Factors Influencing the Infusion of Information Systems: A Literature Review

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Abstract

This paper presents a descriptive review of the information system (IS) infusion literature and proposes a structured framework of factors influencing IS infusion. The IS infusion stage, the last stage of IS implementation, is associated with IS implementation success and evidence suggests the depth of IS use leads to increased efficiency and effectiveness. Despite the introduction of the IS infusion concept in the late 1980s, we observe only a small number of empirical studies that examine factors influencing IS infusion at an organizational and an individual level. In addition, some studies show conflicting results and there is no framework to organize previous studies in a meaningful way. We believe that a descriptive review is an appropriate approach at the current state of IS infusion literature. Given the importance of IS infusion, it seems timely to develop a structured framework detailing all the key factors influencing IS infusion found in the extant literature. The framework is drawn from factors derived from theories used in previous IS infusion studies, such as the technology organization environment theory and the theory of planned behavior, to classify different types of influencing factors namely organization, technology, task-job, firm environment and the individual factors. This review paper facilitates further theory development in the IS infusion domain by highlighting under-researched areas, suggesting future directions, and providing a reference source and a classified framework for IS researchers interested in IS infusion.

Keywords: IS infusion, descriptive literature review, organizing framework

Introduction

Organizations continue to invest in information systems (IS) to maintain its competitive advantage and keep up with changing customer behaviors. There is a consensus that successful IS implementations have significant effects on organizational productivity, efficiency, innovation, decision-making and positive returns (Venkatesh and Goyal, 2010). An under-utilization of IS has been identified as one of the major reasons to prevent organizations from gaining the full expected benefits from their IS investments (Kim and Gupta, 2014; Saeed and Abdinnour-Helm, 2008; Venkatesh and Goyal, 2010). While different reasons may contribute to the unrealized benefits, a recurrent theme is the fact that these systems are rarely infused into individuals' work practices (Kim and Gupta, 2014).

IS implementation is portrayed as a six-stage model, which includes initiation, adoption, adaptation, acceptance, routinization, and finally the infusion stages (Cooper and Zmud, 1990). Infusion as the last stage of a technology implementation process came to light in a study conducted in the late 1980s (Kwon and Zmud, 1987; Sullivan, 1985) and is defined as the degree to which "the IT application is used within the organization to its fullest potential" (Cooper and Zmud, 1990, p. 125). To realize the benefits from IS infusion, organizations need to understand factors that influence infusion (Winston and Dologite, 1999). As a consequence, scholars in the last decade have started to pay more attention to IS infusion because it is linked to increased business performance from embedding IS into business processes (Ramamurthy et al., 2008; Tennant et al., 2011; Winston and Dologite, 1999). However, some of these studies show conflicting results and there is no framework to organize previous studies in a meaningful way. Having an organizing framework of factors influencing IS infusion would help scholars better understand the current state of knowledge and identify areas for future research.

The organizing framework presented in this study is derived from rigorous and systematic review of literature based on the descriptive review method (Paré et al., 2015; Rowe, 2014). A descriptive review provides a snapshot of a research area through a frequency analysis of existing studies. The goal of this review is to evaluate to what extent the existing literature supports a specific proposition or unfolds an explainable pattern of a phenomenon (King and He, 2005; Paré et al., 2015). Webster and Watson (2002) suggest that an effective review of literature provides a stable foundation for advancing knowledge. It helps to facilitate theory development, tighten areas where a saturation of research exists, and reveal areas where future research is required. Therefore, review articles play a critical role to strengthen IS as a field of study (Webster and Watson, 2002). This paper describes a current landscape of IS infusion research, identifies areas where a plethora of study exists and suggests where more effort should be focused in the future in order to provide novel insights and contributions. We propose an organizing framework to synthesize previous studies and classify independent and dependent variables examined in the IS infusion literature.

The rest of this paper is organized as follows: First, the research methodology and our classification scheme of previous works are presented. Second, an overview of IS infusion from past empirical studies is presented. This is followed by the findings of our literature review and the proposed framework that classifies independent and dependent variables. Finally, we discuss the implications of this review, future research directions, and the limitations of this study.

Research Methodology

A literature review can be conducted in different ways such as narrative, descriptive,

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vote counting and meta-analysis. The objective of this study is to present a landscape of IS infusion research and provide suggestions to guide future research. We believe that a descriptive review is an appropriate approach at the current state of IS infusion literature. A narrative review mainly depends on the reviewer's personal preference, so this method is vulnerable to subjectivity (Guzzo et al., 1987; Paré et al., 2015). Vote counting and meta-analysis are quantitative methods that require a large collection of studies examining the same relationships between independent and dependent variables (King and He, 2005; Paré et al., 2015). We conclude that these methods are not suitable for reviewing IS infusion studies due to the small number of IS infusion studies in the literature.

A descriptive literature review evaluates to what extent the existing literature supports a specific proposition or unfolds an explainable pattern of a phenomenon (Guzzo et al., 1987; King and He, 2005). A descriptive literature review portrays a body of works in the form of frequency analysis, such as publication year, research methodology, theoretical approaches, and research findings (e.g., positive, negative or non-significant relationships).

A descriptive review method mostly involves a systematic manner of searching, filtering, coding and classifying processes. First, we conducted a comprehensive literature search to collect as many related studies as possible in the investigated area. The author team treats each study as one data record and identifies patterns and trends among the surveyed papers (King and He, 2005; Yang and Tate, 2012). Next, we removed the irrelevant articles (Bitner et al., 2000; Kiefer, 2010) followed by coding independent and dependent variables. Then we classified these variables and their relationships into different categories. By following these steps, we can claim that the findings of our review are representative of the fact or state of a research domain.

To identify empirical studies on IS infusion, we searched scholarly databases including ACM Digital Library, IEEE Xplore, IGI Global's Database, ProQuest Computing and SpringerLink using terms [1] such as 'information systems AND infusion', 'information technology AND infusion', 'information systems AND utilization'. The preliminary search result after eliminating conferences and book chapters showed a list of 116 to 381 journal papers among these different databases. Next, for filtering, we scanned titles and abstracts to remove irrelevant articles, conceptual papers, those articles that do not address IS infusion as a central theme, duplicate findings (i.e., authors using the same data to report similar results in different journals), and papers that did not investigate the influencing factors on IS infusion. In addition, we have reviewed the cited articles in the selected papers. After the elimination, 30 peer-reviewed journal articles remained for further coding and classification. These articles span 26 years from 1990 to 2015.

In order to aggregate study findings, we compiled a list of variables and their descriptions from the identified studies. We coded the dependent and independent variables as used by the author(s) of each study. We also identified variables that convey the same meanings and could be combined across studies. For example, we combined 'IT champion' defined as the senior manager who would actively promote the use of the technology within organization (Pongpattrachai et al., 2014), and 'management support' defined as the ways in which organizations encourage IS usage and provide necessary resources to facilitate IS implementation (Wang et al.,

[1] The full list of search terms are: 'information systems AND infusion', 'information technology AND infusion', 'information systems AND utilization', 'information systems AND extended use', 'information systems AND deep use', 'information systems AND innovative use', 'information systems AND effective use', 'information systems AND emergent use', 'information systems AND exploratory use'.

2008). In other case, the authors used slightly different terminology to essentially capture the same variable. For example, Thatcher and colleagues (2011) examined 'Trust in IT' variable and McKnight et al. (2011) used the term 'Trusting beliefs in specific technology' to capture the same underlying concept (McKnight et al., 2011), which we coded it as 'Trust in IT'. Overall, we coded 86 different independent variables. To facilitate the discussion of independent variables, we classified them into five categories; organization, technology, task-job, environment and individual categories. The list of variables and descriptions is presented in Appendix A.

In our sample, we found 13 dependent variables of IS infusion in organizations. Researchers examined distinct types of infusion behaviors such as extended use, integrative use, deep structure use, exploratory use, trying to innovate, and innovative use. We fully discuss these dependent variables in the next section.

Next, we identified the relationship between an independent variable and a dependent variable within each study. We assigned three possible values to the relationship: '+1', '-1' and '0'. We defined a '+1' for positive relationships, '-1' for negative relationships, '0' for relationships that were studied but not significant. We coded 86 relationships between an independent and a dependent variable. Among these relationships, 47 were positive and significant (+1), 6 were negative and significant (-1), and 20 were not significant (0).

Empirical Research on IS Infusion

We use a concept-centered approach to present the literature review. In other words, concepts are the building block of the structured framework of a review (Webster and Watson, 2002). We first offer a summary of IS infusion studies, theoretical perspectives employed and empirical contexts (See Table 1). The studies in our sample examined various aspects of IS infusion across various technologies in organizations using dependent variables such as deep structure use, innovative use, extended use, and emergent use. These variables were used to investigate the use of technology's features to support an individual's task performance, to reinforce linkages among tasks, to support the underlying structure of the task or using a system in an innovative and new manner to support tasks respectively. The list of the terminologies and definitions of dependent variables is presented in Table 2. Different types of technologies under investigation are enterprise resource planning (ERP), customer relationship management (CRM), knowledge management systems (KMS), Microsoft Access and Excel, advanced manufacturing technology (AMT), data warehousing (DW), material requirements planning (MRP), electronic medical system (EMS), among others. Most of these studies were conducted in the U.S and employed quantitative methods (23 out of 30). Four studies used a mixed method of interview, case study and survey and two studies used a qualitative approach.

The findings of this research are organized into three sub-sections. The first sub-section presents the theoretical foundations of IS infusion studies. The second sub-section presents the analysis of dependent variables used in IS infusion research. The third sub-section presents the independent variables, the relationships between independent and dependent variables, their statistical significance and our proposed framework.

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Table 1 - Review of IS Infusion Studies

#	Authors/Year	Journal	Level of Study	Theoretical Foundation	Target System	Organization/Region	Study Method
1	Afonso, Schwarz, Roldán, and Sánchez-Franco, 2015	International Journal of Electronic Government Research	Individual	-	Electronic Document Management System (EDMS)	Portugal	Quantitative-Survey
2	Grublješič and Jaklič, 2015	Journal of Computer Information Systems	Individual	TOE, ECT, UTAUT, TAM, DeLone and McLean IS success model	Business intelligence systems (BIS)	A public company and a broadcast company.	Qualitative-Case Study
3	Kim and Gupta, 2014	IEEE Transactions on Engineering Management	Individual	Psychological empowerment theory	Customer Relationship Management (CRM)	A telecommunications service company.	Mixed method-Main data collection by Survey.
4	Maas, Fenema and Soeters, 2014	New Technology, Work and Employment	Individual	-	Enterprise Resource Planning (ERP)	A military public-sector organization. Netherlands	Quantitative-Survey
5	Pongpattrachai, Cragg and Fisher, 2014	International Journal of Accounting Information Systems	Individual	-	Spreadsheet	Seven audit firms. Thailand	Qualitative-Interview, case study
6	Donaldson and Yakel, 2013	Archival Science	Individual	DOI	Preservation metadata: implementation strategies (PREMIS)	University and Library.	Qualitative-in-depth semi-structured interviews
7	Li, Hsieh and Rai, 2013	Information Systems Research	Individual	Motivation theory	Business intelligence system	One of the largest telecom service companies. China	Quantitative-Survey

8	Fadel, 2012	Journal of Computer Information Systems	Individual	Coping Theory	Electronic Medical System (EMS)	At the campus health (CH) center of a large public university. Western United States.	Quantitative-Survey
9	Ke, Tan, Sia and Wei, 2012	Journal of Management Information Systems	Individual	Motivation theory	ES (Enterprise system)	Across three manufacturing companies. China	Quantitative-Survey
10	Sun, 2012	MIS Quarterly	Individual	-	Microsoft Office users, active server pages and tables driven by a Microsoft Access database.	-	Quantitative-Online Survey
11	Hester, 2011	Information Technology and Management	Individual	DOI, TAM	Wiki technology-based knowledge management systems (KMS)	-	Quantitative-Survey
12	McKnight, Carter, Thatcher and Clay, 2011	ACM Transactions on Management Information Systems	Individual	-	MS Access or MS Excel	Through university Students enrolled in MIS classes. Northwestern United States	Quantitative-Survey
13	Hsieh, Rai and Xu, 2011	Management Science	Individual	Sense-making theory	Operational customer relationship management (OCRM)	One of the world's largest telecommunications service providers. China	Quantitative-Longitudinal-Field survey
14	Thatcher, McKnight, Baker, Arsal and Roberts, 2011	IEEE Transactions on Engineering Management	Individual	TAM	Knowledge management systems (KMS).	Study1: business students at a large public university in the Southeastern United States. Study2: knowledge workers employed in the IT industry in India.	Quantitative-Survey
15	Saeed and Abdinnour-Helm, 2008	Information and Management	Individual	TAM	A web-based Student Information System	A university in the Midwest region. United States	Quantitative-Survey

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16	Ramamurthy, Sen and Sinha, 2008	IEEE Transactions on Systems, Man and Cybernetics	Organizational	DOI	Data warehousing (DW)	Through faculty members and IS managers. United States	Quantitative-Questionnaire-Field survey
17	Wang, Hsieh, Butler, and Hsu, 2008	Journal of Computer Information Systems	Individual	ISC	ERP	A large manufacturing firm. United States	Quantitative-Survey
18	Hsieh and Wang, 2007	European Journal of Information Systems	Individual	ISC, TAM and Synthesized model	ERP	A large manufacturing company. South China	Quantitative-Field Survey
19	Kishore and McLean, 2007	IEEE Transactions on Engineering Management	Individual	Structuration and Sense-making theories	Software process innovation (SPI)	IS professionals at a large U.S. bank. United States	Quantitative-Survey
20	Sundaram, Schwarz, Jones and Chin, 2007	Journal of the Academy of Marketing Science	Individual	TPB/TRA and performance concept	Sales force Automation (SFA)/CRM systems	A large US-based insurance company. United States	Quantitative-Survey
21	Ahuja and Thatcher, 2005	MIS Quarterly	Individual	Theory of trying	-	Student volunteers at a large public university. Southeastern United States	Quantitative-Survey
22	Pao-Long and Lung, 2002	International Journal of Management	Individual	Organizational change model and Job characteristic model (JCM)	Advanced manufacturing technology (AMT)	The computer-integrated manufacturing (CIM) firms. Taiwan	Quantitative-Survey
23	Jones, Sundaram and Chin, 2002	Journal of Personal Selling and Sales Management	Individual	TRA and TAM	SFA	U.S. based insurance company. United States	Quantitative-Survey
24	Eder and Igbaria, 2001	The international Journal of Management Science	Organizational	-	Intranet	United States	Quantitative-cross-sectional field survey
25	Eder, Arinze, Darter, and Wise, 2000	Information resources management journal	Organizational	-	Intranet	Among senior-level computer executives. United States	Quantitative-Survey

26	Lee, Han and Park, 2000	Telecommunication Systems	Organizational	-	Electronic data interchange (EDI)	Through employees of 110 organizations. Korea	Quantitative-Survey
27	Nambisan, Agarwal and Tanniru, 1999	MIS Quarterly	Individual	Delphi study	-	Bank and insurance and manufacturer of medical equipment devices companies. Northeastern United States	Mixed method-Interview and Survey
28	Winston and Dologite, 1999	Information Resources Management Journal	Organizational	-	-	Small Businesses. United States	Quantitative-Survey, Secondary data
29	Zmud and Apple, 1992	Journal of Product Innovation Management	Organizational	-	Electronic scanners	Supermarket chains. United States	Mixed method; quantitative and qualitative
30	Cooper and Zmud, 1990	Management Science	Organizational	-	Material requirements planning (MRP) United States	Random sample of manufacturing firms. United States	Quantitative: cross-sectional field survey

Notes: TOE: Technology Organization and Environment framework, ECT: Expectation-confirmation theory, UTAUT: Unified Theory of Acceptance and Use of Technology, TAM: Technology Acceptance Model, ISC: IS Continuance model, DOI: Diffusion of Innovation Theory, TRA: Theory of Reasoned Action, TPB; Theory of Planned Behavior and "-" means that the authors did not explicitly describe the underlying theory

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Theoretical Foundations of IS Infusion Studies

In the 26 years span (1990 to 2015), researchers have used different theoretical foundations to study IS infusion. The literature review revealed common theoretical lenses in the IS infusion research at the individual, group and organizational levels. Most of the identified studies in this review examined individual IS infusion and a few studies studied organizational IS infusion (Cooper and Zmud, 1990; Eder and Igbaria, 2001; Eder et al., 2000; Lee, Han and Park, 2000; Winston and Dologite, 1999; Zmud and Apple, 1992). All the organizational level studies of IS infusion do not specify the underlying theories except Ramamurthy et al (2008), who used diffusion of innovation (DOI) theory. Therefore, in our study, we focus on theories underpinning individual level IS infusion studies to derive our framework of the factors influencing IS infusion. Several studies used technology acceptance model (TAM) and unified theory of acceptance and use of technology (UTAUT) and their antecedents to explain individual IS infusion. The antecedents are the two belief constructs, perceived usefulness and perceived ease of use (e.g., Grublješič and Jaklič, 2015; Hester, 2011; Hsieh and Wang, 2007; Jones et al., 2002; Saeed and Abdinnour-Helm, 2008; Thatcher et al., 2011). Some studies used the technology, organization and environment (TOE) framework to study individual IS infusion (e.g., Grublješič and Jaklič, 2015). The TOE framework as originally presented, and later adapted in IS infusion studies, provides a useful analytical framework that can be used for studying infusion of different types of IS within organizations. TOE framework is consistent with the DOI theory, in which Rogers (2003) emphasized individual characteristics, and both the internal and external characteristics of the firm as antecedents for organizational infusion. The TOE framework complements diffusion of innovation theory (DOI) by explaining intra-organization infusion (Oliveira and Martins, 2011). Some studies used diffusion of Innovation theory (DOI) to examine user perceptions of the IS innovation such as reciprocity expectation, voluntariness, image, compatibility, ease of use (e.g., Hester, 2011; Ramamurthy et al., 2008).

IS continuance model (ISC), which draws on the expectation-confirmation theory (ECT), has been used to explain individual IS use behavior after their initial usage (e.g., Grublješič and Jaklič, 2015; Hsieh and Wang, 2007; Wang et al., 2008). ISC and ECT theories investigate determinants of IS continuous use through the embedding of IS into employees' work routines. The ISC model also contends that, after initial usage, cognitive beliefs such as an individual's perception of system usefulness may change, and that personal affects such as satisfaction will become a salient behavioral determinant. Other studies (e.g., Jones et al., 2002; Sundaram et al., 2007) draw on theory of reasoned action (TRA) and theory of planned behavior (TPB) to examine the role of individuals' attitude toward IS before deployment on their intention to use IS after deployment.

Hackman and Oldham (1975) propose a job characteristic model (JCM) that shows the insightful awareness of the tasks comprising skill variety, task identity, task significance, autonomy, and feedback. Few researchers (e.g., Pao-Long and Lung, 2002) take the core dimension of JCM as a base to explain how task characteristics influence employee IS infusion.

Kim and Gupta (2014) used psychological empowerment theory to assess the influence of psychological empowerment on IS infusion which is considered as proactive behaviors. Conger and Kanungo (1988, p. 474) defined empowerment as "a process of enhancing feelings of self-efficacy among organizational members through the identification of conditions that foster powerlessness and through their removal by both formal organizational practices and informal techniques of providing efficacy information". Psychological empowerment

motivates individuals to have a sense of ownership and authority to complete their job tasks and improve their performance.

Further, some studies used motivation theory, which argues that an individual is driven by intrinsic and extrinsic motivation to engage in activities. These motivations can generate enjoyment, cognitive flexibility, and satisfaction during an activity (e.g., Ke et al., 2012; Li et al., 2013). Lastly, Ahuja and Thatcher (2005) draw on theory of trying because they believe that trying is an important outcome variable that should be included in IS use studies. According to this theory, trying to innovate with IS is an appropriate infusion measure.

We observe that several IS infusion studies (e.g., Grublješič and Jaklič, 2015; Hester, 2011; Hsieh and Wang, 2007; Jones et al., 2002; Saeed and Abdinnour-Helm, 2008; Sundaram et al., 2007; Thatcher et al., 2011; Wang et al., 2008) applied theories that have been used to study IS acceptance which is considered as an early stage in the IS implementation model. These theories include the technology acceptance model (TAM), the unified theory of acceptance and use of technology (UTAUT), the theory of reasoned action (TRA) and the theory of planned behavior (TPB). The earlier studies (Ahuja and Thatcher, 2005; Hsieh et al., 2011) also used the antecedents of technology acceptance and IS continuance in examining IS infusion. As such, it seems meaningful to study IS infusion by extending previous research on technology acceptance and IS continuance theories, some scholars point out that the reliance on the repeated viewpoints limits the development of new knowledge on IS infusion (Jasperson et al., 2005; Kim and Gupta, 2014). In addition, according to Cooper and Zmud (1990), rational-oriented factors and theories applied in IS adoption and continuance research are less appropriate for investigating IS infusion which is an extra-role behavior. Kim and Gupta (2014) contend that theories such as TAM, IS continuance, UTAUT, TRA and TPB are inherently limited to elucidate IS infusion that demonstrates a form of motivated behavior. Compared to IS adoption and continuance, IS infusion studies should explore the authentic motivation of users (Ng and Kim, 2009). We urge future IS infusion studies to recognize that IS infusion is a distinct stage in an IS implementation model which is different from IS acceptance. Therefore, there is a need to move beyond those theories that have been used in IS acceptance to better explain IS infusion.

Findings on the Dependent Variables

IS infusion has been operationalized in the literature in different ways (See Table 2). The gist of the infusion definitions implies that IS infusion can be studied at organizational, group and individual levels.

A successful IS implementation does not automatically translates into enhanced organizational performance. When users do not use and commit to the IS to its fullest potential to perform work activities, the desired benefits cannot be met and hence the increase in performance will not follow (Murphy et al., 2012). The utilization of the applications is the crucial link between technology investments and improved performance through IS (Devaraj and Kohli, 2003). The sophisticated level of usage, often referred to as infusion, enables an organization to gain higher benefits from its IS investment (Fadel, 2012; Moore, 2002; Saga and Zmud, 1994).

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Table 2 - Dependent variables used in IS infusion research

Dependent Variable(s)	Definition(s)
Infusion-individual	The infusion stage is the last stage in the IS implementation process. Infusion means that full potential of the innovation's features/functionality has been embedded in a complete and sophisticated manner within an organization's managerial or operational work systems to support a higher level of individuals' work (Pao-Long and Lung, 2002; Cooper and Zmud, 1990; Donaldson and Yakel, 2013; Fadel, 2012; Gallivan, 2001; Jones et al., 2002; Kishore and McLean, 2007; Zmud and Apple, 1992).
Infusion-organizational	The extent to which the full potential of the innovation has been embedded within an organization's operational or managerial work systems (Cooper and Zmud, 1990; Zmud and Apple, 1992).
Extended Use	Defined as using more of the IS features to complete/support individual's tasks/performances (Hsieh and Wang, 2007; Kim and Gupta, 2014). By learning and using more of the functions available in the technology, users make deeper use of the technology to support their work. Such post-adoptive behavior is referred to as extended use (Hsieh et al., 2011).
Integrative Use	Defined as "using the system to reinforce linkages among tasks" (Kim and Gupta, 2014, p. 2).
Emergent Use	Defined as "using a system in an innovative and new manner to support tasks" (Kim and Gupta, 2014, p. 2).
Deep Structure Use	Defined as "the use of features in the IS that support the underlying structure of the task" (Burton-Jones and Straub, 2006, p. 18).
Exploratory Use	Defined as "the extent to which a user discovers the active examination and innovative uses of the system features to support job tasks" (Ke et al., 2012; Saeed and Abdinnour-Helm, 2008).
Trying to Innovate	Refers to "a user's goal of finding new uses of existing workplace information technologies" (Ahuja and Thatcher, 2005, p. 430).
Innovative Use	Defined as "a form of innovation at the individual level, describes employees' application of IS in novel ways to support their work" (Li et al., 2013, p. 662). Users explore and use system features that were not known to them before (Jasperson et al., 2005).
Innovate with IT	Defined as "new uses of existing workplace information technologies by an individual to support his/her task performance" (Wang et al., 2008, p. 28).
Adaptive system use	Includes four distinct behaviors: trying new features, feature substituting, feature combining, and feature repurposing (Sun, 2012).
Intention to explore (Emergent use)	Defined as "a user's purpose and motivation to innovate based on the perceived business related benefits she will derive from IT deployment" (Nambisan et al., p. 373). Intention to Explore "reflects a user's willingness and purpose to explore a new technology and find potential use" (Nambisan et al., 1999, p. 373).
Embeddedness of IS	Defined as "the extent to which the use of BIS is an integral part of organizational activity" (Grublješič and Jaklič, 2015, p. 6).

The studies in our sample used 13 dependent variables to study IS infusion in organizations (See the 1st column in Table 2). Some studies used the variable, infusion at an individual level (Fadel, 2012; Hsieh and Wang, 2007; Kim and Gupta, 2014; Maas et al., 2014; McKnight et al., 2011; Sundaram et al., 2007) and organizational level (Cooper and Zmud, 1990; Eder and Igbaria, 2001; Eder et al., 2000; Lee et al., 2000; Ramamurthy et al., 2008; Winston and Dologite, 1999). Other studies examined distinct types of infusion behaviors including extended use, integrative use, emergent use, deep structure use, exploratory use, trying to innovate, innovate with IT, innovative use, adaptive system use, intention to explore, and embeddedness of IS. Extended use refers to using more of the technology's features to support an individual's task performance (Hsieh and Wang, 2007). Integrative use is defined as "using the system to reinforce linkages among tasks" (Kim and Gupta, 2014, p. 2). Emergent use refers to "using a system in an innovative and new manner to support tasks" (Kim and Gupta, 2014, p. 2). Deep structure use is defined as "the use of features in the IS that supports the underlying structure of the task" (Burton-Jones and Straub, 2006, p. 18). Exploratory use is defined as "the extent to which a user discovers the innovative uses of the system features to

support job tasks" (Ke et al., 2012, p. 263). Trying to innovate refers to "a user's goal of finding new uses of existing workplace information technologies " (Ahuja and Thatcher, 2005, p. 430). Innovative use defined as "a form of innovation at the individual level, describes employees' application of IS in novel ways to support their work" (Li et al., 2013, p. 662). Adaptive systems use includes four distinct behaviors such as trying new features, feature substituting, feature combining, and feature repurposing (Sun, 2012). Intention to explore "reflects a user's willingness and purpose to explore a new technology and find potential use" (Nambisan et al., 1999, p. 373) and innovate with IT, which is defined as "new uses of existing workplace information technologies by an individual to support his/her task performance" (Wang et al., 2008, p. 28). Table 2 presents the list of dependent variables and their definitions.

Findings on the Independent Variables and Proposed Framework

We identified 85 independent variables from the studies in our sample. We grouped these variables into five factors namely organization, technology, task-work, firm environment and individual as antecedents of IS infusion (See Figure 1).

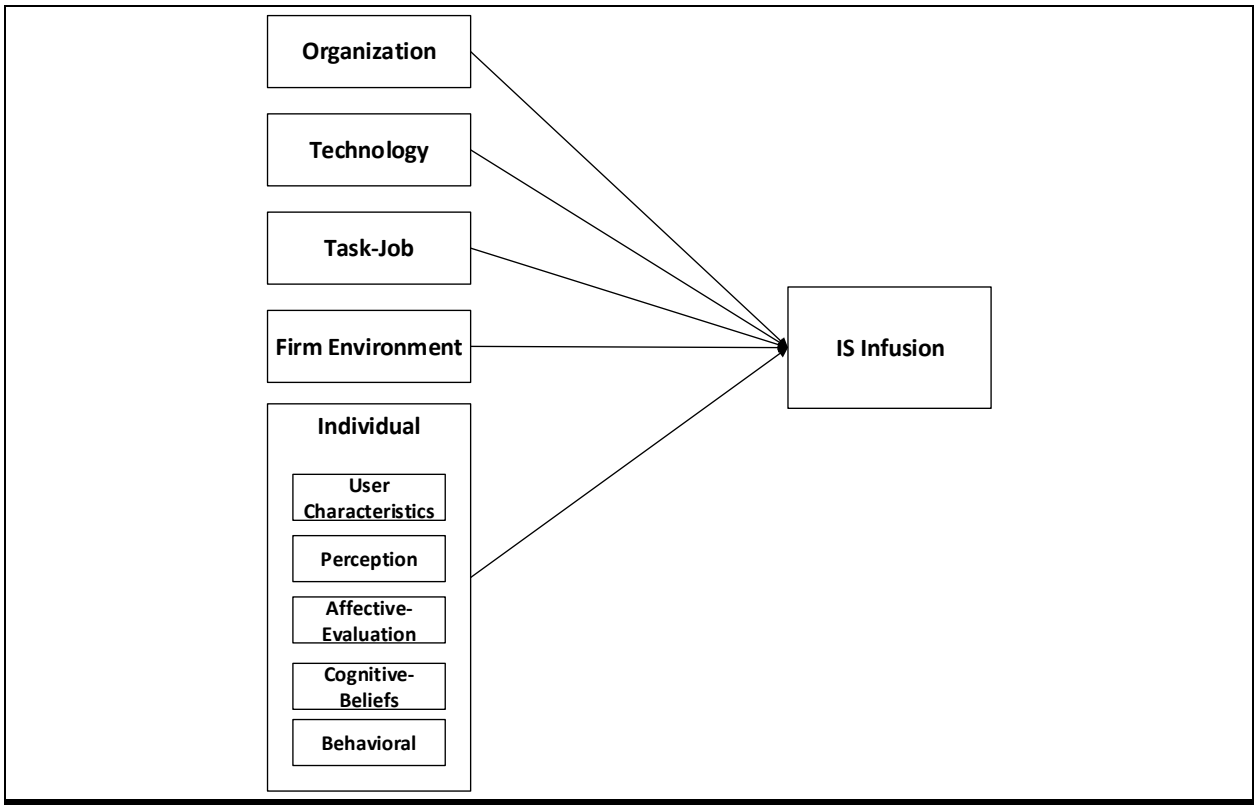

Figure 1 - Proposed Framework

Organization Factors

The organizational factor relates to the resources and characteristics of an organization. Organizational-related factors have been found to shape the IS innovation process (Baker, 2012). Previous IS infusion studies evaluated 30 organizational variables. Top management support, facilitating condition, observability, sufficiency of education and training, information culture, organizational earliness of adoption, organizational diffusion,

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organization IT experience, competition, training, focus on customer, organizational alignment, novel situations, discrepancies, quality of project management processes and empowerment showed positive significant influence on IS infusion. Negative significant relationships reported between organizational control, staff turn over and IS infusion. However, no statistically significant relationships were reported between complexity of organizational structure, organizational structure, business scope, analytic decision-making culture, elapsed time after adoption of system, role of IS, IS sophistication, managerial interventions, IS-business relationship, IS structure and IS infusion. Nevertheless, some variables show conflicting results. Centralization of structures which had a positive significant relationship in one study (Winston and Dologite, 1999) and a negative significant relationship in another research (Pao-Long and Lung, 2002). Formalization of structure indicated positive significant (Winston and Dologite, 1999) and non-significant (Pao-Long and Lung, 2002) relationships from two previous studies. Organizational size showed negative significant (Eder et al., 2000) and non-significant (Eder and Igbaria, 2001) results from prior studies (See Table 3).

Table 3 - Organization Factors

Organizational Factors (IV)	Frequency	Positive	Negative	Not Significant	Inconclusive
Top Management Support	6	✓			
Facilitating Condition	4				
Empowerment	4				
Organizational Earliness of Adoption	2				
Organizational Alignment	1				
Organizational Diffusion	1				
Information Culture	1				
Sufficiency of Education and Training	1				
Organization IT Experience	1				
Competition	1				
Training	1				
Focus on Customer	1				
Novel situations	1				
Discrepancies	1				
Quality of the Project Management Process	1				
Organizational Control	1		✓		
Staff Turn Over	1				
Managerial Interventions	1			✓	
Complexity of Structure	1				
Organizational Structure	1				
Business Scope	1				
Analytic Decision-making Culture	1				
Elapsed Time	1				
Role of IS	1				
IS Sophistication	1				
IS-Business Relationship	1				
IT Structure	1				
Centralization of Structures	2				✓
Formalization of Structure	2				
Organizational Size	2				

Notes: +1 (significant): means statistically positive significant relationship at p< .05 in quantitative studies or strong evidence to support the relationship in qualitative studies. -1 (significant): means statistically

negative significant relationship at p< .05 in quantitative studies or strong evidence to support the relationship in qualitative studies. 0 (not significant): Relationship was studied and no significant relationship was found. Inconclusive: Relationship was studied and conflicted results were found.

Technology Factors

Studies have extensively evaluated the influence of technology characteristics on IS infusion (Premkumar, 2003). The technological category refers to the characteristics of the implemented technology and includes 10 independent variables covering an array of technological-related factors. Information quality, system integration, technology quality, service quality, relevance of information, IT infrastructure, trialability have had positive and significant influence on IS infusion. Previous studies found no significant relationship between compatibility with existing system and IS infusion. In addition, some variables show conflicting results such as technology complexity, which had a positive significant relationship in one study (Ramamurthy et al., 2008) and non-significant relationship in another study (Cooper and Zmud, 1990). Relative advantage showed a positive significant relationship in two previous studies (Grublješič and Jaklič, 2015; Pongpattrachai et al., 2014) and non-significant relationships from two other studies (Hester, 2011; Kishore and McLean, 2007). (See Table 4).

Table 4 - Technology Factors

Technological Factors (IV)	Frequency	Positive	Not Significant	Inconclusive
IT Infrastructure	2	✓		
Technology Quality	2			
Relevance of Information	1			
Trialability	1			
Information Quality	1			
System Integration	1			
Service Quality	1			
Compatibility with Existing System	4		✓	
Relative Advantage	4			✓
Technology Complexity	2			

Notes: +1 (significant): means statistically positive significant relationship at p< .05 in quantitative studies or strong evidence to support the relationship in qualitative studies. 0 (not significant): Relationship was studied and no significant relationship was found. Inconclusive: Relationship was studied and conflicted results were found.

Task-Job Factors

Although jobs and work tasks play a role in technology use in organizations, few studies have looked at the influence of job and task related variables on IS infusion. Task-related factors are important for identifying the fit among the system, the organization and the user (Premkumar, 2003). In the task and job related category, 10 independent variables were examined. Studies reported that task identity, feedback of task, qualitative overload for men, job relevance, and task structuredness have positive and significant influence on IS infusion. A negative significant relationship reported between quantitative overload for women and IS infusion. Studies did not find

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statistically significant relationship between task significance, qualitative overload for women, and quantitative overload for men and IS infusion. In addition, a conflicting result was reported on the impact of autonomy on IS infusion from previous studies, a positive significant relationship was reported in Ahuja and Thatcher (2005) and a non-significant relationship was reported in Pao-Long and Lung (2002). (See Table 5).

Table 5 - Task-Job Factors

Task-Job Factors (IV)	Frequency	Positive	Negative	Not Significant	Inconclusive
Task Identity	1	✓			
Feedback of Task	1				
Qualitative Overload for Men	1				
Job Relevance	1				
Task Structuredness	1				
Quantitative Overload for Women	1		✓		
Task Significance	1			✓	
Qualitative Overload for Women	1				
Quantitative Overload for Men	1				
Autonomy	2				✓

Notes: +1 (significant): means statistically positive significant relationship at p< .05 in quantitative studies or strong evidence to support the relationship in qualitative studies. -1 (significant): means statistically negative significant relationship at p< .05 in quantitative studies or strong evidence to support the relationship in qualitative studies. 0 (not significant): Relationship was studied and no significant relationship was found. Inconclusive: Relationship was studied and conflicting results were found.

Firm Environment Factors

Information systems are no longer catering to just internal audiences, but also to the firm's customers, suppliers, and other trading partners. Therefore, it is not surprising that external environmental factors are increasingly being studied in the IS post-adoption stage. In the firm environment category, five independent variables were examined. Complexity of client, strategic alliances, IT consultants, competitiveness of the environment show positive and significant influence on IS infusion. Negative and significant relationship was reported between partner support and IS infusion (Pongpattrachai et al., 2014). (See Table 6).

Table 6 - Firm Environment Factors

Firm Environment Factors (IV)	Frequency	Positive	Negative
Complexity of Client	1	✓	
Strategic Alliances	1		
IT Consultants	1		
Competitiveness of the Environment	1		
Partner Support	1		✓

Notes: +1 (significant): means statistically positive significant relationship at p< .05 in quantitative studies or strong evidence to support the relationship in qualitative studies. -1 (significant): means statistically negative significant relationship at p< .05 in quantitative studies or strong evidence to support the relationship in qualitative studies.

Individual Factors

Individual related factors refer to the characteristics of individuals who utilize an IS (Winston and Dologite, 1999). Overall, the individual category has the highest number of independent variables compared to other categories previously discussed. Within this category, 30 different independent variables have been examined. These factors are sub categorized into user characteristics, perception, affective evaluation, cognitive beliefs and behavioral factors. Intrinsic motivation is the only motivational variable we have found in the literature. We could not fit it well in our proposed framework, but we want the readers to be aware that this variable has been studied in the IS infusion literature. Intrinsic motivation has been examined in two studies (Ke et al., 2012; Li et al., 2013) and showed positive significant relationships with IS infusion.

User Characteristics refers to the attributes and traits of an individual that may shape their use of an information system in an organization. Six variables related to user characteristics were examined and all were found to be positive and significant influence on IS infusion. These variables are user skill variety, personal innovativeness, competence, experience, readiness for change, and knowledge acquisition. (See Table 7).

Table 7 - Individual Factors-User Characteristics Variables

Individual Factors (IV)	Frequency	Positive
Personal Innovativeness	3	✓
Skill Variety	1	
User Competence	1	
Experience	1	
Readiness for Change	1	
Knowledge Acquisition	1	

Notes: +1 (significant): means statistically positive significant relationship at p< .05 in quantitative studies or strong evidence to support the relationship in qualitative studies.

User Perception: Several perception variables have been evaluated and, to a limited extent, are shown to be predictors of IS infusion behaviors. Both theory of reasoned action and technology acceptance model suggest that an individual's perceptions about an innovation are salient in the development of attitudes that ultimately lead to IS utilization behavior (Agarwal and Prasad, 1998). Nine variables were studied under this sub category. Perceived usefulness and perceived ease of use have positive and significant influence on IS infusion. A negative significant relationship was reported between reciprocity expectation and IS infusion. Studies reported no significant relationship between perceived result demonstrability, subjective norms and IS infusion. In addition, there are some variables that show mixed results such as perceived image and perceived visibility, which had positive significant relationship in one study and non-significant relationship in another research. (See Table 8).

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Table 8 - Individual Factors-Perception Variables

Individual Factors (IV)	Frequency	Positive	Negative	Not Significant	Inconclusive
Perceived Usefulness	8	✓			
Perceived Ease of Use	3				
Perceived Voluntariness	3				
*Observability	1				
Perceived Reciprocity expectation	1		✓		
Subjective Norms	2			✓	
Perceived Result Demonstrability	1				
*Perceived Visibility	2				✓
Perceived Image	2				

Notes: +1 (significant): means statistically positive significant relationship at p< .05 in quantitative studies or strong evidence to support the relationship in qualitative studies. -1 (significant): means statistically negative significant relationship at p< .05 in quantitative studies or strong evidence to support the relationship in qualitative studies. 0 (not significant): Relationship was studied and no significant relationship was found. Inconclusive: Relationship was studied and conflicting results were found.
*Even though observability and visibility are interpersonal variables, we include interpersonal factors under the individual perception factor.

Affective evaluation is "a general term to refer to a set of affective concepts that represent the person's appraisals of the stimulus' affective quality. The meanings of affective evaluations are between a person and a stimulus, and an affective evaluation values are temporally unconstrained" (Zhang, 2013, p. 260). Affective evaluations can be primary (e.g., perceived affective quality), cognitively hidden (e.g., perceived enjoyment of using an IS), or experientially heavy (e.g., satisfaction with a decision support system) (Zhang, 2013). Affective evaluations are about something special and the values of the evaluations do not vanish when an individual stops thinking about the specific object. According to Zhang (2013), affective evaluations are very similar to attitudes, and attitude can be viewed as a type of affective evaluation if the focus is on its affective component. Davis (1993) stated that attitude toward the IS refers to an individual's affective evaluation of a specified attitude object.

Three variables are studied under this sub category. Attitude toward new system showed positive significant influence on IS infusion. Findings reported a non-significant relationship between prior attitude towards IT and IS infusion. In addition, satisfaction presented conflicting results, which had a positive significant relationship in one study (Wang et al., 2008) and a non-significant relationship in another study (Hsieh and Wang, 2007). (See Table 9).

Table 9 - Individual Factors-Affective Evaluation Variables

Individual Factors (IV)	Frequency	Positive	Not Significant	Inconclusive
Attitude toward New System	2	✓		
Prior Attitude towards IT	1		✓	
Satisfaction	2			✓

Notes: +1 (significant): means statistically positive significant relationship at p< .05 in quantitative studies or strong evidence to support the relationship in qualitative studies. 0 (not significant): Relationship was studied and no significant relationship was found. Inconclusive: Relationship was studied and conflicting results were found.

User Cognitive Beliefs refers to individuals' assumptions and ideas towards IS. To understand IS infusion, research needs to examine individual's cognitions about the IS use that lead to infusion of IT (Thatcher et al., 2011). Three cognitive beliefs have been studied. Trusting beliefs in specific technology shows conflicting results, which had a non-significant relationship in one study (Thatcher et al., 2011) and a positive significant relationship in another study (McKnight et al., 2011). Findings reported a non-significant relationship between trust in IT support, computer self-efficacy and IS infusion. (See Table 10).

Table 10 - Individual Factors-Cognitive Beliefs Variables

Individual Factors (IV)	Frequency	Not Significant	Inconclusive
Trust in IT Support (Individual's Cognition)	1		
Computer Self-Efficacy	1	✓	
Trust in IT	2		✓

Notes: +1 (significant): means statistically positive significant relationship at p< .05 in quantitative studies or strong evidence to support the relationship in qualitative studies. 0 (not significant): Relationship was studied and no significant relationship was found. Inconclusive: Relationship was studied and conflicting results were found.

User Behavioral Factors refers to individuals' actual behavior toward specific IS. Nine user behavioral variables have been studied. Problem-focused adaptation, routinization, involvement, extent of use and usage show positive significant influence on IS infusion. A negative significant relationship was reported between avoidance oriented emotion-focused adaptation and IS infusion. Findings reported a non-significant relationship between approach oriented emotion-focused adaptation, frequency of use, prior intention to use and IS infusion. (See Table 11).

Table 11 - Individual Factors-Behavioral Variables

Individual Factors (IV)	Frequency	Positive	Negative	Not Significant
Routinization	2	✓		
Problem-Focused Adaptation	1			
Involvement	1			
Usage	1			
Extent of Use	1			
Avoidance Oriented Emotion-Focused adaptation	1		✓	
Frequency of Use	1			✓
Prior Intention to Use	1			
Approach Oriented Emotion-Focused adaptation	1			

Notes: +1 (significant): means statistically positive significant relationship at p< .05 in quantitative studies or strong evidence to support the relationship in qualitative studies. -1 (significant): means statistically negative significant relationship at p< .05 in quantitative studies or strong evidence to support the relationship in qualitative studies. 0 (not significant): Relationship was studied and no significant relationship was found.

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Figure 2 represents the detailed framework of this study that incorporates all independent variables and categorize them into five broad factors. This framework delineates 85 variables that shape IS infusion. The five key factors are; organization, technology, task-job, environment and individual.

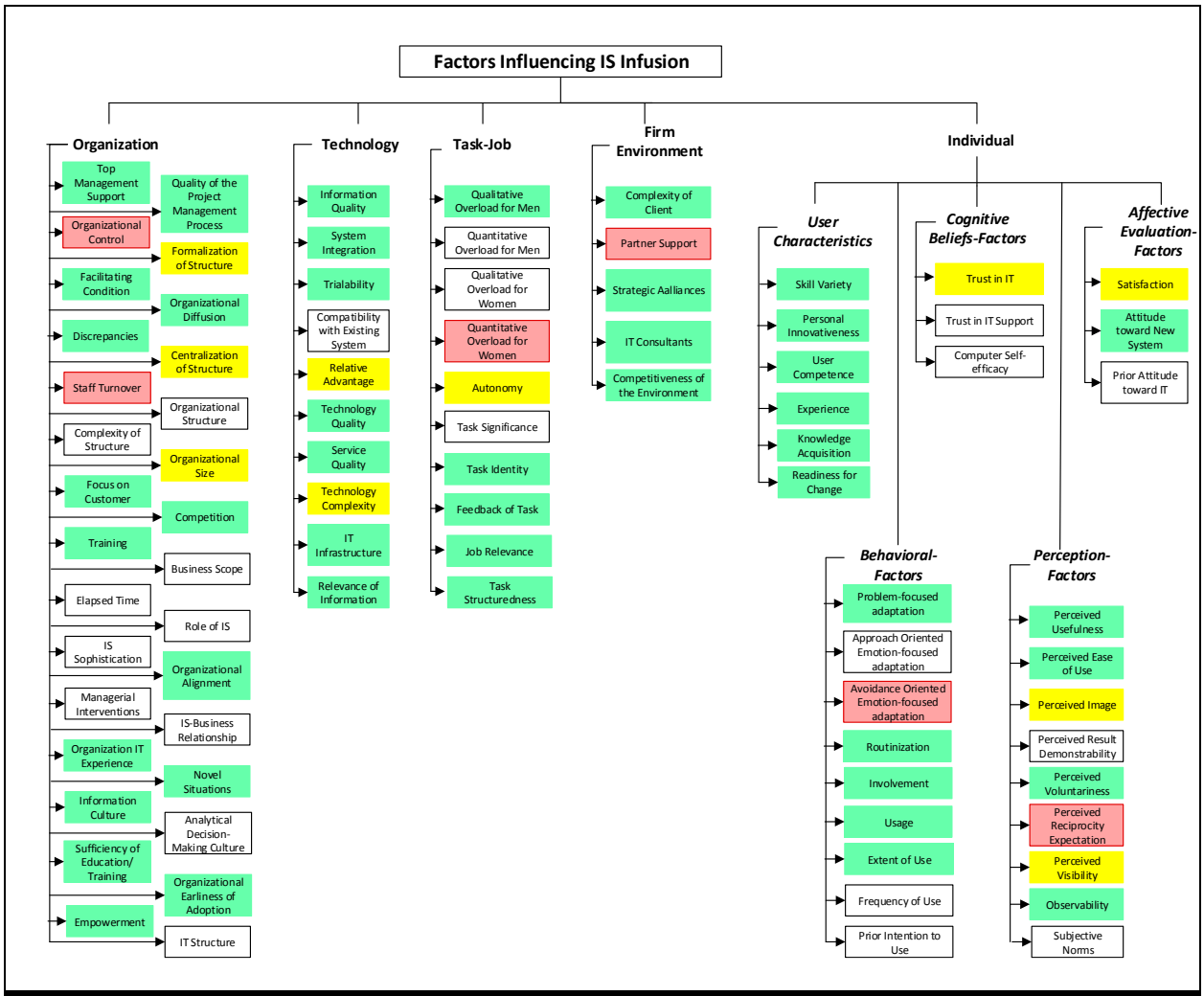

Figure 2 - Grouped Independent Variables from Previous IS Infusion Studies[2]

Note: Green color represents a positive significant relationship. Red color represents a negative significant relationship. No filled color represents a non-significant relationship. Yellow color represents conflicting results.

[2] Moderator: Personal innovativeness with IT is also identified as an important individual characteristic that positively moderates the relationships between some independent variables and IS infusion. Some of these independent variables are individual's intrinsic motivations (Li et al., 2013), perceived result demonstrability (Hester, 2011), and novel situations (Sun, 2012).

Discussion and Future Research

This review paper synthesizes existing research on IS infusion, identifies knowledge gaps and motivates scholars to close this breach. The aim of this paper is to present a descriptive review, along with the proposed framework to delineate factors that shape IS infusion. The framework facilitates further theory development and reveals areas where future research is required. The findings presented in this paper offer useful insights to practitioners to better understand factors associated with IS infusion which is an important precursor for organizations to get the most benefit from technology.

In this review paper, 85 independent variables from different categories have been identified. There are some variables that received an adequate amount of attention with clear results from previous studies. The mentioned factors are top management support, facilitating conditions and empowerment (organization factors); compatibility with existing system (technology factors); and personal innovativeness with IT (individual-characteristic category), perceived usefulness and ease of use from (individual-perception category). On the other hand, there are some variables with conflicting results, which show the need for further research. According to Soh and Markus (1995), mixed empirical results are always an invitation to seek better theory. These variables are centralization and formalization of structure and organizational size (organization category); technology complexity and relative advantage (technology category); perceived image and visibility (individual-perception category); and satisfaction (individual-affective evaluation category).

In this review, we have identified the main constructs and key critical categories of influencing factors and their relationships with IS infusion that is necessary for advancing theory in the IS infusion domain entirely from previous studies. Theories adopted in previous studies were used to identify some influencing factors of IS infusion but not all the key factors. Abstract and generic theories in the early stage of IS implementation such as adoption is not precise enough to explain IS infusion. Although theories such as TAM offer useful insights to relate the effects of attitudes on IS acceptance and use, there is a need to incorporate theoretical lens that not only represent IS infusion behaviors in the work context but can also predict individual and organizational benefit outcomes (Barki et al., 2007). According to Webster and Watson (2002), extended theories should be constructed from multiple paradigms that would unveil relevance, creativity, and comprehensiveness. Future research can advance theory on IS infusion through the integration of various early adoption theories (such as the theory of planned behavior and technology organization environment model), with theories that are more relevant to the deeper use of IS, which can then help develop a comprehensive model of IS infusion.

For instance, using psychological factors such as individuals' identity, IT identity and role identity can help us better understand IS infusion (Hassandoust et al., 2015). According to Ortiz de Guinea and Markus (2009), psychological factors have not been studied in the IS continuance use research. These factors can drive continuing IS use directly rather than through behavioral intentions (Ortiz de Guinea and Markus, 2009). Armitage and Conner (1999) stated that, in addition to beliefs and attitude, which influence an individual's behaviors, identity can be added to the behavioral model to improve and explain an individual's continuance behavior. Thus, future research may examine the impact of individuals' identity on their IS infusion behavior. Identity theories can be used to illuminate the role of identity as a core construct in explaining individuals' IS use behavior (Carter, 2013; Stein et al., 2013).

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There has been minimal focus on user's unique characteristics in relation to IS and professional roles that may shape infusion behaviors (Hassandoust et al., 2015). Infusion is derived from organizational citizenship behavior as an extra-role behavior, which refers to the user activities that exceed the formal requirements and contribute to effective functioning of the organization (Dávila and Finkelstein, 2010). This kind of behavior primarily depends on user characteristics and their intrinsic motivational forces (Kim and Gupta, 2014; Ng and Kim, 2009). Therefore, future research may consider incorporating user characteristics and motivational forces among determinants of IS infusion behaviors.

Previous IS studies argue that IT identity is one of the core constructs explaining the evolution of individuals' IS use behavior (Carter, 2013; Leclercq-Vandelannoitte, 2014; Lee et al., 2006). Identity theories (e.g., McCall and Simmons's (1978) role identity theory, Burke and Stets (2009) person identity theory and Stryker's (1968, 1980) identity theory) would contribute to examine the influence of an individual's IT identity and IS infusion role identity on technology infusion behavior (Hassandoust et al., 2015). From an IS perspective, individuals develop multiple identities through their interactions with various information systems, the range of roles they perform and the personal characteristics they claim. Individuals' relationships with the systems are significant to them because these relationships are a salient part of their self-concepts that are not shared with other people (Carter, 2012). The sense of who they are in relation to IS is their IT identity. Future research may want to explore how employees' roles and IT identify shape their IS infusion behaviors in organizations (Reid, 1999; Hassandoust et al., 2015).

Motivational related factors are another promising avenue that should be further examined in future studies (Ng and Kim, 2009). To develop a better understanding of IS infusion, research should take into account an active motivational orientation that can explain an individual's IS infusion (Cooper and Zmud, 1990; Kim and Gupta, 2014). Psychological forces enable individuals to innovate beyond management's prescribed and standardized IS usage (Jasperson et al., 2005; Kim and Gupta, 2014). Hence, theories that are based on authentic motivation, such as the psychological empowerment theory, can help to explain IS infusion. In particular, psychological empowerment theory emphasises both processes and outcomes. Empowerment theory adopts a political and learning model in illustrating users' feeling of being in control through an active engagement in an organization to pursue extra-roles behaviors (Ng and Kim, 2009). This theory argues that actions, activities, or structures may be empowering, and the result of such processes influences a level of being empowered (Perkins and Zimmerman, 1995). So, an individual's work context and motivational factors shape empowerment cognitions, which in turn motivate individual behavior.

Much of IS infusion research attempted to identify factors that influence infusion behaviors. However, research to date has not paid much attention on explaining how and why infusion comes about. In addition, process theory can help throw more light. Process theory has been shown to have distinct advantages in explaining and tracing how an outcome occurs in other IS phenomena such as IS investment studies (Soh and Markus, 1995). It has been shown that a process theory not only accounts well for conflicting empirical findings but also offers important new lines of empirical research (Soh and Markus, 1995). Much of IS infusion research has used the variance approach to relate predictor variables to IS infusion outcomes. Future studies may want to develop process theory to gain further insights on underlying mechanisms that lead to IS infusion behaviors.

As the dependent variable and domain of study, IS infusion can be conceptualized as an aggregate behavior or different levels of

use (e.g., extended use, integrative use and emergent use). Only one study in our sample (Kim and Gupta, 2014) examined multiple levels of IS infusion behaviors. Additional research is needed to discern factors that shape different levels of use.

Previous research studied IS infusion at either an individual or organizational level. There is a gap in the literature regarding IS infusion across multiple levels namely individual, group and organizational levels. Multilevel analysis describes an analytical approach that allows the simultaneous examination of the influences between individual, group and organizational level variables. According to Burton-Jones and Gallivan (2007), researchers have learned a great deal from investigating IS usage at single levels. However, studying IS usage one level at a time eventually leads to an incomplete, unnatural, and disjointed view of how organizations proceed. Multilevel studies can resolve conflicting and incomplete results by examining the linkages between levels (Burton-Jones and Gallivan, 2007). Therefore, future research may examine the relationships between influencing factors and IS infusion at multiple levels.

Limitation of Research

The following limitations are recognized in this review article. The articles included in this review are all journal papers. Thus, the classification scheme does not reveal the investigation of IS infusion from conference articles. The review is based on the other researchers' work; therefore, some weaknesses in previous studies may reflect in this review. It cannot be guaranteed that all the empirical IS infusion studies published in journals are covered. When we verified codes with a sample of the original authors, we did need to change three relationships from '+1' to '0' as the authors of these papers considered $p<0.1$ as a significant relationship and for this review study we have made the criteria for the $p<0.05$ as a significant relationship ('+1').

Conclusion

This paper reviewed the IS infusion literature and delineated 85 variables that shape IS infusion from previous studies. We classified them into five categories; organization, technology, task-job, environment and individual categories. This study offers both theoretical and practical contributions. From a theoretical perspective, the current study incorporates concepts from previous IS infusion research to provide an integrated theoretical model to reflect the current landscape of antecedents of individual IS infusion behaviors in organizations.

The study findings have practical implications for leaders and managers in organizations. The findings will provide managers with an understanding of factors that influence the full use of information systems in organizations. IS practitioners have a vested interest in ensuring that a system is used fully and appropriately within their organizations. Results from this study can be used to help organizations assess actual benefits from information system investments through system use. Findings may be used to foster higher levels of infusion among users, ultimately helping organizations to secure full benefits from their technology investments.

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APPENDIX A: Definitions of Variables

Independent Variables	Definition(s)/Explanation(s)
Analytic Decision-Making Culture	Refers to the decision-making culture that prevails within an organization (Ramamurthy et al., 2008).
Attitude toward New System	Is a measure of the overall attitude toward the usage of the new system (Jones et al., 2002).
Autonomy	Refers to "the degree to which the job provides substantial freedom, independence and discretion in scheduling the work and in determining the procedures to be used in carrying it out" (Hackman and Oldham 1975, p. 162).
Autonomy	Is “the degree to which the job provides substantial freedom, independence, and discretion to employees in scheduling and carrying their work out” (Pao-Long and Lung, 2002, p. 3).
Avoidance Oriented Emotion-Focused Adaptation	Avoidance strategies are described as “cognitive attempts to deny or minimize threat, and behavioral attempts to get away from or avoid confronting the situation. . . .” (Ebata and Moos, 1991, p. 34).
Business Scope	“The extent to which the business environment provides opportunities for using the innovation” (Ramamurthy et al., 2008, p. 981).
Centralization of Structures	Where the decision-making authority is found and authority is concentrated or delegated (Pao-Long and Lung, 2002; Winston and Dologite, 1999).
Compatibility with Existing System	The degree to which an innovation fits with the potential adopter's existing values, previous experiences, and current needs of potential adopters (Jones et al., 2002; Kishore and McLean, 2007; Rogers, 2003).
Complexity of Client	Refers to client characteristic (Pongpattrachai et al., 2014).
Complexity of Structure	The amount of differentiation in an organization (Pao-Long and Lung, 2002, p. 2).
Computer Self-Efficacy	“The belief in one's ability to use an information technology” (Wang et al., 2008, p. 29).
Diffusion	The extent to which the innovation has diffused through an organization (i.e., whether or not the innovation has been adopted by each of the organization's work units) (Zmud and Apple, 1992).
Discrepancies	A discrepancy represents situations where an unexpected failure, a disruption, or a significant difference exists between expectations and the reality (Armstrong and Hardgrave, 2007, p. 456).
Earliness of Adoption	The amount of time that elapsed between an innovation's introduction until it was first adopted by one of the organization's work units. (Zmud and Apple, 1992). According to Eder and Igbarisa (2001), earliness of adoption refers to the organizations that are early adopters of a technological innovation.
Empowerment	Rationalizes the system by removing or minimizing organizational barriers and giving employees the means (information, authority and autonomy) by which they can achieve institutional objectives more efficiently and effectively (Maas et al., 2014, p. 91).
Extent of Use	Conceptualized as “a combination of the duration and frequency of use.” (Afonso et al., 2015, p. 21).
External Support	Refers to organizational facilitating condition (Pongpattrachai et al., 2014).
Facilitating Conditions	Is the degree to which a person believes that she has been provided with the resources and the external support to use a particular system (Jones et al., 2002).
Feedback of Task	“The degree to which carrying out the work activities required by the job results in the employees obtaining direct and clear information about the effectiveness of their performance” (Pao-Long and Lung, 2002, p. 3).
Focus on Customers	Which is related to the competitiveness of the environment. Employees in organizations that focus on customer satisfaction use IS more and IS is more embedded into the business since they are more dependent on innovative and competitive information (Grublješič and Jaklič, 2015).
Formalization of Structure	“The degree to which rules and procedures of an organization direct the behavior of employees” (Pao-Long and Lung, 2002, p. 3).
Frequency of Use	The extent of using the technology by individuals (Sundaram et al., 2007).

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Information Culture	Six information behaviors are identified that characterize the information culture of an organization: information integrity, informality, control, sharing, transparency, and pro-activeness (Grublješič and Jaklič, 2015).
Information Quality	Refers to "the information product for desired characteristics such as accuracy, meaningfulness, and timeliness" (Delone and McLean, 1992, p. 62).
Intrinsic Motivation	"The pleasure and satisfaction that users experience when solving problems or overcoming difficulties in using IS or learning new things or trying to understand something new in using IS" (Li et al., 2013, p. 664).
IT champion-Management Support	A senior manager who would actively and vigorously promote their personal vision for the use of the technology (Pongpattrachai et al., 2014).
IT Infrastructure	Has been defined as "a set of shared, tangible, IT resources that provide a foundation to enable present and future business applications" (Eder, 2000, p. 16).
IT Structure	Defined as "being either centralized, decentralized, or as a hybrid of the two. In a truly centralized environment, the IS responsibilities lie exclusively within the corporate IS function" (Eder and Igbaria, 2001, p. 236).
Knowledge Acquisition	Defined as "the set of activities associated with acquiring IT knowledge from internal and external sources and distributing it to relevant members of the organization" (Nambisan et al.,1999, p. 371).
Managerial Interventions	''actions taken and resources made available by managers'' to facilitate secondary adoption (post-adoption), including policy decisions such as mandating usage, providing training, and providing support (Gallivan, 2001 p. 61).
Novel Situations	Situations where a person encounters things that are unfamiliar, previously unknown, unique, or that appear to be out of ordinary (Sun, 2012).
Observability	The degree to which the results of an innovation are visible to others (Rogers, 2003, p. 33).
Organizational Alignment	Is defined as "the extent to which the various organizational components support the philosophy and technology of interest embedded within the focal IT innovation so that the full potential of the innovation can be harnessed (Kishore and McLean, 2007, p. 758).
Organizational Control	Attempts by the organization to increase the probability that individuals will behave in ways that will lead to the attainment of organizational objectives (Maas et al., 2014).
Organizational IT Experience	Refers to "the number of years of experience the organization has with IT" (Winston and Dologite, 1999, p. 30).
Organizational Size	Refers to the size of organization and number of employees (Eder and Igbaria, 2001).
Organizational Structure	Defined in terms of their centralization (Kwon and Zmud, 1987), More concentrated decision-making is associated with a centralized organizational structure (Eder and Igbaria, 2001).
Perceived Ease of Use	The extent to which a user expects an information system to be free of effort or easy to learn and use (Davis et al., 1989; Hester, 2011; Hsieh and Wang, 2007).
Perceived Image	The degree to which the use of the system enhances individual's image or status within the organization (Hester, 2011).
Perceived Reciprocity Expectation	The degree to which use of the system for knowledge contribution will cause future requests for knowledge being met (Hester, 2011).
Perceived Usefulness	"The prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context" (Davis et al., 1989, p. 985).
Perceived Voluntariness	The degree to which use of the system/innovation is perceived as being voluntary or of free will (Hester, 2011; Kishore and McLean, 2007).
Personal Innovativeness	Is the degree to which an individual is relatively earlier in adopting new ideas than other members of a system and willing to try out any new system (Jones et al., 2002; Rogers 2003; Wang et al., 2008).
Prior Attitude towards IT	Refers to the individual's pre-deployment attitudes to specific types of systems usage, or a person's attitude toward the technology before deployment (Sundaram et al., 2007).
Prior Intention to Use	Refers to the individual's pre-development intention to use the technology before receiving it (Sundaram et al., 2007).
Quantitative Overload	Refers to people's perception that they cannot do something because of limitations imposed by their environment such as time or accessibility to a resource. (Ahuja and

	Thatcher, 2005, p. 435-436).
Relative Advantage	"The degree to which an innovation is perceived as better than the idea it supersedes" (Rogers, 2003, p. 33).
Result Demonstrability	"The degree to which the results of using the KMS are observable by others" (Hester, 2011, p. 342).
Role of IS	Indicates the dependency of the company on its information systems (Lee et al., 2000).
Routinization	The extent to which the use of technology has been integrated into the normal work routine of a user and user adapts to IT usage or incorporates it into his or her routine work pattern (Afonso et al., 2015; Sundaram et al., 2007).
Satisfaction	"Is an experience-based affect reflecting users' overall feeling about their interaction with a technology" (Wang et al., 2008, p. 30).
Service Quality	Users perceive whether the work system is capable of delivering high-quality output (Hsieh et al., 2011, p. 2022).
Skill Variety	"The degree to which a job requires a variety of activities" (Pao-Long and Lung, 2002, p.3)
Staff Turn Over	Refers to the number of employees who leave an organization and are replaced by new staff (Pongpattrachai et al., 2014).
Strategic Alliances	Are formulated "when a small business allies itself with one or more other organizations to enjoy potential benefits including technical training, improved technology diffusion, an increased resource pool, and a greater technical critical mass" (Winston and Dologite, 1999, p.31).
Subjective Norms	The degree to which individuals perceive that their superiors, peers, and customers would want them to use a particular system and regarding their own secondary adoption behavior (Gallivan, 2001; Jones et al., 2002).
System Integration	"The extent to which the IS brings together multiple systems and offers access to such systems through a unified interface" (Saeed and Abdinnour-Helm, 2008, p. 378).
Task Identity	"The degree to which the job requires completion of a whole and identifiable piece of work" (Pao-Long and Lung, 2002, p.3).
Task Significance	"The degree to which the job has a substantial impact on the lives or work of other people" (Pao-Long and Lung, 2002, p.3).
Task Structuredness	Indicates how well structured and predefined the company's business rules and operating procedures are for the EDI-assisted applications such as sales, distribution, purchase, trade and banking (Lee et al., 2000, p. 334).
Top Management Support	Refers to "the ways in which organizations encourage IT usage and the degree to which they provide necessary resources to facilitate IT implementation" (Wang et al., 2008, p. 29).
Trialability	The degree to which it is possible to try using the system (Hester, 2011).
Trust in a Specific Technology	Beliefs that a specific technology has the attributes necessary to perform as expected in a given situation in which negative consequences are possible (McKnight et al., 2011).
Trust in IT	Refers to favorable object-specific beliefs about a system's attributes (Thatcher et al., 2011, p. 56).
Usage	The activities engaged in by users who are using a system to perform tasks that involve acquiring, updating and creating knowledge" (Hester, 2011).
User Experience	Refers to "both previous exposure to IT, or computer experience, and attitude toward the IT implementation process, or implementation experience" (Winston and Dologite, 1999, p.31).
User Image	Refers to perceived benefits on user image (Grublješič and Jaklič, 2015).
User Involvement	Refers to "both a subjective psychological state and user participation in various steps in the implementation process" (Winston and Dologite, 1999, p.31).
Visibility	The degree to which using the system is visible within an organization (Hester, 2011).
*Elapsed Time	The longer the *elapsed time* since the adoption of IS, the more likely the integration and utilization of IS have levelled up (Lee et al., 2000).
*Emotion-Focused Adaptation Behaviors	Are directed at regulating emotional response to the problem (Fadel, 2012).
*Individual's Attitude	Refers to an individual's expression toward a specific IS (Pao-Long and Lung, 2002).
*Intrinsic Hedonic Motivation	Is propelled by the goal of being engaged in self-determining and competence-enhancing behavior (Deci and Ryan, 2000; Ke et al., 2012).
*IS Sophistication	Is measured using several items such as IT staff size, budget and percentages are ratio-

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	scaled (Lee et al., 2000).
*IS-Business Relationship	Developing a good relationship between IT and the business areas (Ramamurthy et al., 2008).
*IT competence	Refers to user competency regarding using a specific IS (Pongpattrachai et al., 2014).
*Partner Support	Is an extra organizational support (Pongpattrachai et al., 2014).
*Problem-Focused Adaptation Behaviors	Is directed at managing or altering the problem causing the distress and focus on altering the external environment (Fadel, 2012).
*Qualitative Overload	Occurs when employees perceive assigned work as exceeding their capability or skill level (Ahuja and Thatcher, 2005, p. 435-436).
*Relevance of Information	It reduces the gap between what the system offers and what users actually need so that it increases the relevance of information (Grublješič and Jaklič, 2015).
*Sufficiency of Education and Training	Refers to sufficiency of individuals' level of education to use a specific IS and training provided for them (Pao-Long and Lung, 2002).
*Technology Complexity	Refers to the level of complexity and complication of an IS (Cooper and Zmud, 1990).
*Technology Quality	Refers to technology quality perceived by CSEs (customer service employee) (Hsieh et al., 2011).
*Trust in IT Support (Staff)	Refers to trust in receiving support from IT support team (Thatcher et al., 2011).

Note: *The authors did not define these independent variables in their papers. We infer these explanations from reading their papers.

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