JYU DISSERTATIONS 513

Truth Lumor

Sustaining the Derivation of Information Technology Benefits

Perspectives on Post-Adoption Use of IT and the Renewal of IT-enabled Resources in Higher Education Context

UNIVERSITY OF JYVÄSKYLÄ
FACULTY OF INFORMATION TECHNOLOGY

JYU DISSERTATIONS 513

Truth Lumor

Sustaining the Derivation of Information Technology Benefits

Perspectives on Post-Adoption Use of IT and the Renewal of IT-enabled Resources in Higher Education Context

Esitetään Jyväskylän yliopiston informaatioteknologian tiedekunnan suostumuksella
julkisesti tarkastettavaksi yliopiston Ylistönrinteen salissa FYS1
toukokuun 3. päivänä 2022 kello 12.

Academic dissertation to be publicly discussed, by permission of
the Faculty of Information Technology of the University of Jyväskylä,
in Ylistönrinne, auditorium FYS1, on May 3, 2022 at 12 o'clock noon.

JYVÄSKYLÄN YLIOPISTO
UNIVERSITY OF JYVÄSKYLÄ

JYVÄSKYLÄ 2022

Editors
Marja-Leena Rantalainen
Faculty of Information Technology, University of Jyväskylä
Ville Korkiakangas
Open Science Centre, University of Jyväskylä

ISBN 978-951-39-9128-9 (PDF)
URN:ISBN:978-951-39-9128-9
ISSN 2489-9003

Permanent link to his publication: http://urn.fi/URN:ISBN:978-951-39-9128-9

ABSTRACT

Lumor, Truth
Sustaining the derivation of information technology benefits: Perspectives on post-adoption use of IT and the renewal of IT-enabled resources in higher education context
Jyväskylä: University of Jyväskylä, 2022, 103 p.
(JYU Dissertations
ISSN 2489-9003; 513)
ISBN 978-951-39-9128-9 (PDF)

Organizations make huge investments in Information Technology (IT) expecting to derive performance benefits from their investments but often struggle to derive the anticipated benefits. Research indicates that over 70% of investment in IT fail either during the implementation of the IT or during post-implementation where the IT is underused, misused, or abandoned even after a successful implementation. However, for an organization to derive IT benefits, users need to actively use the IT to accomplish work tasks long beyond initial adoption. Further, research shows that even when organizations derive benefits from IT, the benefits are usually short-lived. Apparently, whilst users use an IT, they combine the IT with other organizational resources to form IT-enabled resources from which they derive IT benefits. Paradoxically, the combination and integration needed to derive IT benefits may also constrain the renewal of IT-enabled resources to achieve new strategic imperatives, thus derailing the derivation of IT benefits in the long term.

This doctoral dissertation examines how organizations can sustain the derivation of IT benefits. Drawing on a systematic review of the post-implementation literature, this dissertation finds that IT use co-evolves with its antecedents, which can be grouped into support structures, support activities, and support attributes. Further, drawing on an in-depth case study of a multi-feature mobile app, it explicates a nuanced explanation of post adoption use and how organizations can sustain post adoption use of multi-feature mobile apps. Furthermore, drawing on a review of published empirical cases and an in-depth case study, it finds that three structural properties, namely component flexibility, component centrality, and component coupling, emerge during the formation of IT-enabled resources to constrain or enable the renewal of IT-enabled resources. Together, the findings shed light on how managers can promote and sustain IT use after initial adoption and on the structural properties that managers can orchestrate to enable the renewal of IT-enabled resources to address shifting goals thereby sustaining the derivation of IT benefits. We discuss the implications for research.

Keywords: IT assets, IT use, IT benefits, post adoption, IT-enabled resource, structural properties of IT-enabled resources, multi-feature mobile apps.

TIIVISTELMÄ (ABSTRACT IN FINNISH)

Lumor, Truth
Tietotekniikan hyötyjen ylläpitäminen: Näkymät IT:n käyttöönoton jälkeiseen käyttöön ja IT-pohjaisten resurssien uusimiseen
University of Jyväskylä, 2021, 103 p.
(JYU Dissertations
ISSN 2489-9003; 513)
ISBN 978-951-39-9128-9 (PDF)

Organisaatiot tekevät valtavia investointeja informaatioteknologioihin (IT) odottaen siten parantavansa suorituskykyään mutta usein kamppailevat saavuttaakseen odotetut hyödyt. Tutkimukset osoittavat, että yli 70 % IT-investoinneista epäonnistuu joko jo implementointivaiheessa tai hankittu teknologia on implementoinnin jälkeen vajaalla käytöllä, sitä käytetään väärin tai se hylätään, vaikka se olisikin aluksi otettu onnistuneesti käyttöön. Jotta organisaatio saisi IT-hyötyjä, käyttäjien täytyy aktiivisesti hyödyntää IT:tä työtehtävissään vielä kauan käyttöönoton jälkeen. Lisäksi tutkimukset osoittavat, että vaikka organisaatiot saavat hyötyjä teknologioista, hyödyt ovat yleensä lyhytaikaisia. Käytössä IT yhdistetään organisaation muihin resursseihin, joista näin muodostuu IT-pohjaisia resursseja. Tällainen IT-hyötyjen varmistamiseen tarvittava yhdisteleminen voi myös rajoittaa IT-pohjaisten resurssien uusimista uusien strategioiden mukaiseksi, mikä johtaa paradoksaalisesti siihen, ettei hyötyjä saada pitkällä aikavälillä.

Tässä väitöskirjassa tarkastellaan, miten organisaatiot voivat säilyttää IT:n tuottaman hyödyn. Kirjallisuuskatsauksen pohjalta todetaan, että IT-käyttö kehittyy rinnakkain edeltäjiensä kanssa, jotka voidaan ryhmitellä tukirakenteisiin, tukitoimintoihin ja tukiominaisuuksiin. Mobiilisovelluksen käyttöönoton tapaustutkimus selventää monikäyttöisten mobiilisovellusten omaksumista ja käyttöä käyttöönoton jälkeen. Lisäksi aiemmin julkaistujen empiiristen tapausten ja perusteellisen tapaustutkimuksen pohjalta todetaan, että IT-pohjaisten resurssien muodostamisen aikana ilmenee kolme rakenteellista ominaisuutta, komponenttien joustavuus, komponenttien keskeisyys ja komponenttien kytkentä, jotka joko rajoittavat tai mahdollistavat IT-pohjaisten resurssien uusimisen. Tulokset valaisevat sitä, kuinka IT:n käyttöä voidaan edistää ja ylläpitää käyttöönoton jälkeen ja rakenteellisia ominaisuuksia organisoimalla mahdollistaa IT-pohjaisten resurssien uusiminen muuttuvien tavoitteiden saavuttamiseksi ja siten ylläpitää IT-hyötyjen syntymistä. Tästä esitetään johtopäätöksiä tutkimukseen.

Avainsanat: IT-hyödyke, IT:n käyttö, IT-hyödyt, implementoinnin jälkeinen käyttö, IT-pohjainen resurssi, rakenteelliset ominaisuudet, monikäyttöinen mobiilisovellus

Author

Truth Lumor
Faculty of Information Technology
University of Jyväskylä
Finland

Supervisors

Dr. Mirja Pulkkinen
Faculty of Information Technology
University of Jyväskylä
Finland

Dr. Ari Hirvonen
Digital Services
University of Jyväskylä
Finland

Reviewers

Professor Mikko Ruohonen
Faculty of Management and Business
Tampere University
Finland

Professor Princely Ifinedo
Goodman School of Business
Brock University
Canada

Opponent

Professor Virpi Kristiina Tuunainen
School of Business
Aalto University
Finland

ACKNOWLEDGEMENTS

Several people have touched my life and have influenced the trajectory of my doctoral studies. I remain thankful to them. I express my sincere gratitude to my supervisors, Dr Mirja Pulkkinen and Dr. Ari Hirvonen, for guiding and supporting my doctoral studies. I thank my opponent, Prof. Virpi Kristiina Tuunainen, and the two pre-examiners of my dissertation, Prof. Princely Ifinedo and Prof. Mikko Ruohonen, for their time and comments. My sincere gratitude goes to Prof. Mikko Siponen and Prof. Yolande E. Chan for showing interest in my career aspirations, mentoring me, and commenting on my papers. I thank Prof. Tuure Tuunanen and Prof. Pekka Abrahamsson for their words of encouragement and advice, and for supporting my efforts whenever I call on them. I also thank Dr Ville Seppänen for giving me opportunities to develop my teaching skills which have proven very useful in my current role. I am grateful to the students, teachers, administrators, and managers from my case university and the developers around the world who participated in my research. I could not have made it without them. Also, my sincere gratitude goes to Nina Pekkala for coordinating the examination of my dissertation, to Quivine Ndomo for proofreading my dissertation, and to Marja-Leena Rantalainen for providing editorial assistance towards publishing my dissertation.

My life at the IT Faculty would have been unbearable without friends like Hojat Mohammadnazar, Fufan Liu, and Juuli Lumivalo, just to mention a few, and friends from the SIM programme, Aseem Sood and Kamila Khudaibergenova, who often sent words of encouragement. I am thankful to them. Thanks to the countless friends from the Jyväskylä International Christian Fellowship (JICF), the Ghanaian and African communities in Central Finland, and the Kortepohja Students Village. Together, they gave me a home-away-from-home experience for which I am so thankful.

To my family, I am eternally grateful for their unwavering love and care that cushioned me from the several daunting situations along the way. I thank my ever-caring mum, Rejoice Kudah (a.k.a *Sister*), for her unwavering dedication to my progress and her love for me and my family. I am grateful to my lovely wife, Asantewaa, and my three awesome children, Dzodzi, Malorwoda, and Makafui, for their love and presence. Our early morning calls that gave me energy for each day and our night calls that brought laughter after each hectic day kept me sane and alive. I am also grateful to the Owusus, my in-laws, and to my other family, the Larteys, for their love and support. Thank you all for journeying with me.

Jyväskylä 03.05.2022
Truth Lumor

FIGURES

TABLES

CONTENTS

LIST OF INCLUDED ARTICLES

I Lumor, T. (2019a). Factors that influence information technology use during post-implementation: A literature review. In *Proceedings of the 27th European Conference on Information Systems* (ECIS 2019), Stockholm-Uppsala, Sweden.

II Lumor, T., Pulkkinen, M., & Hirvonen, A. (2020). The actual adoption and use of mobile apps: The case of a higher education context. In *Proceedings of 26th Americas Conference on Information Systems* (AMCIS 2020), Salt Lake City (Virtual), USA.

III Lumor, T. (2019b). Investigating the structural properties of an IT-enabled resource. In *Proceedings of the Tenth Scandinavian Conference on Information Systems (SCIS 2019),* Nokia, Finland.

IV Lumor, T., Pulkkinen, M., Chan,Y. E., & Hirvonen, A. Exploring the renewal of IT-enabled resources from a structural perspective. Under review.

In Articles I and III, the candidate is the sole author. As such, the candidate did all the work regarding the two articles. In Articles II and IV, the candidate is the lead author and thus did most of the work regarding concept development, literature review, data collection, data analysis, theory development, and manuscript writing. The co-authors provided guidance and valuable reviews towards developing the quality of the manuscripts. Articles I and II have been further developed into journal manuscripts.

1 INTRODUCTION

In this chapter, we briefly provide a background to the studies in this dissertation and explicate the objectives and scope of the doctoral study. We also explain how the four studies in this dissertation contribute toward attaining our objectives and answering our main research question.

1.1 Background of the Research

Organizations invest in Information Technology (IT) expecting to derive performance benefits from their investments. However, often they struggle to derive or sustain the anticipated benefits. Research shows that about 70% of IT investments fail to yield anticipated benefits because either the IT implementation fails or the IT is sparingly used, misused, or abandoned even after a successful implementation (Babar et al. 2018; Bagayogo et al. 2014). Research shows that even when organizations successfully implement and integrate an IT asset and organizational resources, and derive benefits from the IT asset, the benefits are usually short-lived, especially in dynamic environments (Kohli and Grover 2008; Wade and Hulland 2004). Thus, one of the fervent quests of Information Systems (IS) research and practice has been to uncover how organizations can sustain the derivation of IT benefits. This dissertation attempts to contribute to this stream of IS research by answering the research question: *how can an organization sustain the derivation of IT benefits?* Specifically, this dissertation attempts to answer this question from two main perspectives.

The first perspective discusses the use of IT applications during post-implementation or beyond initial adoption. IT application in this dissertation refers to both traditional IT applications (e.g., enterprise systems, and desktop applications) and mobile apps (e.g., m-commerce apps, and location-based apps). IT use during post-implementations refers to the applications that a user makes of the original or extended features of an IT application to accomplish work tasks after the user has access to the IT application.

The literature suggests that for an organization to derive benefit from its investments in traditional IT applications, users within the organization should have actively used the IT applications to accomplish their work tasks for an extended period beyond initial adoption (Limayem et al. 2007; Maruping and Magni 2015; Stein et al. 2015). Thus, researchers have committed efforts to studying the factors that influence IT use during post-implementation; however, the factors are dispersed across individual publications (Jasperson et al. 2005; Shaikh and Karjaluoto 2015; Sykes 2015).

Unlike research on post-implementation use of traditional IT applications, research on post-adoption use of mobile apps is scanty, and rarely focuses on actual use, but rather on user intention, for example, to buy (e.g., Kim et al. 2016), to install (e.g., Harris et al. 2016), to use (e.g., Munoz-Leiva et al. 2017), and to continue using a mobile app (Chen et al. 2012). Further, research on post-adoption use of mobile apps has focused on the mobile app as a unit of analysis impeding our understanding of the myriad applications that users make of the features of multi-feature mobile apps. We use multi-feature mobile apps to mean mobile apps that have two or more features (e.g., mobile banking apps, and mobile learning apps). Though research on post-adoption use of mobile apps has improved our knowledge of the factors that may influence a user to use or not use a mobile app, it misses the intricate realities of post-adoption use, especially of the features, of multi-feature mobile apps.

The second perspective investigates the structural properties that ensue whilst users combine IT assets and other organizational resources to create IT-enabled resources from which they derive IT benefits (Nevo and Wade 2010; Wade and Hulland 2004), and how the structural properties enable or constrain the derivation of IT benefits especially in dynamic environments. In this dissertation, we refer to IT applications as IT assets (Nevo and Wade 2011). The IS literature on IT benefits has shown that integrating IT assets and organizational resources lead to IT benefits 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 extent to which an organization can reconfigure and redeploy its IT assets and organizational resources to meet new organizational goals (Saraf et al. 2013). This constraint may derail the derivation of IT benefits in dynamic environments. IS researchers have noted that IT benefits derived from IT assets are short-lived, especially in dynamic environments (Kohli and Grover 2008; Wade and Hulland 2004). They have thus called for research into how organizations can sustain the derivation of IT benefits especially in dynamic environments (e.g. Kohli and Grover 2008; Schryen 2013; Wade and Hulland 2004).

The first perspective seeks to understand how organizations can promote active use of IT applications during post-implementation or beyond initial adoption to sustain the derivation of IT benefits. The second perspective focuses on the structural properties that ensue whilst users combine IT applications and organizational resources to form IT-enabled resources from which they derive IT benefits, and how the structural properties may enable or constrain the renewal of the IT-enabled resources to sustain the derivation of IT benefits. Taken

together, the two perspectives help find answers to the overarching research question of this dissertation and to advance knowledge on how organizations can sustain the derivation of IT benefits.

1.2 Scope and objective of the research

The overarching objective of this dissertation is to advance our understanding of how organizations can sustain the derivation of IT benefits. This overarching objective is important for three main reasons. Firstly, several organizations invest in IT but struggle to harness the IT benefits that they anticipate (Akhlaghpour and Lapointe 2018; Babar et al. 2018) largely because users do not actively use the IT beyond initial adoption (Bagayogo et al. 2014; Jones et al. 2008). Secondly, 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). Thirdly, organizations are exposed to dynamic environments and need to constantly reconfigure and redeploy their resources and capabilities to create shifting synergy to address new strategic imperatives, without which they may fail (Eisenhardt and Martin 2000; Sirmon et al. 2011; Thornhill and Amit 2003).

In pursuance of our overarching objective, we organize this dissertation into four specific sub-objectives which are further organized into two main strands (see FIGURE 1). The first strand deals with the intricate realities of post-implementation and post-adoption IT use behaviours, whereas the second strand deals with the structural properties that enable or constrain the renewal of IT-enabled resources. Strand one deals with sub-objectives one and two, and strand two deals with sub-objectives three and four. Sub-objective one is to advance our understanding of how management can promote active use of traditional IT applications during post-implementation by collating and synthesizing the factors that influence IT use during post-implementation, and by explicating how IT use and its antecedents evolve during post-implementation. Sub-objective two is to shed light on how mobile service providers and organizations can promote post-adoption use of multi-feature mobile apps by shedding light on the intricate realities of post-adoption use of multi-feature mobile apps. Sub-objective three is to improve our understanding of the structural properties of IT-enabled resources that emerge whilst users use IT assets to perform their work tasks. Sub-objective four is to unravel how the structural properties enable or constrain the renewal of IT-enabled resources to sustain the derivation of IT benefits. Each sub-objective is explored in an article.

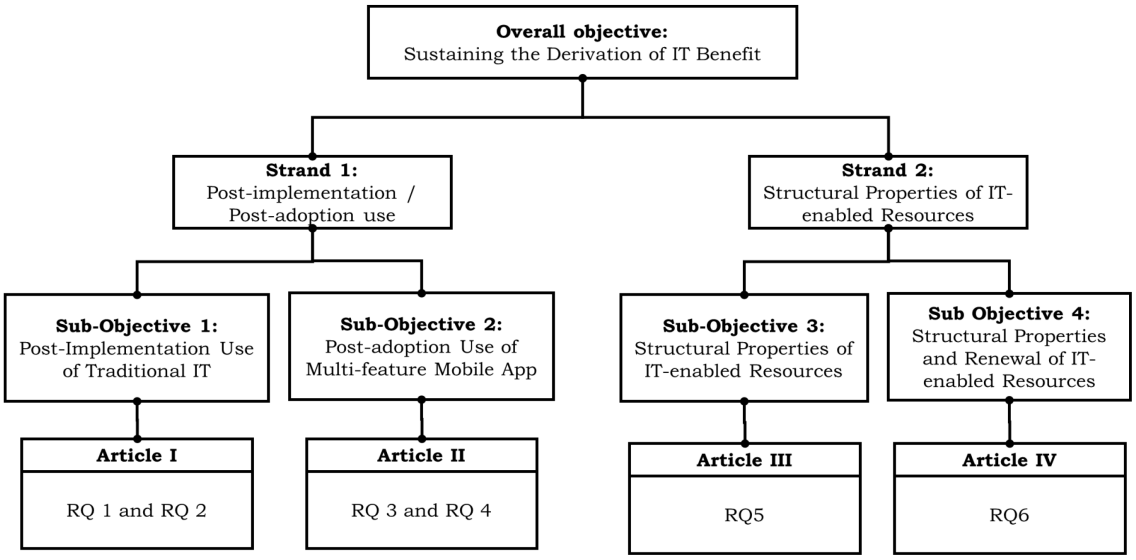

FIGURE 1 Relation between research objectives and studies

Articles I and II focus on the uses that users make of an IT application and how organizations can sustain active use of the IT application to sustain the derivation of IT benefits. Our conception of IT applications comes from Orlikowski and Iacono (2001)'s definition of IT artifacts as "bundles of material and cultural properties packaged in some socially recognizable form such as hardware and/or software" (2001, p. 121). We focus on IT applications from whose use organizations intend to derive IT benefits. These IT applications include traditional IT applications (e.g., enterprise systems) and mobile apps (e.g., mobile commerce apps, and mobile healthcare apps).

There are several empirical studies on the post-implementation use of traditional IT in organizations. These studies explore several research methods including field studies (e.g., Sykes 2020), case studies (e.g., Davison et al. 2019), and surveys (e.g., Lu et al. 2020) to elucidate the factors that influence post-implementation use of traditional IT in organizations. However, though there is a rich repertoire of knowledge on post-implementation use of IT in organizations, the knowledge is split over several individual articles with each article studying a few factors (e.g., see Sykes 2015). Therefore, in Article I, we employ a systematic literature review of empirical research articles to answer two research questions:

RQ1 What are the forms of IT use and the factors that influence IT use during post-implementations?

RQ2 How do IT use and its antecedents evolve during post-implementation?

Mobile apps have gained acceptance in several areas including, commerce (Chopdar et al. 2018), banking (Munoz-Leiva et al. 2017), healthcare (Kim et al. 2019), travel (Li and Liu 2014) communication (Oghuma et al. 2015), dating (Jung et al. 2019), tourism (Gibbs et al. 2016) and higher education (Alraimi et al. 2015). The several applications of mobile apps and the advanced capabilities of recent mobile devices have influenced the structure and functionalities of mobile apps. Consequently, mobile apps nowadays offer several functions and features (Gibbs

et al. 2016; Ho and Syu 2010) that allow users to communicate and engage in transactions, work, and entertainment (Nickerson et al. 2013). For instance, mobile banking apps, e.g., Nordea Mobile (Nordea Bank Abp 2020), allow user to make bank transactions, manage e-invoices, apply for and make changes to loans, manage debit and credit cards, manage savings and investments, and contact customer service (also see Oliveira et al. 2014). WeChat, a Chinese social media app originally called Weixin, started as an instant messaging mobile app, however, it has evolved to provide features including video conferencing, e-commerce, location sharing, and business-to-business transactions. Mobile apps are departing from their earlier form that consisted of one or two features (e.g., simple games, and alarm clock) to more sophisticated forms that consist of several features to allow users to perform a wide range of tasks in various use contexts. We refer to mobile apps with two or more features as *multi-feature* mobile apps.

However, unlike research on post-implementation use of traditional IT, research on post-adoption use of mobile apps is scanty and is mostly focused on the intention of users and the mobile app as the unit of analysis. For instance, mobile app use intention is usually measured with proxies like "I intend to continue using the application "(Bhattacherjee 2001; Chen et al. 2012) and actual use by proxies such as frequency and duration of use (Parthasarathy and Bhattacherjee 1998). Research rarely focuses on the actual applications that users make of the various features of a mobile app during post-adoption.

Further, although there are high download rates and indications of user interest in mobile apps, user retention is low and on the decline (Statista 2021). Research shows that users have a high tendency to abandon or discontinue using mobile apps (Parthasarathy and Bhattacherjee 1998; Salo and Makkonen 2018). The low and declining retention rates concern mobile service providers because their success depends on their effective subscriber base and post-adoption use of mobile apps (Bhattacherjee 2001; Parthasarathy and Bhattacherjee 1998). Thus, in Article II we employ an in-depth case study of the post-adoption use of a multi-feature mobile app in a higher education context to answer two research questions:

RQ3 How does post-adoption use of multi-feature mobile apps, and its antecedents evolve?

RQ4 How can mobile service providers and organizations promote the use of multi-feature mobile apps beyond initial adoption?

Articles III and IV focus on the structural properties that are formed as users combine IT assets and other organizational resources to form IT-enabled resources from which they derive IT benefits, and how the structural properties enable or constrain the renewal of the IT-enabled resources to address new strategic imperative to sustain the derivation of IT benefits. IT applications are commodity-like and result in IT benefits when they are synergistically combined with other organizational resources to form IT-enabled resources that possess the capability with which tasks are performed (Nevo and Wade 2011). The formation of IT-enabled resources extends the existing capabilities of the IT asset and the

organizational resource or results in the formation of new capabilities (Nevo and Wade 2011). During the formation of IT-enabled resources, certain structural properties emerge. Articles III and IV focus on the systems theory end of IT-enabled resources (see Nevo and Wade 2010) and investigate the structures properties that are formed during the formation and renewal of IT-enabled resources and how the structural properties may enable or constrain the renewal of the IT-enabled resources to meet shifting goals (Nan and Tanriverdi 2017; Saraf et al. 2013). A detailed discussion on the initial formation and the resource base view of IT-enabled resources are not within the scope of this dissertation. The resource base view of IT-enabled resources concerns the strategic potential (i.e., value, rarity, inimitability, and non-substitutability) of an IT-enabled resource by virtue of the synergy among its components (i.e., IT and other organizational resources). Therefore, we humbly refer the reader to Nevo and Wade (2011, 2010) for a detailed discussion on the formation and the resource based view of IT-enabled resources.

The argument in Articles III and IV is that, when the structural properties of an IT-enabled resource are enabling, an organization can renew the IT-enabled resource by tweaking and recombing its components in new ways to create new synergy or "*shifting synergies*" (Eisenhardt and Martin 2000, p. 1107) with which the organization can address new goals thereby sustaining the derivation of IT benefits. Whereas, when the structural properties are constraining, the organization's ability to renew its IT-enabled resources is derailed thereby dwindling the derivation of IT benefits.

Article III draws on systems theory (Ackoff 1971; Friedman and Allen 2011), network theory (Bonacich 2007; Ibarra 1993), and loose coupling theory (Orton and Weick 1990), and a review of the literature and empirical cases on post-implementation change to answer the research question

RQ5 What are the structural properties of IT-enabled resources?

Article IV builds on Article III by employing an in-depth case study of an IT-enabled resource in a university to unravel the structural properties of the IT-enabled resource and to explicate how the structural properties enabled or constrained the renewal of the IT-enabled resource to address new goals. Specifically, Article IV answers the research question

RQ6 How do the structural properties of an IT-enabled resource enable or constrain the renewal of the IT-enabled resource to sustain the derivation of IT benefits?

2 THEORETICAL FOUNDATION AND RESEARCH CONTEXT

In this chapter, we provide an overview of the literature, first relating to the main theme of the dissertation (i.e., IT benefits), then relating to the two perspectives that we take in pursuance of our main theme. We discuss the literature on IT benefits and the derivation of IT benefits. Then we review the literature on our first theme, i.e., the post-implementation and post-adoption use of IT assets consisting of traditional IT applications and mobile apps. We thereafter review the literature on our second theme, i.e., IT-enabled resources and their structural properties. We explore general systems theory, loose coupling theory, and social network theory to conceptualize the structural properties of IT-enabled resources.

2.1 Derivation of Information Technology Benefits

IT benefits 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). How and the extent to which organizations generate IT benefits at the process level and organization level are influenced by several factors (Melville et al. 2004). For instance, organization level differences may account for up to 50% of the effect of IT spending on organization productivity (Brynjolfsson and Hitt 1995). Also, national-level investments in IT capital, IT-related labour, and policies may influence the impact of IT on performance at the organization level (Brynjolfsson and Hitt 1998; Dedrick et al. 2013; Melville et al. 2004; Sabherwal and Jeyaraj 2015; Wade and Hulland 2004). Drawing on the resource-based view of the firm (see Barney 1991; Barney et al. 2001), Melville et al (2004) provide an integrative model for IT benefit research that groups these factors into macro-environment factors (e.g., country characteristics), competitive environment factors (e.g., industry characteristics,

and effect of trading partners), and organization level factors (e.g., IT resources and complementary organizational resources). IT resources consist of technological IT resources (e.g., IT infrastructure and business applications) and Human IT resources (e.g., technical skills and managerial skills). Based on Wade and Hulland (2004)'s definitions of resources[1] and assets[2], we refer to technological IT resources as IT assets. Like Nevo and Wade (2011, 2010), this dissertation focuses on the derivation of IT benefits from IT assets.

IT assets are commodity-like and may result in IT benefits only when they are synergistically combined with other organizational resources (or complementary resources) such as processes, departments, and teams to form new resources called IT-enabled resources (Nevo and Wade 2011, 2010), for example, digital business capabilities (Kohli and Grover 2008) and business analytics-enabled customer relationship management processes (Someh et al. 2019). These new resources (i.e., 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 is the source of an IT-enabled resource's ability to achieve organizational tasks. For instance, Nevo and Wade (2011) demonstrate how the synergistic combination of an IT asset and a customer relationship management unit produces the strategic potentials needed to drive operational and strategic performance. Similarly, Someh et al. (2019) demonstrate how the synergistic combination of business analytics and other organizational resources led to the derivation of IT benefit.

However, because IT assets are not automatic generators of IT benefits, that is, organizations much synergistically combine IT assets with complementary resources and use the IT assets to perform tasks to derive IT benefits, organizations do face challenges in deriving and sustaining the derivation of IT benefits (Melville et al. 2004; Wade and Hulland 2004). Therefore, in this dissertation, we pursue knowledge on sustaining IT benefits from two perspectives. First, we study the literature on post-implementation and post-adoption use of IT and second, we leverage relevant theories to understand the structural properties of an IT-enabled resource that may influence the renewal of IT-enabled resources to address shifting goals.

[1] Wade and Hulland (2004) define resources as "assets and capabilities that are available and useful in detecting and responding to market opportunities or threat" (2004, p. 109)
[2] Wade and Hulland (2004) define assets as "anything tangible or intangible the firm can use in its processes for creating, producing, and/or offering its products (goods or services) to a mark" (2004, p. 109)

2.2 Post-Implementation and Post-adoption Use of IT

2.2.1 Post-implementation Use of Traditional IT

When an organization implements an IT, the organization expect users to actively use the IT to perform their work tasks, however, users sometimes abandon, misuse or underutilize the IT (Bagayogo et al. 2014; Jones et al. 2008). Users' IT use behaviour during post-implementation of an IT is very important to organizations because IT benefits depend on active use of the IT (Hornyak et al. 2020; Maruping and Magni 2015). Literature shows that organizations usually observe a performance dip after implementing an IT (Saeed et al. 2010); and that, for an organization to start realizing performance gains from its investment in IT, the IT should have been actively used for a duration well beyond the initial adoption of the IT(Limayem et al. 2007; Maruping and Magni 2015; Stein et al. 2015). The duration depends on the type of IT investment and the benefit that is anticipated. Benefits from operational IT may manifest in a year, whereas benefits from strategic IT may manifest after two to three years (Kohli and Sherer 2002; Sabherwal and Jeyaraj 2015).

Several researchers have studied IT use during post-implementation. Following Jasperson et al (2005)[3], we define IT use during post-implementation as *the applications that a user makes of the original features or extended features of an IT application to accomplish work tasks after the IT application has been installed and made accessible to the user*. Researchers explore several theories including identity theories (e.g., Carter et al. 2020), proactive behaviour theory (e.g., Rahrovani and Pinsonneault 2020), job demands-resources model (e.g., Ke et al. 2021), psychological attachment theory (e.g., Lu et al. 2020), expectation disconfirmation theory (e.g., Bala and Bhagwatwar 2018), and situated learning theory (e.g., Chadhar and Daneshgar 2018) to explore the IT use behaviours of users during post-implementation. Several research methods and designs have been used to explore the IT use behaviours of users during post-implementation of IT. Whereas some studies explore longitudinal design through, for example, field studies (e.g., Maas et al. 2018; Sykes 2020; Sykes et al. 2014), and case studies (e.g., Bagayogo et al. 2014; Chauhan and Gupta 2020; Stein et al. 2015), others employ cross-sectional design mostly through surveys (e.g., Lu et al. 2020; Mishra et al. 2012; Rahrovani and Pinsonneault 2020) to study IT use during post-implementation.

IT use during post-implementation is frequently measured, especially in quantitative studies, with proxies such as frequency or duration of use (Venkatesh et al. 2008, 2011), amount of gigabit of RAM storage space used (e.g., Retana et al. 2018), the intensity of use (e.g., Nwankpa and Roumani 2014; Ruivo et al. 2014), and the number of employees using IT (e.g., Ruivo et al. 2014). Also,

[3] Jasperson et al (2005) defines post-adoptive behavior as "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 use, and applied by the user in accomplishing his/her work activities" (2005, p. 531).

see Burton-Jones and Straub Jr (2006) for a list of proxy measures for IT use. To enhance our understanding of IT use beyond the usual proxies, scholars have expressed the need to reconceptualize IT use. For instance, Burton-Jones and Straub (2006) propose that the conception of IT use for each study should cover elements of the user, IT, and task to the extent appropriate for the study (e.g., see Bala and Bhagwatwar 2018; Sykes and Venkatesh 2017). Other researchers have also considered different forms of IT use behaviours during post-implementation including, routine use (e.g., Tong et al. 2015), innovative use (e.g., Li et al. 2013), extended use (e.g., Hsu et al. 2015), and adaptive use (Sun 2012).

Research on IT use during post-implementation has also identified several factors that influence IT use. These factors include things related to the IT, work task, the user, group of users, the organization, and the institutional environment of the organization. Factors relating to IT include ease of use (Stein et al. 2015), helpfulness (Lankton et al. 2014), and efficiency (Ruivo et al. 2014). Factors that relate to work tasks include job/task autonomy (Liang et al. 2015), task variety (Liang et al. 2015), and task interdependence (Jarvenpaa and Staples 2000). Factors that relate to individuals include expectations (Veiga et al. 2014), IT skills (Auer 1998; Brown et al. 2002), and habit (Limayem et al. 2007), whereas factors that relate to user groups include group empowerment (Maruping and Magni 2015) and group social capital (Sasidharan et al. 2012). Organization-level factors include organizational trust and mindfulness (Nwankpa and Roumani 2014), and control (Maas et al. 2018). Institutional level factors include competition (Ruivo et al. 2014), and normative pressure (Tong et al. 2008; Vaast and Walsham 2009).

Despite the rich literature on the factors that influence IT use during post-implementation, the factors are split across several individual publications. Further, in the current literature, IT use and its antecedents are treated as though they are static phenomena. Several factors that influence IT use may be emergent rather than static, that is, they change with time. For instance, self-efficacy can influence IT use (Brown et al. 2002) at one point, and IT use can in turn influence self-efficacy (Walsh et al. 2016) at another point, depicting the dynamic relationship between IT use and its antecedents. Similarly, the complexity of an IT may influence the initial adoption of the IT. However, as users engage in learning and adaptation activities, they may build skills that reduce their perception of the complexity of the IT, thus increasing adoption and use; or they may engage in adaptation activities that further increase the complexity of the IT, thus plunging IT use over time.

In this dissertation, we seek to collate and integrate knowledge on the forms and antecedents of IT use during post-implementation, and to explore the dynamic relationship between IT use and its antecedents.

2.2.2 Post-adoption Use of Mobile Apps

2.2.2.1 Mobile Apps

Mobile apps are "a type of application software designed to run on a mobile device such as a smartphone or tablet computer" (Techopedia 2018). They were initially designed as usually small software units with limited and isolated functions which provide users with specific services (Techopedia 2018). Mobile apps are either native, running on a specific mobile operating system, or web-based, running via a browser. The ubiquity and fast penetration rates of mobile devices have increased the adoption and use of mobile apps.

Statistics show that there were 218 billion mobile apps downloads globally in 2020 (Statista 2021) and that in each of the three months of the second quarter of 2020, users collectively spent on average about 200 billion hours using mobile apps (Iqbal 2020). Mobile internet traffic represents 55.64% of total online traffic (Statista 2021). In 2019, mobile apps revenue from paid downloads and in-app adverts reached 462 billion US dollars and is projected to increase to 935.2 billion US dollars in 2023 (Statista 2021).

Apart from being used as games, mobile apps have gained popularity in almost every aspect of our life, for example, commerce (Chopdar et al. 2018), banking (Munoz-Leiva et al. 2017), healthcare (Kim et al. 2019), travel (Li and Liu 2014) communication (Oghuma et al. 2015), dating (Jung et al. 2019), tourism (Gibbs et al. 2016) and higher education (Alraimi et al. 2015). In higher education in particular, mobile apps have been widely applied especially in the area of mobile learning to provide users with ubiquitous access to learning materials and other resources (Motiwalla 2007; Teri et al. 2014). For instance, mobile learning has gained tremendous popularity since the beginning of the year 2020 because of the COVID-19 pandemic which makes virtual access to educational resources the new normal. In September 2019, over 29% of android users used educational mobile apps. As of March 2021, the educational mobile app category was the third most popular category of mobile apps in the Apple app store after games and business categories which were in the first and second positions, respectively (Statista 2021).

The several applications of mobile apps and the advanced capabilities of recent mobile devices have influenced the structure and functionalities of mobile apps. Mobile apps nowadays offer several features (Gibbs et al. 2016; Ho and Syu 2010) which allow users to engage in transactions, work, entertainment, and to communicate (Nickerson et al. 2013). Features of a mobile app are "the building blocks or components of" the mobile app (Griffith 1999, p. 473). The features of a mobile app provide the occasion for sensemaking about the use of, and the tasks that can be performed with, the mobile app (Burton-Jones and Gallivan 2007; Griffith 1999). Mobile banking apps, e.g., Nordea Mobile (Nordea Bank Abp 2020) has features that allow users to make bank transactions, manage e-invoices, apply for and make changes to loans, manage debit and credit cards, manage savings and investments, and contact customer service (also see Oliveira et al. 2014). Features of travel mobile apps allow user to book tours and tickets, find

locations and keep travel diaries. WeChat has features that allow users to engage in video conferencing, e-commerce, location sharing, and business-to-business transactions. Mobile apps are departing from their earlier form that consisted of one or two features (e.g., basic timers, and simple games like Nokia's iconic *snake*) to more sophisticated forms that consist of several features to allow users to perform a wide range of tasks in various use contexts. We refer to mobile apps with two or more features as *multi-feature* mobile apps.

Despite the high download rates, the many hours that users spend using mobile apps, and the high mobile internet traffic, user retention is low and on the decline. In 2019, only about 32 percent, a six percentage point drop from the previous year, of users returned to a mobile app 11 times or more (Statista 2021). Mobile app retention statistics in August 2020 show that few mobile apps categories have retention rates after 30 days between 10.2 percent to 13.4 percent. All other categories including education (2.5 percent), communication (6.0 percent), and medical (3.5 percent) have retention rates after 30 days below 10 percent (Statista 2021).

Users tend to easily abandon or discontinue using a mobile app because of several reasons including low cost of acquisition, availability of alternatives, and trialability of mobile apps (Parthasarathy and Bhattacherjee 1998; Salo and Makkonen 2018). Users usually do not even complain, they rather find it easier to switch when they are dissatisfied with a mobile app (Salo and Makkonen 2014).

Mobile service providers are concerned by the low and declining retention rates because profitable service provisioning depends on an effective subscriber-base and post-adoption use of mobile apps (Bhattacherjee 2001; Parthasarathy and Bhattacherjee 1998). Besides, acquiring new customers is usually more expensive than retaining existing customers (Parthasarathy and Bhattacherjee 1998). Further, discontinuers could generate negative interpersonal influence, e.g., through negative word of mouth, that triggers further discontinuance and obstruct new adoption (Parthasarathy and Bhattacherjee 1998). The low adoption rates and their effect on the success of mobile services make research on the adoption and use of mobile apps, especially the post-adoption use behaviour of users, important.

2.2.2.2 Research on Post-Adoption Use of Mobile Apps

In this subsection, we briefly discuss research on mobile apps adoption and post-adoption use of mobile apps. We focus on the theories, research methods, and unit of analysis employed in research on the post-adoption use of mobile apps. TABLE 6 in Appendix provides a summary of research on the post-adoption use of mobile apps.

Scholars have studied the adoption and post-adoption use of mobile apps from different theoretical perspectives. Mostly, the expectation confirmation theory and its derivative, and the information systems continuance model, are the most widely used theories to study the post-adoption use of mobile apps (Bhattacherjee 2001; Bhattacherjee et al. 2008; Thong et al. 2006). Other theories

that are frequently used include the technology acceptance model (TAM) (e.g., Groß 2015; Lai and Lai 2014), UTAUT (e.g., Gupta et al. 2020; Oliveira et al. 2014), UTAUT2 (e.g., Chopdar et al. 2018; Yu 2012), task technology fit theory (e.g., Lin 2012), theory of planned behaviour (e.g., Kim 2010; Lee 2010), innovation diffusion theory (e.g., Parthasarathy and Bhattacherjee 1998), IS success model (e.g., Lin and Wang 2012; Zhou 2011), and service quality theories (e.g., Hsiao 2018; Kim et al. 2019).

Apart from a few (e.g., Jung et al. 2019), research on the adoption and use of mobile apps relies heavily on cross-sectional designs. We suggest two plausible reasons for the heavy reliance on cross-sectional designs. Firstly, research on post-adoption use of mobile apps has focused mainly on continuance intention and rarely on actual continuance use which warrants studying the actual use behaviour of a user over a period. Secondly, research on the post-adoption use of mobile apps has rarely focused on the nuances of how users use the various features of mobile apps.

Usually, research on mobile app use studies whether users use or intend to use (or continue using) a certain mobile service (Groß 2015; Yu 2012), mobile apps in general (Tam et al. 2020), or a specific mobile app (Alraimi et al. 2015; Jung et al. 2019) without considering the attributes of the user, mobile app, or task (see Burton-Jones and Straub Jr 2006). For instance, continuance intention is usually measured by items like "I intend to continue using mobile apps (or mobile service) rather than discontinue its use" (e.g., Bhattacherjee 2001; Koohikamali et al. 2019). Few studies have highlighted elements of tasks in constructing the measure of mobile app use (e.g., Jung et al. 2019) or intention to use (e.g., Lin 2012; Lin and Wang 2012). For instance, Lin and Wang (2012)'s conception of continuance intention includes the intention to use an e-learning system to gather knowledge, construct knowledge, share knowledge, and prepare course work. Similarly, Jung et al. (2019)'s measure of mobile app use includes the use of dating apps to search and view profiles, send and receive matches, send and receive messages, and send and receive votes (or likes).

Nevertheless, unlike research on post-implementation use of traditional IT, research on post-adoption use of mobile apps has made little progress in studying factors that inform how users select, use, reshuffle, or discontinue the various features of a mobile app. In this dissertation, we explore an intricate understanding of the post-adoption use of multi-feature mobile apps.

2.3 Structural Properties and Renewal of IT-enabled Resources

At the strategic level, factors such as the turbulence of the business environment (e.g., competitor actions), the life cycles of products and services, and the life cycles of resources, can influence the sustainability of strategic performance (e.g., competitive advantage) derived from a strategic resource (Helfat and Peteraf 2003; Kettinger et al. 1994). Research shows that competitive advantage, especially in dynamic environments, is temporal, and that a firm can approach

sustained competitive advantage by gaining a series of temporary competitive advantages or successive competitive advantages (Sirmon et al. 2010, 2011). In that regard, organizations need to continually innovate and reconfigure their resources to address changes in the environment and goals of the organization (Eisenhardt and Martin 2000; Helfat and Peteraf 2003; Kettinger et al. 1994; Sirmon et al. 2011; Wade and Hulland 2004). One of such resources is IT-enabled resources (Nevo and Wade 2011; Someh et al. 2019).

Because IT-enabled resources, rather than IT assets, are the unit for deriving IT benefits, organizations and users engage in efforts to integrate IT assets and other organizational resources to form IT-enabled resources. Research has shown that integrating IT assets and other organizational resources lead to the derivation of IT benefits which include operational and strategic benefits (e.g., Nevo and Wade 2011; Someh et al. 2019). However, research has shown that the integration needed to form IT-enabled resources from which organizations and users derive IT benefits can also constrain the renewal of IT-enabled resources in pursuit of emerging goals thus derailing the derivation of IT benefits especially in dynamic environments (Nan and Tanriverdi 2017; Saraf et al. 2013; Wade and Hulland 2004). In other words, integration leads to the formation of synergy but can also impede the renewal of synergy.

Further, in the strategic management literature, research shows that the alignments needed to create synergy make resources whose value depends on complementarity or synergy particularly vulnerable to environmental disruptions because of the high likelihood that their synergy will be disrupted by misalignments (Le Breton-Miller and Miller 2015). In line with findings in the strategic management literature, IS research on IT benefit has also shown that factors such as environmental turbulence and ambivalence can derail synergy making IT benefit short-lived (Wade and Hulland 2004). Therefore, to sustain the derivation of benefits from resources whose value depends on synergy, organizations need to continually reconfigure or renew the resources creating new synergies or "shifting synergies" with which they can attain emerging goals (Eisenhardt and Martin 2000, p. 1107).

Some researchers have taken an organizational capability view to the renewal of resources and have suggested that by possessing certain capabilities, an organization can renew and redeploy its IT resources together with other resources to meet new organizational goals and strategies. These organizational capabilities include 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). However, research shows that the nature of a resource (e.g., deployment flexibility) can enable or constrain the ability of an organization to renew and redeploy the resource to address new strategic imperatives (Le Breton-Miller and Miller 2015; Sirmon et al. 2008). Therefore, although we acknowledge the importance of organizational capabilities, e.g., dynamic capabilities, in renewing organizational resources, we focus on the structural properties of IT-enabled resources and how they affect the renewal and redeployment of IT-enabled resources.

In this dissertation, we adopt Nevo and wade (2010,2011)'s conception of IT-enabled resources and concentrate on the systems end of the model to explore the structural properties of IT-enabled resources. We draw on general systems theory (Ackoff 1971; Kast and Rosenzweig 1972), loose coupling theory (Orton and Weick 1990; Perrow 2011), and social network theory (Freeman 1978; Friedkin 1991) to understand the nature of the internal structures of IT-enabled resources that can affect the renewal of IT-enabled resources to address shifting goals. These theories were not arbitrarily chosen; we chose them based on a review of published cases on post-implementation changes (see Article III).

The three theories complement each other in conceptualizing the structural properties of IT-enabled resources. General systems theory highlights the composition (i.e., components) of IT-enabled resources and the existence of interactions that lead to the formation of synergy among the components. However, it does not explicate the number and nature of links along which such interactions happen between components. Loose coupling theory complements general systems theory in that, it explicates the nature and number of links between any two components and their implication for the efficiency (e.g., synergy), and effectiveness (e.g., ability to change) of the component combination. However, from the published cases we reviewed (see Table 9 in Appendix), hardly do IT-enabled resources consist of only two components. We, therefore, draw on social network theory to understand how several components are linked together in a network and the implications of the network positions of the components for synergy formation and the ability to change. That is, whereas loose coupling theory looks at the type and number of links between two components, social network theory explores the number of links between a focal component and other components within a network. Thus, the three theories together provide a comprehensive theoretical base to conceptualize the structural properties of IT-enabled resources. We briefly discuss each of the theories in the following subsections.

2.3.1 General Systems Theory

A system consists of at least two elements or components that are interconnected and react with each other (Ackoff 1971; Kast and Rosenzweig 1972). Without the interconnection and reaction, there is no system (Ackoff 1971). In essence, each component of a system should be connected to and interact with at least one other component of the system (Ackoff 1971). Though each component of a system may have its role or function and may be a system on its own (i.e., a subsystem), the total function of the entire system is of interest to system theorists. A holistic view of systems suggests that a system is more than the sum of its parts (Ackoff 1971; Kast and Rosenzweig 1972). That is, as parts interact, they do so in ways that synergistically enhance the abilities of each part or form composite abilities that are more than the abilities of the individual components put together (Ackoff 1971).

Systems can be closed or open, and static or dynamic (Ackoff 1971; Kast and Rosenzweig 1972). A closed system has an impermeable boundary that shields

the internal operations of the system from the system's environment (Ackoff 1971; Kast and Rosenzweig 1972). An open system on the other hand has a permeable boundary that allows the system to exchange resources with, influence and be influenced by, its environment (Ackoff 1971; Kast and Rosenzweig 1972). Organizations (or firms) and their components (e.g., resources) typify open systems (Kast and Rosenzweig 1972). Resources (e.g., IT-enabled resources) that are formed from the combination of other resources can have synergy when their components are themselves open systems that allow interactions across their boundaries (Ackoff 1971; Chatterjee et al. 2021). Without such interactions across permeable boundaries, there will be no synergy nor changes (i.e., reactions, and responses) in one component in relation to the other. A static system is a system in which no event occurs and therefore "displays no change of structural properties" or state (Ackoff 1971, p. 663). A dynamic system is a system in which events occur and whose state changes over time (Ackoff 1971; Kast and Rosenzweig 1972). Dynamic systems change in pursuit of an outcome (e.g., maintaining a state, seeking a goal or multiple goals) or in being purposeful (Ackoff 1971). That is, dynamic systems change in response to their external or internal environments to produce an existing outcome or to craft and pursue a new outcome via existing or new means.

Organizations are purposeful in the exploration and exploitation of at least some of their resources, including IT-enabled resources (O Reilly and Tushman 2004; Scott and Davis 2016; Sirmon et al. 2011). To allow organizations to do so, IT-enabled resources should be open and dynamic systems capable of adapting to different conditions to remain relevant in attaining shifting organizational goals. Each component of an IT-enabled resource must thus be adaptable or be able to change itself or induce change in its environment to attain existing or new organizational goals. The extent of change will however depend on the goal, and the potential and structural properties of the IT-enabled resource. When the current potential or synergy of the IT-enabled resource can attain the new goal, little changes may be needed. The change will get more prominent as the new goal goes beyond the current potential of the IT-enabled resource. For instance, consider an IT-enabled teaching process (e.g., a synergistic combination of an IT asset, e.g., Zoom or Teams, and teaching processes) that has the capability to host 200 students. If the new goal is to host less than 200 students, there may be no apparent changes needed. However, if the new goal is to host more than 200 students, then the components of the IT-enabled teaching processes will have to change to meet the new goal. The components of an IT-enable resource include IT assets and other resources e.g., processes, departments, and teams (Nevo and Wade 2011, 2010).

Renewal of an IT-enabled resource to address current or new goals will therefore require changes to IT assets and other resources (Baird et al. 2017; Leonardi 2011; McGann and Lyytinen 2008; Nevo et al. 2016; Orlikowski 1996; Robey et al. 2002). We refer to the extent to which the individual components of an IT-enabled resource can change to attain existing or new goals as *component flexibility*.

2.3.2 Loose Coupling Theory

According to loose coupling theory (Orton and Weick 1990), the type of coupling describes the number and strength of connections or interdependencies among the components that form an IT-enabled resource. When the components are closely connected such that they are indistinctive yet responsive to each other but not to external forces, the components are tightly coupled (Orton and Weick 1990). Tightly coupled components have less variance, e.g., in routines and use of resources, and thus support efficiency (Berente et al. 2008). However, tightly coupled components may also pose high constraints when management needs to separate (i.e. *uncouple*), reconfigure and redeploy the components in a different context, e.g. in pursuit of a new strategic goal (Orton and Weick 1990). Thus, though tightly coupled resources generally lead to efficiency (Berente et al. 2008), they can as well hamper autonomy, agility, and effectiveness (Berente et al. 2008; Marabelli and Newell 2010).

Components that are only loosely connected such that they retain their distinctiveness, and are not responsive to each other, are said to be *coupled* (Orton and Weick 1990). A case in point is the actions of project managers who obtained data from an ERP via a business warehouse and locally processed the data using a spreadsheet to meet their project budgeting needs (Berente et al. 2016). Because *coupled* components have weak interdependencies and are not responsive to each other, the components may evolve indiscriminately. Azad and King (2012) provide an example of a coupled IT asset and work processes for tax administration which resulted in indiscriminate evolution of the IT asset and work processes. Thus, coupled components enable change and can lead to optimizing individual components at the expense of optimizing the IT-enabled resource as a whole (Orton and Weick 1990).

When components are both tightly and loosely connected such that they retain their distinctiveness, and yet are responsive to each other and external forces, the components are said to be loosely coupled (Orton and Weick 1990). In other words, components that are loosely coupled have tight links and loose links between them. Loose coupling is thus not the absence of tight links but the existence of both tight and loose links between any two components (Berente et al. 2008). For example, though institutionally, departments in a university may be loosely connected and independent of each other, individuals from the different departments may form tight relationships (Rubin 1979). Loosely coupled components handle an external change either by neutralizing or assimilating the change (Orton and Weick 1990). The tight links provide stability or persistence, whereas the loose links provide a buffer to neutralize the change, and also provide the opportunity for experimentation, learning, and adaptation to assimilate the change (Orton and Weick 1990). Loosely coupled components are thus more open to changes than tightly coupled components are (Scott and Davis 2016, p. 86). Loosely coupled components may thus lead to stability, flexibility, effectiveness, autonomy, and resilience to risk (Berente et al. 2008; Marabelli and Newell 2010; Orton and Weick 1990).

It is worth noting that generally, there is no one type of coupling that is preferable for all component combinations (Berente et al. 2008). Besides, multiple types of coupling can exist among the components of an IT-enabled resource (Scott and Davis 2016, p. 94). For instance, a digital platform can have a stable core, consisting of tightly coupled components, that is controlled by a platform owner, and dynamic interfaces that allow several actors to contribute modular components, e.g., plugins and APIs, that are *loosely coupled* to provide platform services (Cusumano 2010; Gawer and Cusumano 2008, 2014; de Reuver et al. 2018).

The types of coupling that exist among the components of an IT-enabled resource will influence the renewal of the IT-enabled resource by enabling or constraining the rearrangement or reconfiguration of the components of the IT-enabled resource. We refer to this structural property as *component coupling* which we define as the number and strength of interdependencies or interactions that exist among the components of an IT-enabled resource.

2.3.3 Social Network Theory

Social network theory explains the influence and gains of a focal actor within a network of actors in terms of the actor's links to other actors within the network (Freeman 1978; Friedkin 1991). A network consists of actors (represented as nodes) and ties (represented as links) between the actors (Borgatti and Ofem 2010; Liu et al. 2017). Apart from its use in studying the effect of social actors in social networks, e.g., advice-giving and advice-seeking networks (e.g., Sykes et al. 2009), the social network theory, especially the concept of *centrality*, has been applied in several other contexts. For example, it has been used to study organizational performance within inter-organizational networks (Ferriani and MacMillan 2017; Hoffman et al. 1990; Williams 2005), open-source software development processes (Madey et al. 2002), the vulnerability of components in cyber-physical systems (Umunnakwe et al. 2021), and electrical power transmission systems (Cadini et al. 2008). Generally, the centrality of a unit (or component) refers to "its summed connections to others" (Bonacich 1987, p. 1172). A component that is connected to several other units or components has high centrality, whereas a component that is connected to a few other units or components has low centrality. The extent of centrality is a spectrum and can have several forms of measures depending on the focus of a study (Freeman 1978; Landherr et al. 2010).

Centrality is usually associated with positive effects. High centrality can lead to influence (Burkhardt and Brass 1990; Sykes et al. 2009), improved access to information (Vardaman et al. 2012), resource leveraging (e.g., Kohli and Devaraj 2004; Tanriverdi 2006), and organizational performance (Ferriani and MacMillan 2017). However, centrality can also have negative implications. For instance, the high centrality of a component may increase the risk and vulnerability associated with the component (Cadini et al. 2008; Umunnakwe et al. 2021). Organizations with high centrality may also experience a decline in performance because of the cognitive cost of maintaining several links (Ferriani

and MacMillan 2017). Within innovative networks, increasing centrality aids innovation up to a point beyond which it tends to hurt innovation (Dong et al. 2017). In terms of change, actors with high centrality may be imprisoned in "maladaptive situations" or forced to exhibit undesirable behaviour (Borgatti and Foster 2003, p. 994). Similarly, there are usually high risks and costs associated with making changes to components with high centrality because of the possible disruptions that the change may cause to several other components (Saraf et al. 2013; Harrison and Easton 2002).

IT-enabled resources consist of a focal IT asset that is connected to other components (i.e., organizational resources which may include other IT assets). Connecting the focal IT asset to several resources (e.g., departments or functions) can lead to resource leveraging and performance (Nevo and Wade 2011; Tanriverdi 2006). However, connecting or integrating the focal IT asset with several resources can also lead to rigidity because of the cost and risk associated with making changes to the focal IT asset. Thus, the centrality of the components of an IT-enabled resource is a structural property that has implications for the renewal of the IT-enabled resource to address shifting goals. We refer to the number of components to which a focal component is connected as *component centrality*.

2.3.4 Structural Properties and Renewal of IT-enabled Resource

In this dissertation, we concentrate on the structural properties and renewal of IT-enabled resources. Detail discussions on how IT-enabled resources lead to IT benefits are outside the scope of this dissertation. We kindly refer the reader to Nevo and Wade (2011, 2010) for a detailed discussion on how synergy affords the IT-enabled resource strategic potentials, and how the strategic potentials lead to IT benefit. In this dissertation, we assume that an IT-enabled resource loses its strategic potential when its synergy is disrupted, or its strategic potential is not adequate for achieving existing or new goals and that the strategic potential can be restored by realigning or reconfiguring the components of the IT-enabled resource to create new synergy relevant for the existing or the new organizational goal. We thus focus on how the structural properties of an IT-enabled resource can enable or constrain the ability of an organization to renew its IT-enabled resource.

FIGURE 2 attempts to improve the use of Nevo and Wade (2011, 2010)'s conception of IT-enabled resources with the structural properties of an IT-enabled resource. Drawing on general systems theory (Ackoff 1971; Kast and Rosenzweig 1972), loose coupling theory (Orton and Weick 1990), and social network theory (Freeman 1978; Friedkin 1991), we suggest that the structural properties of an IT-enabled resource consist of component flexibility, component coupling, and component centrality and that the structural properties influence the renewal of IT-enabled resources to sustain the derivation of IT benefits especially in dynamic environments.

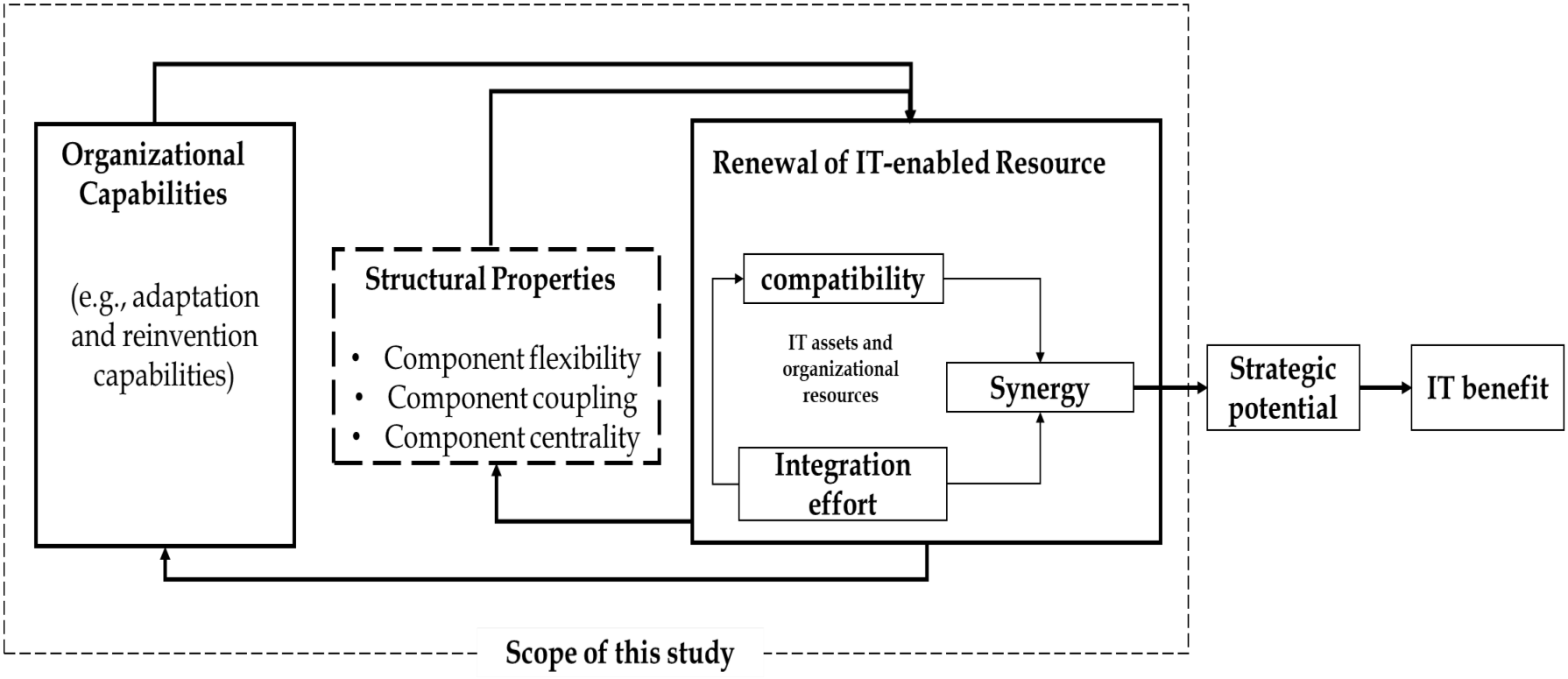

FIGURE 2 An attempt to improve IT-enabled resource formation model with the structural properties of IT-enabled resources

3 RESEARCH METHODOLOGY

In this chapter, we briefly discuss the ontological and epistemological assumptions that informed our choice of research methods. Further, we provide a detailed explanation of the various research methods employed in the articles included in this dissertation.

3.1 Selection of Research Methodology

Research methodology does have underlying ontological and epistemological assumptions. Ontological assumptions reflect the "essence of phenomena under investigation" (Orlikowski and Baroudi 1991, p. 8). They are concerned with thoughts about whether our physical and social world objectively exists irrespective of humans or that they subjectively exist only because humans create and recreate them (Orlikowski and Baroudi 1991). Epistemological assumptions reflect how we can acquire and evaluate valid knowledge about our physical and social world (Hirschheim 1985; Orlikowski and Baroudi 1991). One epistemological assumption is that knowledge about our world can be objectively studied and the other is that knowledge about our world is socially constructed and dependent on the researcher and social others who construct and make sense of our world (Orlikowski and Baroudi 1991).

The information systems community adopts multiple research approaches. Each approach subscribes to a mix of epistemological and ontological beliefs (Landry and Banville 1992; Orlikowski and Baroudi 1991; Weber 2004). Leading among these research approaches are the positivist and interpretivist approaches (Orlikowski and Baroudi 1991). However, the critical realist approach which generally adopts ontological views from positivist and epistemological views from interpretivist is on the increase in IS research (Mingers 2001; Mingers et al. 2013).

The positivist approach holds the ontological belief that our physical and social world objectively exist independent of humans, and the epistemological

view that knowledge of our world can be objectively obtained without being tainted by social actors who create and make sense of our world (Klein and Myers 1999; Orlikowski and Baroudi 1991). The positivist approach thus pursues law-like knowledge engendering disregards for historical and contextual conditions that create a phenomenon or inform human action (Orlikowski and Baroudi 1991). This approach favours research methods like surveys and experiments in pursuit of deterministic correlations and unidirectional causations (Lee 1991; Orlikowski and Baroudi 1991). In the IS research community, the positivist approach is dominant at least among top IS journals (Mingers 2003; Vessey et al. 2002).

The interpretivist approach ontologically believes that phenomena in our social world are subject to the social actors who create or make sense of them (Klein and Myers 1999; Orlikowski and Baroudi 1991). Epistemologically, the interpretivist approach asserts that our knowledge of the world is subjective and is influenced by social actors and interactions among social actors (Klein and Myers 1999; Orlikowski and Baroudi 1991). Research methods explored by the interpretivist approach include field studies (Klein and Myers 1999; Orlikowski and Baroudi 1991), hermeneutics, phenomenology, and case studies (Lee 1991; Orlikowski and Baroudi 1991).

Positivist and interpretivist world views each have their strengths and weaknesses (Orlikowski and Baroudi 1991). They also share a common weakness of either predicting or explaining the status quo (Orlikowski and Baroudi 1991). Scholars who exclusively align to either positivist or interpretivist view tend to criticize the other view and endorse the prevalence of a single world view (Weber 2004). Some scholars accept the co-existence of the two world views and acknowledge the strengths of each view and how the two world views can thrive in different research settings, answer different research questions, and even complement each other (Lee 1991).

A growing research approach that seeks to abate the weakness of positivist and interpretivist world views is the critical realist view. Critical realism partly agrees (and disagrees) with the ontological and epistemological assumptions held by positivists and interpretivists. Though critical realists believe that reality is produced and reproduced by social actors, they also believe in the existence of objective structures, whether observable or unobservable (Mingers 2003), that shape human experiences and behaviour (Orlikowski and Baroudi 1991). Those who hold this view believe that social actors can "consciously act to change their social and economic conditions. They do, however, recognize that human ability to improve their conditions is constrained by various forms of social, cultural, and political domination as well as natural laws and resource limitations" (Klein and Myers 1999, p. 69). Critical realism thus seeks to understand how structures and human experiences and behaviour are historically constructed and to unravel the reciprocal relationship among structures, and human experiences and behaviour (Klein and Myers 1999; Mingers 2004; Orlikowski and Baroudi 1991). Unlike positivist and interpretivist views that predict and explain the status quo (Orlikowski and Baroudi 1991), the critical realist view "wants to get beneath the surface to understand and explain why things are as they are, to

hypothesise the structures and mechanisms that shape observable events."(Mingers 2004, p. 20). In this regard, although critical realism welcomes multiple methodologies, critical realists often adopt interpretive methods (e.g., in-depth case studies) rather than positivist methods (e.g., surveys) because of their quest to offer in-depth explanations of structures and mechanisms that underpin observable events (Mingers 2004).

In this dissertation, we adopt a critical realist view and employ systematic literature reviews and in-depth case study methods. Specifically, we employ a systematic literature review method to synthesize the factors that influence IT use during post-implementation and to unravel the reciprocal relationship between IT use and its antecedents and how the relationship evolves over time. We also employ a systematic literature review of published empirical cases on post-implementation changes to explore the structural properties of IT-enabled resources. We use one in-depth case study to explore the intricate realities of the post-adoption use of multi-feature mobile apps. We employed another to explore the structural properties that emerge during the formation of IT-enabled resources and how the structural properties constrain or enable the renewal of IT-enabled resources to meet emerging strategic imperatives. We explain the research methods in the subsections that follow.

3.2 Systematic Literature Review

Systematic literature reviews enable the synthesis of dispersed knowledge on a subject into a coherent view of the subject (Rowe 2014; Schwarz et al. 2007; Webster and Watson 2002). Thus, a systematic literature review provides the opportunity to synthesize findings from empirical research on IT use during post-implementation to form a coherent view of how IT use and its antecedents evolve during post-implementation. Similarly, it is suitable for exploring prior empirical research on post-implementation changes to form a nuanced understanding of the structural properties of IT-enabled resources.

Following Webster and Watson (2002), we 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". A first literature search was done between 7th to 10th July 2018. "Post Implementation" was used as the search term because the literature search was meant to serve two studies (i.e., Articles I and III) dealing with how users interact with IT during post-implementation. Also, we did not prefix "Post Implementation" with keywords such as IT, IS and IT use because by searching through IS journals and libraries we assume discussions on post-implementation will mostly relate to IT. However, because Google Scholar contains research articles from several disciplines, we used the search term "Post Implementation" AND "Information Technology" to improve the relevance of the results to the study. The search result reduced from 55,400 to 17,258. We made other database-specific adjustments to improve the relevance of the articles that were returned. For

example, in the AIS e-Library, we searched for only peer-reviewed articles. Research articles from MISQ and JAIS were obtained from the AIS e-library. 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. Attributes, including the title, author names, publication outlet, and year of publication of each article, were extracted and stored in a spreadsheet application file. In Google Scholar, we extracted and stored the attributes of articles in the first 30 tabs (300 results) of the search results. In total, attributes of 2384 articles were extracted and stored (see TABLE 1). Thereafter, the articles were screened for each of the two studies. We discuss the details below.

3.2.1 IT use During Post-Implementation

For this study, the title and abstract of each article were read to access the potential fit of each article. Empirical articles on IT use during post-implementation or post-adoption in an organizational context were selected for further reading. We excluded non-empirical articles, editorials, and articles written in other languages than English. All selected articles were read in full. Articles on the factors that influence IT use during post-implementation were retained. In total, 68 articles were retained from the first search (see TABLE 1).

To augment the list of 68 articles with more recent articles that were published after the initial search (see Lumor 2019a), an exploratory search was done in the AIS e-library and the basket of eight journals. Thirteen relevant articles were retrieved and included bringing the total number of articles to 81. FIGURE 3 illustrates the number of articles per year of publication.

TABLE 1 Article search and selection results

Journal	**No. of articles from search**	**Included (Initial/Additional)**	**Included (Total)**
EJIS	338	7/0	7
ISJ	190	3/0	3
ISR	324	12/1	13
JAIS	17	3/2	5
JIT	284	3/0	3
JMIS	357	6/0	6
JSIS	209	4/0	4
MISQ	66	11/2	13
AIS Elibrary (Others)	299	10/7	17
Google Scholar (17258)	300	9/1	10
Total	2384	68 /13	81

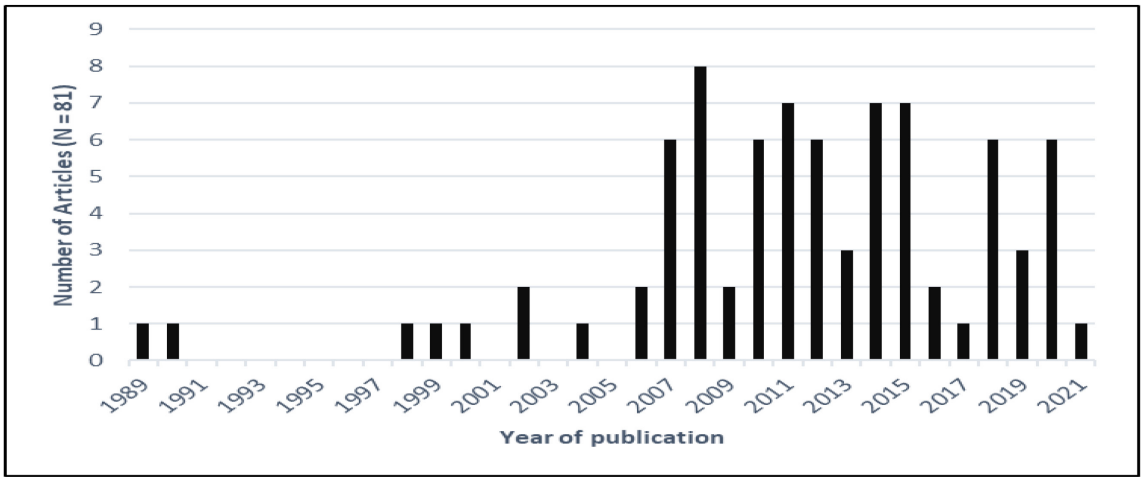

FIGURE 3 Distribution of articles by year of publication

Analysis of the Literature

We did not limit the analysis of the included articles to a particular theory. Rather, we allowed the framework consisting of concepts with which we analysed the literature (Rowe 2014; Webster and Watson 2002) to emerge whilst we read and coded the articles with the help of a spreadsheet. We read each article noting the type of IT use behaviour that was studied and the factors that influenced the IT use behaviour. Whilst we read each article, we categorized the IT use behaviours and the influencing factors. We iteratively refined the categorization until new findings resulted in no further refinement of the categories. Five categories of IT use behaviours and three categories of influencing factors emerged. The categories of IT use behaviours and influencing factors are discussed in the next subsection. We also recorded the research methods and theories employed by each article.

Categories of IT use Behaviour during Post-implementation

IT use during post-implementation is frequently measured, especially in quantitative studies, with proxies such as frequency or duration of use (Venkatesh et al. 2008, 2011), amount of gigabit of RAM storage space used (e.g., Retana et al. 2018), the intensity of use (e.g., Nwankpa and Roumani 2014; Ruivo et al. 2014), and the number of employees using IT (e.g., Ruivo et al. 2014). Although studies that employ these measures improve our understanding of the relationship between IT use and its antecedents, the relationships are seemingly static. In other words, they do little to elucidate the dynamics of how IT use and its antecedents evolve during post-implementation.

IT usually consists of several features with which users interact in diverse ways to accomplish their work tasks. The intricacies of how users interact with the various features provide a rich account of organizational realities regarding IT use. For example, although employees may appear to actively use IT (i.e., frequency, duration, and intensity of use), they may be using features in ways that do not improve their performance (e.g., Auer 1998). They may also use IT features to register their displeasure (e.g., Stein et al. 2015) or engage in

exploratory behaviours that are dysfunctional (e.g., Khoo et al. 2011). Conversely, users can engage in adaptation behaviours that improve their performance (e.g., Davison et al. 2019). Research suggests that users reshuffle the set of features as their work tasks change (e.g., Sun 2012) and as they gain more knowledge about the IT and its features (e.g., Benlian 2015). Apparently, user behaviours towards IT take many forms and different concepts have been used to describe IT use behaviours in the literature.

However, several studies, especially those that focus on finding a statistical correlation between IT use and its antecedents, treat IT as a unit paying less attention to the features that make up the IT and how users interact with the various features in completing their work tasks. They, therefore, miss the complex and dynamic organizational realities that surround IT use during post-implementation. Apart from using the usual proxies, correlation-based research may better serve our understanding of the organizational reality of IT use if it adopts methods and develops instruments for studying the various forms of IT use behaviours.

To enhance our understanding of the various IT use behaviours and to propel research towards unravelling the dynamics of IT use during post-implementation, this subsection provides a synthesis of the IT use behaviours present in the literature. We synthesise IT use behaviours along five perspectives (see TABLE 2**)**.

1. **Work tasks** perspective focuses on work tasks and how users accomplish their work tasks with an IT and its features.
2. **The learning/knowledge** perspective focuses on the users' knowledge of an IT and work tasks. It relates to how users employ their existing knowledge or engage in learning activities to acquire new knowledge in order to use IT in accomplishing their work tasks.
3. **IT features** perspective sheds light on how users extend and interact with the various features of an IT to accomplish work tasks.
4. **IT use obligations** perspective focuses on the IT use context and explicates IT use behaviours under conditions where users are mandated or not mandated to use an IT to accomplish their work tasks.
5. **The focal user** perspective focuses on the users of an IT and classifies IT use as **direct use** when a focal user by himself or herself uses the IT and **indirect use** when someone else uses the IT on behalf of the focal user.

The concepts that a researcher uses to describe IT use during post-implementation are influenced by the perspective of the researcher. TABLE 2 presents brief descriptions of the concepts used to describe IT use in the 81 empirical articles.

TABLE 2 Types of IT use discussed in the 81 empirical articles.

Perspective	Type and Brief Descriptions of IT use
Work task	**Routine use:** involves using an IT in a standardized manner to complete one's work task (Tong et al. 2015). Routine use is pre-intended and conforms to the standard task procedures and workflows embedded in the system (Maas et al. 2018). **Innovative use**: involves using an IT in a way that is not pre-intended, or in a "non-standardized" manner to enhance how effectively and efficiently one performs his/her work task (Li et al. 2013; Tong et al. 2015). Innovative use is also referred to as *infusion* (Maas et al. 2018) and may include changes to existing work tasks or the IT, or the creation of new work tasks and IT (Davison et al. 2019; Santhanam et al. 2007; Stein et al. 2015).
Learning / Knowledge	**Exploitative use:** involves using existing knowledge about work tasks and an IT in order to solve existing or new problems (Tong et al. 2015) **Explorative use:** involves gaining new knowledge (e.g., by experimenting with work tasks and IT features) to device new and innovative ways of doing existing work tasks (i.e. gaining efficiency) or addressing new challenges and opportunities (i.e. gaining effectiveness) (Tong et al. 2015)
IT Features	**Narrow use**: involves a user using a few of the IT features related to his/her work task, leaving other applicable IT features unused (Liang et al. 2015) **Extended use**: involves a user using several of the IT features related to his/her work task (Hsieh and Wang 2007; Hsu et al. 2015; Liang et al. 2015). The use of IT features can be **shallow** (general knowledge of IT features) or **deep** (mastery of IT features) (Benlian 2015). **Adaptive use:** reflects the dynamics in post-adoptive IT use behaviour. It refers to a user's active revision of the set of IT features that he/she uses and how he/she uses the IT features (Sun 2012). **Enhanced use:** refers to using IT features in novel ways and consists of; 1. using formerly unused sets of available IT features to perform current or additional work tasks; 2. using current IT features to perform additional work tasks; 3. extending IT features to perform current or additional work tasks (Bagayogo et al. 2014).
IT use obligation	**Voluntary use:** refers to when a user uses an IT to perform his/her work task although he/she is under no obligation to do so (Eriksen et al. 1999; Nwankpa and Roumani 2014). Voluntary use can take many forms including routine use, innovative use, explorative use, extended use, etc. **Involuntary (Mandatory) use:** refers to when a user uses an IT to perform his/her work task under direct obligations (e.g., IT use policies) (Liang et al. 2013), or indirect obligations (e.g., work tasks and IT are tightly fitted such that the user cannot perform his/her work task without using the IT) (Veiga et al. 2014). Under direct obligations IT use may be referred to as **appropriate use** (Liang et al. 2013), whereas under indirect obligations IT use may be referred to as **proficient use** (Veiga et al. 2014). **Appropriate use** and **proficient use** involve using IT features to accomplish work tasks in a manner that is "designed and intended by the designers and management" (Venkatesh 2006, p. 501).

	Thus, involuntary use is usually routine use (cf. Jasperson et al. 2005). Nevertheless, in involuntary, or mandatory use environments, users can engage in IT use behaviours that do not conform to IT use guidelines (**non-compliance use**), yet may be beneficial for users, the organization, and its customers (Davison et al. 2019).
Focal user	**Direct use:** is when a focal user, by himself or herself, interacts with and uses an IT to perform his/her work task (Auer 1998; Tong et al. 2008). **Indirect use:** is when the focal user engages another user (e.g., a subordinate or a co-worker) to use the IT to perform a work task on his/her behalf (Auer 1998; Tong et al. 2008). Auer (1998, p. 198) refers to indirect use as "delegation in use".

Factors that influence IT use during post-implementation

Each of the 81 articles studied a limited number of factors that influence IT use during post-implementation. As a result, there is missing a comprehensive view of IT use and the factors that influence it during post-implementation. To offer such a synthesis, we collate from the 81 articles the factors that influence IT use during post-implementation, and group them into three categories (see TABLE 7 in Appendix):

1. **Support structures** are the entities that are orchestrated to support IT use during post-implementation. Examples of support structures include IT-help desks (Santhanam et al. 2007), core teams (Robey et al. 2002), and peer-support networks (Auer 1998; Sykes et al. 2009).
2. **Support activities** consist of activities that are formally or informally enacted to support IT use during post-implementation. Examples include formal training (Eriksen et al. 1999; Ruivo et al. 2014), advice seeking and giving (Sasidharan et al. 2012; Venkatesh et al. 2011), and IT and work task adaptation (Bagayogo et al. 2014; Tong et al. 2015).
3. **Support properties** consist of the properties of organizational entities that support IT use during post-implementation. Organizational entities may refer to all the *things* (e.g., IT, users, workgroups, work tasks, functions, departments, programs, support groups, policies, and strategies) that constitute an organization and the overall organization itself (Van de Ven and Poole 1995). Examples of support properties include IT complexity (Liang et al. 2015), group empowerment (Maruping and Magni 2015), IT skills of users (Brown et al. 2002), organizational innovativeness (Roberts et al. 2016), and work task interdependence (Jarvenpaa and Staples 2000).

We note that most prior studies examine a few factors, mostly within one category of factors that influence IT use during post-implementation. For instance, Bagayogo et al. (2014) 's conception of ***enhanced use*** considered only support properties associated with IT, user, and work tasks. Maruping and Magni (2015) studied the effects of user and group-level support properties on IT use during post-implementation, and Nwankpa and Roumani (2014) studied the effect of organizational-level support properties (e.g., organizational trust and

mindfulness) on IT use during post-implementation. Similarly, some studies (e.g., Chang et al. 2011; Sykes et al. 2014) considered only support activities (e.g., post-implementation learning, workflow, and software advice seeking and giving). Further, others (e.g., Gallagher and Gallagher 2012; Sykes 2015) considered only support structures (e.g. centralised and distributed support teams, peer advice ties, and online support). Few studies (e.g., Häkkinen and Hilmola 2008; Liu et al. 2011; Santhanam et al. 2007) considered factors beyond one category. Thus, though extant research has done much to study the relations between factors, mostly within a category, it has done little to consider the dynamics that occur among the three categories of factors and how such dynamics influence IT use during post-implementation.

3.2.2 Structural Properties of an IT-enabled Resource

From the 2384 articles that we searched for (see Section 3.2), we selected relevant articles for this study. The title and abstract of each article were read. We selected empirical articles that employed case study research methods to explore post-implementation change or post-adoption change in an organizational context. We selected articles that employed case studies because such articles tend to offer rich descriptions of post-implementation changes and how the changes occur. We excluded non-empirical articles, editorials, and articles written in other languages than English. We then read all selected articles in full and retained articles that provided detailed narratives on how post-implementation changes were enacted. In total, we retained 20 articles (see TABLE 3). The 20 empirical articles were based on 18 distinct empirical cases.

TABLE 3 Summary of search results

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

Analysis of the literature

In line with earlier studies (e.g., Grabski et al. 2011; Huang and Yasuda 2016; Nevo et al. 2016), there are few research articles (especially, case study articles) on post-implementation change. However, a review of 18 distinct empirical cases on post-implementation changes, published mostly in the AIS senior scholars'

basket of eight, is adequate to explore a nuanced understanding of the structural properties of IT-enabled resources.

We read each of the empirical cases for the IT-enabled resource, the components of the IT-enabled resource, and the structural properties of the IT-enabled resource. Also, for each case, we provide a summary of how the structural properties influenced the renewal of the IT-enabled resource. TABLE 9 presents a summary of our review of the 18 published empirical cases on post-implementation change.

3.3 Case Study Research

We adopt the case study method because it enables the study of complex phenomena which are embedded in their contexts (Lee 1989; Yin 1981, 2012). A case study provides the opportunity to uncover the nuances and complex dynamics that underlie how phenomena (e.g., post-adoption use and structural properties) emerge within an organizational context (Eisenhardt 1989). Curry et al. (2009) assert that the case study method "can be useful when researchers are interested in looking beyond identified variables that are statistically linked with a desired effect to understand why a given intervention has a specific impact, how the impact occurs, and in what organizational context" (2009, p. 1443). This application of the case study method is in line with critical realism, the methodological assumptions adopted in this dissertation. Thus, two in-depth case studies are employed in this dissertation. One in-depth case study explores factors that influence how users adopt and use a multi-feature mobile app and how the influence occurs. Another in-depth case study unravels the roles that the structural properties of IT-enabled resources play in their renewal to address new organizational goals. We describe the two case studies in the subsections that follow.

3.3.1 Post-adoption Use of Multi-feature Mobile apps

Case Context

As part of its digitalization strategy, our case university (an international university in Finland) has three objectives. The objectives include the digitalization of educational learning, the digitalization of research, and the creation of a smart campus. In line with its objective to create a smart campus, the case university has planned several mobile services, including a mobile service that allows users, especially students, to connect to educational resources and activities. Students were chosen as the primary users of the initial rollout of the mobile service in the case university. Later, the mobile service will be incrementally rolled out to other users, including visitors and university employees.

A digital service team at the case university collected digital service use cases and feature requirements that were important to users. They first collected the use case suggestions and feature requirements from students in a digital service innovation course, and then from other students on the various campuses of the case university. Based on the requirements, the digital service team developed a mobile app (hereafter *SmartCampus* – a pseudonym). SmartCampus was made available to students during the spring semester of 2019. Students are not obliged to use *SmartCampus,* making the use context voluntary. An online report of the university indicates that *SmartCampus* had, as of 19th December 2019, 5028 users which are roughly one-third of the almost 15 000 on-campus students at the case university. The users include degree students (i.e., Finnish and international students) and exchange students.

The case university has several web services and platforms, including a learning management platform, and web services for student activities, news, and cafeteria. *SmartCampus* serves as a hub and provides several features that use data from the various web services provided by the case university. By using SmartCampus, students can access their study schedules on a calendar feature [CampusCalender], explore sporting activities with the university sports feature [CampusSports], and locate places, including classrooms and other facilities, around the campuses with a map feature (CampusMap). Further, *SmartCampus* has features that allow students to access all the various cafeterias across the campuses, see job vacancies, view events, search for university staff, and read campus news. We refer to *SmartCampus* as a multi-feature mobile app because of its several features that enable students to perform a wide range of activities using one mobile app instead of using several mobile apps.

Data Collection

We conducted semi-structured interviews involving 23 student users from the different faculties of the case university. The doctoral candidate randomly contacted students from the various faculties for interviews on *SmartCampus*. The students that were interviewed included Finnish and international students (degree students and exchange students). Each interview was recorded. After each interview, the recording was replayed and analyzed for insights. We stopped conducting new interviews when additional interviews yielded no new insights. We interviewed 11 female and 12 male users (see TABLE 4). To explore how the various users interacted with *SmartCampus*, we interviewed three groups of users. The first group consists of users who adopted and have used *SmartCampus* over time. The second group consists of users who adopted but abandoned *SmartCampus* after initial use. The third group consists of users who heard of but did not install or did install but did not use *SmartCampus*. Each interview lasted between 18 to 32 minutes and was recorded and transcribed verbatim. To understand the strategic intent of *SmartCampus* and how the rollout has evolved, we interviewed other stakeholders, including the digital director in charge of the initiative. We also reviewed online reports on *SmartCampus* to understand its context and its progress.

TABLE 4 List of participants for study on post-adoption use of SmartCampus

Pseudonym	Gender	Field of Study	Student Type
Int.A	Male	Business & Economics	International
Int.B	Female	Business & Economics	International
Int.C	Female	Humanity & Social Science	Finnish
Int.D	Male	Information Technology	Finnish
Int.E	Female	Sport & Health Sciences	Finnish
Int.F	Male	Business & Economics	Finnish
Int.G	Male	Information Technology	Finnish
Int.H	Male	Humanity & Social Science	Finnish
Int.I	Male	Sport & Health Sciences	Finnish
Int.J	Male	Information Technology	Finnish
Int.K	Female	Business & Economics	International
Int.L	Male	Business & Economics	International
Int.M	Male	Humanity & Social Science	International
Int.N	Female	Information Technology	International
Int.O	Male	Business & Economics	International
Int.P	Female	Humanity & Social Science	International
Int.Q	Female	Business & Economics	Finnish
Int.R	Female	Humanity & Social Science	International
Int.S	Female	Business & Economics	International
Int.T	Female	Business & Economics	International
Int.U	Male	Business & Economics	International
Int.V	Male	Business & Economics	International
Int.W	Female	Humanity and Social Science	International

Data Analysis

We adopted an inductive and an interpretive approach (Klein and Myers 1999; Walsham 1995, 2006) to code and analyse the data. We analysed the interview transcripts using Atlas.ti. First, we read through the transcripts and generated open codes. Codes are labels for cataloguing key concepts without disrupting the context in which these concepts occur (Curry et al. 2009). We re-read the transcripts to ensure that we coded all relevant pieces of data. Second, we grouped the open codes under code groups or categories (i.e., axial coding). Third, we analysed and grouped the categories under eight themes or constructs (see TABLE 8 in Appendix). The coding did not occur linearly. Instead, it occurred iteratively, alternating between the codes and data, until the eight constructs emerged (Curry et al. 2009). Fourth, we analysed the eight constructs for relationships among them. Based on the relationships, we propose a model (see FIGURE 4) that illustrates the factors that influence the adoption and post-adoption use of a multi-feature mobile app in a higher educational context. We present the findings in the next section.

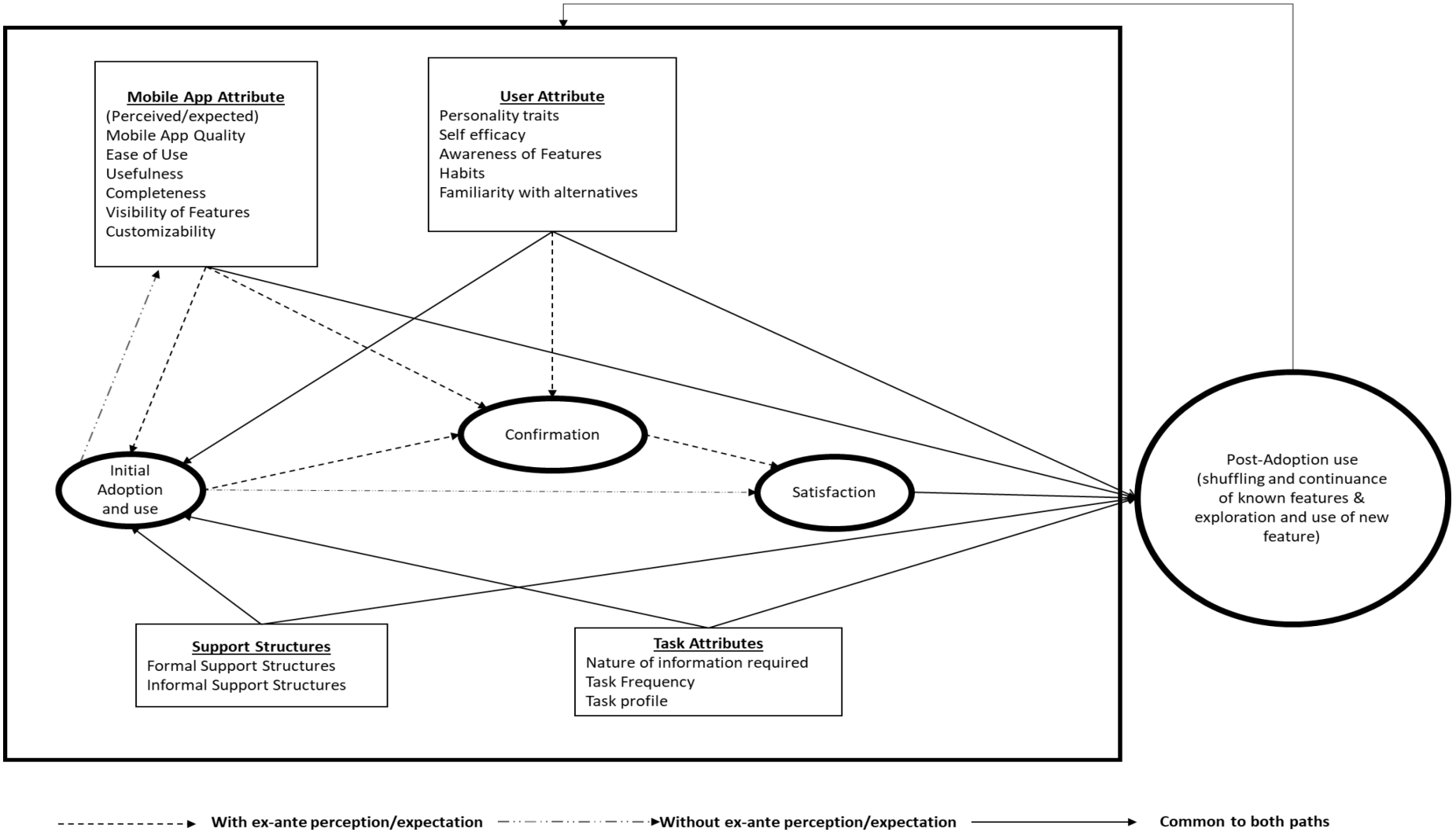

FIGURE 4 Post adoption use of a multi-feature mobile app in a higher education context

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

Case Context

The case university, as part of its digitalization strategy, has three objectives: the digitalization of education, the digitalization of research, and the creation of a smart campus. As part of the strategy to digitalize education, the case university combines IT and its teaching and learning processes to extend its teaching and learning capabilities (Nevo and Wade 2011, 2010). We refer to the combination of IT and teaching and learning processes as IT-enabled teaching and learning processes (simply, IT-enabled education).

The case university is an international university with about 15000 students and 1600 teaching and research staff. The case university has used UniLMS (a pseudonym for a learning management system) since 2004. However, until 2016, UniLMS was not the primary learning management system for the university. The university replaced its primary learning management system because it lacked functionality and its data structure had become complex. User logins to UniLMS escalated from about a thousand per week before 2016 to over 100 thousand per week after UniLMS was made the primary learning management system.

UniLMS is an open-source learning management system whose first version was released in 2002 and the most recent version was released in 2021. UniLMS supports several pedagogical practices and can support IT-mediated learning modes including blended learning, distance education, and flipped classroom. It is maintained by a head office and an open-source community of developers. It has a core with interfaces upon which users, including universities and other institutions, can build using plugins to deliver customized services and experiences. UniLMS is also interoperable with other IT assets within the case university.

At the time of this study, the entire case university uses only one instance of UniLMS which is connected to several other IT assets and work processes across 11 faculties and institutes including an open university. UniLMS in the case university is connected to UniSIM (a pseudonym for a student information system), OldUniSIM (a pseudonym for an old student information system) which is being phased out, and UniVideo (a pseudonym for an online file repository) on which educators upload recorded lectures and other teaching materials. Apart from the open university which will migrate from OldUniSIM to UniSIM in fall 2022, all other faculties and institutes have migrated to UniSIM. Unlike OldUniSIM which is an in-house system developed in the case university, UniSIM is a vendor system used by other universities and institutes across Finland.

Before the spring semester of 2020, the case university used UniLMS to support face-to-face teaching and learning. Generally, UniLMS was used to share course materials, organize discussion fora, and return student assignments. However, in response to a national guideline on the Covid-19 pandemic in March

2020, the case university redeployed its IT-enabled education to achieve a new goal; make all teaching and learning activities virtual. By theoretical sampling (Eisenhardt 1989), this case provides a unique opportunity to study the intricacies of the structural property of IT-enabled education and how the structural properties enabled or constrained the ability of the case university to quickly reconfigure and redeploy IT-enabled education to achieve a new goal. The focus of the study is on understanding the IT-enabled resource, its structural properties, and how the structural properties enabled or constrained the renewal of the IT-enabled resource. The sudden nature of the change in response to national directives on the Covid-19 pandemic makes the case interesting because it "simulates" a dynamic environment where the effects of the structural properties are apparent. Therefore, although the case company is a university, the results are not limited to the higher education context. Rather, they apply to resources, especially IT-enabled resources, formed from the combination of two or more resources.

Data Collection

We conducted 22 semi-structured interviews between September 2020 and February 2021. Other sources of data include online reports and emails from the case university, especially concerning its response to the Covid-19 pandemic. The interview respondents included degree students, teachers, technical administrators, and managers of IT services in the case university, and developers from the open-source community that maintains UniLMS (see TABLE 5). The teaching and learning processes at the open university have always been virtual and have not changed much during the Covid-19 pandemic. Therefore, students and teachers from the open university were not included in the study.

TABLE 5 List of participants for the study on the structural properties of IT-enabled resources

Pseudo-nym	Dura-tion	Gender	Description
Res1	31:41	Female	Administrator and developer (case university)
Res2	45:42	Male	Lecturer / community developer
Res3	55:50	Female	Consultant / Community developer
Res4	47:54	Female	Manager (case university)
Res5	47:12	Male	Lecturer
Res6	36:35	Male	Teaching Assistant
Res7	34:37	Female	Lecturer
Res8	40:02	Male	Lecturer
Res9	33:18	Female	Lecturer
Res10	18:05	Female	Student
Res11	44:36	Female	Lecturer
Res12	39:52	Female	Manager (case university)
Res13	48:46	Female	Lecturer
Res14	51:26	Female	Lecturer
Res15	26:10	Male	Lecturer
Res16	48:04	Male	Lecturer
Res17	49:13	Male	Lecturer
Res18	30:07	Male	Student
Res19	20:53	Female	Student
Res20	20:10	Female	Student
Res21	28:16	Female	Student
Res22	26:45	Male	Lecturer

Data Analysis

We transcribed the interview data verbatim and analysed the data using Atlas.ti software. We employed an inductive and interpretive approach (Walsham 1995, 2006) to code and analyse the data. First, we read and open-coded the data (i.e., open coding). According to Curry et al. (2009), codes are labels for cataloguing key concepts without disrupting the context in which these concepts occur. We re-read the data to ensure that every relevant piece of data was coded. The coding was done with the definitions of the three structural properties in mind (Eisenhardt 1989). After the data was open coded, the open codes were analysed and grouped to form code groups or categories (i.e., axial coding). Finally, the categories were further grouped to form the relevant constructs for this study. The coding did not occur linearly, but through iterations from the codes to data, until the key constructs emerged (Curry et al. 2009). FIGURE 6, FIGURE 7, and FIGURE 8 in Appendix illustrate the transition from data through open codes, axial codes to constructs. The relationships among the constructs were also analysed to propose a conceptual model (see FIGURE 5) that relates the structural properties of an IT-enabled resource and organizational capabilities to the renewal of the IT-enabled resource in a higher education context

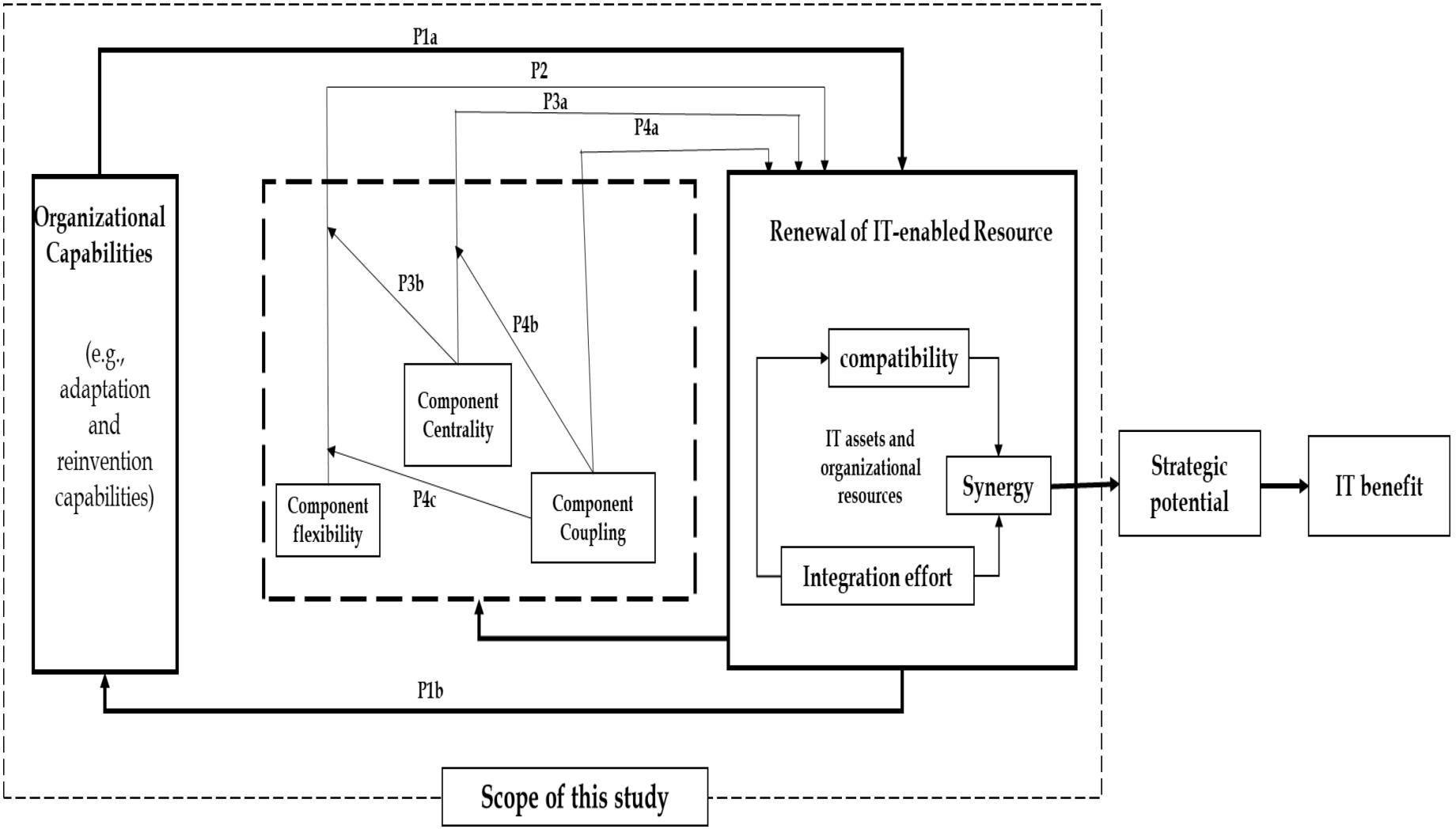

FIGURE 5 Relating the structural properties and the renewal of IT-enabled resources in a higher education context

4 FINDINGS

In this chapter, we present the summary of the findings in the four articles that are included in this dissertation. Findings from Articles I and II relate to how organizations can support post-implementation and post-adoption use of IT to sustain the derivation of IT benefits. Whereas findings from Articles III and IV concern the structural properties that emerge during the formation of IT-enabled resources and how the structural properties can enable or constrain the renewal of IT-enabled resources in sustaining the derivation of IT benefits.

4.1 Article I: Factors that influence information technology use during post-implementation: A literature review

In Article I, we draw on a review of the literature on IT use during post-implementation to answer the following research questions.

RQ1 What are the forms of IT use and the factors that influence IT use during post-implementations?

RQ2 How do IT use and its antecedents evolve during post-implementation?

The study reported in Article I makes three major findings. First, it identifies and classifies the diverse types of IT use behaviours during post-implementation. The diverse types of IT use behaviours can be classified along work task, learning and knowledge need, IT features, IT use obligation, and focal user of the IT. These forms of IT use provide a rich understanding of the different applications that users make of the features of an IT beyond usual proxy measures of IT use for instance, frequency or duration of use (Venkatesh et al. 2008, 2011), amount of gigabit of RAM storage space used (e.g., Retana et al. 2018), the intensity of use (e.g., Nwankpa and Roumani 2014; Ruivo et al. 2014), and the number of employees using IT (e.g., Ruivo et al. 2014).

Second, the study finds that there are three main categories of factors that influence IT use during post-implementation. The categories are support

structures, support properties, and support activities. Further, it finds that these categories relate to organizational entities including IT, work tasks, individuals, groups, organization, and institutional environment. Though these three categories of factors interact and influence each other, several prior studies on IT use during post-implementation have considered a few factors (also see Sykes 2015) mostly within one category of factors that influence IT use during post-implementation.

Third, the study finds that IT use as a social phenomenon and its antecedents emerge through interactions among the three categories of factors (i.e., support structures, support activities, and support properties). It finds that interactions among the categories of factors proceed unpredictably to produce, sustain, improve, or derail IT use. To sustain IT use during post-implementation, an organization needs to orchestrate support structures (e.g., help desk and peer support networks) to enact support activities (e.g., training, advice-giving, and continuous IT and work task integration) that produce support properties (e.g., IT skills and knowledge, and IT-task fit). IT use during post-implementation in turn influences the three categories of factors creating a feedback loop that supports the co-evolution of IT use and its antecedents during post-implementation. In other words, the relationship between IT use and its antecedents are rarely unidirectional but are historically created through reciprocal or feedback effects that IT use and its antecedents have on each other during post-implementation.

4.2 Article II: The actual adoption and use of mobile apps: The case of a higher education context

In Article II, we employ an in-depth case study of a multi-feature mobile app deployed in a higher education context to answer the following research questions.

RQ3 How do post-adoption use of multi-feature mobile apps, and its antecedents evolve?

RQ4 How can mobile service providers and organizations promote the use of multi-feature mobile apps beyond initial adoption?)

The study reported in Article II makes five main findings. First, it finds that post-adoption use of a multi-feature mobile app is a dynamic phenomenon and consists of the continuance use and revisions of known and new features of the mobile app as a users' attribute, task, and support structures change over time. This finding is consistent with Burton-Jones and Straub Jr (2006)'s conceptualization of IT use and with Sun(2012)'s notion of adaptive use.

Second, it suggests a model that highlights the importance of serendipity in the adoption and use of multi-feature mobile apps and illustrates how the post-adoption use of a mobile app influences its antecedents in ways that increase, sustain, or derail use over time.

Third, it finds that in an organizational context, formal support structures and informal support structures are instrumental in influencing the adoption and use of multi-feature mobile apps. Further, it finds that whereas formal support structures, e.g., orientation programs and student tutors, are important in introducing users to a mobile app, informal support structures, e.g., an individual's social network, are more instrumental in extending and sustaining the use of a multi-feature mobile app. This finding is consistent with findings on the role of support structures in sustaining the use of traditional IT during post-implementation (e.g., Gallagher and Gallagher 2012; Sykes 2015).

Fourth, it unravels the effect of task attributes on the adoption and post-adoption use of multi-feature mobile apps. For communication mobile apps (Nickerson et al. 2013), tasks that require dynamic information or information which is difficult for a user to memorize promote the adoption and post-adoption use of multi-feature mobile apps, whereas tasks that require static information or information which a user can readily memorize are less likely to sustain post-adoption use of a multi-feature mobile app. It also finds that the task profile of a user influences how the user uses a multi-feature mobile app. A user who has a few or identical tasks tends to use few features whilst a user who has diverse tasks tends to use several features of a multi-feature mobile app. These findings cement the importance of considering the elements of a user, task, and features (Burton-Jones and Straub Jr 2006) in the conception and study of post-adoption use of multi-feature mobile apps.

Fifth, the study identifies two conflicts related to the design and use of multi-feature mobile apps. One is the conflict between users' affinity for mobile apps with multiple features to allow them to perform a range of tasks with a single app on the one hand, and the quest for the visibility of the several features on the other. We observe that though users require several features, they tend to use features that are visible and rarely use features that are not readily visible. The other conflict is between the quest for customizability and the effect of customizability on the exploration of new or multiple features. Whereas customizability positively influences post-adoption use of known features, it derails the exploration and use of unknown or new features and feature options.

4.3 Article III: Investigating the structural properties of an IT-enabled resource

In Article III, we draw on relevant theories, a review of the literature and published empirical cases on post-implementation change to answer the following research question:

RQ5 What are the structural properties of IT-enabled resources?

The study reported in Article III has two main findings. First, it conceptualizes the structural properties of IT-enabled resources and identifies three structural properties namely, component flexibility, component centrality,

and component coupling. It also finds that these structural properties can enable or inhibit the renewal of IT-enabled resources to address new and emerging imperatives.

Second, it highlights the importance of organizational capabilities in the formation and renewal of IT-enabled resources. It finds from the analysis of published cases that organizational capabilities affect and are affected by the renewal of IT-enabled resources. Organizations need capabilities (e.g., reinvention or adaptation capabilities) to renew IT-enabled resources. However, as organizations, through individuals and teams, engage in the renewal of IT-enabled resources, they strengthen existing capabilities or develop new ones. Further, users and support teams engage in effective adaptation and reinvention when the organizational context is enabling and when institutional pressures do not conflict with organizational norms or negatively affect the productivity of users in an organization.

4.4 Article IV: Exploring the renewal of IT-enabled resources

Article IV builds on Article III and draws from an in-depth case study of an IT-enabled resource in a university to study the structural properties of the IT-enabled resource and to answer the research question:

RQ6 How do the structural properties of IT-enabled resources enable or constrain their renewal to sustain the derivation of IT benefits?

The study reported in Article IV has three key findings on how the structural properties individually and collectively influence the renewal of IT-enabled resources to sustain the derivation of IT benefits. First, it empirically finds that each of the structural properties affects the renewal of IT-enabled resources. Components with high component flexibility enable the renewal of IT-enabled resources whilst those with low component flexibility constrain the renewal of IT-enabled resources. Components with high component centrality have mixed effects. On one hand, they constrain the renewal of IT-enabled resources by increasing the risk and cost of change, and on the other hand, provide alternative paths along which change can be enacted. Conversely, components with low centrality are generally associated with low cost and risk of change but provide few alternative paths for effecting change. Component coupling provides a trade-off between renewal and synergy. Whereas tight links enable synergy but constrain renewal, loose links enable renewal but weaken synergy.

Second, it finds that the structural properties collectively influence the renewal of IT-enabled resources. The study finds that a component's component centrality moderates the effect of its component flexibility on the renewal of IT-enabled resources by providing alternative paths along which change can be enacted. For example, if a focal IT asset is inflexible yet connected to several other components that are flexible, the burden of change can be shifted to the other

components that are connected to the focal IT asset. Also, it finds that a component's component coupling moderates the effect of its component centrality and component flexibility on the renewal of IT-enabled resources. Loose coupling aids the effect of flexibility and centrality whilst tight coupling derails component flexibility and increases the cost of component centrality on the renewal of IT-enabled resources. Thus, to enable the renewal of IT-enabled resources, managers need to holistically orchestrate the three types of structural properties during the formation and renewal of IT-enabled resources.

Third, the study finds that organizational capabilities affect and are affected by the renewal of IT-enabled resources. On the one hand, organizations, through users and groups, need to have capabilities to renew IT-enabled resources to address new goals. On the other hand, whilst organizations, through users and groups, engage in the renewal of IT-enabled resources, they strengthen existing capabilities or develop new ones.

5 DISCUSSION

In this dissertation, we draw on the four interrelated studies to answer the overarching research question:

RQ How can an organization sustain the derivation of IT benefits?

We approach answering this question from two perspectives.

The first perspective focuses on understanding the dynamics of IT use beyond initial adoption and how organizations can promote active use of IT applications beyond initial adoption. From this perspective, we conduct two studies. One employs a systematic literature review to synthesize knowledge on IT use during post-implementation (see Article I) and the other employs an in-depth case study to promote our nuanced understanding of post-adoption use of multi-feature mobile apps in a higher education context (see Article II).

The second perspective focuses on unravelling the structural properties that are formed as users combine IT applications and work processes to form IT-enabled resources from which they derive IT benefits, and how the structural properties either constrain or enable the renewal and redeployment of the IT-enabled resources to address new strategic imperatives. We draw on relevant theories, a review of published empirical cases (see Article III) and an in-depth case study in a university context to identify the structural properties of an IT-enabled resource and to propose a model that theorizes how the structural properties influence the renewal of the IT-enabled resource to sustain IT benefits (see Article IV).

In the following subsections, we discuss the theoretical and managerial implications of this dissertation and identify areas for future research.

5.1 Implications for Research and Theory

This dissertation has implications for research and theory which are organized along the objectives of this dissertation.

5.1.1 IT use during Post-implementation

Based on a systematic review of the literature, this dissertation brings three main insights to research on IT use in an organizational context, especially during post-implementation. Firstly, the diverse types of IT use behaviour during post-implementation draw attention to the organizational realities and the multifaceted nature of IT use during post-implementation. IT use behaviours during post-implementation can be organized around work tasks (Maas et al. 2018), learning or knowledge requirements (Tong et al. 2015), IT features (Sun 2012), users (Auer 1998; Tong et al. 2008) and use obligation (Veiga et al. 2014). This insight is in line with Burton-Jones and Straub Jr (2006)'s conceptualization of IT use in terms of the attributes of IT, user, and task.

Secondly, although there are three categories of factors (i.e., support structures, support activities, and support properties) that influence IT use during post-implementation, several previous studies (e.g., Bagayogo et al. 2014; Maruping and Magni 2015; Sykes 2015) examined few factors, usually within one category of factors that influence IT use during post-implementation. Thus, though previous research has done much to improve our understanding of the factors that influence IT use, it has done little to improve our understanding of the interactions that occur among factors in the various categories and how such dynamic interactions influence IT use during post-implementation. By highlighting the various categories of factors that influence IT use during post-implementation, we hope to stimulate research on the interaction among the categories. That is, instead of concentrating on a few factors, mostly within one category, researchers should design more encompassing research that considers factors across the three categories of factors.

Thirdly, by shedding light on how IT use as a social phenomenon and its antecedents emerge during post-implementation, this dissertation leans towards a process theory perspective on IT use (Markus and Robey 1988). The interactions among the categories of factors proceed unpredictably to produce, sustain, improve, or derail IT use. Likewise, IT use in turn produces, sustains, improves, or derails its antecedents. The dissertation highlights the rippling effects that interventions in one category of factors may have on the other two categories and the effects that interventions at one level may have at other levels. Researchers may find this useful in designing research (e.g., longitudinal research or case studies) that considers the organizational realities and dynamics in conceptualizing and analysing the relationship between IT use and its antecedents, especially during post-implementation.

5.1.2 Post-adoption use of multi-feature mobile apps

Drawing on a case study of the post-adoption use of a multi-feature mobile app, primarily for communication purposes (Nickerson et al. 2013), in a university context, this dissertation provides four theoretical insights regarding the post-adoption use of multi-feature mobile apps. Firstly, it suggests a model that highlights the importance of serendipity in the adoption and use of multi-feature

mobile apps. Unlike users of traditional IT applications, users of multi-feature mobile apps may not engage in extensive pre-implementation activities (e.g., training) that help them to form ex-ante expectations of a multi-feature mobile app and its features. Instead, a user can chance on and use a multi-feature mobile app without ex-ante expectations. During actual use, the user derives satisfaction (or dissatisfaction) from the multi-feature mobile app and forms his/her perceptions of the attributes of the multi-feature mobile app, which in turn influences his/her future use behaviour (i.e., post-adoption use). In such instances, the user proceeds from "initial adoption" to "satisfaction" without "confirmation". This path highlights the role of intuition and spontaneity in the selection of multi-feature mobile apps (Constantiou et al. 2014).

Secondly, this dissertation proposes a nuanced explanation of the post-adoption use of multi-feature mobile apps. Findings from this dissertation suggest that post-adoption use of a multi-feature mobile app is dynamic and consists of the continuance use and revision of known and new features of the multi-feature mobile app. Since a user can, for example, use one or more features or discontinue one feature whilst using another, proxies like "I intend to use mobile app XYZ" or "I use mobile app XYZ" reflect idealizations of post-adoption use. Using such proxies can lead to conflicting conclusions (see Burton-Jones and Straub Jr 2006) and can impede our ability to impact how service providers and organizations can promote post-adoption use of multi-feature mobile apps. For instance, the literature is conflicted about the role of social influence on the adoption and use of mobile apps. Whereas some findings (e.g., Lai and Lai 2014; Venkatesh et al. 2012; Yu 2012) suggest that social influences affect the adoption and use of mobile apps, others (e.g., Chopdar et al. 2018; Hew et al. 2015; Oliveira et al. 2014; Tam et al. 2020) suggest otherwise. From our findings, it appears positive social influences affect the adoption of new features and continuance use of known features, whereas negative social influences negatively affect only the adoption of new features but not the continuance use of known features. Further, although our findings agree with those of others (e.g., McLean 2018) that customization generally supports post-adoption use, it appears that customization supports continuance use of known features and feature options but hurts post-adoption use by impeding the exploration and use of new features and feature options.

Thirdly, this dissertation finds that though both formal and informal support structures may act as "facilitating conditions" in influencing the use of a multi-feature mobile app, their relevance differs at different stages. Whereas informal structures are relevant before initial adoption, they are less relevant during post-adoption use of multi-feature mobile apps. On the other hand, informal support structures are relevant before adoption and during post-adoption. Coupling this finding with the findings in Kim et al (2008) and Parthasarathy and Bhattacherjee (1998) that discontinuers are more reliant on personal networks to adopt and continue using an IT, we suggest that studies employing models that include *"facilitating conditions"*, e.g., UTAUT (Venkatesh et al. 2003), should examine the role of facilitating conditions on the intention to adopt, initial adoption, and post-adoption use of multi-feature mobile apps.

Further, we propose that disaggregating the facilitating conditions construct into formal and informal support structures may lead to more insightful findings on the specific support structures (or facilitating conditions) that are needed at various stages to influence the adoption and post-adoption use of multi-feature mobile apps in different use contexts.

Fourthly, the dissertation highlights the effects of task attributes (i.e., the nature of information, task frequency, and task profile) on a user's adoption and post-adoption use of multi-feature mobile apps. Till now, research on the adoption and post-adoption use of multi-feature mobile apps has focused mainly on whether a user intends to use a mobile app (e.g., Munoz-Leiva et al. 2017), uses a mobile app (e.g., Chopdar et al. 2018), or intends to continue using a mobile app (e.g., Tam et al. 2020). A few studies have considered task elements in conceptualizing post-adoption use constructs (e.g., Lin and Wang 2012; Oliveira et al. 2014). We argue that studies do not often consider the effect of task attributes on mobile apps adoption and post-adoption use because of two reasons. One, mobile apps are treated as a unit with little regard for their features. Studying mobile apps as a unit (i.e., without considering their various features) was ideal when mobile apps were nibble and simple consisting of one or two features in which case using a mobile app can be synonymous to using all the features of the mobile app to perform tasks. Two, the conceptualization of adoption and post-adoption constructs in existing research rarely include the attributes of the IT, user, and tasks (see Burton-Jones and Straub Jr 2006). By conceptualizing post-adoption use of multi-feature mobile apps, and by highlighting the effects of user attributes, mobile apps attributes, task attributes, and support structures on the adoption and post-adoption use of multi-feature mobile apps, this dissertation advances a nuanced understanding of post-adoption use and how it evolves with its antecedents. We hope that by pursuing a nuanced understanding of post-adoption use and its antecedents, we inspire other researchers to adopt a detailed approach to studying the adoption and use of multi-feature mobile apps.

5.1.3 Structural properties of IT-enabled resources

Drawing on relevant theories, a systematic review of published cases on post-implementation changes, and a case study in a university context, this study adds to the literature on IT benefits, and specifically to discussions on sustaining the derivation of IT benefits. It augments Nevo and Wade (2011, 2010)'s conception of IT-enabled resources by going beyond the formation of IT-enabled resources to study the structural properties that ensue when IT and other organizational resources are combined and integrated to form IT-enabled resources. That is, whereas Nevo and Wade (2011, 2010)'s model is concerned with the initial formation of IT-enabled resources as a means by which IT assets result in IT benefits, this study is concerned with the structural properties that emerge during the formation of IT-enabled resources and how the structural properties can influence the renewal of IT-enabled resources to sustain the derivation of IT benefits.

The study notes that an IT-enabled resource is rarely formed from a connection between one IT asset and one organizational resource, e.g., a work process. Rather, it is formed by connecting a focal organizational resource (which may be an IT asset) to several other organizational resources. For example, the literature on shared services (e.g., Fielt et al. 2014), collaboration (e.g., Smith and McKeen 2011) and digital platforms (e.g., Sandberg et al. 2020) demonstrate the interconnectedness and centrality of organizational resources (especially IT assets) mostly for resource leveraging and the formation of synergy. Therefore, although researchers may isolate an IT asset and a work process for clarity during an initial study of IT-enabled resources, considering nuanced details of the complex structure of IT-enabled resources can improve our understanding of the structural properties of IT-enabled resources. In this study, we considered several components of an IT-enabled resource (i.e., IT-enabled education) to make a first attempt at explicating the nuances of the structural properties of IT-enabled resources, which include component flexibility, component coupling, and component centrality.

In line with general systems theory, the effect of component flexibility on the renewal of IT-enabled resources highlights the need for IT assets and other organizational resources to be flexible. IS research concentrates largely on the flexibility of IT assets and IT capabilities. However, in line with loose coupling theory, a flexible IT infrastructure tightly integrated with rigid work processes can undermine the flexibility of the IT infrastructure, in that changes to the IT infrastructure will be constrained and disruptive (Rodon et al. 2011; Schneider et al. 2018). Since an IT-enabled resource, rather than an IT asset, is the unit for deriving IT benefits, IS research and practice should also be concerned about the flexibility of other organizational resources in the discourse on renewing IT-enabled resources and sustaining the derivation of IT benefits.

Component coupling is a trade-off between the synergy or value potential of an IT-enabled resource and its renewal. In line with loose coupling theory, tight integration of the components of an IT-enabled resource may result in synergy (Nevo and Wade 2011, 2010) but can constrain the renewal of the IT-enabled resource. This finding affirms the importance of integration in the formation of synergy but also calls for research to closely consider the long-term effects of integration activities. Apart from delineating horizontal and vertical integration (Seethamraju 2009), a careful orchestration of tight and loose links (i.e., loose coupling) among the components of an IT-enabled resource is therefore needed for synergy formation and the ability to change. Whereas tight links can result in the formation of synergy, loose links can provide the avenue to effect change. Research should therefore delineate integration activities that lead to the formation of synergy and the renewal of IT-enable resources from those that lead to the formation of synergy but constrain the renewal of IT-enabled resources.

Component centrality has implications for the renewal and redeployment of IT-enabled resources. Changes to a focal component (e.g., a focal IT asset) with high component centrality, can be costly and risky, because of the potential disruption the changes may cause to several other components. However,

combining social network theory and loose coupling theory shed light on the nuances of how component centrality affects change. The effect that the component centrality of a focal component has on the renewal of an IT-enabled resource depends on how tightly or loosely other components are connected to the focal component. Besides, the high component centrality of a focal component can provide alternative paths for effecting changes, which would have otherwise been constrained by an inflexible component, through flexible components or loose links. These intricate understanding of the effect of component centrality on the renewal of IT-enabled resources lends support to the disputed relationship between IT and organizational agility (Liang et al. 2017; Van Oosterhout et al. 2006) and begs a nuanced approach to research on concepts, such as IT connectedness, inter-organizational infrastructure, and digital platforms, that promote component centrality.

Taken together, the three structural properties provide a comprehensive view of the internal structures that emerge during the formation of resource combinations and how the structures influence the renewal of resource combinations to address new and emerging needs. The complementarity among the three structural properties reflects how the theories that underpin them (i.e., general systems theory, loosely coupling theory, and social network theory) complement each other in conceptualizing the structural properties of an IT-enabled resource. We thus encourage researchers interested in the internal structures of resource combinations, e.g., IT-enabled resources, to consider the interplay among these three theories as considering only one of these theories may provide a limited view. For instance, research that considers only general systems theory (e.g., Nevo and Wade 2010) may highlight the importance of high integration in the formation of synergy but miss, from loosely coupling theory and social network theory perspectives, the effect of such integration on the ability to renew the resource.

In that regard, this study sheds light on the dynamic nature of resources. The literature has established that resources are dynamic and that their structures evolve over time (Le Breton-Miller and Miller 2015; Nevo and Wade 2010; Sirmon et al. 2008; Wade and Hulland 2004). Sirmon et al.,(2007) proposed a resource management model that explicates how organizations structure, bundle, and leverage resources to gain performance benefits. In the IS literature, Nevo and Wade (2011, 2010) conceptualized and empirically demonstrated how resources can be changed through the formation of synergies. This study furthers our understanding of the dynamic nature of resources by explicating the internal structures (i.e., the structural properties) that emerge during the formation of resources and how they enable or constrain the dynamic nature (i.e., renewal or reconfigurability) of resources.

Further, the study adds to the discussions on how IT assets can influence organizational performance, including sustained competitive advantage. The literature has shown that IT assets can, through the formation of synergy, contribute to competitive advantage but questions whether IT assets can contribute to sustained competitive advantage since IT benefits are usually short-lived (Mata et al. 1995; Melville et al. 2004; Nevo and Wade 2011; Wade and

Hulland 2004). Based on our findings, we argue that IT assets can contribute to a sustained competitive advantage when IT assets are combined with other organizational resources to form IT-enabled resources in ways that endow the IT-enabled resources with the structural properties that enable their renewal to create successive or a series of temporary competitive advantages (Sirmon et al. 2010, 2011).

Furthermore, the findings support existing theories on organizational capabilities. Existing theories (e.g., Helfat and Peteraf 2003) suggest that organizations form, develop, and modify their capabilities over time through acquisitions and organizational learning. In line with existing literature on organizational capabilities, this study finds that on the one hand, organizations (through individuals and teams) employ their existing capabilities to form and renew resources, and on the other hand, organizations develop new capabilities or strengthen existing ones as they form and renew resources. This also empirically supports Li and Chan (2019)'s assertion that dynamic IT capabilities can be further developed whilst they are employed to change IT-related ordinary capabilities. Thus, the trajectory along which organizations develop their capabilities will depend partly on the structural properties of resources that they form and renew. An organization that seeks to sustain the derivation of IT benefits through the creation and renewal of reconfigurable IT-enabled resources needs to develop and strengthen two capabilities namely the capability to form and reconfigure IT-enabled resources, and the capability to endow the IT-enabled resources with enabling structural properties. Therefore, IS research on capabilities relating to IT-enabled resources should not study only the organizational capabilities needed to form and reconfigure IT-enabled resources, but also the organizational capabilities and practices required to endow IT-enabled resources with enabling structural properties.

5.2 Implication for Practice

This dissertation has insights that can be relevant to management. We organize the managerial implications along the objectives of this dissertation.

5.2.1 IT use during Post-implementation

We share insights on how management can influence IT use during post-implementation thereby sustaining the derivation of IT benefits. Firstly, managers can find the different forms of IT use behaviours discussed in this dissertation useful in orchestrating and targeting interventions to promote appropriate forms of IT use behaviours during post-implementation. Besides, although certain behaviours like explorative and innovative use may be attractive, they can be counter-productive if users do not grasp the fundamental structures of the IT and work task before engaging in such behaviours. Therefore, in choosing which IT use behaviour to promote, managers should examine

existing IT use behaviours and the support structures available for the IT, user, and task.

Secondly, the three categories of factors provide insights that can inform managers in designing interventions that consider a wide range of factors across the three categories of factors (i.e., support structures, support activities, and support properties) to influence IT use during post-implementation. By elaborating on the dynamic interactions that occur among the three categories of factors, this dissertation can inform managers on how to target interventions and manage the spillover effects of the intervention in ways that promote IT use during post-implementation.

Thirdly, by highlighting the interplay between formal support structures and informal support structures, this dissertation can inform managers about the importance of dovetailing the two forms of supports structures. Managers should support activities in informal support structures. For instance, they can do so by encouraging socialization (Walsh et al. 2010) and motivating advice sharing and seeking activities (Sykes 2015; Sykes et al. 2014). Further, managers can also create an organizational environment in which users can freely seek and share information and have a sense of ownership of the information that they generate and share (Jarvenpaa and Staples 2000). Human resource managers and supervisors can help in this regard by guiding employees to set personal development goals to build enabling support properties (e.g., social capital and network structures) that can support current and future IT investments.

Fourthly, managers should also carefully consider how institutional pressures influence IT use within their organization, since conflicting influences from institutional pressures may hamper IT use (e.g. see Chu and Robey 2008). In this regard, we make two suggestions. One, managers can organize support activities (e.g., training and certifications) that expose groups and employees to the influences of desired institutional support structures (e.g., a professional body) that support a chosen IT. Two, managers can choose an IT whose use fulfils the demands of multiple institutional pressures (e.g., the need to be competitive yet fulfil regulatory requirements, and adhere to professional practice).

5.2.2 Post-adoption use of multi-feature mobile apps

We share insight on how mobile apps developer and mobile service providers can improve the adoption and post-adoption use of multi-feature mobile apps. Firstly, managers and developers need to manage the conflict between the quest for multiple features and the visibility of features. Modern users are gravitating towards multi-feature mobile apps that have several features with which users can perform a wide range of tasks with one mobile app instead of using multiple mobile apps. Such drift calls for design considerations that satisfy two conflicting requirements. One, managers and developers should create a synergistic bundle of features that provides users with the ability to address several use cases within a use context. Two, since mobile devices are usually limited in terms of display (Jung et al. 2019), managers and developers should consider interface design elements that improve the visibility of several features.

Secondly, designers and managers should consider design options (e.g., in-app activities) that minimize the negative effects of customizability on the exploration and use of new features and feature options. Customizability is believed to generally support adoption and post-adoption use (McLean 2018). However, our findings suggest that customizability hurts post-adoption use by derailing the exploration of multi-feature mobile apps for new features and feature options. That is, whereas customizability supports the post-adoption use of known features and already selected feature options, it impairs the post-adoption use of new features and feature options. Therefore, designers and developers should explore, for example, periodic in-app feature tours and patch notes that inform users of new features and unused options of a multi-feature mobile app.

Thirdly, managers and service providers should orchestrate and nurture formal and informal support structures to improve the adoption and post-adoption use of multi-feature mobile apps. We note that informal support structures are more effective than formal support structures, especially during post-adoption use. Discontinuers are especially susceptible to social influences within informal support structures (Kim et al. 2008; Parthasarathy and Bhattacherjee 1998) and are likely to discontinue the use of a multi-feature mobile app when informal support structures fade during post-adoption. Therefore, apart from using formal support structures to concretely introduce the key features of multi-feature mobile apps highlighting use cases, managers and service providers should also support the formation of informal support structures around multi-feature mobile apps, e.g., by providing enabling features. For instance, multi-feature mobile apps for higher education can have features around which students can organize learning and social activities within their social networks.

Fourthly, managers and service providers should develop and rollout multi-feature mobile apps in ways that do not engender negative feedback, at least concerning the technical functionality of the features. Negative feedback within social networks is very effective in preventing new adoption (Parthasarathy and Bhattacherjee 1998) and the exploration of new features. Users tend to propagate negative feedback within their networks when they have negative experiences with multi-feature mobile apps, for instance, crashes, and non-functioning features. Multi-feature apps should therefore be rolled out incrementally starting with a few functional features, and then updated with other functional features that entrench the use of existing features and provide new use cases in which users can use the multi-feature mobile app.

5.2.3 Structural properties of IT-enabled resources

We discuss how managers can sustain the derivation of IT benefits by leveraging the structural properties that emerge during the formation of IT-enabled resources in ways that can enable the renewal of IT-enabled resources to create "shifting synergies" needed to address shifting organizational goals, especially in dynamic environments (Eisenhardt and Martin 2000, p. 1107). Firstly, IS

managers should shift attention from architecting and managing the characteristics of IT assets to architecting and managing the structural properties of IT-enabled resources. Since changes to even a flexible IT asset can be constrained if the IT asset is tightly coupled with several other organizational resources (Seethamraju 2009), IS managers need to comprehensively consider the structural properties of each component whilst architecting and managing IT-enabled resources.

Secondly, during the formation and renewal of IT-enabled resources, IS managers should consider the interplay among the three structural properties and their effects on synergy formation and renewal. For instance, whereas high component centrality can generally be costly to change (Saraf et al. 2013; Harrison and Easton 2002), it can also provide an avenue to shift the burden of change from an inflexible component to a flexible component (e.g., see Davidson and Chismar 2007). Besides, high centrality enables resources shearing and the creation of synergy (Kohli and Devaraj 2004; Tanriverdi 2006). Similarly, tight coupling restrict change but enables efficiency, whereas loose coupling enables changes but derails efficiency. Each type of coupling might be desirable at distinct parts of the IT-enabled resource. For instance, the core of a digital platform can be tightly coupled and provided with interfaces to which external components (e.g., plug-ins) are loosely coupled (Cusumano 2010; Gawer and Cusumano 2008, 2014; de Reuver et al. 2018). In this regard, we recommend that IS managers should holistically consider the roles that the structural properties play in the formation of synergy and renewal of IT-enabled resources.

Third, managers should focus not only on developing capabilities that enable them to combine IT assets and other organizational resources to meet current goals but should also invest in capabilities that make IT-enabled resources renewable to meet shifting strategic imperatives. In other words, managers should invest in capabilities that enable the formation of an IT-enabled resource and the capabilities that endow the IT-enabled resource with the structural properties that enable the renewal and redeployment of the IT-enabled resources to sustain the derivation of IT benefits

5.3 Limitations

The studies in this dissertation have some limitations. First, the scope of the study on IT use during post-implementation is limited to articles that discussed IT use during post-implementation and to articles in top AIS journals (i.e., the AIS senior scholars' basket of eight journals). Articles on other topics, for instance, the transformative effect of IT, can also have findings on the factors that influence IT use during post-implementation. Nevertheless, by restricting the focus and scope of the review, we have been able to adequately collate, synthesize, and discuss findings from prior literature on IT use during post-implementation. An attempt to achieve "comprehensiveness" by extending the focus and scope of the research to include articles on several other topics may blur the focus of the review or

make the review process extremely difficult if not unachievable (Rowe 2014). Future reviews can treat our work as a starting point and extend it by considering a wider set of journals and databases, and by studying factors that influence IT use in different or specific contexts, e.g., IT use in organizations undergoing IT-enabled transformation or organizations operating in very dynamic environments. Further, from our review, we identified five categories of IT use behaviours during post-implementation. We invite researchers to verify and extend the categorization of IT use behaviours discussed in prior literature.

Second, the study on the post-adoption use of multi-feature mobile apps is limited by the type of mobile app we studied. The mobile app we studied is a communication mobile app (Nickerson et al. 2013) used within a higher education context. Thus, factors such as risk, security, and trust did not come up during the interviews. However, we envisage such factors may come up in future rollouts that include transactional features (Nickerson et al. 2013). We thus invite other scholars to investigate whether transactional features will introduce factors such as risk, security, and trust, and how the factors may influence the adoption and post-adoption use of mobile apps with transactional features for smart campus initiatives.

Third, although we have made some progress exploring the intricate realities of adoption and post-adoption use of multi-feature mobile apps, we have made some idealizations (McMullin 1985) ourselves. For instance, we did not model all the relationships among the several factors that influence adoption and post-adoption use. Visibility of mobile app features may influence a user's awareness of mobile app features. Likewise, the completeness of a mobile app may influence the visibility of its features. Such links remain unmodelled primarily in favour of parsimony. However, we consider the nuanced understanding of post-adoption use of multi-feature mobile apps introduced in this dissertation as a significant improvement in our understanding of the phenomenon. Further, existing research has studied some of the relationships between the factors, e.g., the relationship between ease of use and usefulness (e.g., Chen et al. 2013; Park et al. 2012). Future research can also study the links that have not already been explored.

Fourth, we employ a single primary case study in a theory building endeavour to suggest propositions that link the structural properties and the renewal of IT-enabled resources. According to Eisenhardt (1989), theories from case studies are stronger when they are based on multiple case studies. Thus, this study leveraged the narratives from the 18 published cases, and one primary case in the theory-building process. The eight propositions from this study, therefore, emerged from the analysis of the 18 published cases, and the one primary case. We, nevertheless, acknowledge that reviewing published cases does not count as multi-case studies and therefore invite future research to employ other cases to refine the propositions. Further, we also invite researchers to test our propositions using a variety of research methods and in different contexts.

5.4 Direction for Future Research

This dissertation has identified several areas for future research. We organize the areas for future research along the objectives of the dissertation.

5.4.1 IT use during Post-implementation

This dissertation contributes four new directions for future research on IT use during post-implementation. First, whilst users engage in support activities (e.g., adaptation and learning activities) new support properties (e.g., the complexity of, and the type of coupling between, IT and work tasks) emerge. The new support properties may affect (i.e., enable or constrain) the ability of users and support structures to adapt or reconfigure IT and work tasks to address future demands (e.g., see Saraf et al. 2013). Future research should study how the emerging support properties of IT and work tasks affect the ability of an organization to adapt and reinvent its IT assets and work processes to address new strategic imperatives. Findings from such research may shed light on practices that result in support properties that constrain or sustain IT use during post-implementation. They may also suggest how organizations can avert practices that are dysfunctional and promote those that sustain IT use during post-implementation.

Second, research has shown that institutional pressures may influence IT use within an organization through several paths and that some of the influences may conflict, stalling IT use during post-implementation (e.g., see Chu and Robey 2008; Davison et al. 2019). Researchers should study how management can leverage and create synergy between the influences from factors within (e.g., organizational IT policies, professional norms, and the quest for efficiency) and outside (e.g., institutional pressure) an organization in ways that promote IT use during post-implementation.

Third, apart from studying the different types of IT use in isolation, future research should also investigate the conditions under which users may transition from one form of IT use to another. Findings from such research will improve our understanding of how organizations can prevent drifts to undesirable IT use behaviours, especially those that dwindle IT benefits, and design interventions that propel users towards more desirable IT use behaviours.

Fourth, whereas informal support structures are more effective than formal structures during post-implementation, they may also derail IT use or result in inappropriate exploration of IT and work processes (Khoo et al. 2011). Future research should investigate how formal support structures can influence, for example, learning and adaptation activities within informal support structures such that innovations and explorations are not dysfunctional.

5.4.2 Post-adoption use of multi-feature mobile apps

This dissertation identifies four areas for future research on the post-adoption use of multi-feature mobile apps. First, future research should evaluate the efficacy of existing IS adoption theories and models in studying the adoption and post-adoption use of multi-feature mobile apps. We entreat researchers to adopt a nuanced understanding of IT use (Burton-Jones and Gallivan 2007) and post-adoption use (Lumor et al. 2020), and to extend existing theories in ways that support research on the nuanced understanding of adoption and post-adoption use of multi-feature mobile apps.

Second, we invite researchers to employ our model (Lumor et al. 2020) in exploratory and longitudinal research to further scholarly understanding of the adoption and post-adoption use of multi-feature mobile apps in different contexts beyond higher education. Particularly, researchers should consider contexts (e.g., commerce and banking) where there are other types of features (e.g., online payment) beyond communication features (Nickerson et al. 2013) and modify the model to reflect the effects of such features.

Third, with the drift towards multi-feature mobile apps, future research can investigate interface design considerations that can help resolve the paradox created by the surging need for and visibility of multiple features. Such research may adopt the design science research paradigm and experiments to explore how designers can organize multiple features without impairing their visibility.

Fourth, future research can also further investigate the relationship between customizability and the formation of habits that sustains the post-adoption use of known features but impairs the exploration and adoption of new features. Such research can identify mechanisms by which developers and mobile service providers can momentarily disrupt habits and improve the adoption and use of new features without hurting the interest of users or engendering discontinuance.

5.4.3 Structural properties of IT-enabled resources

This dissertation also identifies three avenues for future research on the structural properties of IT-enabled resources and their role in sustaining the derivation of IT benefits. First, future research can examine our model and its associated propositions, especially through longitudinal research design in different contexts. Such research will contribute towards building understanding of the complexities of IT-enabled resources and how their structural properties can either enable or constrain the derivation of IT benefits in the long term.

Second, future research can also investigate organizational capabilities and practices that lead to the formation of synergy and enable the renewal of IT-enabled resources, and contrast them with capabilities and practices that may lead to the formation of synergy but constrain the renewal of IT-enabled resources. We invite scholars, especially those who study architectures, e.g., enterprise architecture, to engage in research along these lines.

Third, since an IT-enabled resource, rather than only an IT, is the vehicle for deriving IT benefit, future research should consider a broader set of capabilities beyond those that focus on only the IT, for example, IT capability (Bharadwaj 2000), IT integration capability (Benitez et al. 2018), and IT reconfiguration capability (Pavlou and El Sawy 2010; Rai and Tang 2010). In that regard, future research should also study capabilities that focus on the IT-enabled resource, especially on its structural properties and renewal.

6 CONCLUSION

Organizations make huge investments in IT, but the literature shows that they mostly struggle to derive IT benefit from their investments or to sustain the derivation of IT benefits especially in dynamic environments. According to the literature, this is mostly because organizations often fail to successfully implement their IT, users do not actively use the IT beyond initial adoption, or whilst users use the IT together with other organizational resources to perform their work tasks, they form structures that derail the derivation of IT benefits in the long term. Organizations are increasingly exposed to fast-changing and disruptive environments in which the derivation of IT benefits is temporary. This makes the fervent calls in the IS literature to study how organizations can sustain the derivation of IT benefits very important and timely. This dissertation responds to such calls.

Drawing on literature reviews and case studies in a higher education context, this dissertation investigates how organizations can sustain the derivation of IT benefits. It does so by exploring a nuanced understanding of IT use after initial adoption to shed light on how organizations can promote active use of IT (including, traditional IT applications and mobile apps) to perform tasks beyond initial adoption. It also explores the structural properties that emerge whilst users combine IT and other organizational resources to form IT-enabled resources from which they derive IT benefits and how the structural properties may enable or constrain the renewal and redeployment of IT-enabled resources to sustain the derivation of IT benefits. The dissertation makes several contributions.

It finds that there are several IT use behaviours during post-implementation and that these IT use behaviours are shaped by the interactions among three categories of factors (i.e., support structures, support activities, and support properties). Managers can therefore orchestrate interventions that leverage the interactions among the categories of factors in supporting the active use of IT during post-implementation. Researchers can find this contribution valuable in designing more comprehensive research on IT use during post-implementation.

It also finds that post-adoption use of multi-feature mobile apps consists of the continuance use and shuffling of known features, and the exploration and use of new features. Based on this nuanced understanding, managers can improve post-adoption use by balancing the need for multiple features and the visibility of the features; incrementally rolling out multi-feature mobile app starting with a few functional and stable features, and by providing features around which users can form and sustain informal support structures. Adopting this nuanced understanding also resolves some conflicting findings in the literature on mobile app adoption and has the propensity to move research toward embracing the intricate realities of post-adoption use of multi-feature mobile apps, especially in organizations.

The dissertation also finds that IT-enabled resources have three structural properties (i.e., component centrality, component flexibility, and component coupling) that individually and collectively influence the ability of an organization to renew and redeploy its IT-enabled resources to address new strategic imperatives. The findings suggest that to sustain the derivation of IT benefits, managers should not only be concerned with the formation of IT-enabled resources to meet immediate needs. Managers should also promote the development of organizational capabilities and practices that endow the IT-enabled resources with structural properties to aid the renewal of the IT-enabled resources to address shifting strategic imperatives. The dissertation also improves Nevo and Wade (2011, 2010)'s model on the formation of IT-enabled resources with the three support structures and proposes eight propositions to guide future research on the renewal of IT-enabled resources to sustain IT benefits.

Together, the findings and contributions in this dissertation advance our understanding of how organizations can sustain the derivation of IT benefits especially in dynamic environments. They do so by shedding light on how management can promote the use of IT applications beyond initial adoption and support the formation of structural properties that enable the renewal of IT-enabled resources to meet shifting goals.

YHTEENVETO (SUMMARY IN FINNISH)

Tietotekniikan hyötyjen ylläpitäminen: Näkymät IT:n käyttöönoton jälkeiseen käyttöön ja IT-pohjaisten resurssien uusimiseen

Organisaatiot investoivat informaatioteknologioihin (IT) huomattavia summia, mutta niistä saatavien hyötyjen kanssa ei välttämättä päästä tavoitteisiin, varsinkaan jos toimintaympäristö muuttuu nopeasti. Investoinnin kohteena olevan IT:n implementointi organisaatioon saattaa epäonnistua, tai sen käyttäjät eivät jatka käyttöä aktiivisesti. Teknologiaa työtehtäviin käytettäessä siitä saatetaan myös muodostaa yhdessä muiden resurssien kanssa rakenteita, jotka myöhemmin muodostuvat esteeksi teknologiahyötyjen saamisen jatkumiselle. Organisaatioiden toimintaympäristöt muuttuvat yhä nopeammin ja disruptiiviset muutokset liiketoiminnan ehtoihin ovat yhä yleisempiä, joten IT-hyödyt voivat jäädä lyhytaikaisiksi. Tämä haastaa tutkimusta löytämään tapoja, joilla organisaatiot voivat saada IT-investoinneista hyötyjä pidempään.

Tämän väitöskirjan tutkimukset keskittyvät vastaamaan tähän haasteeseen. Ensiksi kartoitetaan IT:n käyttöönottovaiheen jälkeen tapahtuvan käytön monitahoisia piirteitä. Näin saadaan valaistusta siihen, miten organisaatiot voivat edistää IT:n aktiivikäyttöä toiminnoissaan pitkään omaksumisvaiheen jälkeen, olipa kyse perinteisistä IT-sovelluksista tai mobiilisovelluksista. Tutkimus kartoittaa rakenteellisia ominaisuuksia, joita kehittyy käyttäjien yhdistellessä IT:tä organisaation muihin resursseihin. Niistä muodostuu IT-pohjaisia resursseja, joista IT-hyödyt saadaan. Edelleen tutkimuksessa selvitetään miten nämä rakenteelliset ominaisuudet joko edesauttavat tai estävät hyötyjen saamista.

Väitöstutkimus tuottaa monipuolisesti uutta tutkimustietoa. Tutkimus tuo esiin erilaisia IT:n käyttötapoja siinä vaiheessa, kun käyttöönotto on tehty ja käyttö aloitettu. Nämä käyttötavat luokitellaan kolmeen ryhmään: *tukirakenteet*, *tukitoiminnot* ja *tukiominaisuudet*. IT-johtamisessa voidaan puuttua näiden ryhmien keskinäisiin vuorovaikutuksiin, jotta käyttöön otettua IT:a käytetään aktiivisesti jatkossakin. Tutkijoille tämä havainto luo lähtökohdan lisätutkimuksille käyttöönoton jälkeen tapahtuvasta IT:n käytöstä.

Edelleen väitöstutkimus selvittää, että monitoimintoisen mobiiliteknologiasovelluksen käyttöönoton jälkeisessä käytössä vaihdellaan tunnettujen toiminnallisuuksien käytön jatkamisen ja uusien ominaisuuksien kokeilun välillä. Sovelluksen kehittämisessä kannattaa ensinnäkin panostaa tasapainoon ominaisuuksien lisäämisen ja niiden näkyvyyden parantamisen välillä. Toiseksi sovellus voidaan ottaa käyttöön asteittain käyttäen aluksi muutamia toimivia ja vakaita ominaisuuksia. Kolmanneksi ominaisuuksia lisäämällä käyttäjät voivat ratkoa sovelluksen käytön pulmia ja muodostaa tukirakenteita. Tämä havainto voisi ratkaista joitakin kirjallisuuden osoittamia ongelmia mobiilisovellusten käytön omaksumisessa ja viedä alueen empiiristä tutkimusta eteenpäin.

Lisäksi väitöstutkimus tuo esiin IT-pohjaisten resurssien kolme ominaisuutta: *komponentin keskeisyys*, *komponentin joustavuus* sekä *komponentin kytkeytyvyys*. Nämä ominaisuudet yhdessä ja erikseen vaikuttavat organisaation kykyyn uudistaa IT-pohjaisia resurssejaan ja ottaa niitä uudelleen käyttöön uudistuvien tavoitteidensa mukaisesti. Tämä havainto osoittaa, että IT-pohjaisten resurssien luomisen lisäksi tulisi edistää niiden uudistamista aina muuttuvien strategioiden mukaan. Väitöskirja myös parantaa Nevon ja Waden (2010, 2011) mallia IT-pohjaisten resurssien muodostamisesta kolmella rakenteellisella ominaisuudella ja tekee ehdotuksia IT-pohjaisten resurssien uusimista koskevan tutkimuksen kehittämiseksi.

REFERENCES

Ackoff, R. L. 1971. "Towards a System of Systems Concepts," *Management Science* (17:11), INFORMS, pp. 661–671.

Akhlaghpour, S., and Lapointe, L. 2018. "From Placebo to Panacea: Studying the Diffusion of IT Management Techniques with Ambiguous Efficiencies: The Case of Capability Maturity Model," *Journal of the Association for Information Systems* (19:6), pp. 441–502.

Alraimi, K. M., Zo, H., and Ciganek, A. P. 2015. "Understanding the MOOCs Continuance: The Role of Openness and Reputation," *Computers & Education* (80), Elsevier, pp. 28–38.

Auer, T. 1998. "Quality of IS Use," *European Journal of Information Systems* (7:3), pp. 192–201.

Azad, B., and King, N. 2008. "Enacting Computer Workaround Practices within a Medication Dispensing System," *European Journal of Information Systems* (17:3), pp. 264–278.

Azad, B., and King, N. 2012. "Institutionalized Computer Workaround Practices in a Mediterranean Country: An Examination of Two Organizations," *European Journal of Information Systems* (21:4), pp. 358–372.

Babar, A., Bunker, D., and Gill, A. Q. 2018. "Investigating the Relationship between Business Analysts' Competency and IS Requirements Elicitation: A Thematic-Analysis Approach," *Communications of the Association for Information Systems* (42:12), pp. 334–362.

Bagayogo, F. F., Lapointe, L., and Bassellier, G. 2014. "Enhanced Use of IT: A New Perspective on Post-Adoption," *Journal of the Association for Information Systems* (15:7), pp. 361–387.

Baird, A., Davidson, E., and Mathiassen, L. 2017. "Reflective Technology Assimilation: Facilitating Electronic Health Record Assimilation in Small Physician Practices," *Journal of Management Information Systems* (34:3), pp. 664–694.

Bala, H., and Bhagwatwar, A. 2018. "Employee Dispositions to Job and Organization as Antecedents and Consequences of Information Systems Use," *Information Systems Journal* (28:4), pp. 650–683.

Barney, J. 1991. "Firm Resources and Sustained Competitive Advantage," *Journal of Management* (17:1), pp. 99–120.

Barney, J., Wright, M., and Ketchen Jr, D. J. 2001. "The Resource-Based View of the Firm: Ten Years after 1991," *Journal of Management* (27:6), pp. 625–641.

Beaudry, A., and Pinsonneault, A. 2005. "Understanding User Responses to Information Technology: A Coping Model of User Adaptation," *MIS Quarterly* (29:3), pp. 493–524.

Benitez, J., Ray, G., and Henseler, J. 2018. "Impact of Information Technology Infrastructure Flexibility on Mergers and Acquisitions," *MIS Quarterly* (42:1), pp. 25–43.

Benlian, A. 2015. "IT Feature Use over Time and Its Impact on Individual Task Performance," *Journal of the Association for Information Systems* (16:3), p. 144.

Berente, N., Lyytinen, K., Yoo, Y., and King, J. L. 2016. "Routines as Shock Absorbers during Organizational Transformation: Integration, Control, and NASA's Enterprise Information System," *Organization Science* (27:3), pp. 551–572.

Berente, N., and Yoo, Y. 2012. "Institutional Contradictions and Loose Coupling: Postimplementation of NASA's Enterprise Information System," *Information Systems Research* (23:2), pp. 376–396.

Berente, N., Yoo, Y., and Lyytinen, K. 2008. "Alignment or Drift? Loose Coupling over Time in NASA's ERP Implementation," *ICIS 2008 Proceedings*, p. 180.

Bharadwaj, A. S. 2000. "A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation," *MIS Quarterly* (24:1), pp. 169–196.

Bhattacherjee, A. 2001. "Understanding Information Systems Continuance: An Expectation-Confirmation Model," *MIS Quarterly* (25:3), JSTOR, pp. 351–370.

Bhattacherjee, A., Perols, J., and Sanford, C. 2008. "Information Technology Continuance: A Theoretic Extension and Empirical Test," *Journal of Computer Information Systems* (49:1), Taylor & Francis, pp. 17–26.

Bonacich, P. 1987. "Power and Centrality: A Family of Measures," *American Journal of Sociology* (92:5), University of Chicago Press, pp. 1170–1182.

Bonacich, P. 2007. "Some Unique Properties of Eigenvector Centrality," *Social Networks* (29:4), pp. 555–564.

Borgatti, S. P., and Foster, P. C. 2003. "The Network Paradigm in Organizational Research: A Review and Typology," *Journal of Management* (29:6), Elsevier, pp. 991–1013.

Borgatti, S. P., and Ofem, B. 2010. "Social Network Theory and Analysis," *Social Network Theory and Educational Change*, Harvard Education Press Cambridge, MA, pp. 17–29.

Brown, S. A., Massey, A. P., Montoya-Weiss, M. M., and Burkman, J. R. 2002. "Do I Really Have to? User Acceptance of Mandated Technology," *European Journal of Information Systems* (11:4), pp. 283–295.

Brynjolfsson, E., and Hitt, L. 1995. "Information Technology as a Factor of Production: The Role of Differences among Firms," *Economics of Innovation and New Technology* (3:3–4), pp. 183–200.

Brynjolfsson, E., and Hitt, L. M. 1998. "Beyond the Productivity Paradox," *Communications of the ACM* (41:8), pp. 49–55.

Burkhardt, M. E., and Brass, D. J. 1990. "Changing Patterns or Patterns of Change: The Effects of a Change in Technology on Social Network Structure and Power," *Administrative Science Quarterly* (35:1), JSTOR, pp. 104–127.

Burton-Jones, A., and Gallivan, M. J. 2007. "Toward a Deeper Understanding of System Usage in Organizations: A Multilevel Perspective," *MIS Quarterly* (31:4), JSTOR, pp. 657–679.

Burton-Jones, A., and Straub Jr, D. W. 2006. "Reconceptualizing System Usage: An Approach and Empirical Test," *Information Systems Research* (17:3), INFORMS, pp. 228–246.

Cadini, F., Zio, E., and Petrescu, C.-A. 2008. "Using Centrality Measures to Rank the Importance of the Components of a Complex Network Infrastructure," in *International Workshop on Critical Information Infrastructures Security*, Springer, pp. 155–167.

Carter, M., Petter, S., Grover, V., and Thatcher, J. B. 2020. "Information Technology Identity: A Key Determinant of IT Feature and Exploratory Usage.," *MIS Quarterly* (44:3), pp. 983–1021.

Chadhar, M., and Daneshgar, F. 2018. "Organizational Learning and ERP Post-Implementation Phase: A Situated Learning Perspective," *Journal of Information Technology Theory and Application (JITTA)* (19:1), pp. 138–156.

Chang, H.-H., Chou, H.-W., Yin, C.-P., and Lin, C. I. 2011. "ERP Post-Implementation Learning, ERP Usage And Individual Performance Impact.," in *Proceedings of the 15th Pacific Asia Conference on Information Systems (PACIS) 2011*, Brisbane, Queensland, Australia: Association For Information Systems(AIS).

Chatterjee, S., Sarker, S., Lee, M. J., Xiao, X., and Elbanna, A. 2021. "A Possible Conceptualization of the Information Systems (IS) Artifact: A General Systems Theory Perspective 1," *Information Systems Journal* (31:4), Wiley Online Library, pp. 550–578.

Chauhan, J. P. S., and Gupta, S. 2020. "Towards a Mindful Sensemaking of Enterprise Systems Assimilation: An Organizational Perspective," in *Proceedings of the Internation Conference on Information Systems (ICIS) 2020*, India: Association For Information Systems(AIS).

Chen, B., Sivo, S., Seilhamer, R., Sugar, A., and Mao, J. 2013. "User Acceptance of Mobile Technology: A Campus-Wide Implementation of Blackboard's Mobile™ Learn Application," *Journal of Educational Computing Research* (49:3), SAGE Publications Sage CA: Los Angeles, CA, pp. 327–343.

Chen, L., Meservy, T. O., and Gillenson, M. 2012. "Understanding Information Systems Continuance for Information-Oriented Mobile Applications," *Communications of the Association for Information Systems* (30:9), pp. 127–146.

Chen, Y., Wang, Y., Nevo, S., Benitez, J., and Kou, G. 2017. "Improving Strategic Flexibility with Information Technologies: Insights for Firm Performance in an Emerging Economy," *Journal of Information Technology* (32:1), pp. 10–25.

Chopdar, P. K., Korfiatis, N., Sivakumar, V., and Lytras, M. D. 2018. "Mobile Shopping Apps Adoption and Perceived Risks: A Cross-Country Perspective Utilizing the Unified Theory of Acceptance and Use of Technology," *Computers in Human Behavior* (86), pp. 109–128.

Choudrie, J., and Zamani, E. D. 2016. "Understanding Individual User Resistance and Workarounds of Enterprise Social Networks: The Case of Service Ltd," *Journal of Information Technology* (31:2), pp. 130–151.

Chu, T.-H., and Robey, D. 2008. "Explaining Changes in Learning and Work Practice Following the Adoption of Online Learning: A Human Agency Perspective," *European Journal of Information Systems* (17:1), pp. 79–98.
Constantiou, I. D., Lehrer, C., and Hess, T. 2014. "Changing Information Retrieval Behaviours: An Empirical Investigation of Users' Cognitive Processes in the Choice of Location-Based Services," *European Journal of Information Systems* (23:5), Taylor & Francis, pp. 513–528.
Curry, L. A., Nembhard, I. M., and Bradley, E. H. 2009. "Qualitative and Mixed Methods Provide Unique Contributions to Outcomes Research," *Circulation* (119:10), Am Heart Assoc, pp. 1442–1452.
Cusumano, M. 2010. "Technology Strategy and Management The Evolution of Platform Thinking," *Communications of the ACM* (53:1), pp. 32–34.
Davidson, E. J., and Chismar, W. G. 2007. "The Interaction of Institutionally Triggered and Technology-Triggered Social Structure Change: An Investigation of Computerized Physician Order Entry," *MIS Quarterly* (31:4), pp. 739–758.
Davison, R. M., Wong, L. H., Alter, S., and Ou, C. 2019. "Adopted Globally but Unusable Locally: What Workarounds Reveal about Adoption, Resistance, Compliance and Non-Compliance," in *In Proceedings of the 27th European Conference on Information Systems*, Stockholm & Uppsala, Sweden June 8-14, 2019. (https://aisel.aisnet.org/ecis2019_rp/19).
Dedrick, J., Kraemer, K. L., and Shih, E. 2013. "Information Technology and Productivity in Developed and Developing Countries," *Journal of Management Information Systems* (30:1), pp. 97–122.
Devaraj, S., Easley, R. F., and Crant, J. M. 2008. "Research Note—How Does Personality Matter? Relating the Five-Factor Model to Technology Acceptance and Use," *Information Systems Research* (19:1), pp. 93–105.
Dong, J. Q., McCarthy, K. J., and Schoenmakers, W. W. 2017. "How Central Is Too Central? Organizing Interorganizational Collaboration Networks for Breakthrough Innovation," *Journal of Product Innovation Management* (34:4), Wiley Online Library, pp. 526–542.
Drummond, H. 2008. "The Icarus Paradox: An Analysis of a Totally Destructive System," *Journal of Information Technology* (23:3), pp. 176–184.
Eisenhardt, K. M. 1989. "Building Theories from Case Study Research," *Academy of Management Review* (14:4), pp. 532–550.
Eisenhardt, K. M., and Martin, J. A. 2000. "Dynamic Capabilities: What Are They?," *Strategic Management Journal* (21), pp. 1105–1121.
Eriksen, L.-B., Axline, S., Markus, M. L., and Drucker, P. 1999. "What Happens after" Going Live" with ERP Systems? Competence Centers Can Support Effective Institutionalization," in *Proceedings of the 5th Americas Conference on Information Systems (AMCIS) 1999*, Milwaukee, Wisconsin, United States of America.
Ferriani, S., and MacMillan, I. 2017. "Performance Gains and Losses from Network Centrality in Cluster Located Firms: A Longitudinal Study," *Innovation* (19:3), Taylor & Francis, pp. 307–334.

Fielt, E., Bandara, W., Miskon, S., and Gable, G. 2014. "Exploring Shared Services from an IS Perspective: A Literature Review and Research Agenda," *Communications of the Association for Information Systems* (34:15), pp. 1–38.
Freeman, L. C. 1978. "Centrality in Social Networks Conceptual Clarification," *Social Networks* (1:3), North-Holland, pp. 215–239.
Friedkin, N. E. 1991. "Theoretical Foundations for Centrality Measures," *American Journal of Sociology* (96:6), University of Chicago Press, pp. 1478–1504.
Friedman, B. D., and Allen, K. N. 2011. "Systems Theory," *Theory & Practice in Clinical Social Work* (2:3), Sage Thousand Oaks, CA, pp. 3–20.
Gallagher, K. P., and Gallagher, C. V. 2012. "Organizing for Post-Implementation ERP: A Contingency Theory Perspective," *Journal of Enterprise Information Management* (25:2), pp. 170–185.
Gallagher, K. P., Jamey Worrell, J. L., and Mason, R. M. 2012. "The Negotiation and Selection of Horizontal Mechanisms to Support Post-Implementation ERP Organizations," *Information Technology & People* (25:1), pp. 4–30.
Gawer, A., and Cusumano, M. A. 2008. "How Companies Become Platform Leaders," *MIT Sloan Management Review* (49:2), pp. 68–75.
Gawer, A., and Cusumano, M. A. 2014. "Industry Platforms and Ecosystem Innovation," *Journal of Product Innovation Management* (31:3), pp. 417–433.
Gibbs, C., Gretzel, U., and Saltzman, J. 2016. "An Experience-Based Taxonomy of Branded Hotel Mobile Application Features," *Information Technology & Tourism* (16:2), Springer, pp. 175–199.
Goh, J. M., Gao, G., and Agarwal, R. 2011. "Evolving Work Routines: Adaptive Routinization of Information Technology in Healthcare," *Information Systems Research* (22:3), pp. 565–585.
Grabski, S. V., Leech, S. A., and Schmidt, P. J. 2011. "A Review of ERP Research: A Future Agenda for Accounting Information Systems," *Journal of Information Systems* (25:1), pp. 37–78.
Griffith, T. L. 1999. "Technology Features as Triggers for Sensemaking," *Academy of Management Review* (24:3), Academy of Management Briarcliff Manor, NY 10510, pp. 472–488.
Groß, M. 2015. "Exploring the Acceptance of Technology for Mobile Shopping: An Empirical Investigation among Smartphone Users," *The International Review of Retail, Distribution and Consumer Research* (25:3), Taylor & Francis, pp. 215–235.
Gupta, A., Yousaf, A., and Mishra, A. 2020. "How Pre-Adoption Expectancies Shape Post-Adoption Continuance Intentions: An Extended Expectation-Confirmation Model," *International Journal of Information Management* (52:102094), Elsevier, pp. 1–13.
Ha, Y. M., and Ahn, H. J. 2014. "Factors Affecting the Performance of Enterprise Resource Planning (ERP) Systems in the Post-Implementation Stage," *Behaviour & Information Technology* (33:10), pp. 1065–1081.

Häkkinen, L., and Hilmola, O.-P. 2008. "ERP Evaluation during the Shakedown Phase: Lessons from an after-Sales Division," *Information Systems Journal* (18:1), pp. 73–100.
Hale, D. P., Haseman, W. D., and Groom, F. 1989. "Integrating Islands of Automation," *MIS Quarterly* (13:4), pp. 433–445.
Harris, M. A., Brookshire, R., and Chin, A. G. 2016. "Identifying Factors Influencing Consumers' Intent to Install Mobile Applications," *International Journal of Information Management* (36:3), pp. 441–450.
Harrison, D., and Easton, G. 2002. "Patterns of Actor Response to Environmental Change," *Journal of Business Research* (55:7), pp. 545–552.
Helfat, C. E., and Peteraf, M. A. 2003. "The Dynamic Resource-Based View: Capability Lifecycles," *Strategic Management Journal* (24:10), pp. 997–1010.
Hew, J.-J., Lee, V.-H., Ooi, K.-B., and Wei, J. 2015. "What Catalyses Mobile Apps Usage Intention: An Empirical Analysis," *Industrial Management & Data Systems* (115:7), Emerald Group Publishing Limited, pp. 1269–1291. (https://doi.org/10.1108/IMDS-01-2015-0028).
Hirschheim, R. 1985. "Information Systems Epistemology: An Historical Perspective," *Research Methods in Information Systems*, North-Holland, Amsterdam, pp. 9–33.
Ho, H.-Y., and Syu, L.-Y. 2010. "Uses and Gratifications of Mobile Application Users," in *2010 International Conference on Electronics and Information Engineering* (Vol. 1), IEEE, pp. V1-315.
Hoffman, A. N., Stearns, T. M., and Shrader, C. B. 1990. "Structure, Context, and Centrality in Interorganizational Networks," *Journal of Business Research* (20:4), Elsevier, pp. 333–347.
Hornyak, R., Rai, A., and Dong, J. Q. 2020. "Incumbent System Context and Job Outcomes of Effective Enterprise System Use," *Journal of the Association for Information Systems* (21:2), pp. 364–387.
Hsiao, C.-H. 2018. "The Effects of Post-Adoption Beliefs on the Expectation–Confirmation Model in an Electronics Retail Setting," *Total Quality Management & Business Excellence* (29:7–8), Taylor & Francis, pp. 866–880.
Hsieh, J. P.-A., and Wang, W. 2007. "Explaining Employees' Extended Use of Complex Information Systems," *European Journal of Information Systems* (16:3), pp. 216–227.
Hsu, P.-F., Yen, H. R., and Chung, J.-C. 2015. "Assessing ERP Post-Implementation Success at the Individual Level: Revisiting the Role of Service Quality," *Information & Management* (52:8), pp. 925–942.
Huang, T., and Yasuda, K. 2016. "Comprehensive Review of Literature Survey Articles on ERP," *Business Process Management Journal* (22:1), pp. 2–32.
Ibarra, H. 1993. "Network Centrality, Power, and Innovation Involvement: Determinants of Technical and Administrative Roles," *Academy of Management Journal* (36:3), pp. 471–501.
Iqbal, M. 2020. "App Download and Usage Statistics 2020," *Business of Apps*, , October 30. (https://www.businessofapps.com/data/app-statistics/, accessed March 14, 2021).

Jarvenpaa, S. L., and Staples, D. S. 2000. "The Use of Collaborative Electronic Media for Information Sharing: An Exploratory Study of Determinants," *The Journal of Strategic Information Systems* (9), pp. 129–154.

Jasperson, J. S., Carter, P. E., and Zmud, R. W. 2005. "A Comprehensive Conceptualization of Post-Adoptive Behaviors Associated with Information Technology Enabled Work Systems," *MIS Quarterly* (29:3), pp. 525–557.

Jones, M. C., Zmud, R. W., and Clark Jr, T. D. 2008. "ERP in Practice: A Snapshot of Post-Installation Perception and Behaviors," *Communications of the Association for Information Systems* (23:25), pp. 437–462.

Jung, J., Bapna, R., Ramaprasad, J., and Umyarov, A. 2019. "Love Unshackled: Identifying the Effect of Mobile App Adoption in Online Dating," *MIS Quarterly* (43:1), pp. 47–72.

Kane, G. C., and Labianca, G. 2011. "IS Avoidance in Health-Care Groups: A Multilevel Investigation," *Information Systems Research* (22:3), pp. 504–522.

Kast, F. E., and Rosenzweig, J. E. 1972. "General Systems Theory: Applications for Organization and Management," *Academy of Management Journal* (15:4), Academy of Management Briarcliff Manor, NY 10510, pp. 447–465.

Ke, W., Kang, L., Tan, C.-H., and Peng, C.-H. 2021. "User Competence with Enterprise Systems: The Effects of Work Environment Factors," *Information Systems Research*, INFORMS, pp. 1–16.

Kettinger, W. J., Grover, V., Guha, S., and Segars, A. H. 1994. "Strategic Information Systems Revisited: A Study in Sustainability and Performance," *MIS Quarterly* (18:1), pp. 31–58.

Khoo, H. M., Robey, D., and Rao, S. V. 2011. "An Exploratory Study of the Impacts of Upgrading Packaged Software: A Stakeholder Perspective," *Journal of Information Technology* (26:3), pp. 153–169.

Kim, B. 2010. "An Empirical Investigation of Mobile Data Service Continuance: Incorporating the Theory of Planned Behavior into the Expectation–Confirmation Model," *Expert Systems with Applications* (37:10), Elsevier, pp. 7033–7039.

Kim, H., Lee, I., and Kim, J. 2008. "Maintaining Continuers vs. Converting Discontinuers: Relative Importance of Post-Adoption Factors for Mobile Data Services," *International Journal of Mobile Communications* (6:1), Citeseer, pp. 108–132.

Kim, H.-W., Kankanhalli, A., and Lee, H.-L. 2016. "Investigating Decision Factors in Mobile Application Purchase: A Mixed-Methods Approach," *Information & Management* (53:6), pp. 727–739.

Kim, K.-H., Kim, K.-J., Lee, D.-H., and Kim, M.-G. 2019. "Identification of Critical Quality Dimensions for Continuance Intention in MHealth Services: Case Study of Onecare Service," *International Journal of Information Management* (46), Elsevier, pp. 187–197.

Klein, H. K., and Myers, M. D. 1999. "A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems," *MIS Quarterly* (23:1), JSTOR, pp. 67–93.

Kohli, R., and Devaraj, S. 2004. "Realizing the Business Value of Information Technology Investments: An Organizational Process," *MIS Quarterly Executive* (3:1), pp. 53–68.
Kohli, R., and Grover, V. 2008. "Business Value of IT: An Essay on Expanding Research Directions to Keep up with the Times," *Journal of the Association for Information Systems* (9:1), pp. 23–39.
Kohli, R., and Sherer, S. A. 2002. "Measuring Payoff of Information Technology Investments: Research Issues and Guidelines," *Communications of the Association for Information Systems* (9:14), pp. 241–268.
Koohikamali, M., Mousavizadeh, M., and Peak, D. 2019. "Continued Usage and Location Disclosure of Location-Based Applications: A Necessity for Location Intelligence," in *Proceedings of the 52nd Hawaii International Conference on System Sciences (HICSS) 2019*, Manoa, Hawaii, United States of America.
Lai, I. K., and Lai, D. C. 2014. "User Acceptance of Mobile Commerce: An Empirical Study in Macau," *International Journal of Systems Science* (45:6), Taylor & Francis, pp. 1321–1331.
Landherr, A., Friedl, B., and Heidemann, J. 2010. "A Critical Review of Centrality Measures in Social Networks," *Business & Information Systems Engineering* (2:6), Springer, pp. 371–385.
Landry, M., and Banville, C. 1992. "A Disciplined Methodological Pluralism for MIS Research," *Accounting, Management and Information Technologies* (2:2), Elsevier, pp. 77–97.
Lankton, N., McKnight, D. H., and Thatcher, J. B. 2014. "Incorporating Trust-in-Technology into Expectation Disconfirmation Theory," *The Journal of Strategic Information Systems* (23:2), pp. 128–145.
Le Breton-Miller, I., and Miller, D. 2015. "The Paradox of Resource Vulnerability: Considerations for Organizational Curatorship," *Strategic Management Journal* (36:3), pp. 397–415.
Lee, A. S. 1989. "A Scientific Methodology for MIS Case Studies," *MIS Quarterly* (13:1), pp. 33–50.
Lee, A. S. 1991. "Integrating Positivist and Interpretive Approaches to Organizational Research," *Organization Science* (2:4), INFORMS, pp. 342–365.
Lee, M.-C. 2010. "Explaining and Predicting Users' Continuance Intention toward e-Learning: An Extension of the Expectation–Confirmation Model," *Computers & Education* (54:2), Elsevier, pp. 506–516.
Leonardi, P. M. 2011. "When Flexible Routines Meet Flexible Technologies: Affordance, Constraint, and the Imbrication of Human and Material Agencies," *MIS Quarterly* (35:1), pp. 147–167.
Li, H., and Liu, Y. 2014. "Understanding Post-Adoption Behaviors of e-Service Users in the Context of Online Travel Services," *Information & Management* (51:8), Elsevier, pp. 1043–1052.
Li, T. C., and Chan, Y. E. 2019. "Dynamic Information Technology Capability: Concept Definition and Framework Development," *The Journal of Strategic Information Systems* (28:4), Elsevier, p. 101575.

Li, X., Hsieh, J. P.-A., and Rai, A. 2013. "Motivational Differences across Post-Acceptance Information System Usage Behaviors: An Investigation in the Business Intelligence Systems Context," *Information Systems Research* (24:3), pp. 659–682.
Liang, H., Peng, Z., Xue, Y., Guo, X., and Wang, N. 2015. "Employees' Exploration of Complex Systems: An Integrative View," *Journal of Management Information Systems* (32:1), pp. 322–357.
Liang, H., Saraf, N., Hu, Q., and Xue, Y. 2007. "Assimilation of Enterprise Systems: The Effect of Institutional Pressures and the Mediating Role of Top Management," *MIS Quarterly* (31:1), pp. 59–87.
Liang, H., Wang, N., Xue, Y., and Ge, S. 2017. "Unraveling the Alignment Paradox: How Does Business—IT Alignment Shape Organizational Agility?," *Information Systems Research* (28:4), INFORMS, pp. 863–879.
Liang, H., Xue, Y., and Wu, L. 2013. "Ensuring Employees' IT Compliance: Carrot or Stick?," *Information Systems Research* (24:2), pp. 279–294.
Limayem, M., Hirt, S. G., and Cheung, C. M. 2007. "How Habit Limits the Predictive Power of Intention: The Case of Information Systems Continuance," *MIS Quarterly* (31:4), pp. 705–737.
Lin, W.-S. 2012. "Perceived Fit and Satisfaction on Web Learning Performance: IS Continuance Intention and Task-Technology Fit Perspectives," *International Journal of Human-Computer Studies* (70), Elsevier, pp. 498–507.
Lin, W.-S., and Wang, C.-H. 2012. "Antecedences to Continued Intentions of Adopting E-Learning System in Blended Learning Instruction: A Contingency Framework Based on Models of Information System Success and Task-Technology Fit," *Computers & Education* (58:1), Elsevier, pp. 88–99.
Liu, L., Feng, Y., Hu, Q., and Huang, X. 2011. "From Transactional User to VIP: How Organizational and Cognitive Factors Affect ERP Assimilation at Individual Level," *European Journal of Information Systems* (20:2), pp. 186–200.
Liu, W., Sidhu, A., Beacom, A. M., and Valente, T. W. 2017. "Social Network Theory," *The International Encyclopedia of Media Effects*, John Wiley & Sons, Inc. Hoboken, NJ, USA, pp. 1–12.
Lu, Z., Cui, T., Tong, Y., and Wang, W. 2020. "Examining the Effects of Social Influence in Pre-Adoption Phase and Initial Post-Adoption Phase in the Healthcare Context," *Information & Management* (57:3), Elsevier, p. 103195.
Lumor, T. 2019a. "Factors That Influence Information Technology Use during Post-Implementation: A Literature Review.," in *Twenty-Seventh European Conference on Information Systems (ECIS2019)*, Stockholm-Uppsala, Sweden.
Lumor, T. 2019b. "Investigating the Structural Properties of an IT-Enabled Resource," in *Tenth Scandinavian Conference on Information Systems (SCIS2019), Nokia, Finland*, Nokia, Finland.
Lumor, T., Pulkkinen, M., and Hirvonen, A. 2020. "The Actual Adoption and Use of Mobile Apps: The Case of a Higher Education Context," in *Proceedings of the Americas Conference on Information Systems (AMCIS) 2020*,

Salt Lake City, United States of America: Association for Information Systems.
Lyytinen, K., Newman, M., and Al-Muharfi, A.-R. A. 2009. "Institutionalizing Enterprise Resource Planning in the Saudi Steel Industry: A Punctuated Socio-Technical Analysis," *Journal of Information Technology* (24:4), pp. 286–304.
Maas, J.-B., Van Fenema, P. C., and Soeters, J. 2018. "Post-Implementation ERP Usage: A Longitudinal Study of the Impact of Control and Empowerment," *Information Systems Management* (35:4), pp. 330–347.
Macredie, R., and Sandom, C. 1999. "IT-Enabled Change: Evaluating an Improvisational Perspective," *European Journal of Information Systems* (8:4), pp. 247–259.
Madey, G., Freeh, V., and Tynan, R. 2002. "The Open Source Software Development Phenomenon: An Analysis Based on Social Network Theory," in *Proceedings of the 8th Americas Conference on Information Systems (AMICS) 2002*, Dallas, United States.
Marabelli, M., and Newell, S. 2010. "Managing Loose Coupling in the Implementation of Large-Scale ERP.," in *Proceedings of the 18th European Conference on Information Systems (ECIS) 2010*, Pretoria, South Africa: Association For Information Systems(AIS), pp. 1–13.
Markus, M. L., and Robey, D. 1988. "Information Technology and Organizational Change: Causal Structure in Theory and Research," *Management Science* (34:5), pp. 583–598.
Maruping, L. M., and Magni, M. 2015. "Motivating Employees to Explore Collaboration Technology in Team Contexts.," *MIS Quarterly* (39:1), pp. 1–16.
Mata, F. J., Fuerst, W. L., and Barney, J. B. 1995. "Information Technology and Sustained Competitive Advantage: A Resource-Based Analysis," *MIS Quarterly* (19:4), pp. 487–505.
McGann, S. T., and Lyytinen, K. 2008. "The Improvisation Effect: A Case Study of User Improvisation and Its Effects on Information System Evolution," in *Proceedings of the 29th International Conference on Information Systems (ICIS) 2008*, Paris, France: Association for Information Systems (AIS), pp. 1–15.
McLean, G. 2018. "Examining the Determinants and Outcomes of Mobile App Engagement-A Longitudinal Perspective," *Computers in Human Behavior* (84), pp. 392–403.
McLeod, A., Clark, J., Warren, J., and Dietrich, G. 2008. "The Impact of Information Systems on End User Performance: Examining the Effects of Cognitive Style Using Learning Curves in an Electronic Medical Record Implementation," *Communications of the Association for Information Systems (CAIS)* (22:9), pp. 165–184.
McMullin, E. 1985. "Galilean Idealization," *Studies in History and Philosophy of Science Part A* (16:3), Elsevier, pp. 247–273.

Melville, N., Kraemer, K., and Gurbaxani, V. 2004. "Information Technology and Organizational Performance: An Integrative Model of IT Business Value," *MIS Quarterly* (28:2), pp. 283–322.
Mingers, J. 2001. "Combining IS Research Methods: Towards a Pluralist Methodology," *Information Systems Research* (12:3), INFORMS, pp. 240–259.
Mingers, J. 2003. "A Critique of Statistical Modelling from a Critical Realist Perspective," in *Proceedings of the 11th European Conference on Information Systems (ECIS) 2003*, Naples, Italy: Association For Information Systems(AIS).
Mingers, J. 2004. "Re-Establishing the Real: Critical Realism and Information Systems," *Social Theory and Philosophy for Information Systems* (372:1), Wiley, Chichester, pp. 372–406.
Mingers, J., Mutch, A., and Willcocks, L. 2013. "Critical Realism in Information Systems Research," *MIS Quarterly* (37:3), JSTOR, pp. 795–802.
Mishra, A. N., Anderson, C., Angst, C. M., and Agarwal, R. 2012. "Electronic Health Records Assimilation and Physician Identity Evolution: An Identity Theory Perspective," *Information Systems Research* (23:3-part-1), pp. 738–760.
Morris, M. G., and Venkatesh, V. 2010. "Job Characteristics and Job Satisfaction: Understanding the Role of Enterprise Resource Planning System Implementation," *Mis Quarterly* (34:1), pp. 143–161.
Motiwalla, L. F. 2007. "Mobile Learning: A Framework and Evaluation," *Computers & Education* (49:3), Elsevier, pp. 581–596.
Munoz-Leiva, F., Climent-Climent, S., and Liébana-Cabanillas, F. 2017. "Determinants of Intention to Use the Mobile Banking Apps: An Extension of the Classic TAM Model," *Spanish Journal of Marketing-ESIC* (21:1), pp. 25–38.
Nan, N., and Tanriverdi, H. 2017. "Unifying the Role of IT in Hyperturbulence and Competitive Advantage via a Multilevel Perspective of IS Strategy," *MIS Quarterly* (41:3), pp. 937–958.
Nevo, S., Nevo, D., and Pinsonneault, A. 2016. "A Temporally Situated Self-Agency Theory of Information Technology Reinvention.," *Mis Quarterly* (40:1), pp. 157–186.
Nevo, S., and Wade, M. 2011. "Firm-Level Benefits of IT-Enabled Resources: A Conceptual Extension and an Empirical Assessment," *The Journal of Strategic Information Systems* (20:4), pp. 403–418.
Nevo, S., and Wade, M. R. 2010. "The Formation and Value of IT-Enabled Resources: Antecedents and Consequences of Synergistic Relationships," *Mis Quarterly* (34:1), pp. 163–183.
Nickerson, R. C., Varshney, U., and Muntermann, J. 2013. "A Method for Taxonomy Development and Its Application in Information Systems," *European Journal of Information Systems* (22:3), Taylor & Francis, pp. 336–359.
Nordea Bank Abp. 2020. "Nordea Mobile Makes Your Everyday Banking Easier," *Nordea Mobile*. (https://www.nordea.fi/en/personal/our-

services/online-mobile-services/nordea-mobile.html, accessed March 15, 2021).
Nwankpa, J. K., and Roumani, Y. 2014. "The Influence of Organizational Trust and Organizational Mindfulness on ERP Systems Usage.," *Communications of the Association for Information Systems (CAIS)* (34:85), pp. 1469–1492.
O Reilly, C. A., and Tushman, M. L. 2004. "The Ambidextrous Organization," *Harvard Business Review* (82:4), pp. 74–83.
Oborn, E., Barrett, M., and Davidson, E. 2011. "Unity in Diversity: Electronic Patient Record Use in Multidisciplinary Practice," *Information Systems Research* (22:3), pp. 547–564.
Oghuma, A. P., Chang, Y., Libaque-Saenz, C. F., Park, M.-C., and Rho, J. J. 2015. "Benefit-Confirmation Model for Post-Adoption Behavior of Mobile Instant Messaging Applications: A Comparative Analysis of KakaoTalk and Joyn in Korea," *Telecommunications Policy* (39:8), Elsevier, pp. 658–677.
Oliveira, T., Faria, M., Thomas, M. A., and Popovič, A. 2014. "Extending the Understanding of Mobile Banking Adoption: When UTAUT Meets TTF and ITM," *International Journal of Information Management* (34:5), Elsevier, pp. 689–703.
Orlikowski, W. J. 1996. "Improvising Organizational Transformation over Time: A Situated Change Perspective," *Information Systems Research* (7:1), pp. 63–92.
Orlikowski, W. J., and Baroudi, J. J. 1991. "Studying Information Technology in Organizations: Research Approaches and Assumptions," *Information Systems Research* (2:1), INFORMS, pp. 1–28.
Orlikowski, W. J., and Iacono, C. S. 2001. "Research Commentary: Desperately Seeking the 'IT' in IT Research—A Call to Theorizing the IT Artifact," *Information Systems Research* (12:2), INFORMS, pp. 121–134.
Orton, J. D., and Weick, K. E. 1990. "Loosely Coupled Systems: A Reconceptualization," *Academy of Management Review* (15:2), pp. 203–223.
Park, S. Y., Nam, M.-W., and Cha, S.-B. 2012. "University Students' Behavioral Intention to Use Mobile Learning: Evaluating the Technology Acceptance Model," *British Journal of Educational Technology* (43:4), Wiley Online Library, pp. 592–605.
Parthasarathy, M., and Bhattacherjee, A. 1998. "Understanding Post-Adoption Behavior in the Context of Online Services," *Information Systems Research* (9:4), INFORMS, pp. 362–379.
Pavlou, P. A., and El Sawy, O. A. 2010. "The 'Third Hand': IT-Enabled Competitive Advantage in Turbulence through Improvisational Capabilities," *Information Systems Research* (21:3), pp. 443–471.
Perrow, C. 2011. *Normal Accidents: Living with High Risk Technologies*, Princeton university press.
Ragu-Nathan, T., Tarafdar, M., Ragu-Nathan, B. S., and Tu, Q. 2008. "The Consequences of Technostress for End Users in Organizations: Conceptual Development and Empirical Validation," *Information Systems Research* (19:4), pp. 417–433.

Rahrovani, Y., and Pinsonneault, A. 2020. "Innovative IT Use and Innovating with IT: A Study of the Motivational Antecedents of Two Different Types of Innovative Behaviors," *Journal of the Association for Information Systems* (21:4), pp. 936–970.
Rai, A., and Tang, X. 2010. "Leveraging IT Capabilities and Competitive Process Capabilities for the Management of Interorganizational Relationship Portfolios," *Information Systems Research* (21:3), pp. 516–542.
Retana, G. F., Forman, C., Narasimhan, S., Niculescu, M. F., and Wu, D. 2018. "Technology Support and Post-Adoption IT Service Use: Evidence from the Cloud," *MIS Quarterly* (42:3), pp. 961–978.
de Reuver, M., Sørensen, C., and Basole, R. C. 2018. "The Digital Platform: A Research Agenda," *Journal of Information Technology* (33), pp. 124–135.
Roberts, N., Campbell, D. E., and Vijayasarathy, L. R. 2016. "Using Information Systems to Sense Opportunities for Innovation: Integrating Postadoptive Use Behaviors with the Dynamic Managerial Capability Perspective," *Journal of Management Information Systems* (33:1), pp. 45–69.
Robey, D., Ross, J. W., and Boudreau, M.-C. 2002. "Learning to Implement Enterprise Systems: An Exploratory Study of the Dialectics of Change," *Journal of Management Information Systems* (19:1), pp. 17–46.
Rodon, J., Sese, F., and Christiaanse, E. 2011. "Exploring Users' Appropriation and Post-Implementation Managerial Intervention in the Context of Industry IOIS," *Information Systems Journal* (21:3), pp. 223–248.
Rowe, F. 2014. "What Literature Review Is Not: Diversity, Boundaries and Recommendations," *European Journal of Information Systems* (23:3), pp. 241–255.
Rubin, I. S. 1979. "Retrenchment, Loose Structure and Adaptability in the University," *Sociology of Education* (5:2), pp. 211–222.
Ruivo, P., Oliveira, T., and Neto, M. 2014. "Examine ERP Post-Implementation Stages of Use and Value: Empirical Evidence from Portuguese SMEs," *International Journal of Accounting Information Systems* (15:2), pp. 166–184.
Sabherwal, R., and Jeyaraj, A. 2015. "Information Technology Impacts on Firm Performance: An Extension of Kohli and Devaraj (2003)," *MIS Quarterly* (39:4), pp. 809–836.
Saeed, K. A., and Abdinnour, S. 2013. "Understanding Post-Adoption IS Usage Stages: An Empirical Assessment of Self-Service Information Systems," *Information Systems Journal* (23:3), pp. 219–244.
Saeed, K. A., Abdinnour, S., Lengnick-Hall, M. L., and Lengnick-Hall, C. A. 2010. "Examining the Impact of Pre-Implementation Expectations on Post-Implementation Use of Enterprise Systems: A Longitudinal Study," *Decision Sciences* (41:4), pp. 659–688.
Salo, M., and Makkonen, M. 2014. "Why Not Complain? A Paradoxical Problem for Mobile Service and Application Providers," in *Proceedings of the 22nd European Conference on Information Systems (ECIS) 2014*, Tel Aviv, Israel: Association for Information Systems (AIS).
Salo, M., and Makkonen, M. 2018. "Why Do Users Switch Mobile Applications?: Trialing Behavior as a Predecessor of Switching Behavior,"

Communications of the Association for Information Systems (42:14), pp. 386–407.
Sandberg, J., Holmström, J., and Lyytinen, K. 2020. "Digitization and Phase Transitions in Platform Organizing Logics: Evidence from the Process Automation Industry," *Management Information Systems Quarterly* (44:1), Management Information Systems Research Center, pp. 129–153.
Santhanam, R., Seligman, L., and Kang, D. 2007. "Postimplementation Knowledge Transfers to Users and Information Technology Professionals," *Journal of Management Information Systems* (24:1), pp. 171–199.
Saraf, N., Langdon, C. S., and El Sawy, O. 2013. "IS Integration and Knowledge Sharing in Multi-Unit Firms: The Winner's Curse," *European Journal of Information Systems* (22:6), pp. 592–603.
Sasidharan, S., Santhanam, R., Brass, D. J., and Sambamurthy, V. 2012. "The Effects of Social Network Structure on Enterprise Systems Success: A Longitudinal Multilevel Analysis," *Information Systems Research* (23:3-part-1), pp. 658–678.
Schneider, S., Wollersheim, J., Krcmar, H., and Sunyaev, A. 2018. "How Do Requirements Evolve over Time? A Case Study Investigating the Role of Context and Experiences in the Evolution of Enterprise Software Requirements," *Journal of Information Technology* (33:2), pp. 151–170.
Schryen, G. 2013. "Revisiting IS Business Value Research: What We Already Know, What We Still Need to Know, and How We Can Get There," *European Journal of Information Systems* (22:2), pp. 139–169.
Schwarz, A., Mehta, M., Johnson, N., and Chin, W. W. 2007. "Understanding Frameworks and Reviews: A Commentary to Assist Us in Moving Our Field Forward by Analyzing Our Past," *ACM SIGMIS Database: The DATABASE for Advances in Information Systems* (38:3), pp. 29–50.
Scott, W. R., and Davis, G. F. 2016. *Organizations and Organizing: Rational, Natural and Open Systems Perspectives*, London and New York: Routledge, Taylor and Francis Group.
Seddon, P. B., Calvert, C., and Yang, S. 2010. "A Multi-Project Model of Key Factors Affecting Organizational Benefits from Enterprise Systems," *MIS Quarterly* (34:2), pp. 305–328.
Seethamraju, R. 2009. "Effects of ES-Enabled Standardization and Integration on Business Process Agility," in *Proceedings of the 13th Pacific Asia Conference on Information Systems (PACIS) 2009*, Hyderabad, India: Association for Information Systems (AIS).
Shaikh, A. A., and Karjaluoto, H. 2015. "Making the Most of Information Technology & Systems Usage: A Literature Review, Framework and Future Research Agenda," *Computers in Human Behavior* (49), pp. 541–566.
Sirmon, D. G., Gove, S., and Hitt, M. A. 2008. "Resource Management in Dyadic Competitive Rivalry: The Effects of Resource Bundling and Deployment," *Academy of Management Journal* (51:5), pp. 919–935.
Sirmon, D. G., Hitt, M. A., Arregle, J.-L., and Campbell, J. T. 2010. "The Dynamic Interplay of Capability Strengths and Weaknesses: Investigating

the Bases of Temporary Competitive Advantage," *Strategic Management Journal* (31:13), pp. 1386–1409.
Sirmon, D. G., Hitt, M. A., and Ireland, R. D. 2007. "Managing Firm Resources in Dynamic Environments to Create Value: Looking inside the Black Box," *Academy of Management Review* (32:1), pp. 273–292.
Sirmon, D. G., Hitt, M. A., Ireland, R. D., and Gilbert, B. A. 2011. "Resource Orchestration to Create Competitive Advantage: Breadth, Depth, and Life Cycle Effects," *Journal of Management* (37:5), pp. 1390–1412.
Smith, H. A., and McKeen, J. D. 2011. "Enabling Collaboration with IT," *Communications of the Association for Information Systems* (28:16), pp. 243–254.
Someh, I., Shanks, G., and Davern, M. 2019. "Reconceptualizing Synergy to Explain the Value of Business Analytics Systems," *Journal of Information Technology* (34:4), SAGE Publications Sage UK: London, England, pp. 371–391.
Spierings, A., Kerr, D., and Houghton, L. 2017. "Issues That Support the Creation of ICT Workarounds: Towards a Theoretical Understanding of Feral Information Systems," *Information Systems Journal* (27:6), pp. 775–794.
Statista. 2021. "Mobile Internet and Apps," *Statista*. (https://www.statista.com/markets/424/topic/538/mobile-internet-apps/#statistic3, accessed March 15, 2021).
Stein, M.-K., Newell, S., Wagner, E. L., and Galliers, R. D. 2015. "Coping with Information Technology: Mixed Emotions, Vacillation and Non-Conforming Use Patterns," *MIS Quarterly* (39:2), pp. 367–392.
Sun, H. 2012. "Understanding User Revisions When Using Information System Features: Adaptive System Use and Triggers.," *MIS Quarterly* (36:2), pp. 453–478.
Svejvig, P., and Jensen, T. B. 2013. "Making Sense of Enterprise Systems in Institutions: A Case Study of the Re-Implementation of an Accounting System.," *Scandinavian J. Inf. Systems* (25:1), pp. 3–36.
Sykes, T. A. 2015. "Support Structures and Their Impacts on Employee Outcomes: A Longitudinal Field Study of an Enterprise System Implementation.," *MIS Quarterly* (39:2), pp. 473–496.
Sykes, T. A. 2020. "Enterprise System Implementation and Employee Job Outcomes: Understanding the Role of Formal and Informal Support Structures Using the Job Strain Model.," *MIS Quarterly* (44:4), pp. 2055–2086.
Sykes, T. A., and Venkatesh, V. 2017. "Explaining Post-Implementation Employee System Use and Job Performance: Impacts of the Content and Source of Social Network Ties.," *MIS Quarterly* (41:3), pp. 917–936.
Sykes, T. A., Venkatesh, V., and Gosain, S. 2009. "Model of Acceptance with Peer Support: A Social Network Perspective to Understand Employees' System Use," *MIS Quarterly* (33:2), pp. 371–393.
Sykes, T. A., Venkatesh, V., and Johnson, J. L. 2014. "Enterprise System Implementation and Employee Job Performance: Understanding the Role of Advice Networks.," *Mis Quarterly* (38:1), pp. 51–72.

Sykes, T. A., Venkatesh, V., and Rai, A. 2011. "Explaining Physicians' Use of EMR Systems and Performance in the Shakedown Phase," *Journal of the American Medical Informatics Association* (18:2), pp. 125–130.
Tam, C., Santos, D., and Oliveira, T. 2020. "Exploring the Influential Factors of Continuance Intention to Use Mobile Apps: Extending the Expectation Confirmation Model," *Information Systems Frontiers* (22:1), Springer, pp. 243–257.
Tanriverdi, H. 2006. "Performance Effects of Information Technology Synergies in Multibusiness Firms," *MIS Quarterly* (30:1), pp. 57–77.
Techopedia. 2018. *Mobile Application (Mobile App)*. (https://www.techopedia.com/definition/2953/mobile-application-mobile-app).
Teri, S., Acai, A., Griffith, D., Mahmoud, Q., Ma, D. W., and Newton, G. 2014. "Student Use and Pedagogical Impact of a Mobile Learning Application," *Biochemistry and Molecular Biology Education* (42:2), Wiley Online Library, pp. 121–135.
Thong, J. Y., Hong, S.-J., and Tam, K. Y. 2006. "The Effects of Post-Adoption Beliefs on the Expectation-Confirmation Model for Information Technology Continuance," *International Journal of Human-Computer Studies* (64:9), Elsevier, pp. 799–810.
Thornhill, S., and Amit, R. 2003. "Learning about Failure: Bankruptcy, Firm Age, and the Resource-Based View," *Organization Science* (14:5), pp. 497–509.
Tong, Y., Tan, S. S.-L., and Teo, H.-H. 2015. "The Road to Early Success: Impact of System Use in the Swift Response Phase," *Information Systems Research* (26:2), pp. 418–436.
Tong, Y., Teo, H.-H., and Tan, C.-H. 2008. "Direct and Indirect Use of Information Systems in Organizations: An Empirical Investigation of System Usage in a Public Hospital," in *Proceedings of the 29th International Conference on Information Systems (ICIS) 2008*, Paris, France: Association for Information Systems (AIS), p. 138.
Umunnakwe, A., Sahu, A., Narimani, M. R., Davis, K., and Zonouz, S. 2021. "Cyber-Physical Component Ranking for Risk Sensitivity Analysis Using Betweenness Centrality," *IET Cyber-Physical Systems: Theory & Applications*, Wiley Online Library, pp. 1–12.
Vaast, E., and Walsham, G. 2009. "Trans-Situated Learning: Supporting a Network of Practice with an Information Infrastructure," *Information Systems Research* (20:4), pp. 547–564.
Van de Ven, A. H., and Poole, M. S. 1995. "Explaining Development and Change in Organizations," *Academy of Management Review* (20:3), pp. 510–540.
Van Oosterhout, M., Waarts, E., and van Hillegersberg, J. 2006. "Change Factors Requiring Agility and Implications for IT," *European Journal of Information Systems* (15:2), Taylor & Francis, pp. 132–145.
Vardaman, J. M., Amis, J. M., Dyson, B. P., Wright, P. M., and Van de Graaff Randolph, R. 2012. "Interpreting Change as Controllable: The Role of

Network Centrality and Self-Efficacy," *Human Relations* (65:7), Sage Publications Sage UK: London, England, pp. 835–859.
Veiga, J. F., Keupp, M. M., Floyd, S. W., and Kellermanns, F. W. 2014. "The Longitudinal Impact of Enterprise System Users' Pre-Adoption Expectations and Organizational Support on Post-Adoption Proficient Usage," *European Journal of Information Systems* (23:6), pp. 691–707.
Venkatesh, V. 2006. "Where to Go from Here? Thoughts on Future Directions for Research on Individual-Level Technology Adoption with a Focus on Decision Making," *Decision Sciences* (37:4), pp. 497–518.
Venkatesh, V., Brown, S. A., Maruping, L. M., and Bala, H. 2008. "Predicting Different Conceptualizations of System Use: The Competing Roles of Behavioral Intention, Facilitating Conditions, and Behavioral Expectation," *MIS Quarterly* (32:3), pp. 483–502.
Venkatesh, V., Morris, M. G., Davis, G. B., and Davis, F. D. 2003. "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly* (27:3), JSTOR, pp. 425–478.
Venkatesh, V., Thong, J. Y., and Xu, X. 2012. "Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology," *MIS Quarterly* (36:1), JSTOR, pp. 157–178.
Venkatesh, V., Zhang, X., and Sykes, T. A. 2011. "'Doctors Do Too Little Technology': A Longitudinal Field Study of an Electronic Healthcare System Implementation," *Information Systems Research* (22:3), pp. 523–546.
Vessey, I., Ramesh, V., and Glass, R. L. 2002. "Research in Information Systems: An Empirical Study of Diversity in the Discipline and Its Journals," *Journal of Management Information Systems* (19:2), Taylor & Francis, pp. 129–174.
Wade, M., and Hulland, J. 2004. "The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research," *MIS Quarterly* (28:1), pp. 107–142.
Wagner, E. L., and Newell, S. 2007. "Exploring the Importance of Participation in the Post-Implementation Period of an ES Project: A Neglected Area," *Journal of the Association for Information Systems* (8:10), pp. 508–524.
Walsh, I., Gettler-Summa, M., and Kalika, M. 2016. "Expectable Use: An Important Facet of IT Usage," *The Journal of Strategic Information Systems* (25:3), pp. 177–210.
Walsh, I., Kefi, H., and Baskerville, R. 2010. "Managing Culture Creep: Toward a Strategic Model of User IT Culture," *The Journal of Strategic Information Systems* (19:4), pp. 257–280.
Walsham, G. 1995. "Interpretive Case Studies in IS Research: Nature and Method," *European Journal of Information Systems* (4:2), Taylor & Francis, pp. 74–81.
Walsham, G. 2006. "Doing Interpretive Research," *European Journal of Information Systems* (15:3), Taylor & Francis, pp. 320–330.
Weber, R. 2004. "Editor's Comments: The Rhetoric of Positivism versus Interpretivism: A Personal View," *MIS Quarterly* (28:4), JSTOR, pp. iii–xii.
Webster, J., and Watson, R. T. 2002. "Analyzing the Past to Prepare for the Future: Writing a Literature Review," *MIS Quarterly* (26:2), pp. xiii–xxiii.

Williams, T. 2005. "Cooperation by Design: Structure and Cooperation in Interorganizational Networks," *Journal of Business Research* (58:2), Elsevier, pp. 223–231.
Yin, R. K. 1981. "The Case Study Crisis: Some Answers," *Administrative Science Quarterly* (26:1), pp. 58–65.
Yin, R. K. 2012. *Applications of Case Study Research*, (3rd ed.), USA: Sage Publications, Inc.
Yu, C.-S. 2012. "Factors Affecting Individuals to Adopt Mobile Banking: Empirical Evidence from the UTAUT Model," *Journal of Electronic Commerce Research* (13:2), Journal of Electronic Commerce Research, pp. 104–121.
Zhou, T. 2011. "An Empirical Examination of Users' Post-Adoption Behaviour of Mobile Services," *Behaviour & Information Technology* (30:2), Taylor & Francis, pp. 241–250.
Zhu, Y., Li, Y., Wang, W., and Chen, J. 2010. "What Leads to Post-Implementation Success of ERP? An Empirical Study of the Chinese Retail Industry," *International Journal of Information Management* (30:3), pp. 265–276.

APPENDIX

TABLE 6 Sample of research adoption and continuance use of mobile app

Authors	Mobile App	Research Method	Theory	Main variable	Unite of Analysis
Jung et al (2019)	Online dating app	experiment	Mechanisms (Ubiquity, Impulsivity, disinhibition)	User behaviour	Mobile app (feature/task)
Tam et al (2020)	unspecified app	survey (304)	Expectation Confirmation Model (ECM) and Extended Unified theory of acceptance and use of technology (UTAUT2)	Continuance Intention	mobile app (unspecified)
Kim et al (2019)	Mobile health app	survey (191)	Service Quality theory (SQT)	Continuance Intention	mobile app
Koohikamali et al (2019)	location based app	survey (319)	ECM, and goal attainment theory	Continuance Intention & use behaviour	Mobile app (feature/task)
Hsiao (2018)	e-retailing app	survey (274)	ECM and SQT	continuance intention	mobile app
Hsiao et al (2016)	social app	survey (378)	IS continuance Model, and social network theory	Continuance intention	mobile app (unspecified)
Alraimi et al (2015)	MOOC apps	survey (316)	IS continuance model and Motivation theory	continuance intention	mobile app (3 apps)
Oghuma et al (2015)	mobile instant messaging app	survey (467)	Expanded Expectation Confirmation Model (Thong et al 2006) and IS benefits	continuance intention	mobile app (2 apps)

Authors	Mobile App	Research Method	Theory	Main variable	Unite of Analysis
Wang (2015)	mobile value-added services	survey (304)	Service dominant logic	continuance intention	mobile app (2 apps)
Li and Liu (2014)	online-travel service	survey (543)	IS continuance model and Word of Mouth	continuance intention	mobile app (1 app)
Stone and Baker-Eveleth (2013)	electronic textbooks	survey (469)	IS continuance model	continuance intention	mobile app (unspecified)
Zheng et al (2013)	travel virtual community	survey (281)	IS continuance model and IS Success model	continuance intention	mobile app (feature/task)
Lin (2012)	virtual learning system	survey (165)	IS continuance model and task-technology fit theory (TTF)	Continuance intention	mobile app (feature/task)
Lin and Wang (2012)	virtual learning system	Focus group interview (8) & Survey (88)	IS success model, TTF, IS continuance model, contingency theory	continuance intention	mobile app (feature/task)
Zhou (2011)	mobile payment app	survey (195)	IS success model and flow theory	continuance intention	mobile app (service)
Lee (2010)	web-based learning app	survey (363)	ECM, technology acceptance model (TAM), theory of planned action and flow theory	continuance intention	mobile app (1 app)
Bhattacherjee (2001)	Online banking	field survey	ECM	continuance intention	mobile app (1 app)
Chopdar et al (2018)	mobile shopping app	survey (366, USA-145, India - 221)	UTAUT2	behavioural intention and use behaviour	mobile app (unspecified)
Yu (2012)	mobile banking app	Survey (441)	UTAUT2	behavioural intention and use behaviour	mobile app (service)
Oliveira et al (2014)	mobile banking app	survey (194)	TTF, UTAUT, Initial Trust Model (ITM)	behavioural intention and use behaviour	mobile app (features/task)

Authors	Mobile App	Research Method	Theory	Main variable	Unite of Analysis
Groß (2015)	mobile shopping app	survey (128)	TAM	behavioural intention and use behaviour	mobile app (service)

TABLE 7 Classification of factors that influence IT use during post-implementation

Org. Entity	**Support Structure**	**Support Properties**	**Support Activities**
IT	Support structures (e.g., IT professionals, core team and help desk, peer support groups) for IT implementation (Robey et al. 2002), and continuous integration (Seddon et al. 2010), extension (Ha and Ahn 2014), and configuration (Zhu et al. 2010), adaptations (Liang et al. 2013; Zhu et al. 2010)	Functional fit (Seddon et al. 2010), (Perceived) usefulness and ease of use (Saeed and Abdinnour 2013; Sykes et al. 2011), system quality and Information quality (Hsu et al. 2015), functionality (Khoo et al. 2011), type of IT (Bagayogo et al. 2014), IT compatibility, complexity, and efficiency (Liang et al. 2015; Ruivo et al. 2014), IT reliability and helpfulness (Lankton et al. 2014)	Continuous IT integration (Seddon et al. 2010), extension (Ha and Ahn 2014), and configuration (Zhu et al. 2010), and adaptations (Liang et al. 2013; Zhu et al. 2010).
Work Task	support structures (e.g., core teams, change management teams, and project leadership teams) for task configuration (Wagner and Newell 2007), task adaptation (Bagayogo et al. 2014), and process optimization (Seddon et al. 2010)	Task-IT fit (Benlian 2015), task variety (Liang et al. 2015), task complexity, analysability, and interdependence (Bagayogo et al. 2014), workflow (Kane and Labianca 2011), task specification (Liu et al. 2011), task identify and task significance (Morris and Venkatesh 2010), change in task (Sun 2012), task structure and clarity (Hale et al. 1989)	Continuous work task configuration (Wagner and Newell 2007), task adaptation (Bagayogo et al. 2014), and process optimization (Seddon et al. 2010).

User	Formal support structures: E.g., IT support staff (Hsu et al. 2015), core teams (Robey et al. 2002), and help desk (Khoo et al. 2011), change management teams (Sykes 2015), online training materials (Tong et al. 2015), subjective norm and incentives systems (Devaraj et al. 2008), training workshops (Brown et al. 2002), performance evaluation scheme (Liu et al. 2011) Informal support structures: E.g., peer-support, social/advice networks (Sasidharan et al. 2012), subjective norm (Devaraj et al. 2008)	work commitment (Maas et al. 2018), expectations (Choudrie and Zamani 2016), intentions (Maruping and Magni 2015), emotions (Stein et al. 2015), IT knowledge type (Bagayogo et al. 2014), motivation and personal innovativeness (Li et al. 2013), reward and punishment expectancy(Liang et al. 2013), disposition to job and organization (Bala and Bhagwatwar 2018), centrality of user (Sasidharan et al. 2012), absorptive capability and level of use (Liu et al. 2011), personality characteristics (Sykes et al. 2011), skills variety and autonomy (Morris and Venkatesh 2010), use culture (Walsh et al. 2016), social capital (Sykes et al. 2009), cognitive style (McLeod et al. 2008), technostress (Ragu-Nathan et al. 2008), habit (Limayem et al. 2007), and prior knowledge of the IT (Auer 1998), skills, confidence, and self-efficacy(Brown et al. 2002)	Learning activities: self - led learning (Tong et al. 2015), peer / supervisor-led learning (Sykes 2015), formal learning (Brown et al. 2002), group learning (Häkkinen and Hilmola 2008; Sykes et al. 2009) Adaptation activities: innovation and idea generation (Hale et al. 1989; Santhanam et al. 2007), IT and Work task configuration (Wagner and Newell 2007)
Group	Similar to user support structures	empowerment (Maruping and Magni 2015), group level social capital (Sasidharan et al. 2012), group identity (Mishra et al. 2012), group workflow and emotion (Kane and Labianca 2011), group diversity (Oborn et al. 2011), and group network structure (Sasidharan et al. 2012; Sykes et al. 2009)	Similar to user support activities

Organization	policies and formal guidelines (Choudrie and Zamani 2016), training, online support, help desk support, change management support, top management support, expert users (Sykes 2015), best practices (Ruivo et al. 2014), rewards and punishment, formal control (Liang et al. 2013), cross-functional teams (Gallagher and Gallagher 2012), stakeholder management methods (Gallagher et al. 2012), ongoing ES improvement projects (Seddon et al. 2010),	control and empowerment (Maas et al. 2018), organizational autonomy, organizational innovativeness (Roberts et al. 2016), service quality (Hsu et al. 2015), organizational trust and organizational mindfulness (Nwankpa and Roumani 2014), use context (mandatory and voluntary) (Brown et al. 2002), use context (stable or dynamic) (Limayem et al. 2007), sense of information ownership (Jarvenpaa and Staples 2000), sense of urgency (Hale et al. 1989; Robey et al. 2002)	Develop structures for IT and process improvement (Eriksen et al. 1999; Seddon et al. 2010), develop innovative climate (Liang et al. 2015), support training and knowledge sharing (Santhanam et al. 2007), provide resources, (Wagner and Newell 2007), motivate users (Liang et al. 2007), enforce policies, guidelines, rewards and controls (Choudrie and Zamani 2016; Liang et al. 2013)
Institution	regulatory bodies (McLeod et al. 2008), competitors (Ruivo et al. 2014), professional networks or "network-of-practice" (Vaast and Walsham 2009).	institutional pressure (normative, coercive, and mimetic) (Liang et al. 2007),	exert institutional pressure on the organization (Hale et al. 1989; Liang et al. 2007) and users within the organization (Chu and Robey 2008; Vaast and Walsham 2009)

TABLE 8 Definition of concepts and indicative quotes

Mobile App Attributes	**Definition**	**Indicative Quote**
Mobile app quality	refers to the extent to which a user believes SmartCampus is functional, stable, and provides accurate information	*"sometimes, some dishes finish but they don't update it there [in SmartCampus] so maybe it's a good idea for them to do it" Int.B*
Ease of Use	the extent of ease with which a user believes s/he can use SmartCampus to perform a task or a set of tasks within their use context	*"…with SmartCampus I think it's a lot easier just you can just open the app and open the map, that's very easy" Int.G*
Usefulness	the extent to which a user believes SmartCampus can enable them to perform a task or a set of tasks within their use context	*"the map is very useful because I'm not used to big campuses like here, so because you have so many buildings, different places" Int.S*
Customizability	the extent to which a user can personalize the features and options of SmartCampus	*"…there are all the restaurants, and I put the hearts on the ones that I usually go, and they appear here on the home, which is easier because I don't have to change, like I just go through it and I see where I want to go." Int.R*
Completeness	the extent to which SmartCampus has features with which users can perform several tasks without using other applications	*"…if it is complete, that's if I don't have to use five apps that I believe could belong together to have the information that I need" Int.S*
Visibility of Features	the ease with which a user can see and interact with the features of SmartCampus	*"I feel like at least me, for the first two months I didn't even click there. I just thought that it was just some kind of options. I didn't understand that some specific very good features are hidden in there." Int.A*
User Attributes	Definition	Indicative Quote
Personality traits	the stable characteristics and tendencies of a user that determine how the user adopts and uses SmartCampus	*"I close the app because it's not responding…like hard close it like in phone management so… because I don't have time to wait like 20 seconds or 30 seconds is too long... but I am quite demanding" Int.D*
Self-efficacy	The extent to which a user believes s/he has enough skills to competently understand the operations of and use SmartCampus to perform tasks	*" I feel like sometimes the application crushes, you know? You cannot log in, maybe that, I am not an IT student so I don't know how you could do that" Int.C*

Awareness of features	the extent to which a user is aware of the features of SmartCampus	*"I saw it [CampusMap feature] there in the app like somehow scrolled through it and saw that there is an option like that and later on when I really needed it then I went for it" Int.F*
Habits	refers to on-going routine behaviours that a user engages in to perform tasks that the user can perform with the features of SmartCampus	*"… like it hasn't like stayed in my normal routine …the lunch page is like, now when I look it, it's great you can see all of them but like somehow, it's not my routine to check the lunch from there, I just, I've got used to check every page like differently…." Int.H*
Familiarity with alternatives	indicates the extent to which a user knows of and has used other (mobile) applications to perform tasks which the user can perform with the features of SmartCampus	*"…I already have everything on the google calendar …, and there, I can also like add things for myself like not just courses, but I can add anything there" Int.R*
Support Structures	Definition	Indicative Quote
formal support structures	these are structures orchestrated by the case university to support the adoption and use of SmartCampus (e.g., orientation programs, and student tutors)	*"I think the first time was through the orientation program but I did not know exactly what it [SmartCampus] was all about…" Int.N*
Informal support structures (social influence)	these are structures (e.g., social networks) within which users get to know about SmartCampus and within which users are exposed to social influences that affect how they use SmartCampus.	*"my friend group usually uses it. We check the lunches, yeah, and we discuss where should we go and how much it is. for example, the price or what it contains and stuff like that" Int.C*
Task Attributes	Definition	Indicative Quote
Task frequency	reflects how frequently a user performs a task	*"…I just open the App and on the home screen, I have the food menu. So, pretty much every day I am using it because I'm having lunch at school so at least once a day I open the App in one way or the other" Int.A*
Nature of information required	reflects the static or dynamic nature of information that a user derives from SmartCampus to perform a task (it reflects whether the information keeps changing or remains the same)	*"…when I first started my Finnish two classes and I was going back to [name of campus] campus, then I started using the map but after I've done it for almost one month plus, I don't use the map frequently because I already know where I am going to" Int.N*
Task profile	the diversity or similarity of task that a user performs	*"… I used SmartCampus pretty much the same as at the time I*

	using the features of SmartCampus.	*downloaded it, but since I bought the sports card …I use the CampusSports now because I have the card so I need that information so I can check there is yoga at this time at this location" Int.C*

TABLE 9 Empirical cases reviewed for the structural properties of IT-enabled resources

Author	**IT-enabled resource**	**Components**	**Structural Properties**	**Renewal**
Macredie and Sandom (1999)	IT-enabled workflow	Workflow application Several Processes (e.g., workflow, documentation configuration control, document review) Other IT assets (e.g., databases)	focal IT asset with high centrality flexible processes Inflexible focal IT assets tightly coupled IT assets and processes	Organizational processes were changed through improvisation to make up for the difficulties in changing the focal IT.
Svejvig, and Jensen (2013)	IT-enabled accounting processes	Focal IT asset (Oracle E-business suite) Accounting processes	Flexible IT asset IT asset with high centrality Inflexible accounting processes tightly coupled IT asset and accounting processes	several changes were made to the focal IT which led to difficulties in upgrade
Azad and King (2008, 2012)	IT-enabled tax administration	Focal IT asset (Tax administration IS) Other IT asset (Spreadsheet) Tax administration processes	Inflexible focal IT asset Inflexible work processes Flexible other IT asset Tightly coupled work process and focal IT asset loosely coupled work process and other IT asset	Other IT asset was used to perform work process instead of the focal IT asset
Azad and King (2008, 2012)	IT-enabled medication administration	focal IT asset (medication dispensing system) medication dispensing processes Teams of nurses and doctors (Actors)	loosely coupled focal IT and medication dispensing processes focal IT asset with high centrality Inflexible focal IT asset Flexible work processes	Actors change their work processes to make up for the inflexibility in the focal IT (caused by healthcare policy)
Rodon, et al. (2011)	IT-enabled transport network	focal IT asset (interorganizational IS) Organizations other IT assets transport work processes	focal IT asset with high centrality Flexible focal IT asset tightly coupled work process and focal IT inflexible work processes	Changes to tightly couple work processes and focal IT assets and organizations constrained further chance (renewal)

Goh et. al, (2011)	IT-enabled clinical documentation	Focal IT asset (computerized documentation system) Team of health workers several healthcare processes Other IT assets	focal IT asset with high centrality Flexible focal IT asset loosely coupled work process and focal IT flexible work processes	co-evolution of flexible IT and work processes to meet emerging user performance needs
Lyytinen et al. (2009)	IT-enabled accounting	Focal IT asset (an ERP) Work processes (including accounting processes)	Flexible IT asset IT asset with high centrality flexible work processes loosely coupled work processes and focal IT tightly coupled IT asset and accounting process	loosely coupled focal IT assets and work processes enabled change and tightly couple focal IT asset (ledger module) and work process (accounting process) led to efficiency
Seethamraju (2009)	IT-enabled processes	focal IT asset (SAP) several organizational functions Several work processes several other IT assets	focal IT with high centrality inflexible processes flexible processes tight coupling between focal IT asset and inflexible processes loose coupling between IT asset and flexible processes	loose coupling between focal IT asset and flexible processes enabled renewal (agility), and tight coupling between focal IT asset and inflexible processes enabled efficiency
Berente et al. (2008), Berente and Yoo (2012)	IT-enabled processes	Focal IT asset (SAP) several organizational functions Several work processes several other IT assets (e.g., spreadsheets) Several teams (e.g., project managers, administrators, and researchers)	focal IT asset with high centrality inflexible processes tight coupling between focal IT asset and processes loose coupling between IT asset and flexible (improvised) processes	Teams leveraged flexible processes and other IT assets to compensate for tightly coupled processes and an inflexible focal IT asset
McGann, and Lyytinen (2008)	IT-enabled supply chain	focal IT asset (inter-organizational IS) Organizations other IT assets (e.g., spreadsheets, legacy system) work processes	focal IT asset with high centrality loose links between other IT assets (legacy system) and other IT assets and work processes flexible work processes flexible other IT assets	changes were effected by extending existing work processes and other IT assets or by creating new work processes and other IT assets

			tight coupling between focal IT assets and work process	
Drummond (2008)	IT-enabled claims processing	A focal IT asset (claim processing application) claims work process improvised processes Other IT assets (e.g., word processing system) Work teams	Inflexible focal IT asset flexible work processes Flexible other IT asset Tightly coupled work process and focal IT asset loosely coupled work process and other IT asset	changes were effected by developing loosely coupled work processes and other IT assets leading to a decline in performance
Santhanam , et al (2007)	IT-enabled loan processing	focal IT asset several functions Work teams (e.g., help desk, portfolio, and project managers) work processes	flexible focal IT asset flexible work processes loosely coupled a focal IT asset and other IT assets improvised processes	changes were effected by adapting work processes and focal IT assets and by reconciling and institutionalizing the adaptations.
Schneider et al (2018)	IT-enabled customer relation management	focal IT asset (a cloud-based CRM system) work processes Multiple functions/division Other IT assets	flexible focal IT asset interface (yet, inflexible workflows) tight coupling between focal IT asset and other IT assets tight coupling between IT asset and work processes high centrality of focal IT asset	Changes to the focal IT asset and the tight coupling between focal IT asset and work processes and other IT assets constrained renewal and derailed performance
Spierings, et. al (2017)	IT-enabled work processes	focal IT asset (Enterprise system) Work processes Other IT assets (e.g., feral information systems)	loosely coupled focal IT and work processes loosely coupled focal IT and other IT assets focal IT asset with high centrality	other IT assets were used to effect changes and to go around the limitations of the focal IT asset
Baird, et al (2017)	IT-enabled physician practices	focal IT asset (electronic health record system) work processes Other IT assets (e.g., lab information system, email) other organizations (e.g., Labs)	Flexible focal IT asset loosely linked focal IT asset and work processes Loosely linked focal IT asset and other IT assets	loose links between focal IT and work process and loosely linked focal IT and other IT (e.g., lab IT assets) made the components evolve discrepantly. Processes were

				modified to establish tight links between processes, focal IT assets and other IT assets.
Beaudry and Pinsonneault (2005)	IT-enabled banking account management	focal IT asset (account management system) work teams (e.g., account manager and administrators) work processes other IT assets (e.g., email and spreadsheets).	focal IT asset with high centrality flexible processes flexible focal IT assets and other IT assets loosely coupled focal IT assets, work processes, work teams, and other IT assets	the loosely coupled focal IT asset, work processes, work teams, and other IT assets enabled renewal to address different goals
Orlikowski, (1996)	IT-enabled customer service department	focal IT asset (incident management system) customer service department work processes work teams	flexible focal IT asset loosely coupled focal IT assets, other IT assets, customer service department and work processes and teams flexible work processes	loose coupling between focal IT asset and flexible processes and teams enabled renewal and co-evolution.
Leonardi (2011)	IT-enabled automotive design	focal IT asset (computer simulation application) Several departments/ functions work teams (e.g., engineers) Other IT assets	Flexible focal IT asset focal IT asset with high centrality Flexible work processes and other IT assets.	The flexibility of a focal IT asset and work processes allowed for renewal through the extension of the work process and the focal IT asset
Davidson and Chismar (2007)	IT-enabled physician order entry	focal IT asset (order entry systems) clinical departments work teams (e.g., nurses, doctors, pharmacists) work processes other IT assets (e.g., pharmacy system, and laboratory system)	Inflexible focal IT asset flexible work processes inflexible work processes focal IT asset with high centrality Flexible other IT asset Tightly coupled work process and focal IT asset loosely coupled work process and other IT assets	The change was effected by adapting flexible work processes and other IT assets to compensate for the inflexibility of the focal IT asset and inflexible work processes

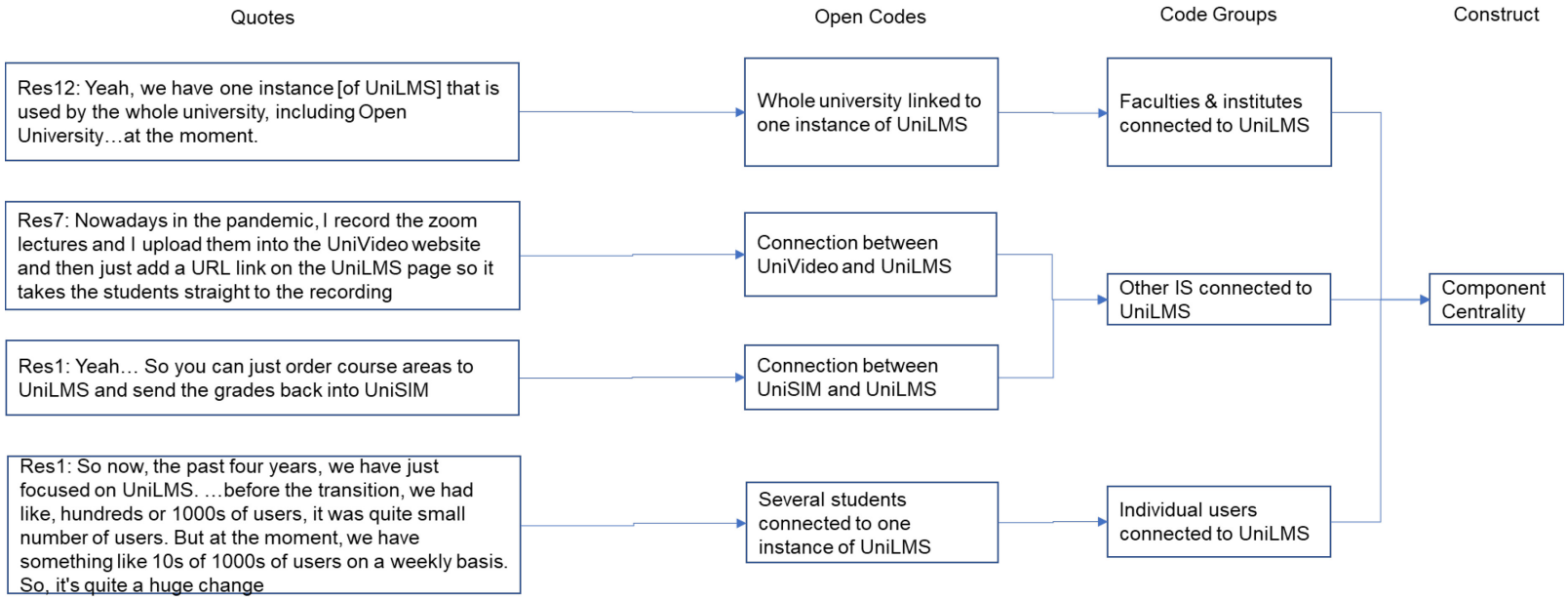

FIGURE 6 Data analysis (component centrality)

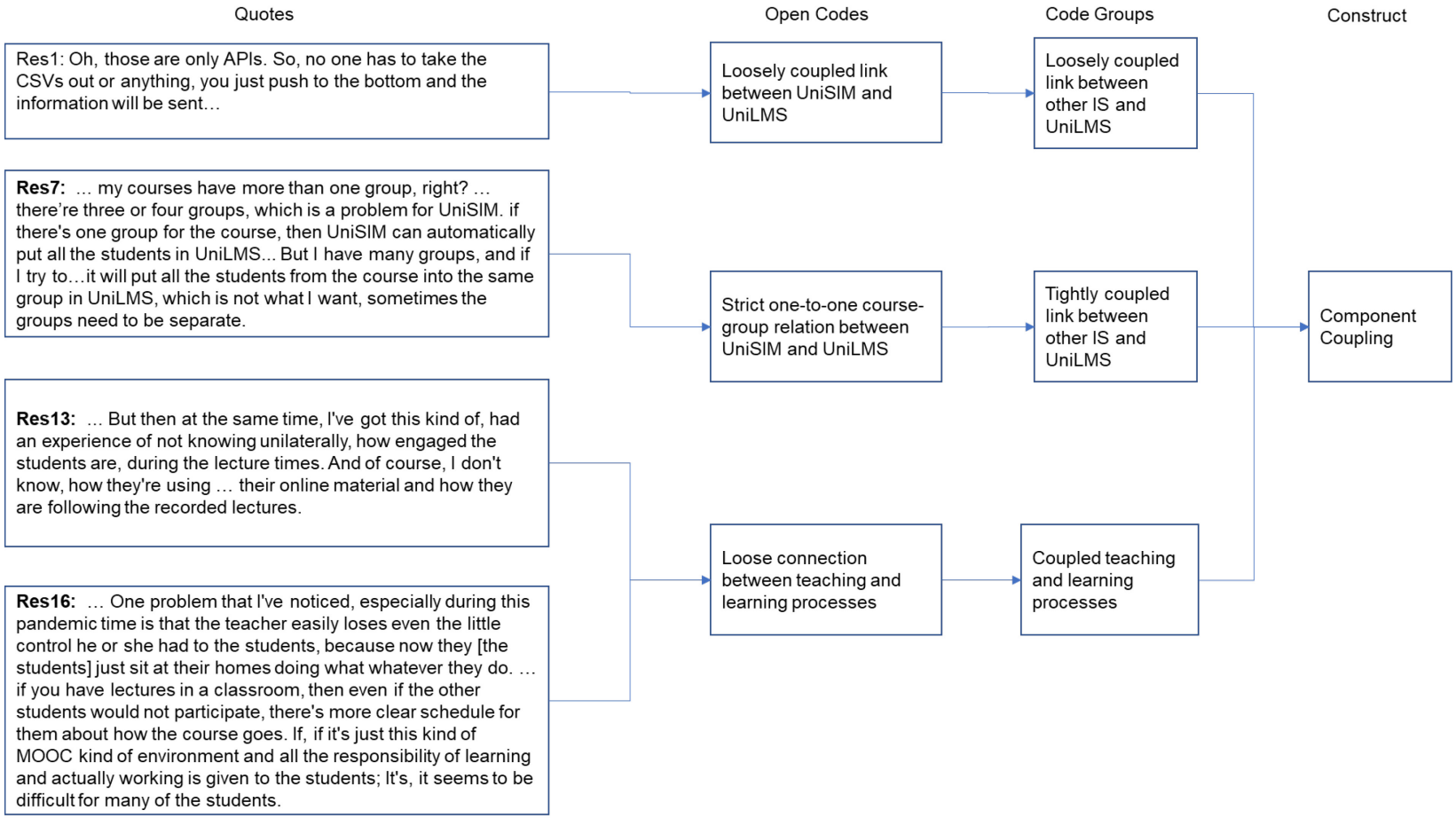

FIGURE 7 Data analysis (component coupling)

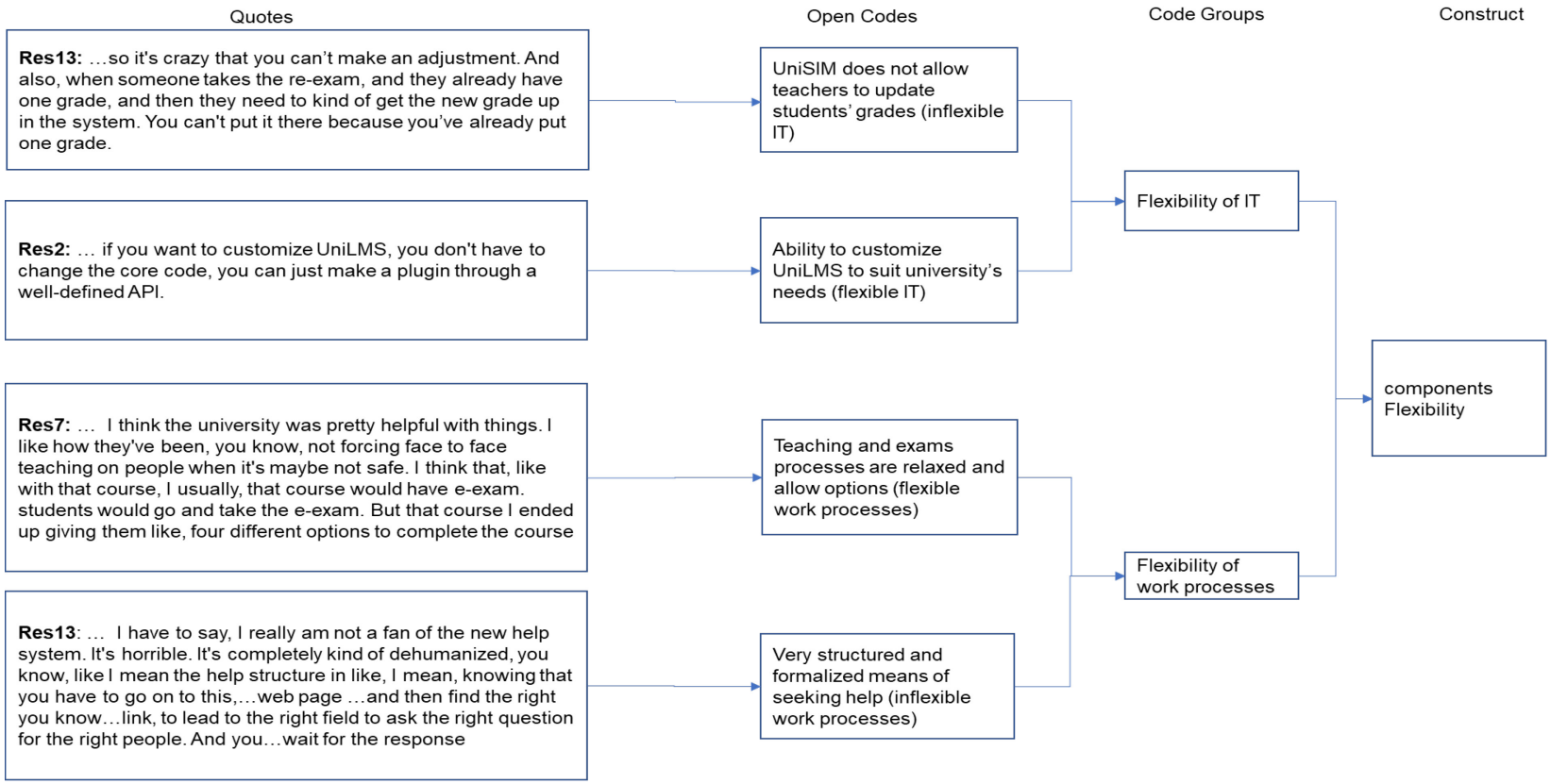

FIGURE 8 Data analysis (component flexibility)

ORIGINAL PAPERS

I

FACTORS THAT INFLUENCE INFORMATION TECHNOLOGY USE DURING POST-IMPLEMENTATION: A LITERATURE REVIEW

by

Lumor, T, 2019

In Proceedings of the 27th European Conference on Information Systems (ECIS 2019), Stockholm-Uppsala, Sweden

FACTORS THAT INFLUENCE INFORMATION TECHNOLOGY USE DURING POST-IMPLEMENTATION: A LITERATURE REVIEW

Research paper

Lumor, Truth, University of Jyväskylä, Jyväskylä, Finland, trlumor@student.jyu.fi

Abstract

Organizations invest in Information Technology (IT) expecting to derive organizational performance benefits from their investments. However, most of the investments do not result in expected benefits because either the implementation fails, or the IT implemented gets misused, underutilized or abandoned during post-implementation. Research suggests that for an organization to derive benefits from its IT investments, users in the organization should actively use the IT for an extended period. Consequently, researchers have investigated factors that can influence IT-use during post-implementation; howbeit, the factors are dispersed across individual publications. Drawing on a review of 68 empirical articles on IT-use, this paper collates and synthesizes factors that influence IT-use during post-implementation. The factors consist of support structures, support properties, and support activities, and do manifest at different levels. Relationships among the factors and IT-use are discussed. Further, this study collates various perspectives on IT-use to improve our understanding of the different ways in which users engage with IT during post-implementation. Finally, the implications of the findings for research and practice are discussed. In general, this study contributes to research on the derivation of business value of IT from IT investments, and specifically, to research on IT-use during post-implementation.

Keywords: IT-use, Post-implementation, Post-adoption, Support structures, Support properties, support activities.

1 Introduction

Organizations invest in information technology (IT) with the hope of deriving operational and/or strategic benefits from such investments. The literature is replete with accounts of costly investments that organizations make in IT (e.g. see Sykes et al., 2014; Tong et al., 2015). However, deriving the intended benefits do not usually follow as hoped. Approximately 70 percent of IT investments fail (Akhlaghpour and Lapointe, 2018; Babar et al., 2018), and several of those that make it beyond implementation do face challenges related to adoption and use (Bagayogo et al., 2014). Some IT get abandoned, misused or underutilized after implementation (Bagayogo et al., 2014; Jones et al., 2008).

An IT results in performance benefits when users actively use the IT to accomplish their work tasks (Maruping and Magni, 2015). Literature shows that, organizations usually observe performance dip after implementing an IT (Saeed et al., 2010); and that, for an organization to start realizing performance gains from its investment in IT, the IT should have been actively used for a duration well beyond the initial adoption of the IT. The duration depends on the type of IT investment. Benefits from investments in operational IT may manifest in months, whereas benefits from investments in strategic IT may manifest after two to three years (Kohli and Sherer, 2002; Sabherwal and Jeyaraj, 2015).

Recognizing the importance of, and the challenges that confront, the use of IT (i.e. IT-use) beyond initial adoption, several researchers have studied the factors that influence IT-use at the post-

implementation or post-adoption phase. Following Jasperson et al (2005)'s definition of post-adoption behaviour, this study defines IT-use during post-implementation as:

the applications that a user makes of the original features or extended features of an IT to accomplish his/her work tasks after the "IT application has been installed, made accessible to the user, and applied by the user in accomplishing his/her work activities [or tasks]" (2005, p. 531).

The manner in which a user, or a group of users, applies the features of the IT is referred to here as *IT-use behaviour*. Several research on IT-use during the post-implementation phase has suggested factors that influence IT-use behaviour at different levels, including the individual level (Roberts et al., 2016), group level (Oborn et al., 2011) and organizational level (Liang et al., 2007). Further, researchers have applied several theories including institutional theory (Liang et al., 2007), network theory (Sasidharan et al., 2012), motivation theory (Li et al., 2013), and theories on organizational trust and mindfulness (Nwankpa and Roumani, 2014), just to mention a few, to study IT-use behaviour during post-implementation. However, despite the apparent existence of a rich repertoire of knowledge on the factors that influence IT-use behaviour, the knowledge is scattered across individual publications. For example, Sykes (2015)'s review of articles (published in MISQ and ISR) for factors (specifically, support structures) that influence IT-use behaviour shows that "the vast majority of studies have been limited to one or two support structures" (2015, p. 475).

Attempts have been made in the past to synthesize the factors that influence IT-use. Jasperson et al (2005) synthesize factors (including organizational interventions and individual cognition and characteristics) that influence post-adoption behaviour. However, Jasperson et al. (2005) noted that most of the prior literature on which they based their review considered factors (e.g., training) that organizations employ during IT implementation to promote adoption. They called for future research to consider post-implementation interventions that promote continuous use of IT. Sykes (2015)'s review mentioned above considered only support structures and was limited to only two journals. The review by Shaikh and Karjaluoto (2015) considered a limited set of factors (e.g., perceived usefulness, perceived ease of use, subjective norm, and satisfaction) that influence IT-use. Walsh et al (2016)'s review of the literature on IT-use concentrated on different terminologies associated with IT-use in order to theoretically ground and position a new concept; "expectable use". Also see Shaikh and Karjaluoto (2015) for a review of prior review article on IT-use. This study augments the efforts of prior literature reviews at collating and synthesizing the factors that influence IT-use during post-implementation. Specifically, it draws on a systematic review of the IT-use literature to answer the following research question: *what factors can an organization leverage to support IT-use during post-implementation*?

This study contributes to the literature by collating and synthesizing factors that an organization can leverage to influence IT-use during post-implementation; and the several perspectives that researchers have taken to describe IT-use. It also contributes a set of implications for research and management. The rest of the paper is organized as follows. Section 2 discusses the research method and preliminary results. Section 3 discusses the different types of IT-use and factors that influence IT-use during post-implementation. Section 4 presents the limitations, implications and conclusions of the study.

2 Research Method

This study employs systematic literature review as its methodology. A systematic literature review provides the occasion to synthesize dispersed knowledge on a subject into a more coherent view on the subject (Rowe, 2014; Schwarz et al., 2007; Webster and Watson, 2002). Thus, a systematic literature review is appropriate for synthesizing findings from prior research on the factors that influence IT-use during post-implementation. 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 comprehensive study on IT-use during post-implementation. In Google Scholar; however, the search term "Post Implementation" AND "Information Technology" was used to limit the results to articles relevant to IT. The search result 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 1*** below).

For this study, the titles and abstracts of each article were read. Empirical articles on IT-use during post-implementation or post-adoption 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 read in full. Articles on the factors that influence IT-use during post-implementation were retained. In total, 68 articles were retained (see ***Table 1*** below)

Journal	No. of articles	Included
EJIS	338	7
ISJ	190	3
ISR	324	12
JAIS	17	3
JIT	284	3
JMIS	357	6
JSIS	209	4
MISQ	66	11
AIS Elibrary (Others)	299	10
Google Scholar (17258)	300	9
Total	**2384**	**68**

Table 1. Search and Selection Results

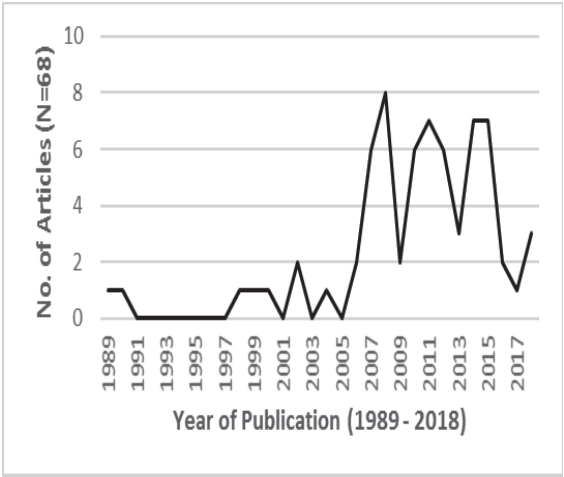

Figure 1. Distribution of articles by year of publication

2.1 Preliminary Observations

There are several notable preliminary observations that have been made. First, a review of the 68 articles reveals that research on the factors that support IT-use during post-implementation is on the increase in recent years, specifically from 2007 on-wards (see ***Figure 1*** above). This is consistent with results from prior reviews (e.g. Shaikh and Karjaluoto, 2015) and corroborates the assertion that most early research on IT-use focused on factors that lead to successful IT implementation and intention to use IT (Jasperson et al., 2005). Second, empirical research on IT-use have mostly employed field study (N = 30), case study (N = 21) and survey (N = 13) as research methods. All empirical research that employed survey used cross-sectional data, whereas those that employed field study used either cross-sectional data or longitudinal data (see ***Table 2***). Most recent research of IT-use rely on longitudinal data, probably because longitudinal data enables researchers to better trace how IT-use and the factors that influence IT-use evolve during post-implementation (Kohli and Sherer, 2002; Sabherwal and Jeyaraj, 2015). Third, although all the articles referred to IT-use, several of them did not specify the type of IT-use behaviour that were observed or measured. The types of IT-use are discussed in the next section. Finally, some researchers have gone beyond IT-use to consider the organizational performance impact of IT-use. However, the organizational impact of IT-use discussed in the IT-use literature are mostly "intermediate process level" performance impacts (Melville et al., 2004, p. 287); for example, business process improvement (Liu et al., 2011), task performance efficiency (Hsu et al., 2015; Sykes et al., 2014), cost reduction (Gallagher and Gallagher, 2012), and quality of information (Sasidharan et al., 2012). A probable explanation is that most of the 68 empirical articles concentrated on the process level where users and groups (e.g. work teams and functions) used IT to complete their work tasks.

Research Method	Articles *(Note: * = used cross-sectional data)*
Case study (N =21)	Auer(1998), Eriksen et al (1999), Robey et al.,(2002), Scheepers et al (2004), Topi et al (2006), Worrell et al (2006), Santhanam et al (2007), Wagner and Newell (2007), Chu and Robey (2008), Häkkinen et al (2008), Sia (2008), Vaast and Walsham (2009), Walsh et al (2010), Khoo et al (2011), Liu et al (2011), Oborn et al (2011), Gallagher et al (2012), Bagayogo et al (2014), Stein et al (2015), Tong et al (2015), Choudrie and Zamani (2016),
Field study (N =30)	**Longitudinal**: Limayem et al (2007), Devaraj et al (2008), McLeod et al. (2008), Ragu-Nathan et al (2008), Sykes et al (2009), Morris et al. (2010), Sykes et al (2011), Venkatesh et al. (2011), Deng and Chi (2012), Sasidharan et al (2012), Li et al (2013), Lankton et al (2014), Sykes et al (2014), Veiga et al (2014), Benlian (2015), Maruping and Magni (2015), Sykes (2015), Bala and Bhagwatwar (2018), Maas et al (2018), **Cross-sectional***: Hale et al (1989), Jarvenpaa et al, (2000), Brown et al (2002), Bhattacherjee and Hikmet (2007), Hsieh and Wang (2007), Tong et al (2008), Fadel and Brown (2010), Saeed et al (2010), Saeed and Abdinnour (2013), Liang et al (2015), Tams et al. (2018)
Survey* (N =13)	Kaye (1990), Liang et al (2007), Zhu et al (2010), Mishra et al (2012), Sun (2012), Liang et al (2013), Chang et al (2011), Gallagher et al. (2012), Ha and Ahn (2014), Nwankpa et al (2014), Hsu et al (2015), Roberts et al (2016), Ruivo et al (2014),
Others ((N =4)	**Content Analysis**: Seddon et al (2010); **Mixed*:** Jones et al (2008), Kane and Labianca (2011), **Action Research**: Baird et al (2017)

Table 2. Research Methods Employed in IT-use Research

3 Findings and Discussions

This section presents; first, the different types of IT-use that have been discussed in the literature, and second, the factors that influence IT-use during post-implementation.

3.1 Types of IT – Use during Post-Implementation

Researchers have discussed IT-use from different perspectives. They have focused on the manner in which users use IT to accomplish work task (work task perspective); on how existing knowledge, and new knowledge acquired via learning, are employed to use IT (learning / knowledge perspective); on how and the extent to which IT features are used (IT features perspective); on whether users use the IT in a context or environment where they voluntarily or mandatorily use the IT (IT-use context perspective); and on whose behalf a user uses an IT (focal user perspective). The perspective that a researcher takes, influences the concept that the researcher uses to describe IT-use during post-implementation. ***Table 3*** presents brief descriptions of the perspectives and concepts used to describe IT-use in the 68 empirical articles. The perspectives on *work task*, learning/*knowledge*, *IT features* and *focal user* seem to hinge on the assumption that IT users act (e.g., gain knowledge to use, adapt, and extend IT features and work tasks) in ways that support their productivity and that of other users in an organization. In other words, IT users *faithfully* use and adapt the IT and work tasks. However, research shows that there are instances where IT users purposefully or unintentionally misuse IT or engage in adaptations that are counterproductive (Khoo et al., 2011; Stein et al., 2015). Similarly, the *IT-use context* perspective assumes that users will use the IT as prescribed or mandated. However, research has shown that even in mandatory use contexts, users still retain some freedom to use, misuse or avoid the IT (Fadel and Brown, 2010; Liang et al., 2013). Researchers have therefore studied factors that organizations can employ to influence IT-use behaviours during post-implementation. These factors are discussed in the next subsection.

Perspective	Type and Brief Descriptions of IT-use
Work task	**Routine use:** involves using an IT in a standardized manner to complete one's work task (Tong et al., 2015). Routine use is pre-intended and conforms to the standard task procedures and workflows embedded in the system (Maas et al., 2018).

	Innovative use: involves using an IT in a way that is not pre-intended, or in a "non-standardized" manner to enhance how effectively and efficiently one performs his/her work task (Li et al., 2013; Tong et al., 2015). Innovative use is also referred to as *infusion* (Maas et al., 2018).
Learning / Knowledge	**Exploitative use:** involves using existing knowledge about work tasks and an IT in order to solve existing or new problems (Tong et al., 2015) **Explorative use:** involves gaining new knowledge (e.g., by experimenting with work tasks and IT features) to device new and innovative ways of doing existing work tasks (i.e. gaining efficiency) or addressing new challenges and opportunities (i.e. gaining effectiveness) (Tong et al., 2015)
IT Features	**Narrow use**: involves a user using a few of the IT features related to his/her work task, leaving other applicable IT features unused (Liang et al., 2015) **Extended use**: involves a user using several of the IT features related to his/her work task (Hsieh and Wang, 2007; Hsu et al., 2015; Liang et al., 2015). Use of IT features can be shallow (general knowledge of IT features) or deep (mastery of IT features) (Benlian, 2015). **Adaptive use:** reflects the dynamics in post-adoptive IT-use behaviour. It refers to a user's active revision of the set of IT features that he/she uses and how he/she uses the IT features (Sun, 2012). **Enhanced use:** refers to using IT features in novel ways and consists of; 1. using formerly unused sets of available IT features to perform current or additional work tasks; 2. using current IT features to perform additional work tasks; 3. extending IT features to perform current or additional work tasks (Bagayogo et al., 2014).
IT-use context	**Voluntary use:** refers to when a user uses an IT to perform his/her work task although he/she is under no obligation to do so (Eriksen et al., 1999; Nwankpa and Roumani, 2014). Voluntary use can take many forms including routine use, innovative use, explorative use, extended use etc. **Involuntary (Mandatory) use:** refers to when a user uses an IT to perform his/her work task under direct obligations (e.g., IT-use policies) (Liang et al., 2013), or indirect obligations (e.g., work task and IT are tightly fitted such that the user cannot perform his/her work task without using the IT) (Veiga et al., 2014). Under direct obligations IT-use may be referred to as **appropriate use** (Liang et al., 2013), whereas under indirect obligations IT-use may be referred to as **proficient use** (Veiga et al., 2014). **Appropriate use** and **proficient use** involve using IT features to accomplish work task in a manner that is "designed and intended by the designers and management" (Venkatesh, 2006, p. 501). Thus, involuntary use is usually routine use (cf. Jasperson et al., 2005)
Focal user	**Direct use:** is when a focal user, by himself or herself, interacts with and uses an IT to perform his/her work task (Auer, 1998; Tong et al., 2008). **Indirect use:** is when the focal user engages another user (e.g., a subordinate or a co-worker) to use the IT to perform a work task on his/her behalf (Auer, 1998; Tong et al., 2008). Auer (1998, p. 198) refers to indirect use as "delegation in use".

Table 3. Types of IT-use Discussed in the 68 Empirical Articles

3.2 Factors that Influence IT-use During Post-Implementation

Each of the 68 articles were thoroughly read, noting down the factors that influence IT-use during post-implementation. The factors were then grouped into three broad categories (see ***Table 4***). The first category consists of the formal and informal structures that are orchestrated to support IT-use during post-implementation. Examples of the structures are IT-help desk (Santhanam et al., 2007), core teams (Robey et al., 2002), and peer-support networks (Auer, 1998; Sykes et al., 2009). The first category is referred to as *support structures*. The second category consists of activities that are formally or informally enacted to support IT-use during post-implementation. Examples of the activities are formal training (Eriksen et al., 1999; Ruivo et al., 2014), advice seeking and giving (Sasidharan et al., 2012; Venkatesh et al., 2011), and IT and work task adaptation (Bagayogo et al., 2014; Tong et al., 2015). The second category is referred to as *support activities*. The third category consists of the properties of organizational entities that support IT-use during post-implementation. Organizational entities may refer to all the *things* (e.g., IT, users, work groups, work tasks, functions, departments, programs, support groups, policies, and strategies) that constitutes an organization and the overall organization (Van de Ven and Poole, 1995). Examples of the properties of organizational entities that support IT-use include IT complexity (Liang et al., 2015), group empowerment (Maruping and Magni, 2015), IT

skills of users (Brown et al., 2002), organizational innovativeness (Roberts et al., 2016), and work task interdependence (Jarvenpaa and Staples, 2000). The third category is referred to as *support properties*.

The support structures, support activities, and support properties can be organized at different levels; namely, IT, work tasks, user, group, organizational, and institutional levels (see ***Table 4***). The support structures, support activities and support properties at each of the levels are briefly discussed below.

IT and Work Task Level Support Structures, Support Activities and Support Properties:

Researchers have studied the support structures, support activities and support properties at the IT and work task level that influence IT-use during post-implementation. Support properties of an IT; for example, ease of use (Stein et al., 2015), usefulness (Choudrie and Zamani, 2016), reliability and helpfulness (Lankton et al., 2014), efficiency (Ruivo et al., 2014), and complexity (Liang et al., 2015), influence IT-use during post-implementation. Consequently, research has shown that organizations form support structures; e.g., IT support teams (Santhanam et al., 2007), competence centres (Eriksen et al., 1999), and core teams (Robey et al., 2002) to perform support activities; for example, IT integration (Seddon et al., 2010), extension (Ha and Ahn, 2014) and configurations (Zhu et al., 2010) in order to improve the support properties of IT. In addition, an IT can influence certain support activities; e.g., structuring and improving clarity of work task (Hale et al., 1989), enabling collaboration (Jarvenpaa and Staples, 2000), and providing help (Lankton et al., 2014). These support activities are found to influence IT-use during post-implementation.

Support properties of work task influence IT-use during post-implementation. Examples include job autonomy (Liang et al., 2015), task variety (Liang et al., 2015), job specification (Liu et al., 2011), task interdependence (Jarvenpaa and Staples, 2000), and IT-work task compatibility (Ruivo et al., 2014). Support structures such as change management teams (Sykes, 2015), and core teams (Robey et al., 2002) are orchestrated to perform support activities such as task adaptation (Bagayogo et al., 2014), task configuration (Wagner and Newell, 2007) and process optimization (Seddon et al., 2010). Also, the nature of a work task can influence the structure (Santhanam et al., 2007), and adoption (Benlian, 2015) of an IT. The enactment of work task related support activities influences the support properties of work tasks, and thus influences IT-use during post-implementation.

User and Group Level Support Structures, Support Activities and Support Properties:

Research has identified several support properties of a user that influence IT-use during post-implementation. These support properties include the user's expectations (Saeed et al., 2010; Veiga et al., 2014), intentions (Maruping and Magni, 2015), empowerment and work commitment (Maas et al., 2018), personality (Devaraj et al., 2008; Sykes et al., 2011), absorptive capability (Liu et al., 2011), personal innovativeness (Li et al., 2013; Liu et al., 2011), IT skills and self-efficacy (Auer, 1998; Brown et al., 2002), habit (Limayem et al., 2007), motivation (Li et al., 2013), emotions (Stein et al., 2015) and social capital (Sykes et al., 2009). Several support structures, both formal and informal; example, IT support/help desk, core team, change management teams, peer-support networks (Auer, 1998; Vaast and Walsham, 2009), social/advice networks (Sykes et al., 2009), are arranged, or do emerge, to influence a user's IT-use behaviour during post-implementation. Whereas formal support structures (e.g., IT support/help desk, and change management team) organize formal training and workshops to improve the skills of users (Khoo et al., 2011; Saeed et al., 2010), informal support structures (e.g., peers support and social networks) provide contextualized assistance to users and groups on day-to-day basis (Sykes, 2015; Topi et al., 2006). Thus, formal and informal support structures influence support properties of user, and thus influence IT-use. However, research shows that informal support structures are more effective than formal support structures in driving IT-use during post-implementation (Sasidharan et al., 2012; Tong et al., 2015). Further, users engage in support activities; e.g., self-led learning, IT adaptation, and IT-use, that influence their support properties and thus their IT-use behaviour. For instance, when users grasp routine use of an IT, they may engage in learning and adaptation activities to extend IT features or to use existing features in a new way (Auer, 1998; Hsieh and Wang, 2007; Veiga et al., 2014). Also, when users use IT for repetitive tasks over sufficiently long time, they form habits that drive their IT-use behaviour especially in stable environments (Limayem et al., 2007; cf. Jasperson et al., 2005).

Group level support properties, support activities, support structures have also received attention in the literature on IT-use during post-implementation. Group level support properties; namely, group em-

powerment (Maruping and Magni, 2015), group level social capital (Sasidharan et al., 2012), workflow and emotions (Kane and Labianca, 2011), group diversity (Oborn et al., 2011), and group network structure (Sasidharan et al., 2012; Sykes et al., 2009), influence IT-use during post-implementation. For instance, Oborn et al (2011) noted that a group that consists of users who have distinct uses of an IT yet work towards a group goal (i.e., group diversity), are likely to have a comprehensive view of the IT and use the IT in ways that support their individual goals and those of other users within the group. This finding corroborates the finding that work task interdependence has positive influence on IT-use (Bagayogo et al., 2014). Also, Maruping and Magni, (2015) found that group members are likely to engage in explorative use of an IT to perform work tasks when group members feel that their collective efforts count, and that they have the autonomy and competence to use the IT to perform their work tasks.

Group level support structures and support activities are similar to those at the user level. For instance, IT support staff, and change management teams train and provide support to user groups; and group members assist each other; e.g., by developing and sharing informal notes (Topi et al., 2006), by giving advice to peers (Sykes et al., 2014) or walking peers through procedures for using an IT to accomplish work tasks (Auer, 1998; Vaast and Walsham, 2009; Sykes et al., 2014). Thus, like users, groups participate in learning and adaptation activities, and use IT to perform work tasks.

Organizational and Institutional level Support Structures, Support Activities and Support Properties:

Though the focus of research on IT-use during post-implementation has mainly been on the user and groups, the literature has also considered the effects of a user's work environment on the user's IT-use behaviour during post-implementation. Some of the environmental factors internal to the focal organization (i.e., organizational support properties) include control and empowerment (Maas et al., 2018), organizational autonomy and innovativeness (Roberts et al., 2016), service quality (Hsu et al., 2015), organizational trust and mindfulness (Nwankpa and Roumani, 2014), and mandatory and voluntary IT-use contexts (Brown et al., 2002). For example, users are more likely to use a collaborative IT when the users believe that they, rather than the organization, own the information and knowledge that they share whilst using the IT (Jarvenpaa and Staples, 2000). Also, when an organization's internal environment allows IT users to independently use an IT in doing their work without (or with minimal) interference (i.e., organizational autonomy), IT users tend to generate creative ideas that are useful for their work tasks (Roberts et al., 2016).

Organizations; thus, orchestrate several support structures including, top management teams (Liang et al., 2007; Sykes, 2015), policies and formal guidelines (Choudrie and Zamani, 2016), rewards, punishments and formal controls (Liang et al., 2013), cross-functional teams (Gallagher and Gallagher, 2012), and ongoing improvement projects (Seddon et al., 2010), to influence IT-use during post-implementation. The organizational support structures influence IT-use by enacting support activities, which may include, training and knowledge sharing (Santhanam et al., 2007), resourcing change projects (Wagner and Newell, 2007), motivating users (Liang et al., 2007), developing innovative climate (Liang et al., 2015), and developing structures for IT and process improvement (Eriksen et al., 1999; Seddon et al., 2010).

The influences that factors in the external environment of a focal organization (i.e., institutional environment) have on IT-use within the focal organization has received less attention in the literature on IT-use during post-implementation. Research shows that support structures at the institutional level; for example, regulatory bodies (McLeod et al., 2008), competitors (Ruivo et al., 2014), customers (Scheepers and Scheepers, 2004), and professional groups or "network – of – practice" (Vaast and Walsham, 2009), exert institutional pressures that influence IT-use within a focal organization (Liang et al., 2007). These institutional pressures may be coercive; e.g., the compulsion that legal regulations and competition exert on organizations to invest in and use an IT (Chu and Robey, 2008; Hale et al., 1989); mimetic; e.g., the urge for organizations and users to use an IT because others are doing so (Ruivo et al., 2014; Scheepers and Scheepers, 2004); and normative; e.g., the influence that a professional body exerts on its members and the quest of users to adhere to work ethos (Tong et al., 2008; Vaast and Walsham, 2009). The effects of institutional pressure on IT-use may be mediated at the organizational level by top management team or at the user and group level by informal support structures; e.g. power users (Liang et al., 2007).

Org. Entity	Support Structure	Support Properties	Support Activities
IT	Support structures (e.g., IT professionals, core team and help desk, peer support groups) for IT implementation (Robey et al., 2002), and continuous integration (Seddon et al., 2010), extension (Ha and Ahn, 2014), and configuration (Zhu et al., 2010), adaptations (Liang et al., 2013; Zhu et al., 2010)	Functional fit (Seddon et al., 2010), (Perceived) usefulness and ease of use (Saeed and Abdinnour, 2013; Sykes et al., 2011), system quality and Information quality (Hsu et al., 2015), functionality (Khoo et al., 2011), type of IT (Bagayogo et al., 2014), IT compatibility, complexity, and efficiency (Liang et al., 2015; Ruivo et al., 2014), IT reliability and helpfulness (Lankton et al., 2014)	Continuous IT integration (Seddon et al., 2010), extension (Ha and Ahn, 2014), and configuration (Zhu et al., 2010), and adaptations (Liang et al., 2013; Zhu et al., 2010).
Work Task	support structures (e.g., core teams, change management teams, and project leadership teams) for task configuration (Wagner and Newell, 2007), task adaptation (Bagayogo et al., 2014), and process optimization (Seddon et al., 2010)	Task-IT fit (Benlian, 2015), task variety (Liang et al., 2015), task complexity, analyzability, and interdependence (Bagayogo et al., 2014), workflow (Kane and Labianca, 2011), task specification (Liu et al., 2011), task identify and task significance (Morris and Venkatesh, 2010), change in task (Sun, 2012), task structure and clarity (Hale et al., 1989)	Continuous work task configuration (Wagner and Newell, 2007), task adaptation (Bagayogo et al., 2014), and process optimization (Seddon et al., 2010).
User	**Formal support structures:** E.g., IT support staff (Hsu et al., 2015), core teams (Robey et al., 2002), and help desk (Khoo et al., 2011), change management teams (Sykes, 2015), online training materials (Tong et al., 2015), subjective norm and incentives systems (Devaraj et al., 2008), training workshops (Brown et al., 2002), performance evaluation scheme (Liu et al., 2011) **Informal support structures:** E.g., peer-support, social/advice networks (Sasidharan et al., 2012), subjective norm (Devaraj et al., 2008)	work commitment (Maas et al., 2018), expectations (Choudrie and Zamani, 2016), intentions (Maruping and Magni, 2015), emotions (Stein et al., 2015), IT knowledge type (Bagayogo et al., 2014), motivation and personal innovativeness (Li et al., 2013), reward and punishment expectancy(Liang et al., 2013), disposition to job and organization (Bala and Bhagwatwar, 2018), centrality of user (Sasidharan et al., 2012), absorptive capability and level of use (Liu et al., 2011), personality characteristics (Sykes et al., 2011), skills variety and autonomy (Morris and Venkatesh, 2010), use culture (Walsh et al., 2016), social capital (Sykes et al., 2009), cognitive style (McLeod et al., 2008), technostress (Ragu-Nathan et al., 2008), habit (Limayem et al., 2007), and prior knowledge of the IT (Auer, 1998), skills, confidence, and self-efficacy(Brown et al., 2002)	**Learning activities**: self - led learning (Tong et al., 2015), peer / supervisor-led learning (Sykes, 2015), formal learning (Brown et al., 2002), group learning (Häkkinen and Hilmola, 2008; Sykes et al., 2009) **Adaptation activities**: innovation and idea generation (Hale et al., 1989; Santhanam et al., 2007), IT and Work task configuration (Wagner and Newell, 2007)
Group	Similar to user support structures	empowerment (Maruping and Magni, 2015), group level social capital (Sasidharan et al., 2012), group identity (Mishra et al., 2012), group workflow and emotion (Kane and Labianca, 2011), group diversity (Oborn et al., 2011), and group network structure (Sasidharan et al., 2012; Sykes et al., 2009)	Similar to user support activities

Organization	policies and formal guidelines (Choudrie and Zamani, 2016), training, online support, help desk support, change management support, top management support, expert users (Sykes, 2015), best practices (Ruivo et al., 2014), rewards and punishment, formal control (Liang et al., 2013), cross-functional teams (Gallagher and Gallagher, 2012), stakeholder management methods (Gallagher et al., 2012), ongoing ES improvement projects (Seddon et al., 2010),	control and empowerment (Maas et al., 2018), organizational autonomy, organizational innovativeness (Roberts et al., 2016), service quality (Hsu et al., 2015), organizational trust and organizational mindfulness (Nwankpa and Roumani, 2014), use context (mandatory and voluntary) (Brown et al., 2002), use context (stable or dynamic) (Limayem et al., 2007), sense of information ownership (Jarvenpaa and Staples, 2000), sense of urgency (Hale et al., 1989; Robey et al., 2002)	Develop structures for IT and process improvement (Eriksen et al., 1999; Seddon et al., 2010), develop innovative climate (Liang et al., 2015), support training and knowledge sharing (Santhanam et al., 2007), provide resources, (Wagner and Newell, 2007), motivate users (Liang et al., 2007), enforce policies, guidelines, rewards and controls (Choudrie and Zamani, 2016; Liang et al., 2013)
Institution	regulatory bodies (McLeod et al., 2008), competitors (Ruivo et al., 2014), professional networks or "network-of-practice" (Vaast and Walsham, 2009).	institutional pressure (normative, coercive, and mimetic) (Liang et al., 2007),	exert institutional pressure on the organization (Hale et al., 1989; Liang et al., 2007) and users within the organization (Chu and Robey, 2008; Vaast and Walsham, 2009)

Table 4. A Classification of Factors that Influence IT-use during Post-implementation

3.3 Forms and Interactions among Support Structures, Support Activities, and Support Properties

Support structures, support activities, and support properties do manifest in different forms. Support structures can be *formal* or *informal*. Formal support structures are very useful during implementation and the initial stages of post-implementation to transfer skills and knowledge from top management team and external sources; e.g. consultants, to users and user groups (Robey et al., 2002). However, during post-implementation, informal support structures are more useful than formal support structures in driving IT-used (Jones et al., 2008; Tong et al., 2015). For effective results, the literature suggests that organizations should encourage the co-existence and collaboration between formal support structures and informal support structures during post-implementation (Santhanam et al., 2007). The co-existence and collaboration between the support structures will; for instance, allow innovation yet prevent dysfunctionality (Santhanam et al., 2007), and encourage learning in social/advice networks yet ensure that peers are not misinformed (Khoo et al., 2011). Support activities can be *planned* or *emergent*. Mostly, formal support structures engage in planned support activities; e.g., organizing formal training, and adapting IT and work tasks (Saeed et al., 2010; Santhanam et al., 2007); whereas, informal support structures mostly engage in emergent support activities to handle the day-to-day learning and adaptation efforts of users and groups (Sykes, 2015; Sykes et al., 2009). Support properties can be *existing* or *new*. For example, users may have existing IT skills or work task knowledge that influence their IT-use during post-implementation. Nevertheless, during post-implementation, users acquire new support properties; e.g., form habits (Limayem et al., 2007), and acquire new IT skills and work task knowledge (Auer, 1998; Sykes et al., 2014). Similarly, work tasks may become more structured (Hale et al., 1989), and an IT may become more fit to work tasks (Santhanam et al., 2007).

Support structures, support activities, and support properties relate with, or influence, each other to support IT-use during post-implementation. ***Figure 2*** illustrates the relationships. Support structures (e.g., IT support desk, core teams, and online training materials) are orchestrated to accompany IT-implementation. Specifically, they are orchestrated to influence support activities; e.g., learning activities of users and the adaptation of IT and work tasks. Enactment of, and participation in, support activities influence the support properties of organizational entities. For example, training influences the self-efficacy and IT skills of users (Brown et al., 2002); adaptation influences the usability of IT, and

the fit between IT and work task (Seddon et al., 2010); and user participation in change activities influences the user's technostress (Ragu-Nathan et al., 2008), emotion and attitude (Stein et al., 2015). Support properties in turn influence support structures and support activities. For example, users who gain superior skills at using an IT to perform work tasks may engage in or form informal support structures; e.g., peer-support networks, enacting support activities; e.g., giving advice to their peers (Auer, 1998; Sykes et al., 2009) or developing and sharing informal notes (Topi et al., 2006). Similarly, an IT that does not fit work task, or that is not usable, may require the intervention of a support structure (e.g., IT support team or core team) to perform support activities (e.g., adapt or reconfigure the IT, and train users) in order to increase the fitness and usability of the IT (Robey et al., 2002; Santhanam et al., 2007).

The interactions among support structures, support activities, and support properties influence IT-use during post-implementation. In turn, IT-use influences the factors that influence it. Knowledge that users gain from routine use may trigger more learning and adaptation efforts to engage in innovative and explorative use (Auer, 1998; Hsieh and Wang, 2007; Veiga et al., 2014). Users who experience performance dip whilst using an IT (Choudrie and Zamani, 2016; Sia, 2008), or who realize that IT-use contradicts their professional practices (Chu and Robey, 2008; Stein et al., 2015) may engage in learning and adaptation actions (e.g., work arounds) to restore past work practices. Users may also revise the set of IT features they use or how they use existing IT features when they encounter discrepancies between the IT features and work task (Sun, 2012). Also, in some cases, users may find an IT useful enough to engage in routine use but may not find it useful enough to engage in explorative use (Jones et al., 2008). Thus, the outcome of IT-use influences the factors, and interaction among the factors, that underlie IT-use (cf. Jasperson et al., 2005).

Environmental/institutional factors also influence IT-use within focal organizations. Some of the influences on IT-use are mediated by formal support structures (e.g., top management team), whereas others are exerted directly on users or mediated by informal support structures (e.g., peer leaders) (Liang et al., 2007). However, because institutional factors may have different foci of their influence, the effects of institutional pressure (i.e., mimetic, coercive, and normative pressures) may conflict thus stalling IT-use. For instance, when an organization adopts an IT in response to mimetic or coercive pressure, users in the organization may momentarily adopt the IT but; however, sparingly use or even abandon the IT when using the IT conflicts with the effects of normative pressure, e.g., work practices or professional norms (e.g. see Chu and Robey, 2008). The dynamics of the organizational environment also has influence on the factors that support IT-use during post-implementation. In stable environments, IT-use is usually routine and driven by habits; whereas, in dynamic environments, IT-use is usually explorative and driven by intention, learning and adaptations (Limayem et al., 2007; cf. Jasperson et al., 2005).

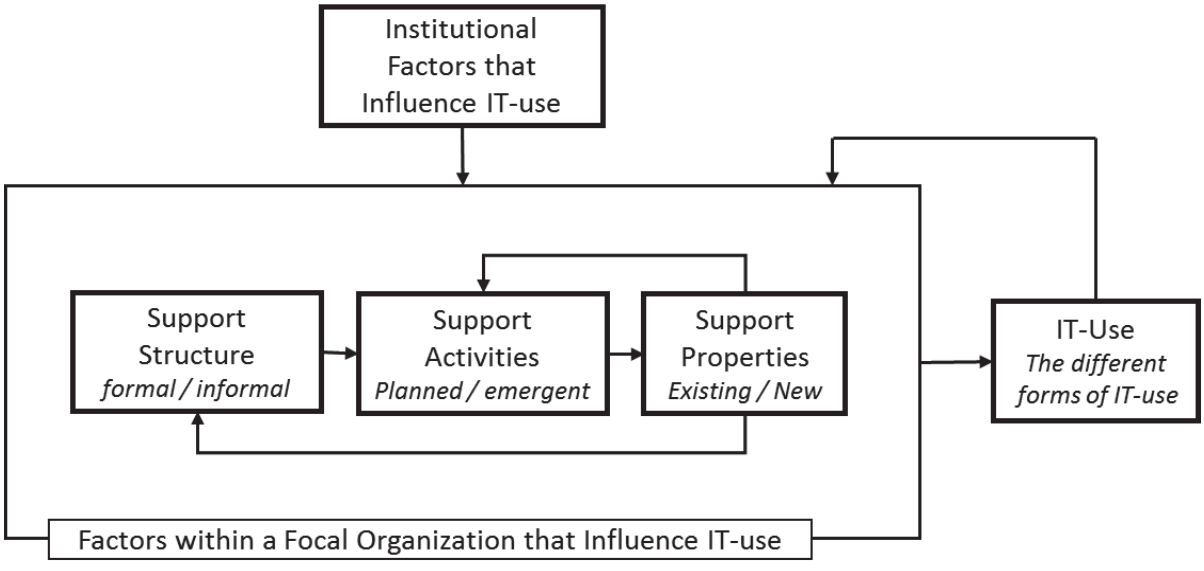

Figure 2. Interactions among Support Structures, Support Properties, Support Activities, and IT-use

3.4 Interactions among Support Structures, Support Activities, and Support Properties across Levels

An additional significant finding from the literature review is that the support structures, support properties, and support activities influence each other across levels (See ***Figure 3***). IT and work task level support structures, support properties, and support activities influence each other. For instance, an IT can bring clarity and structure to an unstructured work task (Hale et al., 1989) and the nature of a work task can influence the adaptation and nature of an IT (Santhanam et al., 2007; Seddon et al., 2010). The support structures, support properties, and support activities at the user and group levels influence each other. For instance, a user with a negative emotion about an IT may influence the emotion of a group towards the IT especially if the user is influential or central to the workflow of the group (Kane and Labianca, 2011; Sykes et al., 2011). The empowerment (Maruping and Magni, 2015) and social capital (Sasidharan et al., 2012) of a group can influence the IT-use behaviour of a user, and the resources available to the user. Further, support structures, support properties, and support activities at the user and group level, and those at the IT and work task levels influence each other. Users and groups engage in support activities (e.g., adaptation activities) to influence; for example, the complexity of an IT or the workflow of a work task (Santhanam et al., 2007; Tong et al., 2015). The functionality of an IT can influence the attitude of a user (Stein et al., 2015; Wagner and Newell, 2007) and the type of IT (e.g., collaborative IT) can influence interactions in groups and between individuals (Devaraj et al., 2008; Jarvenpaa and Staples, 2000). Similarly, the nature of work task (e.g., work task interdependence or diversity) can influence the IT-use behaviour of a user (Liang et al., 2015) and a group (Oborn et al., 2011).

Support structures, support properties, and support activities at the organizational level influence those at the user and group levels, and those at the IT and work task level. Organizational innovativeness (Liang et al., 2015; Roberts et al., 2016) and level of control (Maas et al., 2018) can influence user and group level attitude towards IT and IT-use behaviour. Organizational level support structures for IT implementation can influence user and group level support structures that can be enacted during post-implementation (Gallagher et al., 2012; Worrell et al., 2006), and how users and groups respond to an IT (Stein et al., 2015). In organizations with high control (e.g., in mandatory IT-use contexts), IT is usually closely fitted to work task and users are expected to use the IT as purposed by management (Liang et al., 2013). User and group level support structures, support properties, and support activities influence organizational level support structures, support properties, and support activities. User and group level skills, social capital, and IT assimilation efforts influence organizational level support properties (Liu et al., 2011; Sasidharan et al., 2012). The availability of skilled users (e.g., power users and subject matter experts) provide the basis for formulating a representative and effective support structures (e.g., core teams, and project leadership teams) at the organizational level (Robey et al., 2002; Wagner and Newell, 2007).

Institutional level support structures, support properties, and support activities influence support structures, support properties, and support activities at the organizational level, and those at the user and group level. Competitors, regulatory institutions, and professional bodies can exert institutional pressures on a focal organization and its members (i.e., users and groups), thereby influencing the support structures, support properties, and support activities at the organizational level, and at the user and group level. For instance, when a focal organization is pressured to adhere to certain accounting practices, it may conduct the pressure to groups and users by enacting support structures (e.g., controls and rewards) to ensure that IT is *appropriately* used to accomplish the accounting work task (Liang et al., 2013). Institutional pressures can also directly influence support structures, support properties, and support activities at the user and group level. Professional bodies can serve as the source of skills and know-how for users and groups within a focal organization (Vaast and Walsham, 2009). They can also influence the work practices and IT-use behaviours of users and groups (Bagayogo et al., 2014; Liang et al., 2013; Tong et al., 2008). For instance, accountants and medical doctors may adhere to certain work practices and apply an IT in a manner because of their involvement in a professional body.

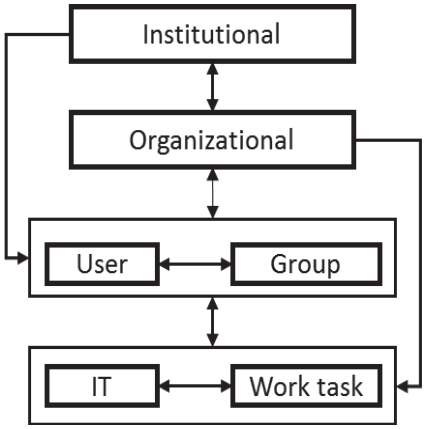

Figure 3. Interactions among Support Structures, Support Activities, and Sup-port Properties Across Levels

4 Implications, Limitations, and Conclusion

This study makes several contributions that have implications for research. It contributes by collating, synthesizing, and discussing the factors (support structures, support properties, and support activities) that influence IT-use during post-implementation. It augments and extends findings in prior literature reviews. For instance, this study extends Jasperson (2005) with factors relating to work tasks and the institutional environment of an organization. Similarly, it extends the support structures presented in Sykes (2015), and augments Sykes (2015) with support properties and support activities that influence IT-use during post-implementation. This study also reveals the dynamic nature of the factors that influence IT-use by explicating the interactions among the support structures, support properties, and support activities and how the interactions influence IT-use. The dynamic nature of the factors requires that research on IT-use employs longitudinal designs with data collection appropriately spaced (Kohli and Sherer, 2002; Sabherwal and Jeyaraj, 2015). It also provides the occasion to combine variance and process theories in studying an information system phenomenon; i.e., IT-use (Markus and Robey, 1988; Robey et al., 2002).

Further, this study finds that IT-use research has concentrated at the user level, perhaps because, it is the user who uses the IT (Jasperson et al., 2005). However, users act as organizational actors whilst they use IT in organizational contexts (Jasperson et al., 2005). For instance, users are more likely to engage in IT-use when they operate in groups that expect them to do so (Maruping and Magni, 2015); and groups in an organization are likely to engage in IT-use when the internal environment of the organization is suitable (Robey et al., 2002). Further attention should be paid to how organizational level support structures, support properties, and support activities can be actively orchestrated and employed to influence group and user level support structures, support properties, and support activities.

Furthermore, there is an apparent lack of research on how management can channel influences in the institutional environment of their organizations to support IT-use within their organizations. Besides, whilst the three institutional pressures may influence IT-use within an organization they may act in ways that conflict with each other and lead to avoidance of IT-use (Chu and Robey, 2008). This corroborates the assertions that the institutional and internal environments of an organization are usually decoupled, and that actors within an organization may choose preferred lines of action (e.g., professional norm, or toward gaining efficiency) over what is dictated by the institutional environment (Meyer and Rowan, 1977; Scott, 2013, p. 185). Further research is needed to guide management on the specific support structures and support activities to employ in order to appropriately direct institutional pressures towards influencing IT-use behaviours within their organizations. Also, future research should investigate how management can improve synergy, and avoid conflict, between the effects of institutional pressures on IT-use behaviour within their organizations.

This study also contributes by collating and synthesizing the several types of IT-use behaviours that have been discussed in prior literature on IT-use. This can guide researchers to focus on the type of IT-use behaviour that they wish to study, e.g., during a field study, or to articulate the type of IT-use be-

haviour that they observe, e.g., during a case study. It can also inform future research on how users progress (or retrogress) from one IT-use behaviour to another, and the factors that enable such drifts (Maas et al., 2018). Further, whereas some IT-use behaviours (e.g., routine and innovative use) have received much attention in the literature, others (e.g., direct and indirect use) have not been studied much. Thus, future research can; for instance, consider the factors that lead to indirect use; the effect of indirect use on other organizational practices (e.g., compliance to IT security policies); the effect of indirect use on organizational performance at the individual and group levels; the contexts in which indirect use may or may not be desirable; and the influence of indirect use on other IT-use behaviours.

For practice, this study elucidates the support structures, support activities, and support properties that management can leverage to support IT-use during post-implementation. Usually, the focus of research and management has been on traditional formal support structures; e.g., change management team, and IT help desk (Sykes, 2015). However, recent literature highlights the importance of informal support structures; e.g. peer advice/social networks, in supporting IT-use during post-implementation. Thus, management can leverage formal and informal support structures to enact support activities needed to influence support properties of organizational entities, and IT-use. The literature suggests that informal support structures are more effective at supporting IT-use during post-implementation (Jones et al., 2008; Tong et al., 2015). Therefore, management should nurture and support the activities of informal support structures; for example, by motivating socialization (Walsh et al., 2010) and advice sharing and seeking activities (Sykes, 2015; Sykes et al., 2014); and by creating the organizational environment that enables users to freely seek and share information and to have a sense of ownership of the information that they generate and share (Jarvenpaa and Staples, 2000). In this regard, human resource management needs to guide employees in setting goals for developing both technical and social skills in order to build enabling factors (e.g., social capital and network structures) that can support current and future IT investments.

Management should additionally pay attention to how institutional pressures are channelled to influence IT-use within their organization, since conflicting influences from institutional pressures may stall IT-use. One plausible means is that management orchestrates support activities that expose groups and users to the influence of an appropriate institutional support structures (e.g., a professional body) that support the chosen IT. Another is that management choose an IT whose use fulfils the demands of multiple institutional pressures.

The scope of this study is limited by focusing on articles that discussed IT-use during post-implementation, and on articles that are mostly from the AIS senior scholars' basket of eight journals. Articles on other topics; for instance, the transformative effect of IT, may as well hold clues to factors that may influence IT-use during post-implementation. However, extending the research to include articles on several other topics in order to achieve "comprehensiveness" may not only blur the focus of the review, but also make the review process extremely difficult if not unachievable (Rowe, 2014). Limiting the focus and scope of the review allows this study to collate, synthesise and discuss findings from prior literature on IT-use. Future reviews may consider a wider set of journals and databases, and study factors that influence IT-use in different or specific contexts, e.g., IT-use in organizations undergoing IT-enabled transformation or operating in very dynamic environments. Future research should also verify and extend the perspectives that are used to categorize the types of IT-use discussed in prior literature.

In conclusion, this research draws on a review of 68 empirical articles to collate and synthesize the factors that influence IT-use during post-implementation. The factors consist of support structures, support activities, and support properties, and do manifest at the IT, work task, user, group, organizational, and institutional levels. This research elucidates the dynamic nature of the factors that influence IT-use during post-implementation by discussing the interactions among the support structures, support activities, and support properties, and the effect of the interactions on IT-use. Further, this study synthesizes the various perspectives on IT-use to improve our understanding of the different ways in which users engage with IT during post-implementation. It extends and augments prior reviews on IT-use and discusses the implications for research and practice. In general, it contributes to research on the derivation of business value of IT from IT investments, and specifically, to research on IT-use during post-implementation.

References

Akhlaghpour, S., Lapointe, L., 2018. From Placebo to Panacea: Studying the Diffusion of IT Management Techniques with Ambiguous Efficiencies: The Case of Capability Maturity Model. J. Assoc. Inf. Syst. 19, 441–502.

Auer, T., 1998. Quality of IS use. Eur. J. Inf. Syst. 7, 192–201.

Babar, A., Bunker, D., Gill, A.Q., 2018. Investigating the Relationship between Business Analysts' Competency and IS Requirements Elicitation: A Thematic-analysis Approach. Commun. Assoc. Inf. Syst. 42, 12.

Bagayogo, F.F., Lapointe, L., Bassellier, G., 2014. Enhanced use of IT: A new perspective on post-adoption. J. Assoc. Inf. Syst. 15, 361.

Baird, A., Davidson, E., Mathiassen, L., 2017. Reflective Technology Assimilation: Facilitating Electronic Health Record Assimilation in Small Physician Practices. J. Manag. Inf. Syst. 34, 664–694.

Bala, H., Bhagwatwar, A., 2018. Employee dispositions to job and organization as antecedents and consequences of information systems use. Inf. Syst. J. 28, 650–683.

Benlian, A., 2015. IT feature use over time and its impact on individual task performance. J. Assoc. Inf. Syst. 16, 144.

Bhattacherjee, A., Hikmet, N., 2007. Physicians' resistance toward healthcare information technology: a theoretical model and empirical test. Eur. J. Inf. Syst. 16, 725–737.

Brown, S.A., Massey, A.P., Montoya-Weiss, M.M., Burkman, J.R., 2002. Do I really have to? User acceptance of mandated technology. Eur. J. Inf. Syst. 11, 283–295.

Chang, H.-H., Chou, H.-W., Yin, C.-P., Lin, C.I., 2011. ERP Post-Implementation Learning, ERP Usage And Individual Performance Impact., in: PACIS. Citeseer, p. 35.

Choudrie, J., Zamani, E.D., 2016. Understanding individual user resistance and workarounds of enterprise social networks: the case of Service Ltd. J. Inf. Technol. 31, 130–151.

Chu, T.-H., Robey, D., 2008. Explaining changes in learning and work practice following the adoption of online learning: a human agency perspective. Eur. J. Inf. Syst. 17, 79–98.

Deng, X., Chi, L., 2012. Understanding postadoptive behaviors in information systems use: A longitudinal analysis of system use problems in the business intelligence context. J. Manag. Inf. Syst. 29, 291–326.

Devaraj, S., Easley, R.F., Crant, J.M., 2008. Research note—how does personality matter? Relating the five-factor model to technology acceptance and use. Inf. Syst. Res. 19, 93–105.

Eriksen, L.-B., Axline, S., Markus, M.L., Drucker, P., 1999. What happens after" going live" with ERP systems? Competence centers can support effective institutionalization. AMCIS 1999 Proc. 268.

Fadel, K.J., Brown, S.A., 2010. Information systems appraisal and coping: The role of user perceptions. Commun. Assoc. Inf. Syst. 26, 6.

Gallagher, K.P., Gallagher, C.V., 2012. Organizing for post-implementation ERP: A contingency theory perspective. J. Enterp. Inf. Manag. 25, 170–185.

Gallagher, K.P., Jamey Worrell, J.L., Mason, R.M., 2012. The negotiation and selection of horizontal mechanisms to support post-implementation ERP organizations. Inf. Technol. People 25, 4–30.

Ha, Y.M., Ahn, H.J., 2014. Factors affecting the performance of Enterprise Resource Planning (ERP) systems in the post-implementation stage. Behav. Inf. Technol. 33, 1065–1081.

Häkkinen, L., Hilmola, O.-P., 2008. ERP evaluation during the shakedown phase: lessons from an after-sales division. Inf. Syst. J. 18, 73–100.

Hale, D.P., Haseman, W.D., Groom, F., 1989. Integrating islands of automation. MIS Q. 433–445.

Hsieh, J.P.-A., Wang, W., 2007. Explaining employees' extended use of complex information systems. Taylor & Francis.

Hsu, P.-F., Yen, H.R., Chung, J.-C., 2015. Assessing ERP post-implementation success at the individual level: Revisiting the role of service quality. Inf. Manage. 52, 925–942.

Jarvenpaa, S.L., Staples, D.S., 2000. The use of collaborative electronic media for information sharing: an exploratory study of determinants. J. Strateg. Inf. Syst. 9, 129–154.

Jasperson, J.S., Carter, P.E., Zmud, R.W., 2005. A comprehensive conceptualization of post-adoptive behaviors associated with information technology enabled work systems. MIS Q. 29, 525–557.

Jones, M.C., Zmud, R.W., Clark Jr, T.D., 2008. ERP in practice: a snapshot of post-installation perception and behaviors. Commun. Assoc. Inf. Syst. 23, 25.

Kane, G.C., Labianca, G., 2011. IS avoidance in health-care groups: A multilevel investigation. Inf. Syst. Res. 22, 504–522.

Kaye, G.R., 1990. Information systems successes and failures: research findings from the compounding industry. J. Inf. Technol. 5, 73–83.

Khoo, H.M., Robey, D., Rao, S.V., 2011. An exploratory study of the impacts of upgrading packaged software: a stakeholder perspective. J. Inf. Technol. 26, 153–169.

Kohli, R., Sherer, S.A., 2002. Measuring payoff of information technology investments: Research issues and guidelines. Commun. Assoc. Inf. Syst. 9, 14.

Lankton, N., McKnight, D.H., Thatcher, J.B., 2014. Incorporating trust-in-technology into Expectation Disconfirmation Theory. J. Strateg. Inf. Syst. 23, 128–145.

Li, X., Hsieh, J.P.-A., Rai, A., 2013. Motivational differences across post-acceptance information system usage behaviors: An investigation in the business intelligence systems context. Inf. Syst. Res. 24, 659–682.

Liang, H., Peng, Z., Xue, Y., Guo, X., Wang, N., 2015. Employees' exploration of complex systems: an integrative view. J. Manag. Inf. Syst. 32, 322–357.

Liang, H., Saraf, N., Hu, Q., Xue, Y., 2007. Assimilation of enterprise systems: the effect of institutional pressures and the mediating role of top management. MIS Q. 59–87.

Liang, H., Xue, Y., Wu, L., 2013. Ensuring employees' IT compliance: Carrot or stick? Inf. Syst. Res. 24, 279–294.

Limayem, M., Hirt, S.G., Cheung, C.M., 2007. How habit limits the predictive power of intention: The case of information systems continuance. MIS Q. 705–737.

Liu, L., Feng, Y., Hu, Q., Huang, X., 2011. From transactional user to VIP: how organizational and cognitive factors affect ERP assimilation at individual level. Eur. J. Inf. Syst. 20, 186–200.

Maas, J.-B., Van Fenema, P.C., Soeters, J., 2018. Post-Implementation ERP Usage: A Longitudinal Study of the Impact of Control and Empowerment. Inf. Syst. Manag. 35, 330–347.

Markus, M.L., Robey, D., 1988. Information technology and organizational change: causal structure in theory and research. Manag. Sci. 34, 583–598.

Maruping, L.M., Magni, M., 2015. Motivating employees to explore collaboration technology in team contexts. Mis Q. 39.

McLeod, A., Clark, J., Warren, J., Dietrich, G., 2008. The impact of information systems on end user performance: Examining the effects of cognitive style using learning curves in an electronic medical record implementation.

Melville, N., Kraemer, K., Gurbaxani, V., 2004. Information technology and organizational performance: An integrative model of IT business value. MIS Q. 28, 283–322.

Meyer, J.W., Rowan, B., 1977. Institutionalized organizations: Formal structure as myth and ceremony. Am. J. Sociol. 83, 340–363.

Mishra, A.N., Anderson, C., Angst, C.M., Agarwal, R., 2012. Electronic health records assimilation and physician identity evolution: An identity theory perspective. Inf. Syst. Res. 23, 738–760.

Morris, M.G., Venkatesh, V., 2010. Job characteristics and job satisfaction: understanding the role of enterprise resource planning system implementation. Mis Q. 143–161.

Nwankpa, J.K., Roumani, Y., 2014. The Influence of Organizational Trust and Organizational Mindfulness on ERP Systems Usage. CAIS 34, 85.

Oborn, E., Barrett, M., Davidson, E., 2011. Unity in diversity: Electronic patient record use in multidisciplinary practice. Inf. Syst. Res. 22, 547–564.

Ragu-Nathan, T., Tarafdar, M., Ragu-Nathan, B.S., Tu, Q., 2008. The consequences of technostress for end users in organizations: Conceptual development and empirical validation. Inf. Syst. Res. 19, 417–433.

Roberts, N., Campbell, D.E., Vijayasarathy, L.R., 2016. Using information systems to sense opportunities for innovation: Integrating postadoptive use behaviors with the dynamic managerial capability perspective. J. Manag. Inf. Syst. 33, 45–69.

Robey, D., Ross, J.W., Boudreau, M.-C., 2002. Learning to implement enterprise systems: An exploratory study of the dialectics of change. J. Manag. Inf. Syst. 19, 17–46.
Rowe, F., 2014. What literature review is not: diversity, boundaries and recommendations. Eur. J. Inf. Syst. 23, 241–255.
Ruivo, P., Oliveira, T., Neto, M., 2014. Examine ERP post-implementation stages of use and value: Empirical evidence from Portuguese SMEs. Int. J. Account. Inf. Syst. 15, 166–184.
Sabherwal, R., Jeyaraj, A., 2015. Information technology impacts on firm performance: an extension of Kohli and Devaraj (2003). MIS Q. 39, 809–836.
Saeed, K.A., Abdinnour, S., 2013. Understanding post-adoption IS usage stages: an empirical assessment of self-service information systems. Inf. Syst. J. 23, 219–244.
Saeed, K.A., Abdinnour, S., Lengnick-Hall, M.L., Lengnick-Hall, C.A., 2010. Examining the impact of Pre-Implementation expectations on Post-Implementation use of enterprise systems: A longitudinal study. Decis. Sci. 41, 659–688.
Santhanam, R., Seligman, L., Kang, D., 2007. Postimplementation knowledge transfers to users and information technology professionals. J. Manag. Inf. Syst. 24, 171–199.
Sasidharan, S., Santhanam, R., Brass, D.J., Sambamurthy, V., 2012. The effects of social network structure on enterprise systems success: A longitudinal multilevel analysis. Inf. Syst. Res. 23, 658–678.
Scheepers, H., Scheepers, R., 2004. The implementation of mobile technology in organizations: expanding individual use contexts. ICIS 2004 Proc. 14.
Schwarz, A., Mehta, M., Johnson, N., Chin, W.W., 2007. Understanding frameworks and reviews: a commentary to assist us in moving our field forward by analyzing our past. ACM SIGMIS Database DATABASE Adv. Inf. Syst. 38, 29–50.
Scott, W.R., 2013. Institutions and organizations: Ideas, interests, and identities. Sage Publications.
Seddon, P.B., Calvert, C., Yang, S., 2010. A multi-project model of key factors affecting organizational benefits from enterprise systems. MIS Q. 34, 305–328.
Shaikh, A.A., Karjaluoto, H., 2015. Making the most of information technology & systems usage: A literature review, framework and future research agenda. Comput. Hum. Behav. 49, 541–566.
Sia, C.L., 2008. Impact of organisational resources on implementaion of ERP by an SME firm: an exploratory study. PACIS 2008 Proc. 111.
Stein, M.-K., Newell, S., Wagner, E.L., Galliers, R.D., 2015. Coping with information technology: mixed emotions, vacillation and non-conforming use patterns.
Sun, H., 2012. Understanding user revisions when using information system features: adaptive system use and triggers. MIS Q. 36.
Sykes, T.A., 2015. Support structures and their impacts on employee outcomes: A longitudinal field study of an enterprise system implementation. MIS Q. 39.
Sykes, T.A., Venkatesh, V., Gosain, S., 2009. Model of acceptance with peer support: A social network perspective to understand employees' system use. MIS Q. 371–393.
Sykes, T.A., Venkatesh, V., Johnson, J.L., 2014. Enterprise system implementation and employee job performance: Understanding the role of advice networks. Mis Q. 38.
Sykes, T.A., Venkatesh, V., Rai, A., 2011. Explaining physicians' use of EMR systems and performance in the shakedown phase. J. Am. Med. Inform. Assoc. 18, 125–130.
Tams, S., Thatcher, J.B., Craig, K., 2018. How and why trust matters in post-adoptive usage: The mediating roles of internal and external self-efficacy. J. Strateg. Inf. Syst. 27, 170–190.
Tong, Y., Tan, S.S.-L., Teo, H.-H., 2015. The road to early success: impact of system use in the swift response phase. Inf. Syst. Res. 26, 418–436.
Tong, Y., Teo, H.-H., Tan, C.-H., 2008. Direct and indirect use of information systems in organizations: An empirical investigation of system usage in a public hospital. ICIS 2008 Proc. 138.
Topi, H., Lucas, W., Babaian, T., 2006. Using informal notes for sharing corporate technology know-how. Eur. J. Inf. Syst. 15, 486–499.
Vaast, E., Walsham, G., 2009. Trans-situated learning: supporting a network of practice with an information infrastructure. Inf. Syst. Res. 20, 547–564.
Van de Ven, A.H., Poole, M.S., 1995. Explaining development and change in organizations. Acad. Manage. Rev. 20, 510–540.

Veiga, J.F., Keupp, M.M., Floyd, S.W., Kellermanns, F.W., 2014. The longitudinal impact of enterprise system users' pre-adoption expectations and organizational support on post-adoption proficient usage. Eur. J. Inf. Syst. 23, 691–707.

Venkatesh, V., 2006. Where to go from here? Thoughts on future directions for research on individual-level technology adoption with a focus on decision making. Decis. Sci. 37, 497–518.

Venkatesh, V., Zhang, X., Sykes, T.A., 2011. "Doctors do too little technology": a longitudinal field study of an electronic healthcare system implementation. Inf. Syst. Res. 22, 523–546.

Wagner, E.L., Newell, S., 2007. Exploring the importance of participation in the post-implementation period of an ES project: a neglected area. J. Assoc. Inf. Syst. 8, 32.

Walsh, I., Gettler-Summa, M., Kalika, M., 2016. Expectable use: An important facet of IT usage. J. Strateg. Inf. Syst. 25, 177–210.

Walsh, I., Kefi, H., Baskerville, R., 2010. Managing culture creep: Toward a strategic model of user IT culture. J. Strateg. Inf. Syst. 19, 257–280.

Webster, J., Watson, R.T., 2002. Analyzing the past to prepare for the future: Writing a literature review. MIS Q. xiii–xxiii.

Worrell, J., Gallagher, K., Mason, R., 2006. Understanding the structure of post-implementation ERP teams. AMCIS 2006 Proc. 307.

Zhu, Y., Li, Y., Wang, W., Chen, J., 2010. What leads to post-implementation success of ERP? An empirical study of the Chinese retail industry. Int. J. Inf. Manag. 30, 265–276.

II

THE ACTUAL ADOPTION AND USE OF MOBILE APPS: THE CASE OF A HIGHER EDUCATION CONTEXT

by

Lumor, T., Pulkkinen, M., & Hirvonen, A., 2020

In Proceedings of 26th Americas Conference on Information Systems (AMCIS 2020), Salt Lake City (Virtual)

The Actual Adoption and Use of Mobile Apps: The Case of a Higher Education Context

Completed Research

Truth Lumor
IT Faculty, University of Jyväskylä
trlumor@student.jyu.fi

Mirja Pulkkinen
IT Faculty, University of Jyväskylä
mirja.k.pulkkinen@jyu.fi

Ari Hirvonen
Digital Services, University of Jyväskylä
ari.p.hirvonen@jyu.fi

Abstract

Mobile applications have gained wide acceptance in several sectors, including eCommerce and education. In higher education, mobile apps are being used not only for mobile learning but also for creating smart campus environments in which physical campuses are augmented with digital services. Mobile apps for smart campus initiatives usually have several features that students and educators are expected to adopt and use. However, although prior studies have investigated the adoption of mobile apps, most of such studies are on the user's intention to use or continue using mobile apps, leaving gaps in our understanding of how actual use occurs. Drawing on a case study of a mobile app for a smart campus in a university in Finland, this study unravels the factors that influence actual adoption and post-adoption use of mobile apps in higher education context, and how the influence occurs. The implications for research and practice are discussed.

Keywords

IT adoption, mobile app adoption, post-adoption, IT continuance, IT use, smart campus, Higher education

Introduction

Mobile applications (or mobile apps) have gained acceptance in recent years. The use for hedonic reasons set aside, mobile apps have been taken into utilitarian use in several sectors including e-commerce (Chopdar et al. 2018), banking (Munoz-Leiva et al. 2017), healthcare (Luxton et al. 2011) and education (FernáNdez-LóPez et al. 2013; Vázquez-Cano 2014). Not surprising, researchers have recognized the importance of mobile apps and have researched factors; for example, that influence their adoption (Chhonker et al. 2017; Harris et al. 2016) and users' continuance behavior (Chen et al. 2012). Several such prior research employed the Technology Acceptance Model (TAM) and its derivatives, expectation confirmation model, a combination of adoption theories, and the IS continuance model, just to name a few. Factors such as perceived usefulness, perceived ease of use, trust, perceived risk, self-efficacy, mobile application customizability, and attitude of the user influence the adoption of mobile apps (Chhonker et al. 2017; Harris et al. 2016; McLean 2018). However, prior literature has mostly focused on user intentions, e.g., to use and continue using mobile apps, leaving gaps in our understanding of how actual use and continuous use of mobile apps occur.

Further, the application of mobile app in higher education is on the increase. Higher education institutions invest in mobile apps to provide mobile learning services connecting students to learning resources within and without university campuses. With the surge and the advancement in mobile devices, some higher education institutions are beginning to move beyond providing mobile learning services to developing a smart campus. A smart campus provides a learning environment in which physical campuses with their resources are augmented with digital services (Atif et al. 2015; Muhamad et al. 2017). Mostly, smart campuses are built on already existing digital infrastructure, including wireless connectivity, learning management platforms, and mobile apps. For instance, there are emerging initiatives that provide university students access to counseling and advisory services on academic issues, over mobile apps (e.g.,

Huda et al. 2017; Shambour et al. 2018). This study is motivated by one of such initiatives in a university in Finland.

Although there are few studies on the adoption of mobile apps in mobile learning (e.g., Krotov 2015), and recommendations for the components of a smart campus (e.g., Atif et al. 2015; Muhamad et al. 2017), there is lack of studies on the adoption of mobile apps designed for smart campus initiatives. Unlike traditional mobile apps that have limited features, mobile apps designed for smart campus tend to have several features with which users can access and use university resources, and other digital and social services. Thus, a study of such a mobile app requires investigating the detail of how users adopt and use the diverse features. To guide our inquiry, we ask the research question: Which factors influence the adoption and post-adoption use of a multi-feature mobile app in a higher education context, and how does this influence occur?

To answer this question, we conducted a case study of how users adopt and use a mobile app designed for the smart campus at a university in Finland. Drawing on an in-depth semi-structured interview with 23 users, we found that mobile app attributes, user attributes, support structures, and task attributes influence the initial adoption and post-adoption use of the mobile app. We present a model that illustrates the findings of the study and discusses how the various factors influence the initial adoption and post-adoption use. We also discuss how the influence happen. This research contributes generally to the adoption of mobile apps, and specifically to the adoption of a multi-feature mobile app in a higher education context.

Literature Review

Mobile App and Mobile App Use

Mobile apps are "a type of application software designed to run on a mobile device such as a smartphone or tablet computer" (Techopedia 2018). Mobile apps were initially designed as usually small software units with limited and isolated function which provide users with services like those accessed on personal computers (Techopedia 2018). However, mobile apps have grown in complexity offering several functions (Gibbs et al. 2016; Ho and Syu 2010) probably because of the advanced resources of recent models of mobile devices, which allow users to, for example, communicate and engage in transactions (Nickerson et al. 2013). Recently, mobile apps have gained popularity in almost every aspect of life. Aside from manifesting as games, mobile apps have been used in different areas including e-commerce (Chopdar et al. 2018), tourism (Gibbs et al. 2016), banking (Munoz-Leiva et al. 2017), and education (FernáNdez-LóPez et al. 2013; Vázquez-Cano 2014).

There is a rich and emerging academic literature on the adoption of mobile apps. Scholars have studied the adoption of mobile apps from different theoretical perspectives; for example, TAM and its extensions including (Hew et al. 2015; Munoz-Leiva et al. 2017; Yu 2012), expectation confirmation model (Hung et al. 2012), a combination of adoption theories (Oliveira et al. 2014; Thakur and Srivastava 2014), and IS continuance model (Chen et al. 2012). However, by virtue of the theoretical perspectives and research methods they employ, several prior research on mobile app adoption focus on user intention to; for example, buy a mobile app (e.g., Kim et al. 2016), install a mobile app (e.g., Harris et al. 2016), use a mobile app (e.g., Munoz-Leiva et al. 2017) and continue using a mobile app (Chen et al. 2012). Though research has shown that intention may not necessarily result in actual behavior (Tao 2009) and that initial use may not guarantee continuous use (Hung et al. 2012), there are few studies on mobile app adoption that have investigated actual use and actual continuous use of mobile apps (e.g., Groß 2015; McLean 2018).

Mobile Apps in Higher Education

Mobile apps have been widely applied in education, especially in the area of mobile learning, to grant users access to learning materials and other resources irrespective of time and location (Motiwalla 2007; Teri et al. 2014). For instance, since the beginning of this year (i.e., year 2020), mobile learning has gained tremendous popularity because of the COVID-19 pandemic which mandates remote access to educational resources. In mobile learning environments, mobile apps are used to supplement in-class learning or to support the so-called blended learning environment (Teri et al. 2014). Apart from being used to access educational materials, mobile apps are also used to enrich student life in higher education. For instance, in digital or smart campus, i.e., learning environment in which physical learning resources are augmented with digital and social services (Atif et al. 2015; Muhamad et al. 2017), mobile apps are used to provide students access to university resources, and services. For instance, there are emerging initiatives to use mobile apps for counseling and advising students on academic issues, including the selection of university courses (e.g., Huda et al. 2017; Shambour et al. 2018).

Studies have identified what the constituents of a smart campus should be (e.g., Atif et al. 2015; Muhamad et al. 2017) and have proposed mobile app features and architectures for smart campus initiatives (e.g., Huda et al. 2017; Shambour et al. 2018). Some researchers have studied the critical success factors that influence the success of mobile learning (e.g., Krotov 2015), the adoption of mobile apps in mobile learning (e.g., Hao et al. 2017). However, there is a lack of studies on the adoption and use of mobile apps that enable students to view and access university resources (e.g., classrooms, computer labs) and social services (e.g., student advisory services, social events, and study calendar). Thus, to improve our understanding of the adoption of mobile apps meant for smart campuses, this study investigates one such mobile app at a university in Finland.

Research Method

We adopt case study as the research method for this study. The case study is a suitable research method when the phenomenon of interest is complex and embedded in its context (Lee 1989; Yin 1981, 2011). It provides the opportunity to uncover the nuances and understand the complex dynamics that underlie the phenomenon within its specific context (Eisenhardt 1989). For instance, Curry et al. (2009) assert that qualitative approach, which includes case study, "can be useful when researchers are interested in looking beyond identified variables that are statistically linked with a desired effect to understand why a given intervention has a specific impact, how the impact occurs, and in what organizational context" (2009, p. 1443). Thus, this study employs an in-depth case study to unravel what influence how students adopt and use a mobile app at a university in Finland, and how the influence occurs.

Case Description

A university in Finland as part of its digitalization strategy has three objectives: the digitalization of educational learning, the digitalization of research, and the creation of a smart campus. As part of the creation of a smart campus objective, the university has decided on several mobile services, including a mobile service to connect to and augment the physical campus resources. For the initial rollout of the mobile service, students were chosen as the primary users. Later, the mobile service will be gradually rolled out to other users, including visitors and university employees. The university's digital team collected suggestions and requirements for important digital services first from the students in a digital service innovation course, and then from other students across the university's campuses. Based on the requirements, a mobile app (hereafter *SmartCampus* – a pseudonym) was developed and was made available to students during the spring semester 2019. Students are under no obligation to use *SmartCampus,* making the use context voluntary. According to an online report of the university, *SmartCampus* had as of 19th December 2019 5028 users, which is roughly one-third of the almost 15 000 on-campus students of the university. The users include degree students (i.e., Finnish and international students) and exchange students.

SmartCampus has several features that derive data from various learning management platforms and services around the university. Students can check their study schedules on a calendar feature and use a map feature to locate classrooms and other university buildings around the campuses. Further, through *SmartCampus*, students can see all the various cafeterias scattered across the campuses, view events, see job vacancies, read campus news, and search for university staff. *SmartCampus* has features that provide students, especially first-year students, with the information needed to settle on campus. Against this backdrop, we refer to *SmartCampus* as a multi-feature mobile app because it has several features.

Data Collection

We collected data through semi-structured interviews with 23 students across the different faculties of the university. The first author visited the various faculties and randomly asked users for interviews about *SmartCampus*. The interviewees include degree students (i.e., Finnish and international students) and exchange students. We stopped conducting new interviews when additional interviews with users yielded no new insights. Our sample of interviewees consists of 11 female and 12 male users. Each of the interviewees belongs to one of these three main groups of users: 1. users who adopted and have used *SmartCampus* over time; 2. users who adopted but abandoned *SmartCampus* after initial use; and 3. users who heard of but did not install, or did install but did not use *SmartCampus*. The interviews lasted between 18 to 32 minutes and were all recorded and transcribed verbatim. Other stakeholders, including the digital director in charge of the initiative, was interviewed on the strategic intent of *SmartCampus*, as well as how the implementation has evolved over almost one year since its introduction. Online reports on *SmartCampus* were also gleaned for data.

Data Analysis

Interview transcripts were analyzed using Atlas.ti. An inductive approach was adopted to analyze and code the data. From the first round of coding (i.e., open coding), 388 of open codes were generated. Codes are labels for cataloging key concepts without disrupting the context in which these concepts occur (Curry et al. 2009). The transcripts were re-read to make sure that all relevant pieces of data were coded. Then, the open codes were analyzed and grouped under 42 code groups or categories (i.e., axial coding). Finally, the 42 categories were further grouped into eight themes. The coding did not occur linearly, but through iterations from the codes to data, until the eight themes emerged (Curry et al. 2009). Five of the 42 categories were left out and not grouped under any of the eight themes because they were user recommendations for improvement on existing features and suggestions for new features and services. The eight themes were analyzed further to identify relationships among them, leading to the construction of a proposed model that illustrates the factors that influence the adoption and post-adoption use of a mobile app in higher education context. We discuss that in the next section.

Findings and Discussion

Evidence from our data suggests that when users are introduced to mobile apps, they progress towards post-adoption use along two main paths influenced by mobile app attributes, user attributes, support structures, and task attributes. After initial adoption, users either progress along confirmation – satisfaction – post-adoption use, or progress along satisfaction – post-adoption use. We noticed that whereas some users did have urgent tasks that they perceived could be performed using *SmartCampus* (i.e., perceived usefulness), others did not have prior perception of usefulness. Instead, they just installed and tried out *SmartCampus* and then serendipitously realized that *SmartCampus* was actually useful (or useless) for performing certain tasks. Figure 1 illustrates the various stages and the factors that influence the initial adoption and post-adoption use of *SmartCampus*. In the sub-sections that follow, we discuss how the various factors influence the adoption, confirmation, satisfaction, and post-adoption use of a mobile app.

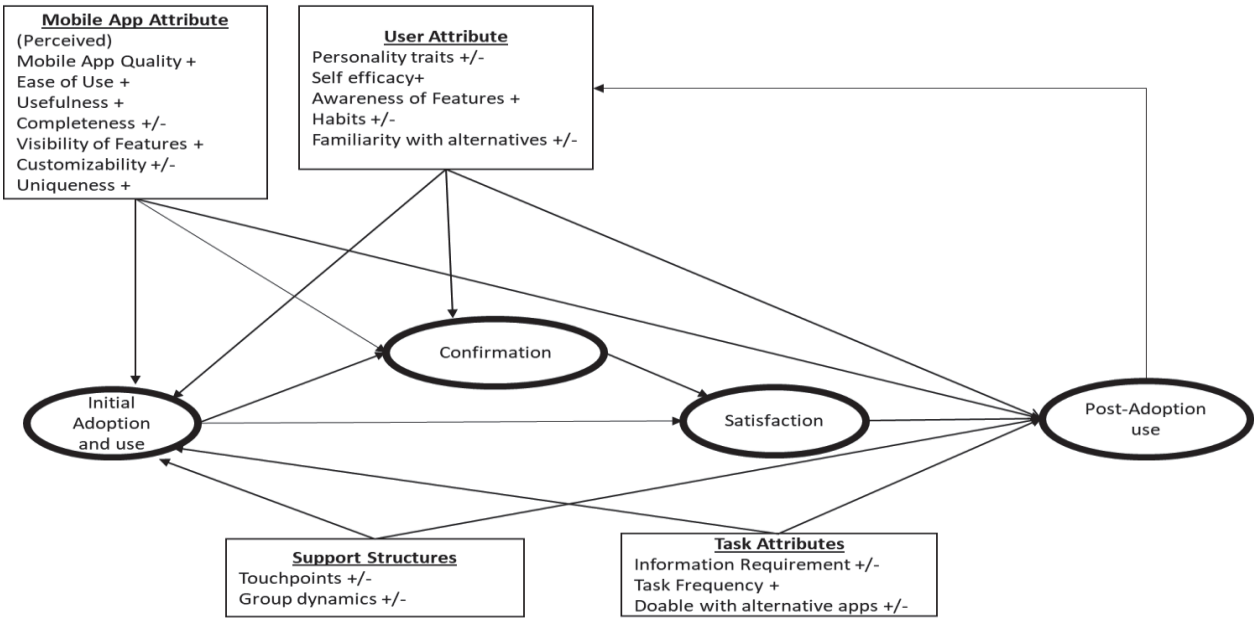

Figure 1. A model for the adoption and post-adoption use of a multi-feature mobile app

Initial Adoption

Initial adoption is the stage where a user is introduced to a mobile app, installs the mobile app, and uses the mobile app to perform some tasks or realizes that the mobile app can be used to perform some tasks. The initial adoption stage is influenced by mobile app attributes, user attributes, support structures, and task attributes. Aside from the well-known mobile app attributes, e.g., ease of use, usefulness, customizability, and mobile app quality (e.g., see Chen et al. 2012; McLean 2018), we noted that other mobile app attributes including visibility of features, completeness, and uniqueness do influence initial

adoption of a mobile app. Mostly, all contents and features in a mobile app hardly fit on a screen (Adipat and Zhang 2005). Thus, whereas some contents and features are displayed on the home screen, others are organized behind menus (e.g., hamburger menu). Depending on how the contents and features are organized, we noticed that users might not discover and use some of the features of a mobile app. Users usually look at the features on the home screen as the important, and sometimes the only, features of the mobile app. Thus, if a user does not find an important feature on the home screen, the user may refrain from adopting and using the app without exploring other features hidden behind menus. Consider this quote from a user:

*"If you click on it then different features come up like jobs, you can book sports sessions, this and that. So, I feel like at least me, for the first two months, I didn't even click there. I just thought that it was just some kind of option. I didn't understand that some specific very good features are hidden in there." (**Int. 1**)*

Some users adopted and used *SmartCampus* because, for example, it had features that made it possible for the users to perform tasks that they would have otherwise performed by browsing several webpages or using several mobile apps. It is apparent that users are gravitating towards adopting and using mobile apps that are *complete*; that is, mobile apps that have several features to enable a user to perform a range of tasks without the user having to use other mobile apps or websites. For example, consider a user's comment about what makes him/her adopt a mobile app:" *…if it is complete, that's if I don't have to use five apps that I believe could belong together to have the information that I need*" (***Int. 19***). Comments from users also suggest that completeness of *SmartCampus* makes a user's life on campus convenient. However, the quest for completeness creates a paradox because the availability of several features means some features may be hidden behind menus reducing their visibility and use.

Another mobile app feature that influences the initial adoption of *SmartCampus* is its uniqueness. The uniqueness of a focal mobile app reflects the extent to which a user believes there exist other mobile apps that can perform a task that the focal mobile app can perform. *SmartCampus* rarely has uniqueness at the feature level since all features in *SmartCampus* are built on existing web services, websites, or mobile apps. Besides, users found third-party mobile apps that could perform certain tasks better than corresponding features in *SmartCampus* can do. For instance, the Google Calendar is named by users as a preferred alternative to the calendar feature in *SmartCampus*. However, at the mobile app level, *SmartCampus* derives uniqueness from the different features it has assembled. We observed that users used *SmartCampus* because of its uniqueness.

User attributes also influence the initial adoption and use of *SmartCampus*. Our data suggest that personality traits (e.g., attitude), the self-belief in one's skills, and capabilities (i.e., self-efficacy) do influence the initial adoption and use of *SmartCampus*. Further, our study also reveals that a user's awareness of features, past habits, and familiarity with alternative mobile apps do influence initial adoption and use of *SmartCampus*. From prior quotes (from **Int.1** and **Int.6**), we infer that a user's awareness of the features of a mobile app may positively influence the likelihood of the user to use the mobile app. Furthermore, evidence from our data suggests that a user's familiarity with alternative mobile apps and past habits positively or negatively influence his/her adoption of *SmartCampus*.

"*…the lunch page is like now when I look it, it's great you can see all of them [the cafeterias on campus] but like somehow, it's not my routine to check the lunch from there [SmartCampus], I just, I've got used to check every page [the webpages of the various cafeterias] like differently…*" (***Int.8***")

"*We use in the browsers, CampusMap (a pseudonym for a campus map), …then when I used SmartCampus, after the first time I noticed it's exactly the same thing. It's the same like the program that you use on your browser. Then of course I already know how to use SmartCampus' maps then of course it was easy for me to start using it because I know that ooh this is the same thing*" (***Int.7***).

The initial adoption and use of the mobile app is also influenced by support structures, namely, touchpoints, and group dynamics. Touchpoints refer to the entities (or activities) that introduce a user to a mobile app. In the case of *SmartCampus,* examples of touchpoints include university webpages, posters, orientation programs, student tutors, and friends. Mostly, formal and impersonal touchpoints (i.e., university webpages, posters, and orientation programs) are less effective than informal and personal touchpoints (e.g., student tutors and friends). Another notable observation is that users are usually content with and mostly limited to the features that they are introduced to by the touchpoints they interact with. Beyond the initial features that users are introduced to, users rarely explore *SmartCampus* for new/other features, including the features on the home screen. This comment illustrates our point.

"*Well, yeah I tend to use a lot, but for example I only use it [SmartCampus] for what people have said, 'you can use it for this, you can use it for that,' but normally I don't like …how can I say, I don't explore the application that much. So maybe that's why I don't see everything that the application has*" (***Int16***)

Further, group dynamics influence the initial adoption and use of the mobile app. Whereas positive group dynamics; e.g., recommendation from friends, group activities, and positive feedback, may positively influence initial adoption and use, negative group dynamics; e.g., negative feedback may negatively influence the initial adoption and use of a mobile app. For example, an interviewee reflects on why s/he uninstalled *SmartCampus* after initial adoption and use.

"*Well, at first, it was really negative…like when I talked with my friends that were using the app, we started using the app at the same time so… it was like negative feedback loop going around so I don't remember maybe not so many crashes happened maybe to myself, maybe a couple but when you are in an environment and the app crashes, you feel that it happens to you when it actually happened to your friend or something so… it might be that it multiplied the external experience with the App*" (***Int.4***)

Finally, task attributes also influence the initial adoption and use of a mobile app. The extent of information required to accomplish a task and the rate at which the information changes do positively or negatively influence the initial adoption and use of a mobile app. We noticed that in situations where a user does not need much information to accomplish a task (e.g., a student locating a familiar classroom), the user might find no need for *SmartCampus*, whereas, in situations where the user needs much information to accomplish a task (e.g., a student looking for menus in student cafeterias) the user is likely to use *SmartCampus*. Further, the frequency of tasks also influences adoption. Users adopt *SmartCampus* for daily tasks (e.g., checking their study schedules) than they do for infrequent tasks. Also, our data suggest that tasks that can be performed with other mobile apps may impede the adoption of *SmartCampus* unless a feature or a bundle of features in *SmartCampus* presents a better alternative.

Confirmation

After initial adoption and use, a user who had an expectation or perception about the attributes of a mobile app (e.g., ease of use, usefulness, quality, completeness, uniqueness, and customizability), may confirm (or disconfirm) such perceptions based on his/her experiences from using the mobile app (Chen et al. 2012). Apart from the actual experiences from the initial adoption and use of the mobile app, the mobile app attributes and user attributes influence the user's confirmation of his/her initial perceptions. For example, a user who is familiar with alternative mobile apps may find the focal mobile app easy to use (e.g., see the *CampusMap* example by **Int7** above). Further, a user's expectation and perceptions may be influenced by his/her familiarity with alternative mobile apps. For example, a user said:

"*…a bit [of lag] with the map and the location process, but I think it's normal because even google maps takes time so…I was not expecting a faster experience if that makes sense. So, this is fine, everything else is pretty quick so…*" (***Int.19***).

Also, the user's awareness of features may influence his/her confirmation about the visibility of features, whereas his/her self-efficacy (i.e., self-belief in his/her skills or capability to use a mobile app) may influence the confirmation of *ease of use* and *quality* of a mobile app. For example, we observed that users who do not profess to have the level of IT skills to understand the operations and failures of *SmartCampus* blame negative experiences with *SmartCampus*, e.g., disruption in use, on other things, including themselves, but not on *SmartCampus*. One user puts it this way: *"[I felt] stupid because I think it's my fault and I didn't manage to use it properly….so the first thing is frustration with myself*" (***Int.19***).

Personality traits (e.g., attitude) also influence a user's confirmation of his/her perception. Whereas some users are patient and tolerant of bugs whilst anticipating improvements in non-functional features in *SmartCampus,* others are less tolerant of bugs and either discontinue using or uninstall *SmartCampus*. For instance, one user said, "*… at first time when I installed it, …I haven't had positive experience with it, so I just deleted it after a while*" (***Int.4***). Whereas, another said:

"*When I used it first, it wasn't actually that functional in my opinion at that time. I was like okay it's nice to have an app for the university but I was realizing that it was something under development, new functional features will come so I kept the app on my phone hoping that there will be some iteration and there will be more features but right now I use the app but previously I did not that much, yeah*"

Satisfaction

Satisfaction relates to an experience a user has from confirming his/her expectations (or perceptions) of a mobile app (Chen et al. 2012), or an experience a user gets from the actual use of a mobile app without any ex-ante expectation of the mobile app. We noted that whereas some users installed *SmartCampus* with ex-ante perceptions (e.g., the ability to find locations on campus, and have access to course schedules), others did not have such ex-ante expectations but just decided to try *SmartCampus* to see what it has to offer. Thus, the first group of users could have satisfaction (or dissatisfaction) from confirming their ex-ante perceptions of *SmartCampus,* whereas the second group could have satisfaction (or dissatisfaction) directly from the actual use of *SmartCampus*. The following comments from users illustrate our point.

" *I was struggling with my routine… I was kind of missing the several lecture change or some other things… So, when I saw this app, I was like maybe this app is the solution where it will just give me the proper calendar with the updated calendar and or something. I remember when I was first using it, it did not actually have those calendar feature…but now it has so it's useful right now*" (**Int.1**)

" I *was very satisfied with it. When I downloaded it, it was quite easy to locate buildings on this map and it's working quite fine without any problems …, I didn't have any expectations but I'm okay with using it.*" (***Int.2***). Another said "*before I started using it, I didn't know anything about what it has before I started using it. It was when I started using it [that] I got to know so many other things about the app"* (**Int.14**).

Thus, on the one hand, users can have ex-ante expectations of a mobile app and confirm them by actually using the mobile app. On the other hand, users can just serendipitously find features of, and uses for, a mobile app leading to satisfaction (or dissatisfaction) without confirmation.

Post-adoption Use

Post-adoption use refers to the actual use beyond initial adoption that a user makes of known and new features of a mobile application in order to perform tasks. *Known features* include used and unused features that a user is aware of. Also, note that a *new feature* of a mobile application, as used here, does not refer to only a feature that was previously non-existent, but also a previously existing feature that was unknown to a user. Thus, post-adoption use does not only refer to the *continuance use* of known features but also the adoption and use of new features, and the revision of the set of features that a user uses (Sun 2012). Our data do suggest that post-adoption use is influenced by satisfaction, mobile app attributes, user attributes, support structures, and task attributes and that post-adoption use in turn influences user attributes, introducing a feedback loop that either re-enforces or derails use.

The quality, ease of use, and usefulness are well-known attributes of a mobile app that influences post-adoption use. From this study, we have observed that other attributes, including completeness, visibility of features, customizability, and uniqueness, influence post-adoption use. Completeness and uniqueness allow users an array of features with which users can perform a wide variety of tasks. We noted that because *SmartCampus* has an array of features, users still use *SmartCampus* even when they discontinue using some of the features they used at initial adoption. The completeness of a mobile app allows a user to revise the set of features the user uses depending on, for example, the attributes of tasks that the user performs. A user comment reflects this assertion:

"… I used SmartCampus pretty much the same as at the time I downloaded it, but since I bought the sports card …I use the sportfeature [pseudonym for a feature] now because I have the card so I need that information so I can check there is yoga at this time at this location" (***Int.3***)

Customizability enables users to select options, including features, to be displayed on the home screen. For example, in the case of *SmartCampus*, users can select their favorite cafeteria and have lunch menus from the favorite cafeteria displayed on the home screen. Customization thus allows users to personalize *SmartCampus*, making it easier for users to integrate the use of *SmartCampus* into their everyday student life on campus. However, we also noted that customization makes users contempt with known features and prevent users from exploring new features, or new options for known features (e.g., a new cafeteria added to the list of cafeterias). In line with McLean (2018), our findings suggest that customizability influences post-adoption use mostly by influencing continuance use of known features. Nevertheless, our findings also suggest that customizability can constrain post-adoption use by hindering the exploration of new features and options. The following quote illustrates our point.

"*…ever since I started using it, I've been using the calendar. I always want to check what I have for the day, most especially. I think it's just now I see that I can view for the whole week. I didn't know that before. Because from the home page, it just says today and tomorrow*." (***Int.14***)

User attributes influence post-adoption use. We have discussed how personality traits (e.g., attitude) and self-efficacy may cause a user to discard a mobile app or to retain it after initial experience with the app. Awareness of features also influence post-adoption use. During the interviews, we observed severally that when users get to know of new features, they are eager to try the new features in performing tasks. For instance, see the quotes from **Int.1** and **Int.6** above**.** Thus, when users become aware of new features, they find more use for *SmartCampus*. Further, we observed that though some users avoid using *SmartCampus* because of existing habits (***e.g., Int.8***), others use *SmartCampus* to either entrench existing habits or form new ones. For instance, a user said "*… it has been really easy for me to know for example where I have to go because it's been like easy to adapt me to SmartCampus that's why I keep using it"* (***Int.16***).

Furthermore, we noted that support structures are valuable in driving post-adoption use. For instance, touchpoints and activities within groups assist users to identify new features of, and new uses for, *SmartCampus*. Likewise, negative feedback within groups and from touchpoints may as well discourage a user from further exploring *SmartCampus* for new features and uses. Our data suggest that after a user finds a functional and important feature in a mobile app, negative feedback may influence the user's opinion about the app and prevent the user from exploring new features, but it may not deter the user from continuing to use the functional feature provided the feature remains useful. For example, a user said "*..no I wouldn't say that they have influence, it's just that…well, maybe not the use really but the opinion to explore the app* (***Int.7***) and another said "*…at the start but now I am minimally satisfied with SmartCampus so I'm not influenced by them*" (***Int.4***).

Lastly, our data suggest that task attributes influence how users interact with *SmartCampus*. For tasks that require a lot of information to complete, users are forced to continue using *SmartCampus* to acquire the needed information. We also noted that, in cases where the information required to complete a task is static (e.g., locating a building), the use of *SmartCampus* to obtain such information declines when users become acquainted with the information. On the other hand, when the information required is dynamic (e.g., checking sports events), users continue to use *SmartCampus* to obtain such information. For example, a user said:

"*… I only used the map when I first came, … when I first started my Finnish 2 classes and I was going back to other campus, then I started using the map again but after I've done it for almost one month plus, I don't use the map frequently because I already know where I am going to*".

How frequently a user performs a task, especially tasks that require dynamic information, also influences the post-adoption use of *SmartCampus*. Further, we observed that using alternative mobile apps to perform tasks may prevent a user from using *SmartCampus*. However, the presence of alternatives may as well serve as a back-up in moments when *SmartCampus* fails, thus reducing the frustration that users experience.

Implications, Limitations, and Conclusions

This study qualitatively examines the actual adoption and post-adoption use of a mobile app in a higher education context. The mobile app is primarily for informative purposes (Nickerson et al. 2013) and provides users with access to university resources. The study contributes to the literature on the adoption of mobile apps. It contributes a model that illustrates how mobile app attributes, user attributes, task attributes, and support structures influence initial adoption and post-adoption use of a multi-feature mobile app. This contribution is important for several reasons. First, it augments prior research in that beyond a user's intention to use and continue using a mobile app, it explains how the factors influence actual adoption and post-adoption use of a mobile app. Second, whilst it confirms findings from prior research (e.g., on the effect of perceived usefulness and ease of use on use), it also unravels nuances beyond the correlations presented in prior research models. For instance, the findings of this study agree with those of McLean (2018) that customization may enhance the influence of ease of use and usefulness on initial adoption and post-adoption use. However, customization may also prevent a user from exploring and using new features in a mobile app. Similarly, though the result of our study agrees that social influences may not affect the continuous use of known features (e.g., see Lu 2014), it does suggest that social influences may affect the exploration of a mobile app for new features and uses. Third, it highlights the importance of the initial features that a user gets to know during initial adoption (e.g., through touchpoints) on the extent to which the user uses a mobile app. Users tend to use few features, especially those that are on the home

screen by default or by customization. This may be because traditionally, users expect mobile apps to have limited features. The finding has implications for future research on how multi-feature mobile apps (e.g., those used in smart campuses) can be designed to aid the exploration of features. Fourth, it has unraveled several details, including completeness and uniqueness of a mobile app, visibility and user awareness of features, familiarity with alternative mobile apps, and task frequency and has highlighted how they influence adoption and post-adoption use of mobile apps.

For practice, managers may find the findings of this study insightful in designing and promoting the adoption and use of multi-feature mobile apps. Specifically, whilst managers design digital services bundled as multi-feature mobile applications, they should do so without constraining the visibility of the various features. Also, the results suggest that managers of mobile apps, especially for smart campuses, should bundle features that may not be unique in isolation, but collectively provide users unique and complete digital service experiences. Furthermore, the findings suggest that the rollout of a multi-feature mobile app in a smart campus initiative should not only be accompanied by formal support structures, but also informal support structures and activities that influence the adoption and use of the several features in the multi-feature mobile app.

This study, aside from its contributions, has limitations. First, the mobile app studied is an informative mobile app used within a higher education context. Thus, factors such as risk, security, and trust did not come up during the interview. However, we envisage that such factors may come up in future rollouts when there are transactional features, especially across third-party services. We thus encourage scholars to research how such factors may influence the development and adoption of mobile apps with transactional features for smart campus initiatives.

REFERENCES

Adipat, B., and Zhang, D. 2005. "Interface Design for Mobile Applications," *AMCIS 2005 Proceedings*, p. 494.

Atif, Y., Mathew, S. S., and Lakas, A. 2015. "Building a Smart Campus to Support Ubiquitous Learning," *Journal of Ambient Intelligence and Humanized Computing* (6:2), Springer, pp. 223–238.

Chen, L., Meservy, T. O., and Gillenson, M. 2012. "Understanding Information Systems Continuance for Information-Oriented Mobile Applications," *Communications of the Association for Information Systems* (30:1), p. 9.

Chhonker, M. S., Verma, D., and Kar, A. K. 2017. "Review of Technology Adoption Frameworks in Mobile Commerce," *Procedia Computer Science* (122), pp. 888–895.

Chopdar, P. K., Korfiatis, N., Sivakumar, V., and Lytras, M. D. 2018. "Mobile Shopping Apps Adoption and Perceived Risks: A Cross-Country Perspective Utilizing the Unified Theory of Acceptance and Use of Technology," *Computers in Human Behavior* (86), pp. 109–128.

Curry, L. A., Nembhard, I. M., and Bradley, E. H. 2009. "Qualitative and Mixed Methods Provide Unique Contributions to Outcomes Research," *Circulation* (119:10), Am Heart Assoc, pp. 1442–1452.

Eisenhardt, K. M. 1989. "Building Theories from Case Study Research," *Academy of Management Review* (14:4), pp. 532–550.

FernáNdez-LóPez, Ál., RodríGuez-FóRtiz, M. J., RodríGuez-Almendros, M. L., and MartíNez-Segura, M. J. 2013. "Mobile Learning Technology Based on IOS Devices to Support Students with Special Education Needs," *Computers & Education* (61), pp. 77–90.

Gibbs, C., Gretzel, U., and Saltzman, J. 2016. "An Experience-Based Taxonomy of Branded Hotel Mobile Application Features," *Information Technology & Tourism* (16:2), Springer, pp. 175–199.

Groß, M. 2015. "Exploring the Acceptance of Technology for Mobile Shopping: An Empirical Investigation among Smartphone Users," *The International Review of Retail, Distribution and Consumer Research* (25:3), Taylor & Francis, pp. 215–235.

Hao, S., Dennen, V. P., and Mei, L. 2017. "Influential Factors for Mobile Learning Acceptance among Chinese Users," *Educational Technology Research and Development* (65:1), Springer, pp. 101–123.

Harris, M. A., Brookshire, R., and Chin, A. G. 2016. "Identifying Factors Influencing Consumers' Intent to Install Mobile Applications," *International Journal of Information Management* (36:3), pp. 441–450.

Hew, J.-J., Lee, V.-H., Ooi, K.-B., and Wei, J. 2015. "What Catalyses Mobile Apps Usage Intention: An Empirical Analysis," *Industrial Management & Data Systems*, Emerald Group Publishing Limited.

Ho, H.-Y., and Syu, L.-Y. 2010. "Uses and Gratifications of Mobile Application Users," in *2010 International Conference on Electronics and Information Engineering* (Vol. 1), IEEE, pp. V1–315.

Huda, M., Jasmi, K. A., Mustari, M. I., Basiron, B., Mohamed, A. K., Embong, W. H. W., and Safar, J. 2017. "Innovative E-Therapy Service in Higher Education: Mobile Application Design.," *IJIM* (11:4), pp. 83–94.

Hung, M.-C., Yang, S.-T., and Hsieh, T.-C. 2012. "An Examination of the Determinants of Mobile Shopping Continuance," *International Journal of Electronic Business Management* (10:1), Electronic Business Management Society, Taiwan, p. 29.

Kim, H.-W., Kankanhalli, A., and Lee, H.-L. 2016. "Investigating Decision Factors in Mobile Application Purchase: A Mixed-Methods Approach," *Information & Management* (53:6), pp. 727–739.

Krotov, V. 2015. "Critical Success Factors in M-Learning: A Socio-Technical Perspective," *Communications of the Association for Information Systems* (36:1), p. 6.

Lee, A. S. 1989. "A Scientific Methodology for MIS Case Studies," *MIS Quarterly*, pp. 33–50.

Lu, J. 2014. "Are Personal Innovativeness and Social Influence Critical to Continue with Mobile Commerce?," *Internet Research*, Emerald Group Publishing Limited.

Luxton, D. D., McCann, R. A., Bush, N. E., Mishkind, M. C., and Reger, G. M. 2011. "MHealth for Mental Health: Integrating Smartphone Technology in Behavioral Healthcare.," *Professional Psychology: Research and Practice* (42:6), p. 505.

McLean, G. 2018. "Examining the Determinants and Outcomes of Mobile App Engagement-A Longitudinal Perspective," *Computers in Human Behavior* (84), pp. 392–403.

Motiwalla, L. F. 2007. "Mobile Learning: A Framework and Evaluation," *Computers & Education* (49:3), Elsevier, pp. 581–596.

Muhamad, W., Kurniawan, N. B., Yazid, S., and others. 2017. "Smart Campus Features, Technologies, and Applications: A Systematic Literature Review," in *2017 International Conference on Information Technology Systems and Innovation (ICITSI)*, IEEE, pp. 384–391.

Munoz-Leiva, F., Climent-Climent, S., and Liébana-Cabanillas, F. 2017. "Determinants of Intention to Use the Mobile Banking Apps: An Extension of the Classic TAM Model," *Spanish Journal of Marketing-ESIC* (21:1), pp. 25–38.

Nickerson, R. C., Varshney, U., and Muntermann, J. 2013. "A Method for Taxonomy Development and Its Application in Information Systems," *European Journal of Information Systems* (22:3), Taylor & Francis, pp. 336–359.

Oliveira, T., Faria, M., Thomas, M. A., and Popovič, A. 2014. "Extending the Understanding of Mobile Banking Adoption: When UTAUT Meets TTF and ITM," *International Journal of Information Management* (34:5), Elsevier, pp. 689–703.

Shambour, Q., Fraihat, S., and others. 2018. "The Implementation of Mobile Technologies in Higher Education: A Mobile Application for University Course Advising," *Journal of Internet Technology* (19:5), pp. 1327–1337.

Sun, H. 2012. "Understanding User Revisions When Using Information System Features: Adaptive System Use and Triggers.," *MIS Quarterly* (36:2).

Tao, D. 2009. "Intention to Use and Actual Use of Electronic Information Resources: Further Exploring Technology Acceptance Model (TAM)," in *AMIA Annual Symposium Proceedings* (Vol. 2009), American Medical Informatics Association, p. 629.

Techopedia. 2018. *Mobile Application (Mobile App)*. (https://www.techopedia.com/definition/2953/mobile-application-mobile-app).

Teri, S., Acai, A., Griffith, D., Mahmoud, Q., Ma, D. W., and Newton, G. 2014. "Student Use and Pedagogical Impact of a Mobile Learning Application," *Biochemistry and Molecular Biology Education* (42:2), Wiley Online Library, pp. 121–135.

Thakur, R., and Srivastava, M. 2014. "Adoption Readiness, Personal Innovativeness, Perceived Risk and Usage Intention across Customer Groups for Mobile Payment Services in India," *Internet Research*, Emerald Group Publishing Limited.

Vázquez-Cano, E. 2014. "Mobile Distance Learning with Smartphones and Apps in Higher Education.," *Educational Sciences: Theory and Practice* (14:4), pp. 1505–1520.

Yin, R. K. 1981. "The Case Study Crisis: Some Answers," *Administrative Science Quarterly* (26:1), pp. 58–65.

Yin, R. K. 2011. *Applications of Case Study Research*, Sage.

Yu, C.-S. 2012. "Factors Affecting Individuals to Adopt Mobile Banking: Empirical Evidence from the UTAUT Model," *Journal of Electronic Commerce Research* (13:2), Journal of Electronic Commerce Research, p. 104.

III

INVESTIGATING THE STRUCTURAL PROPERTIES OF AN IT-ENABLED RESOURCE

by

Lumor, T., 2019

In Proceedings of the Tenth Scandinavian Conference on Information Systems (SCIS 2019), Nokia, Finland

INVESTIGATING THE STRUCTURAL PROPERTIES OF AN IT-ENABLED RESOURCE

Research paper

Lumor, Truth, University of Jyväskylä, Jyväskylä, Finland, trlumor@student.jyu.fi

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.

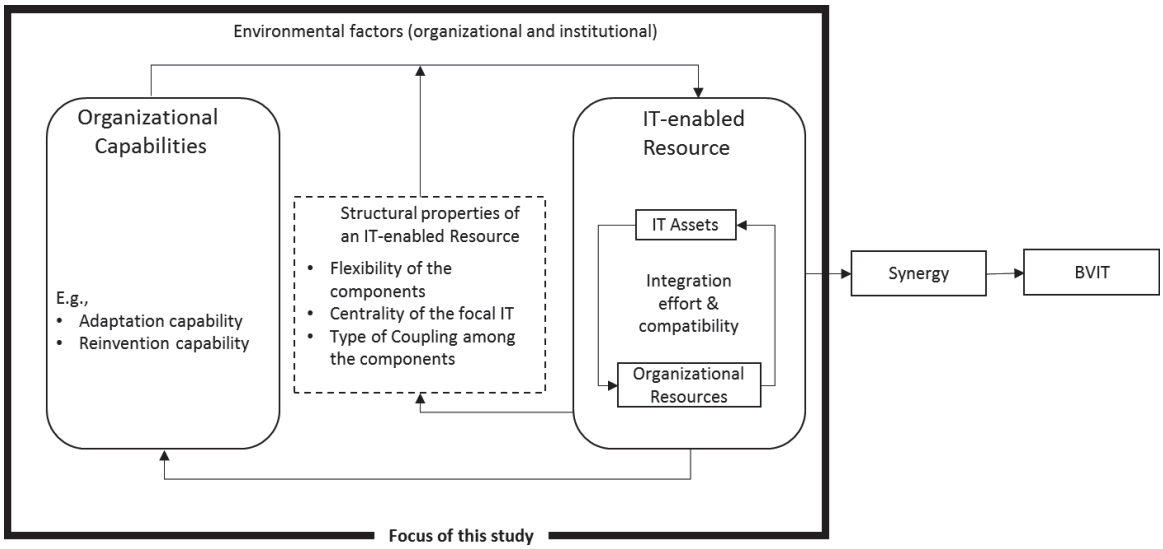

Figure 1. Formation and Renewal of an IT-enable Resource

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.

References

Asadi Someh, I., Wixom, B., Davern, M., Shanks, G., 2017. Enablers and Mechanisms: Practices for Achieving Synergy with Business Analytics.

Azad, B., King, N., 2012. Institutionalized computer workaround practices in a Mediterranean country: an examination of two organizations. Eur. J. Inf. Syst. 21, 358–372.

Azad, B., King, N., 2008. Enacting computer workaround practices within a medication dispensing system. Eur. J. Inf. Syst. 17, 264–278.

Baird, A., Davidson, E., Mathiassen, L., 2017. Reflective Technology Assimilation: Facilitating Electronic Health Record Assimilation in Small Physician Practices. J. Manag. Inf. Syst. 34, 664–694.

Beaudry, A., Pinsonneault, A., 2005. Understanding user responses to information technology: A coping model of user adaptation. MIS Q. 493–524.

Benitez, J., Ray, G., Henseler, J., 2018. Impact of information technology infrastructure flexibility on mergers and acquisitions. MIS Q. Manag. Inf. Syst. Q. 42, 25–43.

Berente, N., Yoo, Y., 2012. Institutional contradictions and loose coupling: Postimplementation of NASA's enterprise information system. Inf. Syst. Res. 23, 376–396.

Berente, N., Yoo, Y., Lyytinen, K., 2008. Alignment or drift? Loose coupling over time in NASA's ERP implementation. ICIS 2008 Proc. 180.

Bharadwaj, A.S., 2000. A resource-based perspective on information technology capability and firm performance: an empirical investigation. MIS Q. 169–196.

Bonacich, P., 2007. Some unique properties of eigenvector centrality. Soc. Netw. 29, 555–564.

Chen, Y., Wang, Y., Nevo, S., Benitez, J., Kou, G., 2017. Improving strategic flexibility with information technologies: insights for firm performance in an emerging economy. J. Inf. Technol. 32, 10–25.

Davidson, E.J., Chismar, W.G., 2007. The interaction of institutionally triggered and technology-triggered social structure change: An investigation of computerized physician order entry. MIS Q. 739–758.

Drummond, H., 2008. The Icarus paradox: An analysis of a totally destructive system. J. Inf. Technol. 23, 176–184.

Eisenhardt, K.M., Martin, J.A., 2000. Dynamic capabilities: what are they? Strateg. Manag. J. 1105–1121.

Goh, J.M., Gao, G., Agarwal, R., 2011. Evolving work routines: Adaptive routinization of information technology in healthcare. Inf. Syst. Res. 22, 565–585.

Grabski, S.V., Leech, S.A., Schmidt, P.J., 2011. A review of ERP research: A future agenda for accounting information systems. J. Inf. Syst. 25, 37–78.

Harrison, D., Easton, G., 2002. Patterns of actor response to environmental change. J. Bus. Res. 55, 545–552.

Helfat, C.E., 2003. Stylized facts regarding the evolution of organizational resources and capabilities. SMS Blackwell Handb. Organ. Capab. 1–11.

Henfridsson, O., Bygstad, B., 2013. The generative mechanisms of digital infrastructure evolution. MIS Q. 37, 907–931.

Huang, T., Yasuda, K., 2016. Comprehensive review of literature survey articles on ERP. Bus. Process Manag. J. 22, 2–32.

Ibarra, H., 1993. Network centrality, power, and innovation involvement: Determinants of technical and administrative roles. Acad. Manage. J. 36, 471–501.

Jasperson, J.S., Carter, P.E., Zmud, R.W., 2005. A comprehensive conceptualization of post-adoptive behaviors associated with information technology enabled work systems. MIS Q. 29, 525–557.

Kohli, R., Devaraj, S., 2004. Realizing the business value of information technology investments: an organizational process. MIS Q. Exec. 3, 53–68.

Kohli, R., Grover, V., 2008. Business value of IT: An essay on expanding research directions to keep up with the times. J. Assoc. Inf. Syst. 9, 23.

Le Breton-Miller, I., Miller, D., 2015. The paradox of resource vulnerability: Considerations for organizational curatorship. Strateg. Manag. J. 36, 397–415.

Leonardi, P.M., 2011. When flexible routines meet flexible technologies: Affordance, constraint, and the imbrication of human and material agencies. MIS Q. 147–167.

Lumor, T., 2019. Factors that Influence Information Technology Use during Post-implementation: A Literature Review., in: Twenty-Seventh European Conference on Information Systems (ECIS2019). Presented at the European Conference on Information Systems, ECIS, Stockholm-Uppsala, Sweden.

Lyytinen, K., Newman, M., Al-Muharfi, A.-R.A., 2009. Institutionalizing enterprise resource planning in the Saudi steel industry: a punctuated socio-technical analysis. J. Inf. Technol. 24, 286–304.

Macredie, R., Sandom, C., 1999. IT-enabled change: evaluating an improvisational perspective. Eur. J. Inf. Syst. 8, 247–259.

McGann, S.T., Lyytinen, K., 2008. The improvisation effect: a case study of user improvisation and its effects on information system evolution. ICIS 2008 Proc. 209.

Melville, N., Kraemer, K., Gurbaxani, V., 2004. Information technology and organizational performance: An integrative model of IT business value. MIS Q. 28, 283–322.

Nan, N., Tanriverdi, H., 2017. Unifying the role of IT in hyperturbulence and competitive advantage via a multilevel perspective of IS strategy. MIS Q. 41, 937–958.

Nevo, S., Nevo, D., Pinsonneault, A., 2016. A Temporally Situated Self-Agency Theory of Information Technology Reinvention. Mis Q. 40, 157–186.

Nevo, S., Wade, M., 2011. Firm-level benefits of IT-enabled resources: A conceptual extension and an empirical assessment. J. Strateg. Inf. Syst. 20, 403–418.

Nevo, S., Wade, M.R., 2010. The formation and value of IT-enabled resources: antecedents and consequences of synergistic relationships. Mis Q. 163–183.

Nusca, A., 2017. 5 Moves Walmart Is Making to Compete With Amazon and Target. Fortune. URL http://fortune.com/2017/09/27/5-moves-walmart-is-making-to-compete-with-amazon-and-target/?iid=sr-link9 (accessed 10.1.17).

Orlikowski, W.J., 1996. Improvising organizational transformation over time: A situated change perspective. Inf. Syst. Res. 7, 63–92.

Orton, J.D., Weick, K.E., 1990. Loosely coupled systems: A reconceptualization. Acad. Manage. Rev. 15, 203–223.

Oseni, T., Foster, S.V., Mahbubur, R., Smith, S.P., 2017. A Framework for ERP Post-Implementation Amendments: A Literature Analysis. Australas. J. Inf. Syst. 21.

Pavlou, P.A., El Sawy, O.A., 2010. The "third hand": IT-enabled competitive advantage in turbulence through improvisational capabilities. Inf. Syst. Res. 21, 443–471.

Piccoli, G., Ives, B., 2005. IT-dependent strategic initiatives and sustained competitive advantage: a review and synthesis of the literature. MIS Q. 29, 747–776.

Rai, A., Tang, X., 2010. Leveraging IT capabilities and competitive process capabilities for the management of interorganizational relationship portfolios. Inf. Syst. Res. 21, 516–542.

Robey, D., Ross, J.W., Boudreau, M.-C., 2002. Learning to implement enterprise systems: An exploratory study of the dialectics of change. J. Manag. Inf. Syst. 19, 17–46.

Rodon, J., Sese, F., Christiaanse, E., 2011. Exploring users' appropriation and post-implementation managerial intervention in the context of industry IOIS. Inf. Syst. J. 21, 223–248.

Rowe, F., 2014. What literature review is not: diversity, boundaries and recommendations. Eur. J. Inf. Syst. 23, 241–255.

Sabherwal, R., Jeyaraj, A., 2015. Information technology impacts on firm performance: an extension of Kohli and Devaraj (2003). MIS Q. 39, 809–836.

Santhanam, R., Seligman, L., Kang, D., 2007. Postimplementation knowledge transfers to users and information technology professionals. J. Manag. Inf. Syst. 24, 171–199.

Saraf, N., Langdon, C.S., El Sawy, O., 2013. IS integration and knowledge sharing in multi-unit firms: the winner's curse. Eur. J. Inf. Syst. 22, 592–603.

Schneider, S., Wollersheim, J., Krcmar, H., Sunyaev, A., 2018. How do requirements evolve over time? A case study investigating the role of context and experiences in the evolution of enterprise software requirements. J. Inf. Technol. 33, 151–170.

Schryen, G., 2013. Revisiting IS business value research: what we already know, what we still need to know, and how we can get there. Eur. J. Inf. Syst. 22, 139–169.

Schwarz, A., Mehta, M., Johnson, N., Chin, W.W., 2007. Understanding frameworks and reviews: a commentary to assist us in moving our field forward by analyzing our past. ACM SIGMIS Database DATABASE Adv. Inf. Syst. 38, 29–50.

Scott, W.R., Davis, G.F., 2015. Organizations and organizing: Rational, natural and open systems perspectives. Routledge.

Seddon, P.B., 2014. Implications for strategic IS research of the resource-based theory of the firm: A reflection. J. Strateg. Inf. Syst. 23, 257–269.

Seethamraju, R., 2009. Effects of ES-enabled standardization and integration on business process agility. PACIS 2009 Proc. 93.

Sirmon, D.G., Gove, S., Hitt, M.A., 2008. Resource management in dyadic competitive rivalry: The effects of resource bundling and deployment. Acad. Manage. J. 51, 919–935.

Sirmon, D.G., Hitt, M.A., Arregle, J.-L., Campbell, J.T., 2010. The dynamic interplay of capability strengths and weaknesses: investigating the bases of temporary competitive advantage. Strateg. Manag. J. 31, 1386–1409.

Sirmon, D.G., Hitt, M.A., Ireland, R.D., Gilbert, B.A., 2011. Resource orchestration to create competitive advantage: Breadth, depth, and life cycle effects. J. Manag. 37, 1390–1412.

Spierings, A., Kerr, D., Houghton, L., 2017. Issues that support the creation of ICT workarounds: towards a theoretical understanding of feral information systems. Inf. Syst. J. 27, 775–794.

Svejvig, P., Jensen, T.B., 2013. Making sense of enterprise systems in institutions: a case study of the re-implementation of an accounting system. Scand. J Inf Syst. 25, 1.

Tanriverdi, H., 2006. Performance effects of information technology synergies in multibusiness firms. Mis Q. 57–77.

Tanriverdi, H., Rai, A., Venkatraman, N., 2010. Research commentary—reframing the dominant quests of information systems strategy research for complex adaptive business systems. Inf. Syst. Res. 21, 822–834.

Thornhill, S., Amit, R., 2003. Learning about failure: Bankruptcy, firm age, and the resource-based view. Organ. Sci. 14, 497–509.

Wade, M., Hulland, J., 2004. The resource-based view and information systems research: Review, extension, and suggestions for future research. MIS Q. 28, 107–142.

Webster, J., Watson, R.T., 2002. Analyzing the past to prepare for the future: Writing a literature review. MIS Q. xiii–xxiii.

.

IV

EXPLORING THE RENEWAL OF IT-ENABLED RESOURCES FROM A STRUCTURAL PERSPECTIVE

by

Lumor,T., Pulkkinen, M., Chan,Y. E., & Hirvonen, A.

Under Review

Request a copy from author.