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Antecedents of employees' extended use of enterprise systems: An integrative view of person, environment, and technology

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ABSTRACT

Employees' extended use of enterprise systems becomes an important concern for firms striving to reap benefits from IT investment. This paper proposes a person-environment-technology (PET) research model to explain how system self-efficacy, leader-member exchange, and system modularity, jointly impact employees' extended use. The model is tested with a survey on enterprise system users in six firms which have already implemented enterprise resource planning (ERP) systems, and several meaningful findings are yielded. First, except for leader-member exchange, both system self-efficacy and modularity are found to positively and directly affect extended use. Second, leader-member exchange, rather than exerting a direct effect, can positively moderate the effects of system self-efficacy and modularity on extended use. Third, system modularity can strengthen the relationship between system self-efficacy and employees' extended use .The limitations and implications for research and practice are discussed.

1. Introduction

In most contemporary firms, enterprise systems (ES, e.g., ERP systems) have been greatly infused into employees' daily business tasks. However, firms that implement ES seldom sufficiently assimilate the systems and realize the full potential of the investments (Jasperson, Carter, & Zmud, 2005). This underachievement issue can be largely attributed to underutilization of the introduced system at the post-adoption stage (e.g., Jasperson et al., 2005; Karahanna, Straub, & Chervany, 1999; Maruping & Magni, 2015; Zhang, 2017). At the individual level, to address the issue of underutilization, employees are expected to use various functions embedded in the introduced system to accomplish their job tasks, i.e., to conduct extended use (Burton-Jones & Grange, 2013; Liang, Peng, Xue, Guo, & Wang, 2015;Sykes & Venkatesh, 2017). In practice, extended use is particularly meaningful for firms to fully reap benefits from their investments in ES (e.g., Cooper & Zmud, 1990; Hsieh & Wang, 2007). Because features embedded in ES are interlinked with job tasks and business processes (Davenport 1998), by engaging in extended use, employees can find successful features of ES that may potentially optimize their task performance and organizational processes (Ahuja & Thatcher, 2005; Burton-Jones & Volkoff, 2017; Sykes & Venkatesh, 2017). Toward this end, it is urgent to explore critical antecedents of employees' extended use in contemporary firms.

Despite the increasing body of relevant literature on extended use over the years (Ahuja & Thatcher, 2005; Hsieh & Wang, 2007; Ke, Tan, Sia, & Wei, 2013; Li et al., 2013; Liang et al., 2015; Magni, Angst, & Agarwal, 2013; Maruping & Magni, 2015), several research gaps remain. First, extended use theoretically belongs to the field of technology acceptance and use. Although prior literature has suggested that personal, environmental, and technological factors are the most critical antecedents for technology acceptance and use (e.g., Davis, 1989; DeLone & McLean, 2003; Goodhue & Thompson, 1995; Gupta & Karahanna, 2004; Joshi, 1991; Karahanna et al., 1999; Speier & Venkatesh, 2002; Thompson, Higgins, & Howell, 1991; Venkatesh & Davis, 2000), extant research on extended use is devoted mainly to partial factors of these three types of antecedents without considering these antecedents simultaneously (e.g., Ahuja & Thatcher, 2005; Hsieh & Wang, 2007; Ke et al., 2013; Magni et al., 2013). Even within the studies on technology acceptance and use, few integrate and underline the interactions among all of these three sets of antecedents, which may potentially limit our understanding of extended use. It is thus imperative to develop a more comprehensive research framework, which can theoretically integrate these antecedents, for predicting technology acceptance and use in general, and extended use in particular. Second, the effect of system *per se* on employees' system exploration has been

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greatly neglected in prior research. Theoretically, extended use refers to the extent to which employees engage in using multiple functions or features embedded in the system to accomplish their tasks (Hsieh & Wang, 2007; Saga & Zmud,1994). However, to the best of our knowledge, few studies have been conducted to investigate how functionality-level system characteristics affect extended use. Furthermore, although ES implementation practically involves social relationships between employees and supervisors (Orlikowski, 1992), the theoretical understanding on the impacts of the social relationships are far from clear with regard to technology acceptance and use in general, and to extended use in particular. Particularly, since ES often involve implementation in multiple business units, and each unit's local management directly interacts with employees on a daily basis (Lewis, Agarwal, & Sambamurthy, 2003), it is thus necessary to explore how employees' interactions with their local supervisors affect their extended use behavior.

Drawing upon relevant literature, we propose a person-environment-technology (PET) framework, and theoretically justify the interactions among the personal, environmental, and technological antecedents for technology acceptance and use. Taking into consideration the features of ES, it is believed that the PET framework is particularly appropriate for analyzing extended use. Accordingly, system self-efficacy, leader-member exchange, and system modularity are theoretically identified as three critical PET factors respectively, and integrated into a research model for predicting employees' extended use of ES. Specifically, system self-efficacy, system modularity, and leader-member exchange can directly affect extended use. Furthermore, based on the PET framework, it is proposed that: (1) leader-member exchange can positively moderate the effects of system efficacy and modularity on extended use; and (2) system modularity can strengthen the relationship between system self-efficacy and extended use. To verify the research model, a survey was conducted on offend-users in six firms which had already implemented ERP systems, and most of our hypotheses were supported except for the direct effect of leader-member exchange on extended use.

This study can make several significant theoretical contributions. First, by theoretically justifying the interactions among personal, environmental, and technological antecedents, our study can contribute to technology acceptance and use literature in general, and extended use in particular. Second, while information systems imply relationships between employees and the organization (e.g., Joshi, 1991; Orlikowski, 1992), we further explain how person-supervisor fit operates to affect employees' extended use by justifying that the impacts of system modularity and self-efficacy are contingent upon the relationship between employees and their supervisors. Third, it is probably the first study that explores the role of basic modules and functionalities in affecting extended use, which can further extend relevant literature. More importantly, despite we underline the impacts of the selected constructs on extended use in this study; the proposed integrative PET theoretical framework goes beyond the findings and suggests that other potential critical personal, environment, and technological antecedents can also interact with each other so as to predict technology use. Toward this end, this explorative study can inspire future research of technology use to explore more interesting findings by considering the interactions among personal, environmental, and technological factors.

2. Theoretical development

With experience and learning processes accumulated in the routine use (which is prescribed by the organization), employees are able to obtain relevant knowledge and skills to use the prescribed enterprise system, thus enabling them to move beyond routine use, and exploit the fullest potential of the system (e.g., Cooper & Zmud, 1990). In practice, users often struggle with the application of the introduced system to support their jobs. During the formal training sessions, they learn how to use a limited number of system functions initially. But over time, users will find additional useful features for accomplishing their own tasks (Robey, Ross, & Boudreau, 2002), and the number of the features being used varies among users (Liang et al., 2015). Theoretically, there is a comparison regarding the number of features being used. On the one hand, users compare with themselves concerning the features already being used and the features which are perceived to be embedded in the system, and need to be explored (Robey et al., 2002). On the other hand, users compare with others in the workplace concerning for the amount of features being used. Those who employ more features to support their work tasks can be conceptualized as higher level of extended use (Hsieh & Wang, 2007; Maruping & Magni, 2015).

2.1. Theoretical framework

Our theoretical frame derives from two streams of research. The first stream is the classic behavior theory, which suggests that the fundamental antecedents of behavior/behavioral intentions are social actors' beliefs, including beliefs of the target of the behavior, social actors themselves, and the context in which the behavior appears (Ajzen & Fishbein, 1974; Fishbein & Ajzen, 1975). The second stream is the well-established technology acceptance and use literature, which actually implies that technology acceptance and use can be described as the phenomenon in which users adopt and actually use an introduced technology in a specific environment (e.g., Davis, 1989; Jasperson et al., 2005; Orlikowski, 1992; Venkatesh, Morris, Davis, & Davis, 2003). Obviously, these two streams of research can be integrated regarding technology acceptance and use because of the theoretical consistency, i.e., technology refers to the target of the behavior, social actors refer to users, and the context refers to the specific environment. Therefore, it is argued that technology acceptance and use are exclusively derived from the users' beliefs regarding technology, environment, and themselves. Accordingly, Fig. 1 presents the conceptual framework of this study, which essentially suggests that technology acceptance and use derived from the interactions among three major sources, i.e., the person (i.e., user), technology, and the surrounding environment. With this integrative person-environment-technology (PET) framework, we attempt to conceptually develop a taxonomy of relevant factors to explore the way in which they interact and integrate with each other so as to facilitate technology acceptance and use.

Specifically, personal factors depict the characteristics of a user *per se*, and environmental factors refer to the context in which the technology is being used. Both types of factors can be either technology-specific (e.g., computer self-efficacy and management commitment to technology use) or more general (e.g., personality and task arrangement). A technological factor is employed to describe the characteristics of technology in use; it refers to either the features internal to technology *per se* (e.g., complexity and system quality) or users' evaluation

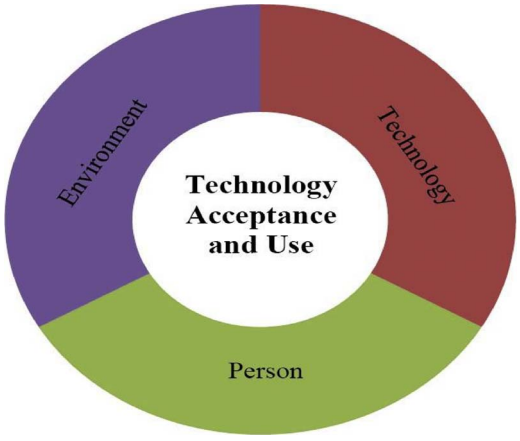

Fig. 1. Conceptual framework.