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

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

*Research paper*

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## **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; however, 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 Karjaluo (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 Karjaluo (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 7<sup>th</sup> to 10<sup>th</sup> 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
<b>Total</b>	<b>2384</b>	<b>68</b>

Table 1. Search and Selection Results

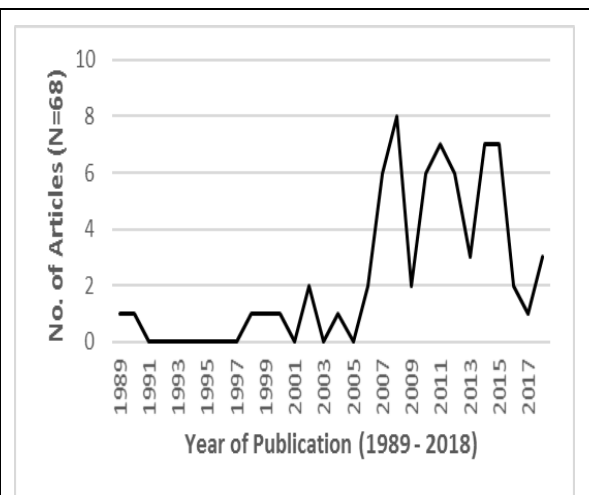


Figure 1. Distribution of articles by year of publication

## 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 Karjaluo, 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 (Jaspersen 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)	<b>Longitudinal:</b> 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), <b>Cross-sectional*:</b> Hale et al (1989), Jarvenpaa et al, (2000), Brown et al (2002), Bhattacharjee 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)	<b>Content Analysis:</b> Seddon et al (2010); <b>Mixed*:</b> Jones et al (2008), Kane and Labianca (2011), <b>Action Research:</b> 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	<b>Routine use:</b> 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 work-flows embedded in the system (Maas et al., 2018).

	<b>Innovative use:</b> 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 <i>infusion</i> (Maas et al., 2018).
Learning / Knowledge	<b>Exploitative use:</b> involves using existing knowledge about work tasks and an IT in order to solve existing or new problems (Tong et al., 2015) <b>Explorative use:</b> 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	<b>Narrow use:</b> 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) <b>Extended use:</b> 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). <b>Adaptive use:</b> 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). <b>Enhanced use:</b> 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	<b>Voluntary use:</b> 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. <b>Involuntary (Mandatory) use:</b> 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 <b>appropriate use</b> (Liang et al., 2013), whereas under indirect obligations IT-use may be referred to as <b>proficient use</b> (Veiga et al., 2014). <b>Appropriate use</b> and <b>proficient use</b> 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. Jaspersen et al., 2005)
Focal user	<b>Direct use:</b> 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). <b>Indirect use:</b> 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. Jaspersen 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), work-flow 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	<b>Formal support structures:</b> 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) <b>Informal support structures:</b> 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)	<b>Learning activities:</b> 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) <b>Adaptation activities:</b> 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

Organ ization	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)
Insti tution	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).

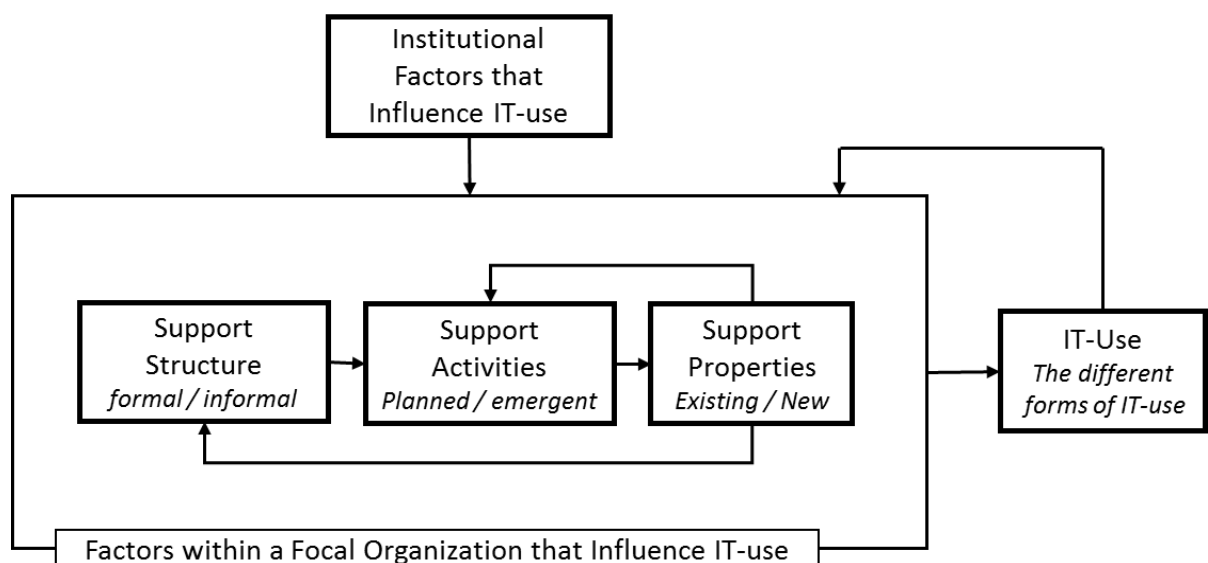


Figure 2. Interactions among Support Structures, Support Properties, Support Activities, and IT-use

### 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 (Devraj 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.

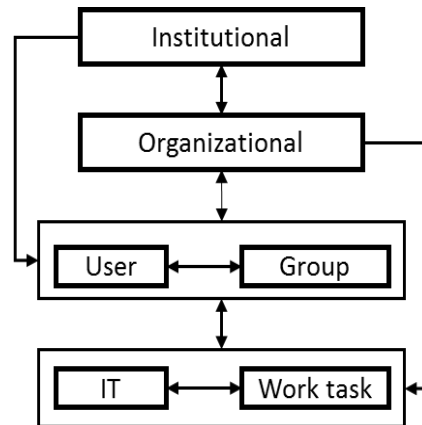


Figure 3. Interactions among Support Structures, Support Activities, and Support Properties Across Levels

#### 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-

behaviour 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.

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