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Investigating the Structural Properties of an IT-Enabled Resource

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INVESTIGATING THE STRUCTURAL PROPERTIES OF AN IT-ENABLED RESOURCE

Research paper

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Abstract

The synergistic combination and integration of information technology (IT) and other complementary organizational resources to form IT-enabled resources, has long been identified as one means through which organizations can derive benefits from IT. However, research shows that the integration required to form IT-enabled resources from which organizations derive benefits, also constrains the renewal and redeployment of the IT-enabled resources to address new strategic imperatives. Thus, there are several calls for further research on how organizations can sustain the derivation of benefits from IT especially in dynamic environments. This study responds to such calls. Specifically, it draws on a systematic literature review of empirical research on post-implementation changes to investigate the structural properties of an IT-enabled resource that may enable or constrain the renewal of the IT-enabled resource to address new strategic imperatives. Three structural properties emerged: the centrality of the focal IT asset, the type of coupling among the components, and the flexibility of the components of an IT-enabled resource. This study also found that organizational and institutional factors influence the formation of the structural properties of an IT-enabled resource. Implications for practice and research are discussed. This study contributes to the literature on the business value of IT.

Keywords: Business value of IT, Sustainability, Structural Properties, Loose coupling, Centrality, Flexibility, Post-implementation changes, IT-enabled resources, Synergy, Renewal, Redeployment

1 Introduction

The business value of information technology (BVIT) is at the core of Information Systems (IS) research. Conclusions from several research (e.g., Nevo and Wade, 2010; Wade and Hulland, 2004), including meta-analyses (e.g., Sabherwal and Jeyaraj, 2015), point to the fact that an IT asset, by itself, rarely results in organizational benefits. The realization of complementarity or *synergy* between IT assets and other organization resources has long been identified as an avenue to derive BVIT from IT assets (Wade and Hulland, 2004; Melville et al., 2004; Piccoli and Ives, 2005; Kohli and Grover, 2008; Seddon, 2014). For example, Nevo and Wade (2011, 2010) suggest that when an IT asset and an organizational resource are *synergistically* combined an IT-enabled resource is formed, and that the IT-enabled resource has *synergy* (i.e., a positive emergent capability) which provides the IT-enabled resource with the ability to achieve organizational tasks and goals, thus resulting in BVIT. In congruence, an executive of Walmart, the number one company on the list of Fortune 500 companies for the year 2017, stated: "It's important to look at not just the technology but what it enables…what does it enable in terms of merchandising and logistics that maybe wasn't possible before?"(Nusca, 2017). The complementarity view hinges on the integration and compatibility of the IT asset and organizational resources (Nevo and Wade, 2010; Seddon, 2014; Wade and Hulland, 2004). Indeed, research has shown that high integration and compatibility of IT assets and organizational resources results in BVIT including strategic and operational benefits (e.g., Nevo and Wade, 2011).

Nevertheless, research has also found that integrating IT assets and organizational resources may constrain the ability of an organization to reconfigure and redeploy the IT assets and organizational resources to meet new organizational goals (Saraf et al., 2013), thus constraining the derivation of BVIT in new and changing organizational environments. IS researchers have noted that BVIT derived from IT assets are short-lived, especially in dynamic environments (Kohli and Grover, 2008; Wade and

Hulland, 2004). Likewise, in the strategic management literature, research has shown that resources, e.g. IT-enabled resources, whose value depends on complementarities or synergy are particularly vulnerable to environmental turbulence that disrupts synergy (Le Breton-Miller and Miller, 2015). It is apparent that the factors; e.g., resource integration and combinations, needed to create complementarities or synergy has paradoxical effects: they enable the formation of synergy to meet current organizational goals, and constrain the *renewal* of synergy to address new organizational goals.

Research suggests that, for organizations to survive in dynamic environments, they need to retain the ability to reconfigure their resources to create "shifting synergy" needed to address changing organizational strategic imperatives (Eisenhardt and Martin, 2000, p. 1107). The inability of established organizations to reconfigure and redeploy their resources and capabilities to address new strategic imperatives may result in failure, e.g. bankruptcy (Thornhill and Amit, 2003). This makes research on sustaining the derivation of BVIT an important research theme in IS research. In congruence, Nevo and Wade (2011) have called for an in-depth study on how organizations create and sustain synergy. Several other researchers (e.g. Kohli and Grover, 2008; Schryen, 2013; Wade and Hulland, 2004) have also called for further research into how organizations can sustain the derivation of BVIT especially in dynamic environments.

In response, some researchers have studied the role of organizational capabilities; for example strategic flexibility (Chen et al., 2017; Pavlou and El Sawy, 2010) and IT integration capability (Benitez et al., 2018), in reconfiguring IT-enabled resources to address changing strategic demands. Others have also studied the effects that the properties of an IT infrastructure; for example, infrastructure malleability (Henfridsson and Bygstad, 2013), and IT infrastructure flexibility (Benitez et al., 2018), have on the reconfiguration of IT assets to address new challenges.

However, there is a paucity of research on how an IT-enabled resource's structural properties that evolve during the formation or modification of the IT-enabled resources may either enable or constrain the renewal and redeployment of the IT-enabled resource. In this study, the structural properties of an IT-enabled resource refer to the nature of the components, and the type and strength of interdependencies among the components, of the IT-enabled resource. This study contributes to our understanding of the structural properties of an IT-enabled resource. It draws on a systematic literature review of articles on post-implementation changes to IT and organizational resources (i.e., work processes), to answer the research question: *what are the structural properties of an IT-enabled resource that enable or constrain the renewal and redeployment of the IT-enabled resource?*

This study makes three main contributions that have implications for research and practice. First, it identifies three structural properties of an IT-enabled resource that enable or constrain the renewal and redeployment of the IT-enabled resource to address new goals. Second, it contributes to the literature on sustaining the derivation of BVIT from IT investment by highlighting the importance of structural properties in creating successive competitive advantage. Third, it contributes insight on the effects that organizational and institutional factors can have on the formation and renewal of IT-enabled resources. In general, it contributes to research on BVIT, and specifically, it offers insight on the structural properties of an IT-enabled resource that may constrain or enable how organizations can sustain the derivation BVIT from IT investments.

The rest of the paper is organized as follows. Section two presents the background literature. Section three presents the research methods. Section four presents the results and discusses the findings from the review. Section five presents the contributions and implications; and section six presents the conclusion and limitation of the study.

2 Background Literature

2.1 Derivation of BVIT

BVIT can be defined as "the organizational performance impacts of information technology at both the intermediate process level and the organization-wide level, and comprising both efficiency impacts and competitive impacts" (Melville et al., 2004, p. 287). IT assets are largely treated as commod-

ity-like and may result in BVIT only when they are synergistically combined with other organizational resources (or complementary resources) to form new resources, e.g. IT-enabled resources (Nevo and Wade, 2011, 2010) or digital business capabilities (Kohli and Grover, 2008). These new resources, (hereafter, IT-enabled resources) do possess emergent capabilities which are "either new capabilities that are possessed by neither the IT asset nor the organizational resource in isolation, or existing capabilities with previously unattainable values" (Nevo and Wade, 2011, p. 405). Positive emergent capabilities are referred to as synergy, which provides the IT-enabled resource with the ability to achieve organizational tasks and goals, thus resulting in BVIT. For instance, synergistically combining an IT and a customer relationship management unit produces an IT-enabled customer relation management unit that has new capabilities to influence operational and strategic performance (Nevo and Wade, 2011). Also see Someh et al. (2017) for how an organization derived value from business analytics by synergistically combining business analytics and other organizational capabilities.

Factors that influence the derivation of BVIT may do so by enabling the formation of synergy, or by disrupting the formation or the longevity of synergy. These factors may include integration efforts and compatibility of the IT and other organizational resources (Nevo and Wade, 2011, 2010). Further, organizational context; for example, IT competence, operational capabilities, and organizational practices (see Schryen, 2013) may influence the formation and sustainability of synergy. Other factors; for example, environmental turbulence or ambivalence (Wade and Hulland, 2004), have been noted to derail synergy making BVIT short-lived. More importantly, researchers (e.g., Nan and Tanriverdi, 2017; Saraf et al., 2013; Wade and Hulland, 2004) have found that the integration necessary for the formation of synergy, and thus the derivation of BVIT, may also constrain the sustainability or renewal of synergy in dynamic environments, and thus derailing the derivation of BVIT in the long-term.

2.2 Sustaining the Derivation of BVIT

Sustaining the derivation of BVIT is important to IS research and practice, and thus has received considerable attention. Some researchers have approached the BVIT sustainability research from an organizational capability view and have suggested that by virtue of possessing certain capabilities, an organization can renew and redeploy its IT resources together with other resources to meet new organizational goals and strategy. Examples of such organizational capabilities are IT capability (Bharadwaj, 2000), improvisational capability (Pavlou and El Sawy, 2010), strategic flexibility (Chen et al., 2017; Pavlou and El Sawy, 2010), IT integration capability (Benitez et al., 2018), and IT reconfiguration capability (Pavlou and El Sawy, 2010; Rai and Tang, 2010). Some other researchers have considered the properties of the IT infrastructure as being relevant for sustaining the derivation of BVIT. Examples, include infrastructure malleability (Henfridsson and Bygstad, 2013), and IT infrastructure flexibility (Benitez et al., 2018).

Research shows that, the properties of a resource; e.g., an IT-enabled resource, are historically constructed as the resource is formed and modified over time (Helfat, 2003; Sirmon et al., 2008). The intricacies of the processes by which an IT-enabled resource is formed and modified over time will therefore be important in understanding the structural properties of the IT-enabled resource that may constrain or enable the renewal and redeployment of the IT-enabled resource. However, there is a paucity of research on how the structural properties of an IT-enabled resource evolves over time. Structural properties of an IT-enabled resource refer to the nature of the components, and the type and strength of interdependencies among the components, of the IT-enabled resource. This study reviews the literature on post-implementation changes to improve our understanding of the structural properties of an IT-enabled resource that enable or constrain the renewal and redeployment of the IT-enabled resource, and the factors that influence the formation of the structural properties.

2.3 Post-implementation changes

Research on post-implementation changes is scanty, yet growing (Grabski et al., 2011; Huang and Yasuda, 2016). Most of literature on post-implementation changes concentrate on changes made to the IT asset and work process in order to address current goals, or to make incremental updates to the IT asset (Nevo et al., 2016; Oseni et al., 2017). From an IT perspective, there are several terminologies; including, adaptation and configuration, that have been used to describe post-implementation changes

to IT assets (Nevo et al., 2016). Nevo et al. (2016) classified these several terms into two broad concepts based on the intention of the post-implementation change. They are IT adaptation, and IT reinvention. IT adaptation are changes made to the IT to address current organizational goals or to reinstate past work practices (Nevo et al., 2016). IT reinvention are changes made to the IT asset to address future and emerging organizational goals (Nevo et al., 2016).

Research shows that during post-implementation, changes are made to work processes as well (Baird et al., 2017; Leonardi, 2011; Orlikowski, 1996). McGann and Lyytinen (2008); for example, provides a two-by-two metrics that describes improvisational types in terms of IT asset and work process. This study combines Nevo et al. (2016) and McGann and Lyytinen (2008) to conceptualize a two-by-two metric for post-implementation changes (see ***Table 1***). Nevo et al. (2016)'s definitions of IT adaptation and IT inventions are retained. Leveraging the conceptual arguments of Nevo et al. (2016) and McGann and Lyytinen (2008), this study defines *work process adaptation* as changes made to a work process in order to use features of an IT to address current organizational goals; and *work process reinvention* as changes made to a work process in order to use features of an IT to address future or emerging organizational goals.

Based on these conceptions, and drawing on Jasperson et al. (2005)'s definition of post-adoptive behaviour; that is, "the myriad feature adoption decisions, feature use behaviors, and feature extension behaviors made by an individual user after an IT application has been installed, made accessible to the user, and applied by the user in accomplishing his/her work activities " (2005, p. 531); this study defines a post-implementation change as;

a change made to an IT asset or a work process in order to attain present organizational goals or reinstate past work practices (adaptation); or a change made to an IT asset or a work process in order to attain future and emerging goals (reinvention) after the IT asset has been implemented and made available to a user.

In line with prior research (e.g., Orlikowski, 1996; Robey et al., 2002; Jasperson et al., 2005; McGann and Lyytinen, 2008; Nevo et al., 2016), post-implementation changes may include the extension and improvisation of current IT features; development of new IT feature (which may include IT workarounds); extension and improvisation of current work processes; and development of new work processes (which may include work process workarounds). Post-implementation changes are likely to influence the structural properties of IT-enabled resources. This study; thus, turns to empirical research on post-implementation changes in quest of the structural properties of an IT-enabled resource that enable or constrain the renewal and redeployment of the IT-enabled resource, and the factors that influence the formation of the structural properties.

Intention	IT Asset	Work process
Current goals and old work practices	**IT Adaptation:** changing an IT/use to attain present needs or past practices (Nevo et al., 2016).	**Work process Adaptation:** changing a work process in order to use IT features to address current organizational goals
Future goals	**IT Reinvention: "**changing an implemented IT and/or its use to pursue new goals" (Nevo et al., 2016, p. 159).	**Work process Reinvention:** changing a work process in order to use IT features to address future or emerging organizational goals

Table 1. Type of Post-implementation changes

3 Research Methods

This study employs systematic literature review to synthesize factors that influence IT-use during post-implementation (Rowe, 2014; Schwarz et al., 2007; Webster and Watson, 2002). Thus, following the guidance of Webster and Watson (2002), this study searched for articles in the AIS Senior Scholars Basket of Eight journals, the AIS Electronic Library and Google Scholar using the search term "Post Implementation". The literature search was done between 7th to 10th July 2018. "Post-implementation" was used as the search term because the current study is part of a more comprehen-

sive study on IT-use during post implementation (also see Lumor, 2019). In Google Scholar; however, the search term "Post Implementation" AND "Information Technology" was used to limit the results to articles relevant to IT. Search result from Google Scholar reduced from 55,400 to 17,258. Other database specific settings were used to limit the number of articles that were returned. For example, in the AIS e-Library, only peer-reviewed articles were sought for. MISQ and JAIS papers were sought for from the AIS e-library. Thus, the search in the AIS e-Library returned a total of 382 articles of which 17 and 66 are JAIS and MISQ journal articles, respectively. Metadata; including the titles, author names, publication outlet, and year of publication of each article, was extracted and stored in a spreadsheet application file. Metadata of the first 30 tabs (300 results) of the search results from Google scholar was stored. In total, metadata of 2384 articles were extracted and stored (see ***Table 2***).

Journal / Source	**No. of Articles**	**Retained**
EJIS	338	3
ISJ	190	2
ISR	324	3
JAIS	17	-
JIT	284	3
JMIS	357	2
JSIS	209	-
MISQ	66	3
AIS Elibrary (Others)	299	4
Google Scholar (17258)	300	-
Total	**2384**	**20**

Table 2. Summary of Search Results

For this study, the titles and abstracts of each article were read. Empirical articles (based on case study research method) on post-implementation change or post-adoption change in an organizational context were selected for further reading. Non-empirical articles, editorials, and articles written in other languages than English were excluded. All articles selected for further reading were then read in full. Articles that provided detail narratives on how post-implementation changes were enacted were retained. In total, 20 articles were retained (see ***Table 2*** above).

4 Results and Discussions

4.1 Results

Indeed, there are few research articles (especially, case study articles) on post-implementation change (Grabski et al., 2011; Huang and Yasuda, 2016; Nevo et al., 2016). The limited number of empirical articles is the most important limitation of this study. However, given that the purpose of this study is to examine the structural properties of IT-enabled resources during post-implementation, a review of 20 empirical articles (based on 18 distinct empirical cases), published mostly in the AIS senior scholars' basket of eight, is adequate.

Each of the empirical cases was read thoroughly looking for the type of post-implementation changes, structural properties of the IT-enabled resource, environmental factors that influenced the formation of the IT-enabled resource, and the organizational capabilities that were employed. The summary is presented in ***Table 3*** below. Note that unlike the type of post-implementation changes, the others (i.e., structural properties, environmental factors, and organizational capabilities) were not predefined and thus were written out in free text based on the case narratives provided in the various empirical articles.

Author	post-imp. change				Structural property	Environment	Organizational capabilities
	IT Asset		Work Process				
	A	R	A	R			
Macredie and Sandom (1999) /			x		inflexible IT, flexible work process, loose coupling	strictly regulated environment, hierarchical organization	adaptation capability, coordinate local improvisation
Svejvig, and Jensen (2013)	x		x		tight coupling, flexible IT, flexible work process, high centrality	industry deregulation, competition, normative pressure	adaptation capability
Azad and King (2012, 2008)	x		x	x	loose coupling, flexible work process	regulation and directives from government, work ethos of users	adaptation capability, dev. and maintain work arounds
Rodon, et al. (2011)	x		x		high centrality, flexible IT, inflexible work process	normative pressure from industrial organization, conflict between external influence and work processes	adaptation capability,
Goh et. al, (2011)	x		x	x	flexible IT, flexible work process, centrality (2 work processes)	prior knowledge on HIT, collaboration	adaptation capability
Lyytinen et al. (2009)	x		x		high centrality, tight and loose coupling, flexible IT,	quest for coordination and performance efficiency, competition, memetic pressure (Y2K compliance), pressure to modernize	adaptation capability
Seethamraju (2009)	x		x		tight coupling, high centrality, flexible work process, flexible IT	volatile and competitive external environment, business rules, policies and metrics, prior knowledge of ERP	prior knowledge of ERP, adaptation capability
Berente et al. (2008), Berente and Yoo (2012)	x	x	x	x	loose coupling, high centrality of IT, inflexible IT, flexible work process,	complex organizational structure, internal competition, professional ethos,	adaptation and reinvention capabilities,
McGann, and Lyytinen (2008)	x	x	x	x	high centrality, flexible IT, flexible work processes, loose coupling, and decoupling.	prior knowledge on IT, collaboration, management support	adaptation, and reinvention capabilities,
Drummond (2008)	x		x		flexible IT, flexible work process, tight coupling,	quest for productivity and efficiency,	adaptation capability, maintain work arounds
Santhanam , et al (2007)	x	x	x	x	flexible IT, flexible work process, tight coupling,	quest for efficiency, motivated users, collaboration between users and support teams	capabilities for adaptation and reinvention
Schneider et al (2018)	x		x		tight coupling, inflexible IT, flexible work process, high centrality	quest to increase efficiency at handling increase work load, resistance to IT, disconnect with IT dept.,	low adaptation capabilities, capability to integrate APIs

Spierings, et. al (2017)	x	x			inflexible IT	quest for efficiency, strong engineering culture, support from colleagues, supervisors, and management; IT dept. not meeting deadlines	IT development, and adaptation capabilities
Baird, et al (2017)	x		x	x	inflexible IT, centrality, tight coupling, and loose coupling	need to maintain efficiency, standards of care, and meet regulatory requirements	adaptation capability, process reinvention cap.
Beaudry and Pinsonneault (2005)			x		flexible IT, flexible work process, centrality	management strongly encouraged IT use, quest for efficiency and effectiveness, strict managerial control	adaptation capability
Orlikowski, (1996)	x	x	x	x	flexible IT, flexible work process, loose coupling,	cooperative culture, quest for performance and efficiency,	adaptation and reinvention capabilities
Leonardi (2011)	x		x		flexible IT, flexible work process	quest to increase efficiency,	adaptation capability
Davidson and Chismar (2007)	x	x	x	x	flexible IT, flexible work process, loose coupling, centrality	quest for cost reduction and decision making, collaboration, management support,	adaptation and reinvention capabilities
A = Adaptation, R = Reinvention,							

Table 3. Summary of Review Results

4.2 Discussion

The summary of review results is organized into a model that illustrates the relationships among organizational capabilities, formation and structural properties of an IT-enabled resource, and the influences of environmental factors. In this study, the concentration is on the formation and renewal of an IT-enabled resource. Detail discussions of synergy and how synergy leads to BVIT are outside the scope of this study (see Nevo and Wade, 2011, 2010). Having said that, this study assumes that, the purpose of renewing an IT-enabled resource is to renew its emergent capability or synergy (Tanriverdi et al., 2010). That is, when an organization's goals and strategies change, IT-enabled resources are renewed to create new synergies to address the new goals and strategies.

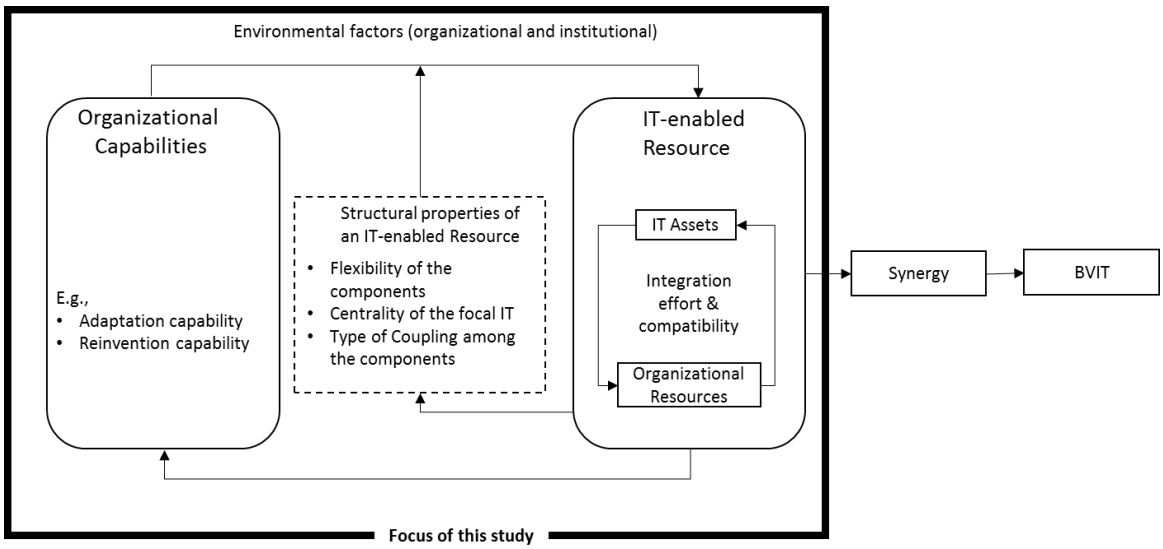

Figure 1. Formation and Renewal of an IT-enable Resource

4.2.1 Organizational Capabilities

During post-implementation, organizations (through users and support teams) exhibit different organizational capabilities in combining the IT asset and other organizational resources (here, work processes) to form IT-enabled resources. Several empirical studies demonstrate organizational capabilities for combining IT assets and work processes. Users and support teams studied by Santhanam et al. (2007) exhibited organizational capabilities for tweaking existing IT features to accommodate work processes (e.g., resubmitting loan package), and for developing new IT features (e.g., IT feature to hold templates for miscellaneous loan packages). The case company in Schneider et al (2018) demonstrated organizational capabilities for customizing and adding new IT features (e.g., APIs) to the interface of a cloud-based enterprise system. Spierings et al. (2017) provide an example of users who demonstrated organizational capability for developing feral information systems (IT workarounds) to abate additional transactional cost imposed by an IT and to gain efficiency. McGann and Lyytinen (2008) present a case study in which the case company demonstrated organizational capabilities for developing new IT features and work processes to address existing goals in shipping and to enable the organization meet new and emerging requirements. Thus, organizational capabilities for combining IT assets and work processes can manifest as the capabilities with which;

- existing IT features and work processes are tweaked to fit each other
- new IT features or work process (including workarounds) are enacted to improve the utility, or the compatibility and integration of, the IT asset and work processes; and
- existing IT features may be put to unintended use to augment the limitations of existing IT asset and work processes.

Organizational capabilities that exist in an organization prior to implementation influence the extent of adaptation or reinvention that can be done towards improving the compatibility and integration of IT asset and work processes to form IT-enabled resources. Where there is low organizational capabilities, IT and work process adaptions and reinventions may be dysfunctional (Schneider et al., 2018). Thus, organizations augment their organizational capabilities; e.g., by training (Spierings et al., 2017), or by hiring new staff (Macredie and Sandom, 1999). Further, as support teams and users engage in adaptation and reinvention, they acquire contextual knowledge that cumulates to improved organizational capabilities. IT support teams and users engage in knowledge transfer whilst adapting IT assets and work processes (Santhanam et al., 2007). Those who engage in configuration activities may gain configuration capabilities associated with the IT and related work processes (Schneider et al., 2018). Spierings et al. (2017) observed that users intentionally engage in learning activities in order to develop quality and usable feral information systems (i.e., IT adaptations, and IT reinventions). In effect, on the one hand, organizational capabilities possessed by users and support teams influence the formation of IT-enabled resources. On the other hand, whilst support teams and use engage in the formation of IT-enabled resources, they obtain new or improved organizational capabilities. This notion is represented in the model above (see ***Figure 1***) by the arrows connecting "Organizational Capabilities" and "IT-enabled Resources".

4.2.2 Formation and Structural Properties of an IT-enabled Resource

An IT-enabled Resource is formed when an organization employs its organizational capabilities to enable the compatibility and integration of IT assets and other organizational resources (Nevo and Wade, 2011, 2010). Though organizations may anticipate that the combination of IT assets and other organizational resources is synergistic (i.e., result in the formation of synergy), the combination is not always synergistic. Whereas combining an IT module and a work process for shipping and receiving materials resulted in synergy, thus improving efficiency and productivity (McGann and Lyytinen, 2008), combining an IT asset and work processes for tax administration did not result in the formation of synergy, but rather in workarounds and practices that reduced the capability for tax administration (Azad and King, 2012).

Further, high integration does not always result in more synergy as may be suggested in the literature (e.g., Nevo and Wade, 2011, 2010); the nature of the IT asset and work process is equally important. Highly standardized work processes (e.g., general ledger or payment processes) require high integration or tight-coupling with a supporting IT asset for synergy to ensue (Lyytinen et al., 2009; Seethamraju, 2009). However, work processes that strive on variability (e.g., project management) may rather require loose integration or loose-coupling with a supporting IT for synergy to ensue (Azad and King, 2012; Berente et al., 2008). Generally, decoupled work processes and supporting IT assets are dysfunctional largely because decoupled system components do not respond to each other and thus evolve indiscriminately (Orton and Weick, 1990). For instance, in Azad and King (2012), because the IT and work processes for tax administration were decoupled, the work processes evolved, with the support of IT workarounds (e.g., spreadsheets), leaving the designated tax administration system unused and stuffed with outdated data. Thus, contrary to the popular notion that high integration leads to synergy, empirical evidence from prior research also suggests that the extent of integration or "type of coupling" needed for synergy will depend on the type of IT and work process in question. This study proposes that the *type of coupling* that exists among the components of an IT-enabled resource is one of the structural properties of an IT-enabled resource.

Furthermore, the literature suggests that IT and work processes co-evolve during the formation of IT-enabled resources (Goh et al., 2011). This is represented in the model above (see ***Figure 1***) by the feedback links between *IT assets* and *Organizational Resources*. Thus, at least either the IT or the work process should be flexible to allow the adaptation and reinvention necessary to *appropriately* integrate the IT and work process. In cases where both the IT asset and work process are flexible, the two can co-evolve with each being adapted or reinvented to fit the other or to actualize affordances provided by the other (Leonardi, 2011). For example, Orlikowski, (1996) describes a case study in which users in a customer support department adapted and reinvented an incident tracking support system and their work processes to address existing and emerging organizational goals, and to seize opportunities.

However, when an IT asset and a work process do not fit, yet either of them is non-adaptive or inflexible, the inflexibility of one is compensated for by either adapting the other or creating workarounds to augment the inflexibility. Being limited by a non-adaptive IT asset, the case company studied by Macredie and Sandom (1999) employed local improvisations and adaptations in work processes to improve synergy between the IT asset and work processes. When a tax administration system did not fit the work processes for tax administration, users created and maintained spreadsheets with which they supported their tax administration work processes (Azad and King, 2012). Other, empirical results suggest that a focal IT asset may be connected to several other resources (including other IT assets and work processes). In such instances, the inflexibility of one work process may not necessarily be augmented by changes to the focal IT asset, but rather it may be augmented by changes to other work processes. Davidson and Chismar (2007) studied an electronic health record that connected work processes of physicians, nurses, and pharmacist. Nurses had to change their work processes (e.g., enter work orders for doctors) to accommodate the inability of some doctors to change their work processes (i.e., enter all their work orders by themselves) to fit the IT (Davidson and Chismar, 2007). This study proposes that the extent to which the components (i.e., IT assets and work processes) of an IT-enabled resource can be adapted or reinvented to fit each other or to actualize the affordances provided by each other, is another structural property of an IT-enabled resource. This structural property is referred to as the *flexibility of the components* of an IT-enabled resource.

Moreover, empirical evidence suggests that the number of other resources (e.g., other IT assets and work processes) to which a focal IT asset is combined may have implications for the structural properties of an IT-enabled resource. Rodon et al. (2011) observed that each of the several organizations connected to an interorganizational information system (IOIS) adapted the interorganizational IS to its IT making the IOIS complex and derailing the adaptability of the IOIS. Berente et al. (2008) illustrate how an ERP at NASA was connected to different work processes; e.g., work processes of researchers and project managers. The user groups circumvented the ERP with workarounds, adapted the ERP to work processes, or improvised by using middleware to loosely-couple the ERP and work processes (Berente et al., 2008). Schneider et al.(2018) provides an account of how an organization obtained performance gain by customizing the interface of a cloud-based enterprise system to its work processes

but had to face severe disruptions in performance when the vendor updated the cloud-based enterprise system. This study proposes that the number of other resources to which a focal IT asset is connected constitute a structural property of an IT-enabled resource. Drawing on network theory (e.g., Bonacich, 2007; Ibarra, 1993), this structural property is referred to as the *centrality* of the focal IT asset and is defined as, the number of resources (including other IT assets and work processes) to which the focal IT asset is connected.

IT-enabled resources thus may have three structural properties; type of coupling among the components, flexibility of the components, and centrality of the focal IT-asset (see ***Table 4***). These structural properties may not only influence the initial combination of the IT assets and the organizational resources to form the IT-enabled resource, but also influence the renewal and redeployment of the IT-enabled resources to form new synergies to address shifting organizational goals and strategic.

Structural Properties	Definition	Indicative Sources
Flexibility of the components	The extent to which the components of an IT-enabled resource can be adapted or reinvented to fit each other or to actualize the affordances provided by each other.	(Benitez et al., 2018; Goh et al., 2011; Leonardi, 2011)
Centrality of the focal IT	The number of organizational resources to which a focal IT asset is connected.	(Bonacich, 2007; Harrison and Easton, 2002; Ibarra, 1993; Rodon et al., 2011; Schneider et al., 2018).
Type of Coupling among the components	Refers to the number and strength of interdependencies that exist among the components of an IT-enabled resource.	(Azad and King, 2012; Berente et al., 2008; Berente and Yoo, 2012; Orton and Weick, 1990)

Table 4. Structural Properties of an IT-enabled Resource

4.2.3 The Effect of Structural Properties on the Renewal of an IT-enabled Resource

Organizations do face the need to renew and redeploy their resources in response to changing goals and strategic intents (Sirmon et al., 2008; Tanriverdi et al., 2010). Given that synergy of an IT-enabled resource provides the capability to attain organizational goals (Nevo and Wade, 2011, 2010), when organizational goals change, the IT-enabled resource needs to be renewed to establish *new* synergy or "shifting synergies" (Eisenhardt and Martin, 2000, p. 1107) needed to address the new organizational goals. However, the ability of an organization to renew and redeploy an IT-enabled resource depends partly on the structural properties of the IT-enabled resource (Sirmon et al., 2008; Tanriverdi et al., 2010).

Organizations will be able to renew an IT-enabled resource whose components can be adapted or reinvented to fit each other or to actualize the affordances provided by each other. For instance, a flexible incident tracking support system (an IT asset) and work processes enabled users in the case company studied by Orlikowski (1996) to adapt and reinvent the IT asset and work processes to their work context, and to seize opportunities. Also see Leonardi (2011). Thus, the *flexibility of the components* of an IT-enabled resource can support managerial efforts (or organizational capabilities) at renewing and redeploying the IT-enabled resource to address shifting organizational goals.

Focal IT assets that are connected to several other resources (e.g., work processes) may offer numerous advantages; e.g., resource leveraging (e.g., Kohli and Devaraj, 2004; Tanriverdi, 2006). An ERP that connected different centres in NASA enabled resource visibility and project collaborations across centres (Berente et al., 2008). High centrality of a focal IT can also provide an additional *degree of freedom* in that the limitations in one resource can be addressed by adapting other resources apart from the focal IT (e.g. see Davidson and Chismar, 2007). High centrality of a focal IT can thus be instrumental in the formation and renewal of an IT-enable resource.

However, high centrality of a focal IT can also constrain, and increase the cost and risk associated with, the renewal and redeployment of an IT-enabled resource (Saraf et al., 2013; cf. Harrison and Easton, 2002). High centrality of an IOIS and individual adaptations that each user organization made to the IOIS reduced the adaptability of the IOIS, increased the risk and cost of updating the IOIS, and

reduced the productivity of user organizations (Rodon et al., 2011). Update to a cloud-based enterprise system can be costly to the performance of a user organization that has adapted and integrated the cloud-based enterprise system with its work processes (Schneider et al., 2018). Thus, though, centrality of a focal IT-enabled resource can enable the formation and renewal of an IT-enabled resource by providing additional degree of freedom for adapting or reinventing components of the IT-enabled resource; it can also constrain managerial efforts at renewing and redeploying IT-enabled resources to address changing strategic imperatives.

The number and strength of interdependencies that exist among the components of an IT-enabled resource (i.e., the type of coupling) can influence managerial efforts at renewing and redeploying the IT-enabled resource to address new organizational goals. Tightly coupling the components of an IT-enabled resource may leads to efficiency (especially in repetitive work processes), yet it may constrain efforts at renewing and redeploying the IT-enabled resource (Berente et al., 2008; Berente and Yoo, 2012; Orton and Weick, 1990). Seethamraju (2009) found that by tightly coupling IT, structures, and processes, the firm that they studied was unable to renew and redeploy its work processes. Loose-coupled components of an IT-enabled resource can be rearranged to address unpredicted situations; e.g., change in strategic directions. Physicians, nurses, and pharmacists were able to handle emergencies because they loosely-coupled their work processes and a medication dispensing system (Azad and King, 2012). Largely, decoupled components are dysfunctional as they evolve discriminately and do not respond to each other (see Orton and Weick, 1990). However, decoupled components can be rearranged in new ways to address existing or emerging challenges. Workarounds created by researchers later became institutionalized as the normal way of doing work (Berente et al., 2008). The otherwise decoupled ERP of NASA, and work processes of project manager were loose-coupled by means of middleware (Berente et al., 2008). Ad-hoc templates developed by users to handle miscellaneous loans became institutionalized in the loan workflow system (Santhanam et al., 2007). The type of coupling that exists among the components of an IT-enabled resource can thus, enable or constrain managerial efforts at renewing and redeploying the IT-enabled resource to address new strategic goals.

Thus far, there are empirical evidence to suggest that individually, the three structural properties of an IT-enabled resource can enable or constrain the renewal and redeployment of the IT-enabled resource. In order words, having superior organizational capability may not be enough to sustain the derivation of BVIT from an IT-enabled resource: the structural properties of the IT-enabled resource also matter (cf. Sirmon et al., 2008).

4.2.4 Effect of Organizational and Institutional Contexts

Empirical results from the articles reviewed in this study suggest that the peculiarities of an organization's internal environment (i.e., organizational context) and its external environment (i.e., institutional context) influence the creation and the longevity of an IT-enabled resource. Organizational context provides the leadership, structures, culture, and work practices that influence the adaptation and reinvention of IT assets and work processes (Nevo et al., 2016). The case studies have provided several examples. Proactivity and innovativeness of senior management led to the development of new IT modules and work processes that later became institutionalized as an IT-enabled resource for handling shipping (McGann and Lyytinen, 2008). Supervisors and colleagues can provide the skills and resource needed to develop and maintain IT workarounds in order to reduce transactional cost and increase efficiency (Spierings et al., 2017). On-going change management support from configuration manager led to successful enactment of local improvisations needed to combine an IT asset and work processes (Macredie and Sandom, 1999). Support teams worked with users to institutionalize, what would have otherwise been ad-hoc IT and work process adaptations (Berente et al., 2008; Santhanam et al., 2007). Owing to how standardized the work practices of accountants are, even when the implementation of all other modules in an ERP failed, the general ledger module was successfully combined with the related work processes (Lyytinen et al., 2009). Healthcare practitioners perceived "saving life" to be more important than following the rubrics of using a medication dispensing system, and thus loosely-coupled the system and work practice in a manner that enabled them to handle emergencies (Azad and King, 2012). The several examples above suggest that organizational context is important in the formation of IT-enabled resources.

The effect of institutional context has also been noted by several researchers. The institutional context refers to the influences that other entities external to a focal organization; e.g., regulatory bodies, competitors, and professional groups, exert on the focal organization and its members (Scott and Davis, 2015, pp. 266–268). Actions of regulatory agencies (e.g., deregulating an industry) and competitors may drive organizations to invest in IT as a means of revamping its resources through the formation and renewal of IT-enabled resources (Svejvig and Jensen, 2013). However, when institutional pressures conflict; for example, coercive pressure from government and normative pressure from professional groups, such conflicts may not work well for the formation of IT-enabled resources. For instance, when a government directive to use an IT for tax administration conflicted with the work ethos of users, the users stuck to their work ethos and proliferated "shadow" IT and work processes that were decoupled from the prescribed IT (Azad and King, 2012). Likewise, for health professionals to enforce work ethos (i.e., quickly attending to patients) over regulatory directives, they used a medication dispensing system in a manner that was different from what was directed by regulation (Azad and King, 2012). Thus, it is apparent that, institutional pressure (e.g., competitive actions, regulations, and professional norms) and how institutional pressure is conveyed to, and perceived by users, influence the formation of IT-enabled resources in a focal organization.

5 Contributions and Implications

This study makes several contributions that have implications for research and practice. First, it responds to the several calls for research on how organization can sustain the derivation of BVIT from their IT investments. Specifically, it unravels three underlying structural properties of an IT-enabled resource (i.e., flexibility of the components, type of coupling among the components, and centrality of the focal IT) that may enable or constrain the renewal and redeployment of the IT-enabled resource. The three underlying structural properties are thus, important to the renewal of synergy, or the creation of "shifting synergies" needed to address shifting organizational goals, especially in dynamic environments (Eisenhardt and Martin, 2000, p. 1107). Further, the three underlying structural properties also provide a more detail view for high level constructs like IT infrastructure malleability (Henfridsson and Bygstad, 2013), and IT infrastructure flexibility (Benitez et al., 2018) that support the redeployment of IT assets. However, further research is needed to investigate the collective effects of the three underlying structural properties on managerial efforts to renew and redeploy IT-enabled resources. For instance, a research that investigates how the interaction between the *centrality of a focal IT* and the *type of coupling among the components* influence managerial efforts at renewing and redeploying an IT-enabled resource will be worthwhile.

Second, this study contributes generally, to the discourse on how IT assets can result in competitive advantage; and especially, to the discourse on creating successive competitive advantage with IT (e.g., see Tanriverdi et al., 2010). An IT-enabled resource may possess capabilities, by virtue of its synergy, with which an organization can attain competitive advantage. However, in dynamic environments competitive advantage erodes rapidly and the organization may need to renew and redeploy the IT-enabled resource to regain competitive advantage in a new context, thereby creating successive competitive advantage (Tanriverdi et al., 2010; Sirmon et al., 2011, 2010). Thus, the structural properties of an IT-enabled resource that enable the renewal and redeployment of the IT-enable resource are very important especially in dynamic environments. Organizations should invest not only in capabilities that enable the initial formation of an IT-enable resource, but also in capabilities that endow the IT-enabled resource with structural properties that enable the renewal and redeployment of the IT-enabled resource. Researchers should investigate and identify the aspect of organizational capabilities; for example; IT capability (Bharadwaj, 2000) and IT reconfiguration capability (Pavlou and El Sawy, 2010; Rai and Tang, 2010) that supports the creation of synergy, and the aspect that endows the IT-enabled resource with enabling structural properties.

Third, this study highlights the importance of organizational and institutional contexts to the formation and renewal of IT-enabled resources. Users and support teams are more likely to engage in effective adaptations and reinventions when the organizational context is enabling. Further, institutional pressure and how users within a focal organization perceive the institutional pressure influence the formation of IT-enabled resources. Users may effectively engage in the formation of IT-enabled re-

sources when management leverages the different institutional pressures such that using the intended IT-enabled resource does not negatively affect the productivity and work practices of users within the organization. Thus, future research should study how management can create appropriate organizational context that enables the formation and renewal of IT-enabled resources.

6 Conclusion and Limitation

IT assets are believed to result in organizational benefits when they are synergistically combined with other organizational resources to form IT-enabled resources (Nevo and Wade, 2010; Seddon, 2014; Wade and Hulland, 2004). However, the integration needed to synergistically combine an IT asset with other organizational resources may also constrain the renewal and redeployment of the IT-enabled resource (Saraf et al., 2013). Congruently, research shows that benefits from IT are short-lived especially in dynamic environments (Kohli and Grover, 2008; Wade and Hulland, 2004). Thus, several researchers (e.g. Kohli and Grover, 2008; Schryen, 2013; Wade and Hulland, 2004) have called for further research into how the derivation of benefits from IT can be sustained. This study responds to these calls.

Specifically, drawing on a systematic review of the literature on post-implementation changes, this study improves our understanding of the structural properties of an IT-enabled resource that may enable or constrain the renewal and redeployment of the IT-enabled resource to achieve new goals. Thus, this study extends Nevo and Wade (2011, 2010). Whereas the initial formation of an IT-enabled resource is important in attaining short-term goals, the structural properties that ensue from the formation process is important in renewing and redeploying the IT-enabled resource to attain new goals. The formation process is influenced by the nature of the IT and organizational resource, organizational factors, and institutional factors. Drawing on a synthesis of empirical evidence on post-implementation changes, this study identifies three structural properties of an IT-enabled resource that may enable or constrain the renewal and redeployment of an IT-enabled resource. They include the flexibility of the components, type of coupling among the components, and centrality of the focal IT. This study offers implications for research and practice. In general, this study contributes to the literature on BVIT and specifically, it offers insight on the structural properties of an IT-enabled resource that may constrain or enable how organizations can sustain the derivation of benefits from IT investments.

Notwithstanding its contributions, this study has a major limitation. The most important limitation of this study is the number of empirical research articles that were reviewed. However, a thorough review of the 18 distinct empirical cases provided rich insight and has enabled this study to unravel the structural properties of an IT-enabled resource, and the factors that influence their formation. Future research can extend the findings of this study; e.g., it can uncover more structural properties of an IT-enabled resource.

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