunity were perceived as negative carriers of change, as commented by an informant:

> Some managers are in a dilemma. On the one hand, they have to accept the challenge of using IT. On the other hand, they quietly reject technology on their own. Worse still, some even fall back on the old system of [manual] paperwork. How can they set a good example for us? (D3).

Employees who had come to terms with technology adopted a more proactive response to change by harnessing their curiosity to improve their work practices. Our observations on the work floor helped us understand how and why individuals questioned their various assumptions about their technology use. We found that such questioning in fact helped them make better sense of the underlying fragments of change caused by work disruptions and connect them to the bigger picture of INFunity's future. Their sensemaking of ongoing change also helped them recognize that failure to respond to change could put them at a disadvantage if they lagged behind and were not seen as part of INFunity's vision. As such, some employees ended up motivating each other to "be bold to use IT!" (M4) Informants who were more positive about change projected a more confident voice when talking about the role of technology in their work environment. In particular, a positive attitude was necessary for them to accept the shortfalls of technology such as "system failure […] viruses […] data leak […] data loss" (D6) as a part of organizational life. Only then can employees at INFunity engage themselves fully in the emergent process of change (Robey *et al.*, 2002).

Influence of technology interpretation and enactment on organizational performance

As a result of e-government implementation, technology-induced change at INFunity influenced their performance in terms of employee engagement, work consistency, and process improvement. First, individual use of technology was largely related to fulfilling specific task requirements. We found that employees were more sensitive to information flow and the speed and ease at which information is exchanged as influencing task interdependencies (Vaast and Walsham, 2005). For instance, storing information on shared folders via the intranet provided the space for individuals not only to draw on relevant resources when needed but also open new networks of collaboration as the virtual space doubles as a collaborative space for others to share work-related problems or challenges. Joint resolution via this space proved useful in promoting employee engagement (Boumgarden *et al.*, 2012). Such a virtual community also developed spillover effects where individuals would choose to connect with each other on a more personal level outside this space, as recounted by an informant:

> The server is a common ground for people to "talk" to one another through the information or data they share. Quietly, IT is redefining information exchange and our relationship with our work. New social networks are indirectly created (D1).

The above is an example of how technology is used as means of organizing human interaction where individuals are engaged at different levels (Orlikowski, 1991). In the process, not only do they make sense of the information they share but they also harness the relationship they seek to develop (Weick and Roberts, 1993).

Second, technology-induced change also led to work consistency at INFunity as centralization of e-government platforms catered for both internal and external users helped reshape task structures, affecting how information was used, disseminated, and deposited. Centralization helped formalize organizational activities and brought clarity

to task boundaries (Fountain, 1995). For instance, centralized IT processes would require employees to filter and channel information based on specific task requirements promoting a different level of responsibility and accountability in terms of work practices (Schultze and Orlikowski, 2004). At the individual level, employees had to be accountable for task deviations such as the misalignment of shared objectives before reaching the group level to negotiate and realign the objectives (Argyris and Schön, 1996). Subsequently, these collective actions led to change that surfaced at the organizational level where the role of technology became an organization of regularized action patterns (Orlikowski, 2000), as reinforced in the following quote:

> Using IT for hiring allows HR and their line managers to enter their comments on each online application (*individual level*). These comments will be shared by all the decision makers (*group level*) before the interview. This kind of sharing has helped us to maintain consistency in our selection, interviewing and final hiring process (*organizational level*) (M5).

Third, change as induced by technology also led to improvement of work processes at INFunity. Systematizing the overall process of tracking and disseminating information helped to minimize the potential occurrences of data discrepancies based on human errors or technical glitches. In order to avoid potential missteps, INFunity developed a reflection and feedback system to identify why certain problems occurred and how they were resolved. The unintended use of technology provoked the need for such a system resulting in the growth of work improvement teams. Activities associated work improvement gave rise to a new level of organizing where change processes were enabled through collective sensemaking and action taking (Thomas *et al.*, 2011; Weick and Roberts, 1993). Such activities contributed to several innovative e-government services, as exemplified in the following quote:

> Apart from the e-Procurement and Account Servicing System, the most crucial application is the Remote Technical Support System where someone can troubleshoot an IT-related problem from another location. A technician doesn't need to be there physically. Isn't this a creative way of solving technical problems? (T2).

The above are some examples of how technology-induced change led to employee engagement and different aspects of work improvement by incorporating technology into work practice.

Integrative framework of technology-induced change

Our data further helped us to develop an integrative framework (see Figure 3) which focusses on the centrality of human agency as a precipitator for change where organizational actors interact with technology to develop interpretive schemes that

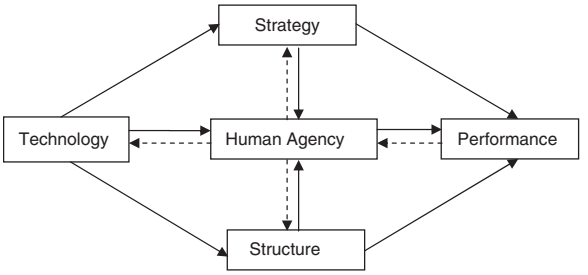


Figure 3.
An integrative framework of technology-induced change

ultimately shape organizational structure, strategy, and performance. The human agency perspective holds that technology induces temporal orientations between actors during socialization affecting the restructuring of actions and human relations (Emirbayer and Mische, 1998). Such temporality gives rise to situated practice where actions are enacted at a particular point in context to serve a specific purpose (Brown *et al.*, 1989). These actions often trigger the intended and unintended use of technology (Yates, Orlikowski and Okamura, 1999). The entrance of technology into INFunity initially led to a state of punctuated equilibrium where deep structures of bureaucracy were disrupted based on the dramatic shift in decision making and work practice (Balogun and Johnson, 2005; Nasim and Sushil, 2010). However, these disruptions surfaced as innovative alterations in social and task structures creating coherence in interdependent work practices (Mellahi and Wilkinson, 2010). This is where human agency plays an active role in modifying institutional properties through centralized and systematized processes (cf. Orlikowski, 2007).

As technology is reconstructed as a result of the intended and unintended consequences of use, there is also a greater interplay of task interdependence and work practice that shapes social action (cf. Vaast and Walsham, 2005). Such interplay provides the context for actors to make further sense of technology and organizational change leading to knowing-in-practice (Orlikowski, 2007). This is where actors draw on their tacit knowledge embedded in their negotiation of technology use during a change process to restructure their action and "inter-action" with others (Dougherty and Dunne, 2012). In doing so, they develop coping mechanisms to deal with task ambiguity at the individual level by demonstrating improvisations in technology use (Balogun and Johnson, 2005). However, as task and social structures become more complex, actors begin to engage in collective sensemaking to resolve urgent and nettlesome technology-related issues. The resolution process in turn helps develop a greater commitment to shared decisions and a more proactive attitude towards change (Mellahi and Wilkinson, 2010). Understanding of shared problems further leads to concertive actions that integrate various tasks into coherent work practices (Weick and Roberts, 1993). The relationship between technology and human agency in turn catalyzes the interplay of organizing (emerging action patterns) and organization (stabilized action patterns), influencing the dynamics of organizational strategy, structure, and performance (cf. Orlikowski, 2000; Yoo *et al.*, 2012), represented by the dotted arrows in Figure 3.

Implications, limitations, and future studies

This study offers a human agency perspective of how organizational change plays out as a result of technology introduction. Unlike similar research, this study extends current understanding of technology use by exploring how technology is interpreted and enacted in work practice through a change perspective. It further extends the structuration perspective of technology in work organizations by exploring how technology enables and constrains organizational change through intended and unintended use (Orlikowski, 1991; Orlikowski and Scott, 2008). This study illuminates the power of human agency to innovate and organize structures of action that modify social relations and organizational strategy influencing organizational performance (cf. Thomas *et al.*, 2011; Yoo *et al.*, 2012).

In this study, technology-induced change at INFunity challenged rather than reinforced institutionalized practice given its entrenched bureaucracy and power structure (Amis and Aïssaoui, 2013). The initial change brought more disruption and ambivalence to INFunity than anticipated. As change took a more emergent course through the intended and unintended use of technology, individuals began to engage in

collective sensemaking of their roles, tasks, and the social relations. This study further offers several pertinent implications for practice. First, it is important for organizations not to underestimate their employees' persistent avoidance of technology as this could develop a negative chain of actions affecting change. Second, organizations should recognize that improvisations of technology use could both enable and constrain change. It is crucial that employees be made aware of and accountable for the consequences of unintended technology use in order to ensure that any potential technology workarounds could facilitate change at a faster rate than expected. Third, organizations should develop their strategies based on the collective sensemaking of technology-induced change as affecting various work practices.

The study has some limitations as well. The research was carried out in a single organization with findings that are not particularly generalizable. Also, our study was based on a convenience sampling hindering us from obtaining a much wider and more random range of responses from employees at INFunity. Our limited access to the research site further prevented us from gaining a longitudinal perspective of the change process at INFunity. As a way of advancing this study, it might be useful to explore the relationship between task interdependence and technology enactment in influencing organizational change (cf. Balogun and Johnson, 2005; Cordella and Iannacci, 2010; Orlikowski, 1996). Also, it might be worthwhile to examine how sensemaking at the individual and collective level influences the structure of action in enabling and constraining technology-related change (cf. Leonardi and Barley, 2008; Thomas *et al.*, 2011). More importantly, the concept of organizing and organization in relation to structures of action could provide a closer link to the interplay of individual and organizational-level change (cf. Orlikowski, 2000; Tsoukas and Chia, 2002). Finally, future research could also focus on the internal and external tensions of technology use affecting organizational change (cf. Barley, 1986; Jansen, 2004). For instance, the dilemma of building internal technology capacity and handling external pressure due to customers' lack of readiness to utilize e-government services poses a real challenge for public organizations to deploy technology as a vehicle to drive change.

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Further reading

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