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The Role of Enterprise Systems in Fostering Innovation in Contemporary Firms

Sachithra Lokuge
Monash University
ksplokuge@gmail.com

Darshana Sedera
Monash University
darshana.sedera@gmail.com

Abstract:

Traditionally, to seek innovation, organizations have made substantial investments into enterprise systems (ES). However, anecdotal reports have noted that many organizations have now begun to shift their focus to digital (i.e., social, mobile, analytics, and cloud) technologies. Considering this contentious contemporary technology landscape, we investigate the role of ES in innovation. Using data gathered from four case organizations, we highlight that the organizations innovate using their digital technologies and that enterprise systems act as a platform that enable innovation. We also highlight the barriers for enterprise systems-led innovations.

Keywords: Innovation, Enterprise Systems, Digital Technologies, Case Studies.

Felix Ter Chian Tan acted as the senior editor for this paper.

1 Introduction

Innovation is the lifeblood of many organizations (Hsu, 2017), and technology plays a vital role in triggering innovation in organizations (Lusch & Nambisan, 2014; Nambisan, 2013). We can see as much in the current era in which organizations that adopt digital technologies can foster innovation (Yoo, Boland, Lyytinen, & Majchrzak, 2012). Thus, we can see why many information systems (IS) scholars focus on understanding the innovations that digital technologies trigger and facilitate (Nylén & Holmström, 2015; Sedera, Lokuge, Grover, Sarker, & Sarker, 2016a; Yoo, 2013). While much research has examined the diffusion of innovation (Peng & Vlas, 2017; Rogers, 1995), antecedents of innovation (Jansen, Van Den Bosch, & Volberda, 2006; Wan, Williamson, & Yin, 2015,) and even some aspects of organizational innovation (Camisón & Villar-López, 2014; Damanpour, 1991), the existing body of knowledge falls short of explaining the present trajectory of innovation through the use of digital technologies, which represents a new and different context. As Nambisan (2013, p. 216) states:

> *In the last one decade or so, the nature of innovation has undergone considerable change in most industries. Innovation has become much more open, global and collaborative in nature to involve a diverse network of partners and emphasizing distributed innovation processes.*

Further, Yoo et al. (2012) argue that the process of innovation itself has shifted dramatically in recent times and, thus, that it requires separate investigation. In line with these observations, we make scientific observations on the innovation process enabled by enterprise systems (ES) and digital technologies specifically to understand the role of ES as it pertains to contemporary digital technologies. We use the term "digital technologies" to refer to contemporary technology applications that one configures using social media, mobile technologies, analytics, and cloud computing (Nambisan, 2013; Sedera et al., 2016a; Yoo et al., 2012).

The technology platform itself represents a key component in the contemporary innovation process (Tan, Tan, Wang, & Sedera, 2016). Enterprise systems have increasingly become the dominant technology in organizations (Lokuge, Sedera, Atapattu, & Samaranayaka, 2016) since they allow organizations to incorporate tools so that organizational members can seamlessly share technology and data resources (Tan, Tan, & Pan, 2016; Tilson, Lyytinen, & Sørensen, 2010). While much of the literature extols the apparent role of ES in process innovation (e.g., Ceccagnoli, Forman, Huang, & Wu, 2012; Gawer, 2014; Sedera et al., 2016a), fewer number of studies question this view (e.g., Sedera & Lokuge, 2017; Srivardhana & Pawlowski, 2007). Some studies highlight the rigidity that results from an ES (Kharabe, Lyytinen, & Grover, 2013; Strong & Volkoff, 2010) and consider ES as a barrier for process innovation. Indeed, some researchers have suggested that an ES restricts innovation by introducing and reifying structural constraints (Davenport, 2000; Sedera et al., 2016a). Highlighting the innovation inhibiting role of ES, Kharabe and Lyytinen (2012) describe an ES as liquid concrete. Given the heavy investments organizations have made in ES (Eden, Sedera, & Tan, 2012) and the imperative to constantly innovate in today's hyper-competitive environment, it is meaningful to seek some clarity regarding this contradiction that surrounds the nature of the relationship between ES and innovation and specifically process innovation. This issue is particularly critical since organizations rarely replace or retire ES (Eden, Sedera, & Tan, 2014), and ES do not serve organizations well if they prevent or constrain the innovation of organizational processes. Also note that even those researchers who hold the view that an ES enables process innovation (Kharabe et al., 2013; Lokuge, 2015; Lokuge & Sedera, 2014b) do not agree on the nature of the innovation that an ES might enable or constrain. However, we know little about these roles in the context of ES. Thus, we examine the following research question (RQ):

RQ: How do organizations innovate using ES in the presence of digital technologies?

Contribution:

Prior research on enterprise systems (ES) and innovation presents diametrically opposite views. Some research argues that ES facilitate innovation, but other research argues that ES hinder it. This study contributes to academia by providing empirical evidence on what role ES play in innovation. The study results illustrate that ES-led innovations are difficult to initiate. However, with the advancements in the technology landscape, organizations have myriad technology options such as social media, mobile technologies, analytics, and cloud computing for innovation. The study highlights that, in the contemporary technology portfolio, when digital technologies are present, an ES acts as a technology platform to facilitate process innovation in an organization.

We empirically examined the use of digital technologies and enterprise systems for technology-led innovation using qualitative data that captured the subtle, experience-near aspects of the innovation process. Further, we applied a multiple qualitative case studies method given that our research question focuses on organizations more broadly (Emory & Cooper, 1991; Yin, 2010). Specifically, we developed five propositions from the literature to investigate the research question. We analyzed the propositions using four cases to better understand an ES's role in facilitating innovation.

The paper proceeds as follows: in Section 2, we provide the background of the research and, via thoroughly review the literature, develop propositions. In Section 3, we describe the methodology we followed. In Section 4, we describe how we analyzed the data and, in Section 5, present our results. In Section 6, we discuss our findings. Finally, in Section 7, we discuss the paper's contributions and conclude the paper.

2 Theoretical Propositions: ES and Innovation

In this section, we review the literature on ES and innovation and develop some key propositions that we subject to deductive empirical examination. We draw on Crossan and Apaydin (2010, p. 1155) who define innovation as "production or adoption, assimilation and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services and markets; development of new methods of production; and establishment of new management systems". This definition ideates that innovation can be new to the world and adopted considering the unit of adoption. In this study, we focus on process innovation, which we define as the improvements that an organization makes to its business processes and component technologies to produce products (Camisón & Villar-López, 2014; Pilav-Velić & Marjanovic, 2016).

As we state in Section 1, the literature seems to contain a basic contradiction regarding the relationship between ES and process innovation: some researchers argue that ES enable process innovation, while others maintain that the rigidity and inflexibility surrounding ES can severely constrain their ability to enable such innovations. To make sense of the contradiction empirically and to understand the nature of innovation in an ES, we first provisionally accept the more dominant view that ES enables innovation. Specifically, we drew insights from IS researchers (e.g., Fichman, 2001; Sedera et al., 2016a; Swanson & Wang, 2005) who argue that an ES penetrates to core business technologies and, thus, enables an array of interrelated process innovations. Srivardhana and Pawlowski (2007, p. 54) argue that an ES can provide "new opportunities to acquire knowledge from external sources, develop common cognitive structures among employees from different functional areas, and implement new routines and processes", which, as a result, impacts the process-related innovation in an organization (Sedera & Gable, 2010). Similarly, Davenport (2013) states that embracing ES represents one of the most important developmental steps in organizations' use of information technology and highlights their innovation potential. Moreover, ES purport to introduce best practices and facilitate organizational-wide innovation (Trantopoulos, von Krogh, Wallin, & Woerter, 2017; Wagner, Scott, & Galliers, 2006; Wu, Wang, & Lu, 2005) by revolutionizing existing business processes and practices (Karim, Somers, & Bhattacherjee, 2007). Thus, we propose:

P1: ES enable process innovation.

However, we need to do more than merely hypothesize about the relationship between the ES and process innovation—we also need to understand the nature of the innovation. Again, the literature lacks consensus on this issue. Some researchers argue that the implementation of the enterprise system to an organization resembles characteristics of radical innovation (Holland & Light, 1999; Lokuge & Sedera, 2014c; Motwani, Mirchandani, Madan, & Gunasekaran, 2002). Organizations typically adopt an ES to introduce best practices and facilitate organizational-wide innovation (Wagner et al., 2006; Wu et al., 2005) by revolutionizing existing business processes and practices (Karim et al., 2007; Sedera et al., 2016a), which evidences radical innovation. For example, scholars who have observed ES implementations report: 1) technological uncertainty (Green, Gavin, & Aiman-Smith, 1995; Murphy, Lyytinen, & Somers, 2016), (2) technical inexperience (Lokuge, 2015; Lokuge & Sedera, 2017), 3) business inexperience (Leifer et al., 2000; Lokuge & Sedera, 2016), 4) technology cost (Germain, 1996; Lokuge, 2015), 5) high risk (Keizer & Halman, 2007; McDermott & O'Connor, 2002; Schenk, 2015), and 6) high initial resource consumption (Davenport, 1993; Eden et al., 2014; Leifer, O'Connor, & Rice, 2001)—all characteristics of radical innovation (Damanpour, 1988; Van Lancker, Mondelaers, Wauters, & Van Huylenbroeck, 2016). Further, Roy and Sarkar (2016) characterizes radical innovation as deep changes to

an organization and its functions through changes to its organizational structures, roles, and responsibilities and through drastic changes to the way the organization carries out its businesses. Researchers have observed all of these characteristics (Kraemmerand, Møller, & Boer, 2003; Yin Yeh & OuYang, 2010).

With respect to the timing of innovation, researchers have established that ES implementation unfolds through several phases. This study subscribes to Markus and Tanis's (2000) ES lifecycle: 1) implementation, 2) shakedown, and 3) onward and upward phase. According to Markus and Tanis (2000), in the implementation phase, the organization introduces and implements an ES. The shakedown phase occurs immediately after the ES goes live and after each major upgrade. During this chaotic period, ES users learn about the new system features and functions and adjust their work practices (Murphy et al., 2016; Sedera & Tan, 2005). In this phase, organizations undergo a "productivity dip" while gaining other productivity-related improvements (Ross & Vitale, 2000, p. 237). Further, users face new challenges due to unfamiliar system features and functions, the introduction of new job roles and conditions, changes to work practices and culture, software-related issues, and a lack of confidence to adopt new technologies over legacy systems (Nah, Lau, & Kuang, 2001; Niu, Jin, & Cheng, 2011). Herein, one can argue that the outcomes and the challenges that organizations face during this phase correspond with the characteristics of radical innovation (Green et al., 1995; Leifer et al., 2000; Norman & Verganti, 2014). Here, researchers purport many of the radical changes to organizational processes to occur during the shakedown phase. Thus, we propose:

P2: ES enable radical process innovation during the shakedown phase.

The onward and upward phase follows the shakedown phase and denotes a stable ES environment (Markus & Tanis, 2000). According to Markus and Tanis (2000), an organization takes three to five years to reach this phase. The radical innovation introduced through the ES plateaus and declines steadily (Norman & Verganti, 2014) in the onward and upward phase. During this phase, an organization usually becomes more internally consistent, and users become more familiar with the systems (Sedera & Dey, 2013; Srivardhana & Pawlowski, 2007). However, as Swanson and Dans (2000) explain, systems deteriorate over time, and, eventually, organizations must retire or upgrade them. Yet, as Eden et al. (2014) point out, organizations rarely do so; thus, they must actively seek innovation through their ES. Even though it is difficult to make a radical innovation, organizations could initiate incremental process innovations. For example, an organization could attain an incremental innovation of an ES by introducing new ES modules, adding new components such as supplier- and customer-management modules, improving the system functionalities by adding plug-ins, making timely upgrades, and engaging in business process improvements (Chua & Khoo, 2011). Thus, we propose:

P3: In the onward and upward phase, ES enable incremental innovation.

The innovation literature highlights the importance of the innovation process's lead time (Kessler & Chakrabarti, 1996; Kordal, Cahoy, Minkabo, & Sherer, 2016), which applies to ES-led innovation as well (Cohen, Nelson, & Walsh, 2000; Drucker, 1998; Lokuge & Sedera, 2016; Marengo, Pasquali, Valente, & Dosi, 2012). In this study, lead time refers to total project time from the beginning of idea generation to the end of market launch in months and years (Ali, Krapfel, & Labahn, 1995). Shorter innovation lead times are especially important for organizations that need to be able to react to opportunities in dynamic markets (Cohen et al., 2000; Duin & van der Duin, 2006). Prior researchers have recognized that the lack of coordination between related departments increases innovation lead time (de Treville et al., 2014; Puranam, Singh, & Zollo, 2006). Thus, as Jansen et al. (2006) state, systems play a substantial role in minimizing the lead time of innovation through formalized processes. Therefore, the standardization, integration, and automation facilitated through an ES enables an organization to collate and coordinate organization-wide initiatives (Prahalad & Hamel, 1990; Schenk, 2015; Sedera, Gable, & Chan, 2003) much faster (Nah et al., 2001), which may reduce the lead time of innovation. Thus, we propose:

P4: ES enable organizations to reduce the lead time of process innovation.

Organizations need to innovate to survive in competitive environments (Alexy & Reitzig, 2013; Qian, Cao, & Takeuchi, 2013; Teece, 1992). Prior studies highlight the role of information technologies (IT) in innovation (Davenport, 2013; Kleis, Chwelos, Ramirez, & Cockburn, 2012; Yoo, 2013). ES is an archetype of contemporary IT and states that IT-enabled innovation contributes to increases in 1) productivity (Hall, Lotti, & Mairesse, 2013; Simpson, 2014), 2) market position (Harris, McAdam, McCausland, & Reid, 2013; Porter, 2011), 3) faster response to business opportunities (Vesey, 1991), 4) better business insights (Stock & Zacharias, 2011), and, ultimately, 5) revenue growth (Nagji & Tuff, 2012; Oke, Walumbwa, &

Myers, 2012). Studies argue that, even though an ES provides benefits such as transparency, improved business processes, and productivity gains, considering its availability for many organizations, it does not likely provide a source of competitive advantage (Seddon, 2005; Seddon, 2014). According to Hendricks, Singhal, and Stratman (2007), organizations that have adopted an ES have gained a higher return on assets. In addition, Stratopoulos (2017) highlights that ES provide an enduring competitive advantage, while most of the emerging technologies fail to provide an enduring competitive advantage. Given these contradictory views, we propose:

P5: ES-led innovation provides a competitive advantage in the onward and upward phase.

3 Research Methodology

We conducted a qualitative study and collected data from multiple cases to investigate how organizations innovate using ES in the presence of digital technologies. We decided on a qualitative approach because it answers "how" questions well and suits investigations into contemporary and complex phenomena such as innovation (Yin, 2009). The overall methodological approach in the study comprised two sequential steps. First, we discerned the propositions about ES and innovation from the extant mainstream literature and subjected them to deductive examination (Lee, 1989; Yin, 2009). Second, we inductively built propositions (Lee, 1989; Sarker & Lee, 2003). We conducted the second phase "to discover concepts and hypotheses not accounted for in the original formulation" of the propositions (Patton, 2002, p.494) and/or to reformulate existing propositions that did not hold up to empirical examination. Many researchers in the IS field have used this approach (e.g., Dibbern, Winkler, & Heinzl, 2008; Rivard, Lapointe, & Kappos, 2011), and it concurs with the approach that some scholars refer to as analytic induction (Patton, 2002). This approach allows one to critically examine the state-of-the-art knowledge about a topic and to incrementally build on the body of work by retaining empirically valid aspects and reformulating questionable or invalid ones. Figure 1 presents the research design.

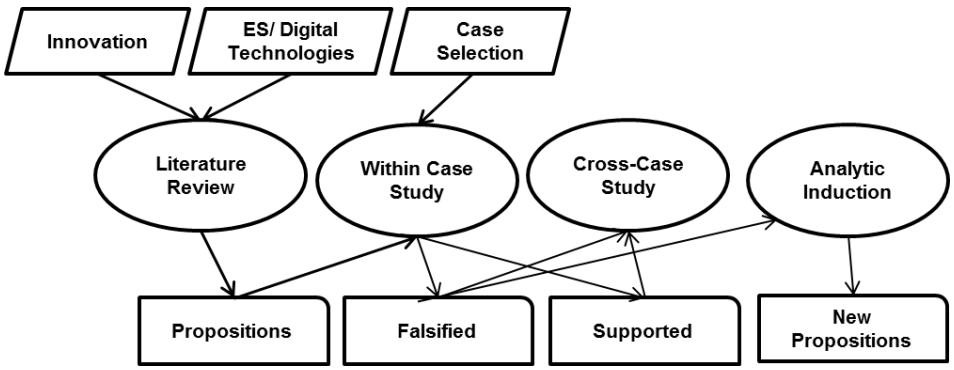

Figure 1. Research Design

3.1 Case Selection

We selected cases while considering both control and variety (Dubé & Paré, 2003), and we conducted the sampling in a deliberate fashion (Patton, 2002). We sought companies with a stable ES that they had implemented at least five years before. A five-year period is generally considered as sufficient for organizations to reach the onward and upward phase of the ES lifecycle (Markus & Tanis, 2000). By selecting organizations that had reached the onward and upward phase, we could better understand what effects ES have on innovation. Further, we ensured that the cases represented diverse industry sectors and ownership structures (i.e., publicly listed and multi-national) in order to more strongly support our findings' generalizability.

We purposefully sampled respondents and, where possible, used the snowballing technique to recruit interviewees[1]. The main informant sought in the case organizations was the chief information officer (CIO) or the individual who held an equivalent position (i.e., chief technology officer (CTO), technology leader).

[1] We had been conducting a "CIO seminar series on enterprise systems" for the past three years in which CIOs presented their strategic IT view that focused on ES. The network developed through this seminar series helped us in developing sufficient background knowledge of the topic and to select the most appropriate cases.

To ensure that we collected data in relevant organizations, we conducted a preliminary telephone interview with their CIO/CTO (hereafter "CIO" for simplicity) before we engaged in more intensive data collection. Furthermore, all the cases fulfilled the following criteria:

1) The organization had a dedicated CIO and a team of IT staff that managed the organization's IT portfolio, including a packaged ES.
2) The organization had used an ES for the past five years and had accessible documentation of the IT roadmap since it had implemented the ES.
3) At the time we collected data, the CIO had been in the position for at least six months, was not in the last six months of their appointment[2], and participated in regular meetings with the executive leadership team (e.g., CEO, CFO).

In addition to interviews with the CIO, we also conducted interviews with other respondents for two purposes. First, we selected a member of the ES implementation team in case the current CIO had not taken part in the organization's ES implementation. Second, we selected a department head from a recent IT-centric project that the organization considered innovative. The unit of analysis in the study is the organization.

As we mention above, we conducted multiple interviews at each organization. We used the same case protocol, which included interview guidelines with open-ended and semi-structured questions, for all interviews. The protocol included questions about the case organization and specific questions about the constructs of the study's theoretical propositions. The Appendix provides a high-level interview guideline. In total, we conducted 19 semi-structured interviews (totaling 39 hours) in the study. Each interview took between one to two hours, and, in most cases, we conducted follow-up interviews for clarification or due to time constraints where the CIO could not meet for enough time in a single session. We conducted all the interviews face to face in English between November, 2013, and July, 2014 (see Table 1 for details of the cases). We then transcribed the interviews. Table 2 provides the descriptors and the categories we employed to describe each interview.

Table 1. Case Details

Pseudonym	Industry sector	Origin	Enterprise system	Interviewees	Hours
C1	Private sector / logistics	Europe	SAP	CIO	7
				Director of logistics	4
C2	Private sector / dairy	Europe	SAP	GLOBE IS/IT manager	1.5
				Brand managers	2.5
C3	Private sector / energy	Europe	SAP	CIO	4
				SAP technical leads	8
C4	Private sector / manufacturing	Australia	SAP	CTO	6
				SAP technical consultants	6

We refer to the four cases in the deductive phase as C1, C2, C3, and C4 due to confidentiality agreements signed between the organization and the university. All four organizations had used reputed implementation partners to implement SAP as their ES from 1997 to 2009. At the time we collected data, C1, C2, and C3 operated in more than two continents, while C4 (a leading producer of fruits and vegetables) operated only in Australia. All four organizations employed a location-based big-bang implementation approach using distributed implementation teams that the company headquarters managed. All the cases had implemented SAP's materials management, sales and distribution, financial, and controlling modules. On average, the organizations took 25 months (minimum 22 months and maximum 27 months) to implement their ES.

[2] This requirement ensured that the IT leadership was not "in transit"—an important consideration because researchers have argued that organizations with in-transit CIOs do not embark on strategic initiatives. In line with this criterion, we did not begin collecting data from the organization with the code name ROAD until June, 2014, because it had appointed a new CIO in November, 2013.

Table 2. Categories and Codes

Category	Codes
Actor	CIO, CTO, technology lead, department manager
Innovation type	Radical, incremental
Technology responsible for innovation	Enterprise system, digital technologies
Resource allocation	Continuous, sporadic, ad hoc
ES resource type	Enabler, barrier, initiator
Lead time	Short, long
Innovation intensity	Low, medium, high
Enterprise systems features	Flexibility, best practices, integration, process nature
Outcomes of innovation	Productivity, response to business opportunities and business insights

Based on the key notions of the five propositions, we derived nine categories and various codes to describe each statement of the transcribed interviews. We used these categories and codes to understand the position of each organization in relation to the five propositions. More broadly, we used the categories to select the appropriate segment/s of the interviews to provide evidence for the five propositions.

4 The Analysis

We analyzed the data in two steps. First, following Chatterjee, Chakraborty, Sarker, Sarker, and Lau's (2009) guidelines, we assessed the formulated propositions using the data we collected from the four cases. To test the propositions, we used pattern-matching whereby we deliberately sought evidence related to the given propositions in the four cases (Dibbern et al., 2008; Sarker & Lee, 2003; Yin, 2009). In the dataset, we looked for incidents, actions, and outcomes of each incident (Wiebe, Durepos, & Mills, 2009). We tested the propositions we developed from analyzing the literature using the propositional patterns. Based on how well the empirical patterns fitted the patterns that the propositions predicted, we characterized the propositions as being "supported", "not supported", or "challenged" (which implied some degree of inconsistency between the predicted pattern and the observed patterns). Second, as Almutairi, Gardner, and McCarthy (2016) suggest, if the pattern of the findings did not match the pattern of the proposition, we used analytic induction to find an alternative explanation (Pascale, 2011).

4.1 Testing Propositions

Tables 3 and 4 provide example quotations for each of the propositions. Tables 5 and 6 present samples of a cross-case analysis to determine whether or not we observed empirical evidence for each proposition in each case (Eisenhardt, 1989). This process enhanced our confidence in the validity of the observed relationships (Dibbern et al., 2008; Sarker & Lee, 2003).

Table 3. Summary of Deductive Analysis

Propositions	C1	C2
P1: ES enable process innovation	**CIO:** "SAP certainly made our business processes better, so all the core functions are on SAP. But, we don't make any changes to SAP now, we now have many systems [non-ES] feeding data from SAP and to SAP to do much creative business activities."	**CIO:** "SAP led us to connect across boundaries. It [SAP] standardized and integrated all the processes. That was a massive thing for us. It [SAP] helped us to sweep all the messy practices we used to follow and introduced new processes. But we do not invest much on SAP; we now have many other systems [non-SAP] to do very innovative stuff."
P2: ES enable radical process innovation	**LOB:** "Introduction of SAP changed the whole company. The roles and the responsibilities of the employees were changed. Some were happy, some were not happy. But overall, it changed the business processes in a good way."	**LOB:** "The implementation of SAP incurred a huge cost. It [SAP] changed everything, even simple things like a SKU (raw material id) was standardized. The change was so drastic that it took few months for us to digest it…"

Table 3. Summary of Deductive Analysis

P3: ES enable incremental innovation	**CIO:** "We wait for the maximum time before we upgrade our SAP system. Now, there are plenty of cheaper specialized technologies such as mobile and cloud.... Some you can just plug-in to SAP; we don't need to spend money on SAP at all. We agree that SAP helps us to run the company - simply keeping the lights on. It's too big, complex and cumbersome to initiate innovation."	**CIO:** "We used our SAP system in the same way for quite some time. It [SAP] did not help us with innovation. Time-to-time, we saw SAP [company] is giving us service packs. We sometimes used those times to push some changes, but those things did not lead to innovation…sometimes, upgrades do. We have much better cheaper and rapid technological solutions [non-SAP] to invest on [sic], rather than SAP."
P4: ES reduce lead time of process innovation	**LOB:** "A big problem with SAP is that it takes much too long to put the system into action. Even a small change takes massive lead time…"	**LOB:** "Changes to our global templates are accepted once a year. That's a minimum 12-month lead time for any SAP project idea. Forget about the time for development, prototype, testing and use."
P5: ES-led innovation provides competitive advantage	**LOB:** "Accountability is much greater with our SAP system. However, we have a better reach to our customers through mobile apps…. We now have huge insights through BI which runs on top of SAP."	**CIO:** "Overall IT investment is up by about 15 percent [compared to last year]. We will keep investing on IT. Mostly on mobile and BI, because it has helped us to sustain, to improve our productivity, reduce the cost and most importantly to innovate."

Table 4. Summary of Deductive Analysis

Propositions	C3	C4
P1: ES enable process innovation	**LOB:** "After implementing SAP, the processes were standardized, and then it was all real-time. Even now we rely so much on it [SAP] to run our core business processes. But the presence of SAP almost stops us from bringing in new technologies for innovation. It's too constrained."	**CIO:** "SAP does a huge workload in the company…regarding the main business processes, but we don't see SAP supporting our innovations…. It's a back-office system."
P2: ES enable radical process innovation	**CIO:** "Our business processes were all messy…When SAP was introduced, it was a huge change, and our employees did not know how to use it [SAP]…it was a brand-new experience to all of us."	**CIO:** "When SAP was introduced, the business practices, processes, and everything we followed earlier changed radically. We didn't know how to use it to our day-to-day business. It was an upside-down change…"
P3: ES enable incremental innovation	**LOB:** "We have some experienced staff coming up with innovative ideas, but SAP global templates are killing innovation, and also we cannot wait for years to upgrade [SAP] to see some innovation."	**CIO:** "We upgrade the system [SAP] to mitigate risk of not having a compliant system, not to innovate. That too we wait till they [SAP company] make it mandatory…"
P4: ES reduce lead time of process innovation	**LOB:** "Even activating a standard SAP feature is a massive effort. Last year, we introduced standard SAP contracts and it took nearly 2 years to implement it."	**CIO:** "We know that SAP has some cool features for innovation, but it takes years to implement. We see lot of potential in our system, only problem is the lead time…"
P5: ES-led innovation provides competitive advantage	**CIO:** "We have 100% reliance on SAP for transactions and financials. But we don't have any new productivity improvements. We rely on third-party IT solutions for new business opportunities…"	**CIO:** "SAP's incremental benefits to our business is so marginal, it is not even worth considering. It's pointless to invest on [sic] such technologies, if what we need is innovation…"

Table 5. Summary of Cross-case Analysis

Proposition	C1	C2
P1: ES enable process innovation	**Challenged** (e.g., SAP covers most of the core business processes, and much of new innovation happens not using SAP but rather mobile and BI technologies.)	**Challenged** (e.g., SAP provides the backbone of IT, but investing in mobile, BI technologies for innovation.)
P2: ES enable radical process innovation	**Supported** (e.g., the logistic manager considered moving from then legacy to SAP as a radical shift, equating it to a shift from the stone-age to new world.)	**Supported** (e.g., introduction of SAP radically changed all core processes, roles, and responsibilities of the employee and organizational structure.)
P3: ES enable incremental innovation	**Not supported** (e.g., all routine / daily activities are done through ES, yet treats it as a barrier for innovation. No additional or continuous allocation of resources for ES; increased spending in non-ES IT.)	**Not supported** (e.g., no new, unscheduled projects have been proposed. The case treats SAP as an inflexible, static system that doesn't give any competitive advantage. There have been three major upgrades with which the company had sought to introduce innovative ideas. In all upgrade projects, these ideas have not been adopted.)
P4: ES reduce lead time of process innovation	**Not supported** (e.g., SAP RFID project was initiated but cancelled due to lengthy lead times.)	**Not supported** (e.g., country-specific, highly innovative sales campaigns took too long to implement in the SAP system.)
P5: ES-led innovation provides competitive advantage	**Challenged** (e.g., SAP increases accountability. Yet, differentiation (competitive advantage) is attained through mobile and BI technologies.)	**Challenged** (e.g., to reap quick benefits and to keep the customers happy, they were investing in mobile and BI technologies rather than SAP.)

Table 6. Summary of Cross-case Analysis

Proposition	C3	C4	Cross-case summary
P1: ES enable process innovation	**Challenged** (e.g., SAP's presence hinders inclusion of other types of technologies.)	**Challenged** (e.g., SAP is the main IT system, yet it is too complex and resource intensive.)	All the cases support that ES enables process innovation. Yet none of the cases recognize ES as a major resource for innovation. Cases highlight complexity, resource intensiveness, and inflexibility as the main reasons why ES does not enable innovation.
P2: ES enable radical process innovation during shakedown phase	**Supported** (e.g., the new technological innovation meant that they did not have the technical experience, which necessitated the creation of a global IT help center.)	**Supported** (e.g., the company replaced all ad hoc purchasing to SAP's best practice procurement strategy, restructuring warehouse, and purchasing departments.)	All the cases supported this proposition. Characteristics of radical innovation were evident in the organization structure, culture processes, roles, and responsibilities of the employees and work practices.
P3: ES enable incremental innovation	**Challenged** (e.g., several special projects identified that their SAP system could support innovation. The case recognizes the potential of ES to initiate innovation. But such innovation is reduced by the SAP global templates. The company had completed three major software upgrades. No evidence of any innovation delivered through SAP.)	**Not supported** (e.g., no internal changes to SAP other than vendor supported patches since its implementation. The rigidity of the system prohibited the organization from thinking beyond the ES boundaries. The second SAP upgrade provided some innovations through vendor managed inventory. However, no further such activities were planned for the 2017 third upgrade.)	All cases challenged or refuted this proposition. Cases affirmed that incremental innovations (upgrades) may yield minimal improvements but that they are not adequate to consider for the survival or growth of the company. Cases alluded to the possibility that other types of systems could be used in parallel with ES for innovation.

Table 6. Summary of Cross-case Analysis

P4: ES reduce lead time of process innovation	**Not supported** (e.g., the hindrances of global templates, in relation to time, were discussed in all global IT meetings in 2013.)	**Not supported** (e.g., commenced an evaluated goods receipt settlement but withdrew due to lengthy implementation times. The CIO places a three-month cap on "idea to use" for IT projects.)	All cases refuted this proposition.
P5: ES-led innovation provides competitive advantage	**Challenged** (e.g., SAP has improved process efficiencies, but nothing innovative happens as they wait till the vendors introduce innovative solutions to them. No competitive advantage gained through SAP.)	**Not supported** (e.g., SAP is not the best solution for a constantly changing business environment, especially for a market where the customers have the upper hand; benefits are marginal through SAP.)	All cases challenged or refuted that ES-led innovations occurred. As such, they did not gain competitive advantage directly through SAP. All cases relied on mobile and BI technologies to sustain competitive advantage.

5 Research Findings

We can make several observations from reviewing Tables 3 to 6. First, we found support only for P2 (i.e., that an ES can introduce radical innovation when first introduced). Here, all case organizations highlighted several dramatic improvements to their business processes, the organizations themselves, and to their culture: 1) the introduction of a strong focus on business process standardization, 2) real-time integration, and 3) enhanced functional coupling (Anaya, Dulaimi, Abdallah, & Al-Mashari, 2015; Teng, Grover, & Fiedler, 1994). However, as for P1 and P3, we found no indication that ES catalyzed innovation beyond the initial implementation. For example, after the implementation of ES, during the onward and upward phase, organizations did not focus on improving the ES (P3). Specifically, organizations found that their ES contributed to unacceptable lead times for innovation (P4) and, as such, did not provide a competitive advantage (P5).

The fact that we found that ES does not enable incremental innovation (see Tables 3 to 6) presented an anomaly and called for further examination. It prompted us to question how organizations innovate given that ES apparently lacks continuous innovation capabilities. With that said, from analyzing the nine categories in Table 2 with respect to the nature of innovation and continuous technology investments, we observed that: 1) all four case organizations continued to innovate and yield substantial benefits regardless of the ES and 2) the respondents highlighted innate barriers of an ES that hinders incremental innovation (P3 and P4). As a result, through the induction analysis phase, we further analyzed these findings. The induction phase of the analysis revealed two new themes: 1) unaccounted for innovation and 2) innate barriers to innovation. Note that these discoveries came about as part of our deductive analysis in discussing support for our propositions. We describe them below but add granularity as we subsequently conducted inductive analysis. We describe each theme in Section 5.1 and 5.2, respectively.

5.1 Unaccounted for Innovation

The cross-case analysis of the propositions provided insights into how organizations engage in innovation without the direct involvement of ES. We found initial evidence for unaccounted for innovation through a "de-coupling" of three terms: "innovation types", "resource allocation", and "technology responsible for innovation" (see Table 2). Here, the cases illustrated no logical connection between the investments made in the ES and the innovation sought. We observed this phenomenon in all four cases and coded it as "unaccounted for innovation".

In further investigating unaccounted for innovation, we found further evidence (where applicable, we provide sample quotes to exemplify the notions that led to our deriving of unaccounted for innovation): 1) organizations do not upgrade ES or add any modules/features to gain innovation through ES, 2) no reference to ES when discussing about innovation, and 3) introduction of digital technologies to attain innovation.

As Figure 2 shows, all the cases demonstrated a continuous upward trend for innovation across the ES lifecycle phases. The first segment of the line of innovation allude to the radical innovation received through the ES implementation (as evidenced through the P2 data). As expected, and as evidenced from

the data for P2, such radical innovation tends to plateau over time. Especially, when the ES reach the onward and upward phase, users become familiarized with the system, and we expected to see innovation stemming from ES in all the case organizations. Yet, we did not find sufficient evidence to suggest that the ES contributed to further innovation (P3).

> *SAP is the backbone…. We don't do much with it.... In the past, few years our focus has been with mobile and analytics to bring innovation.* (CIO, C2)

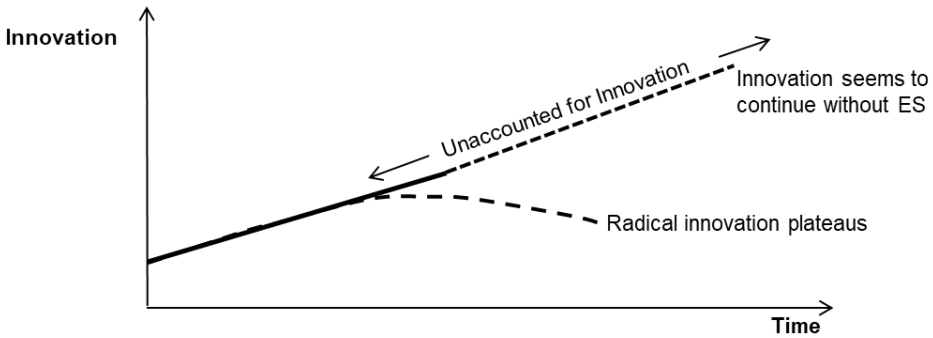

Figure 2. Unaccounted for Innovation

The cases alluded to the importance of ES for innovation. Yet, the respondents rarely mentioned 1) innovation, 2) resource allocation, and 3) the ES in one coherent structure beyond their references to the implementation phase (in the onward and upward phase). When respondents mentioned the three categories/codes, such comments pertained only to the innovation received through "must-have" ES upgrades. After the ES implementation, all the case organizations minimized their ES investments to the "bare minimum" and "essential". Here, although the participants knew about new product and service introductions available for their ES, none of the case organizations had made substantial investments in such technologies beyond mandatory upgrades.

> *We are not going to upgrade our SAP till 2020 until they [SAP company] make it mandatory.* (CIO, C1)

On the other hand, all the case organizations had introduced a range of new non-ES technologies, especially digital technologies such as social media, mobile technologies, analytics, and cloud computing—especially throughout the three years prior to when we began collecting data (2011 to 2013). The organizations introduced such technologies in small, specific functional areas rather than as large-scale, process-based IT projects. This narrower focus demonstrates a clear departure from the ES philosophy of process orientation.

> *We now build software on free Google Apps for some functionality that we expected from SAP…. When we have cheaper options why would we waste money unnecessarily. Every dollar we spend counts.* (CIO, C4)

As such, we can see that all case organizations continued to innovate using their technology portfolio. However, they carried out all innovations using digital technologies together with their ES. All respondents highlighted the importance of ES in providing centralized data and integrated business processes. As such, all cases highlighted the dormant role of ES in innovation. However, for the digital technologies to innovate, the ES acts as a backbone that provides the necessary data, processes, and rules.

5.2 Innate Barriers to Innovation

Further investigating the data we collected to examine P3 and P4 led to our discovering the second theme: innate barriers to innovation. This theme concerns how the generic characteristics of an ES hinder innovation. In general, all the respondents demonstrated their frustration about the difficulty in adopting their ES to meet rapidly changing requirements that arose through specialized, novel, or niche market opportunities. In particular, organizations highlighted the inability of their ES to enable them to attain a competitive advantage. In relation to the lack of flexibility, the cases also highlighted that the presence of their ES discouraged experimentation. Moreover, all four cases reported that they faced challenges in accessing the specialized skills required for continuous innovation. Finally, compliance with legal and

legislative requirements enforced through the ES meant that the organizations found it too risky to change the system to facilitate niche opportunities. We collectively refer to these aspects as "innate barriers to innovation", and we discuss them in more detail below with supporting quotations.

1) **Inflexibility**: the cross-case analysis highlighted that the case organizations did not consider their ES to be flexible and dynamic in reacting to required changes. The highly integrated processes of their ES meant that even a minor change required careful attention to all the functional activities in the entire business process (and any integrated business processes). Thus, the cases considered their ES to be like "a giant ship" that did not allow them to reach "islands"; that is, their ES caused the organizations to miss known opportunities and prevented them from obtaining a competitive advantage due to a lack of flexibility.

Our SAP system is like a giant ship. We avoid making any changes to it, because any small change will have an impact on multiple business processes; our system has not changed for the last six years. (CIO, C1)

2) **Slow change time**: in all the cases, the complexity of the ES required that the IT department centrally controlled requests for changes to the ES functionality and master records. The global or regional IT department evaluated the change requests on a periodic basis (for example, in C1, C2, and C3, the IT department evaluated the change requests only once a year), and a central committee made the implementation decisions without further consulting the change initiator, which created massive innovation lead times and inhibited the organizations from creating novel ideas.

These global templates are so rigid…. They have a change approval process, which checks for compliance and feasibility. Our change requests are evaluated only once a year. Our departments are unhappy that we don't attend to their requests in a timely manner. This does not suit us, because we are missing out a lot on immediate opportunities. (LOB, C2)

3) **Trialability difficulty**: all four cases also highlighted the high risk attached to trialing out ES software features and functionality. On the other hand, users found the ES to be cumbersome such that they followed their routine without further exploring the systems' full potential. The systems' complexity and the lack of appropriate skills in using the ES hindered the organizations from initiating and trialing new ideas at the departmental level.

Five years after our implementation, we are still trying to activate some basic features of the SAP system for our department. We know that these features will add value to us, but we cannot. (LOB, C3)

4) **Cost amplification**: the case organizations suggested that their departments did not clearly understanding the "true cost" of making changes to the ES. In all the cases, the department heads believed they justified the cost at the department level without understanding the cost amplification of ES through configuration, compliance testing, user acceptance testing, and user training.

The warehouse [department] is not happy with us [IT department]. They think we are not going ahead with their project. But we can't. It costs far more to implement those changes and we cannot justify. (CIO, C4)

Overall, all four cases agreed that ES alone cannot bring innovation due to the above-mentioned factors. However, all four organizations agreed on the benefits they gain through the ES. This finding highlights the platform nature of the ES in providing core data, business processes, and functionalities.

6 Discussion

In this study, we more deeply explain the role that ES play in facilitating process innovation in the contemporary business landscape. Specifically, we investigate what role ES play in process innovation in the presence of digital technologies (RQ). Specifically, we developed five propositions about ES and innovation from the extant literature and subjected them to deductive analysis using four cases. We found that ES enable radical innovations in organizations at the shakedown phase, which supports P2. However, our evidence from the cross-case analysis either challenged or refuted the remaining four propositions (P1, P3, P4, P5) (see Tables 5 and 6), which raises doubts about the anticipated role of ES in innovation.

Intriguingly, a common theme that arose through the testing of propositions P1, P3, P4 and P5 related to continuing innovation in the organizations without the direct involvement of their ES. As such, we postulated the positive role of digital technologies in contributing to innovation. Such innovations of digital technologies seem to occur together with ES and not in isolation. Therefore, a future study could investigate the role of ES not as a trigger of innovation (Nambisan, 2013) but as a dormant technology platform on which digital technologies can trigger innovation. Such studies could employ Nambisan's (2013) classification of operand and operant technologies to distinguish the role of the technology as an "enabler" and as a "trigger". This discussion further highlights the role of ES as the most stable IT platform in an organization and allows the digital technologies to trigger innovation (Benkler, 2006; Tiwana, Konsynski, & Bush, 2010; Tuomi, 2002).

However, we do not believe that the mere presence of either ES or digital technologies will deliver innovation to an organization. Organizations should bundle such technologies with a specific strategic intent that considers the capabilities and weaknesses of each technology (Lokuge & Sedera, 2014a; Lokuge, Sedera, & Grover, 2016). Theories such as the resource-based view (Barney, 2001), contingent resource-based theory (Brush & Artz, 1999), and the configuration theory (Vorhies & Morgan, 2003) could assist researchers in building hypotheses for such research.

7 Conclusion

In this study, we investigate how organizations innovate using an ES in the presence of digital technologies**.** By analyzing data collected from four case organizations, we empirically revealed how digital technologies facilitate innovation in organizations and show that managers and CIOs are reluctant to invest in ES for innovation. Most importantly, we uncovered the new role of ES in supporting innovation in organizations. Opposite to Schenk's (2015) findings, our findings highlight that ES have transformed from a source of process innovation to a process-supporting technology. Based on our findings, we propose two hypotheses that future studies could test: 1) digital technologies facilitate process innovations in organizations and 2) digital technologies require a stable ES platform to facilitate continuous process innovation.

7.1 Contribution to Academia

Overall, in this study, we explain the current role that ES play in delivering process innovation in depth. More specifically, we focus on types of innovation, lead time, and the outcomes of innovation—specificity that the academic literature lacks. While our findings confirm some established knowledge about ES, they also provide new insights into the value of ES in continuing innovation and its lead time for innovation. We also found evidence for digital technologies' emerging role in process innovation: namely, that they work together with ES to deliver process innovation.

As such, we derived two hypotheses that can guide future studies that examine what role digital technologies and ES play in facilitating process innovation. The two themes we developed in the analysis illustrate the platform nature of ES in enabling innovation. According to Figure 2, at the organizations we examined, radical innovation plateaued, and the overall process innovation showed an upward trend even though the respondents highlighted the difficulty in initiating innovation through ES. Further, when organizations discussed the innovation attained in each IT project, they implicitly referred to the platform nature of ES in providing necessary data and rules for initiating innovation. Researchers such as Gawer (2014), Ceccagnoli et al. (2012), and Yoo et al. (2012) praise the role of an ES as a platform. Sedera, Lokuge, Salleh, Moghavvemi, and Palekar (2016b) propose how ES facilitate agnosticism by acting as platforms that provide processes, data, and functions. This study empirically validates that ES can provide a platform to enable process innovation.

7.2 Contributions to Practice

Practitioners may find our findings valuable as well. First, in conceptualizing the innovation attained through myriad technologies in an organization, we first highlight the role of ES for innovation. In doing so, we allude to the important, yet dormant, role that ES play in facilitating innovation. Second, we provide a vision of the future of IT portfolio in organizations. Practitioners, particularly senior staff, will benefit from our description of the future IT portfolio as an eclectic heterogeneous collection of IT. However, unlike the disparate legacy systems in the past, organizations will integrate the new IT portfolio with the technological foundations of their ES. As such, for the CIOs and senior managers, rather than investing

unnecessarily in ES, they can invest in digital technologies for attaining innovation and, ultimately, gaining competitive advantage. The four case organizations did not initiate any large IT projects to attain innovation; rather, they focused on specific business processes or functions and improved or introduced new processes using digital technologies. These revolutionary (Hofmann & Woods, 2010), innovative (Sheng, Nah, & Siau, 2005), and cost-effective (López-Nicolás, Molina-Castillo, & Bouwman, 2008) technologies reduce the innovation lead time that helped the organizations to sustain the competitive advantage.

Finally, for technology vendors, this study provides a vision of their clients' technology landscape. For example, for ES vendors, the study highlights the need for openness to facilitate multiple digital technologies and opportunities to market "accelerators" as data volume exchanged between platforms and the digital technologies increases. Further, the study findings provide further rationale for ES vendors to increase their focus on add-on digital technologies because we found that organizations hesitated to adopt even mandatory ES upgrades.

7.3 Future Study Opportunities

Although our findings are encouraging, we need further studies in at least three areas to strengthen the notions about what role IT plays in process innovation. First, anecdotal commentary suggests that "new entrants" (digital technologies) require relatively low resources to facilitate process innovation (Booth, Mohr, & Peters, 2016). Based on our observations, we conclude that organizations have already begun to understand IT's role in innovation differently in that they have continued to innovate without making *new* investments into ES. As such, research needs to examine the changing nature of the IT portfolio for innovation. Second, future studies could observe the challenges of bundling digital technologies with ES. Our findings highlight the role of ES in providing a stable platform for digital technologies to trigger innovation. As such, future work could investigate the potentially valuable role of digital technologies in triggering process innovation in organizations in conjunction with ES. Third, we identified that the innovation attained through ES plateaus and that organizations continue to attain innovation through digital technologies. However, digital technologies do not necessarily change an organization's business processes radically. As such, innovation through business process reengineering may or may not occur. However, organizational innovation attained through digital technologies, which has the characteristics of business process reengineering, constitutes an interesting phenomenon to study. As such, we recommend that future researchers examine the nature of innovation attained through ES and digital technologies.

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Appendix: High-level Interview Guidelines

Landscape and resources

1) Can you describe the current enterprise landscape?
2) What are the main systems that you manage?
   a) Describe the status of those systems?
   b) What do you use them for?
3) Describe main IT projects that you currently manage / initiate / in the pipeline?
4) Do you see any changes in the current technology landscape?
5) Did you rely on your existing resources (i.e., people, knowledge and experience) to introduce such new ideas?

Project initiation

6) Can you describe new IT projects in your organization?
   a) What are the objectives of those projects?
   b) What technologies do these projects employ?
   c) Who initiated the "idea" of these projects?
7) Do you encourage departments / divisions to suggest new technologically driven solutions?

Risk

8) How do you characterize the risk of these projects?
9) How do you characterize the risk of these technologies?

Time span of the project

10) What is the timespan of the projects?
    a) Confirm whether the project objectives are short / long term

Consequences

11) What are the changes to the organization that you envisage?
12) Are / did your organizational business processes cope / respond well the changes introduced by the new system?
13) If the solution/s was / were to be successful, how do you describe the advantage that you gain through it? (short / long term gain)

Supporting Infrastructure

14) Do these new projects rely on the corporate IT?
15) Do these new systems correspond with your corporate IT / existing systems?
16) Did you require substantial additional resources for these projects?

About the Authors

Sachithra Lokuge received her PhD from the Queensland University of Technology in Brisbane, Australia in 2015. Her work has been published in *Information & Management*, *the Communications of the Association of Information Systems*, *the International Conference on Information Systems*, *Americas Conference, European Conference and the Pacific Asian Conference on Information Systems*. Further, she has several years of experience in working with outsourcing organizations as a business analyst.

Darshana Sedera has authored over 100 peer-reviewed publications on enterprise systems, innovation management, technology use, user expertise, outsourcing and social media. His work has been published in journals such as *Journal of the Association for Information Systems*, *Journal of Strategic Information Systems*, *Information & Management Journal*, *Communications of the Association for Information Systems,* and *Australasian Journal of Information Systems*. His research has been funded by several Australian Research Council grants.

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