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# How and why trust matters in post-adoptive usage: The mediating roles of internal and external self-efficacy

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ABSTRACT

Since the underutilization of technology often prevents organizations from reaping expected benefits from IT investments, an increasing body of literature studies how to elicit value-added, post-adoptive IT use behaviors. Such behaviors include extended and innovative feature use, both of which are exploratory in nature and can lead to improved work performance. Since these exploratory behaviors can be risky, research has directed attention to trust in technology as an antecedent to post-adoptive IT use. In parallel, research has examined how computer self-efficacy relates to post-adoptive IT use. While such research has found that both trust and efficacy can lead to value-added IT use and that they might do so interdependently, scant research has examined the interplay between these antecedents to post-adoptive IT use. Drawing on the Model of Proactive Work Behavior with a focus on its predictions about trust and efficacy, we develop a research model that integrates trust in technology and computer self-efficacy in the post-adoption context. Our model suggests that the two concepts are interdependent such that trust-related impacts on post-adoptive use behaviors unfold via computer-related self-efficacy beliefs. Contemporary tests of mediation on data from more than 350 respondents provided support for our model. Hence, our findings begin to open the black box by which trust-related impacts on post-adoptive behaviors unfold, revealing computer self-efficacy as an important mediating factor. In doing so, this study furthers understanding of how, and why, trust matters in post-adoptive usage, enabling strategic change management by elucidating the "fit" between technological characteristics and post-adoptive usage.

## Introduction

*Paula S. Insecurity uses IT in support of her daily work as a plant manager. She has a positive attitude toward the technology and believes it is useful to her job, but she still cannot bring herself to fully utilize its potential. Paula suspects this may have something to do with her lack of confidence regarding computer use, preventing her from using all the features the technology provides and exploring how it could further help her in her job. But she also wonders whether the technology even provides all the functionality she needs, whether it will help her when she gets lost, and whether it will not surprise her with odd behaviors. Still, she somewhat envies Frank, her husband, who keeps telling her exciting stories about all the new ways he found in which IT makes his life easier. But she also knows that Frank fully trusts the technology and has complete confidence that he can use it to improve his job performance. Paula would like to be more like Frank in this regard, but simply doesn't know where to start.*

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This vignette illustrates a common problem in contemporary work environments: the underutilization of information technology (IT) (Lankton et al., 2014; Jasperson et al., 2005; Venkatesh et al., 2008). Even when people perceive IT to be useful to their jobs and easy to use, they often do not engage in exploring new features or trying to find new applications of IT that could improve their job performance (Burton-Jones and Straub, 2006; Thatcher et al., 2011). This failure to engage in extended or innovative IT use is a strategic problem for organizations, because it limits the benefits gleaned from IT investments (Jasperson et al., 2005; Venkatesh et al., 2008). For example, a firm can realize business value from Microsoft Excel® when employees use it for simple calculations, but it could realize more value if they exploited this software's full range of features to create market reports and support strategic decisions. Hence, to realize the full value of IT, it is critical to understand the drivers of individuals' post-adoptive IT use, such as beliefs about a technology or about one's ability to use that technology.

Recent post-adoption research has directed attention to trust in technology as a driver of value-added IT usage behaviors. Trust in technology relates to a technology's specific attributes, such as its functionality, helpfulness, and reliability (McKnight et al., 2011). Trust is thought to be important because it can counteract feelings of risk and uncertainty associated with new, exploratory, or innovative behaviors (e.g., McKnight et al., 2011; Teo et al., 2008; Thatcher et al., 2011). By explicating the nomological net among these trusting beliefs and post-adoption, research can offer practice advice for how individuals' understandings of a specific technology's attributes impact desirable IT usage behaviors.

However, while recent research offers explanations of how trust in technology develops (e.g., Li et al., 2008; Montoya et al., 2010; Montague et al., 2010; McKnight et al., 2011; Thatcher et al., 2007; Vance et al., 2008; Wang and Benbasat, 2008), less research examines how and why such trust, in turn, leads to post-adoptive behaviors. Absent understanding of the mechanisms connecting trust to post-adoptive behavior, research can offer only limited practical guidance for how to develop organizational intervention strategies (MacKinnon and Luecken, 2008). To fully understand the implications of trust for post-adoptive IT use and to offer enhanced guidance to managers, research must investigate more detailed and specific explanations of the causal pathways involved in the process by which trust-related impacts unfold.[1] This process is likely complex and involves additional explanatory factors, rendering such research particularly important (Thatcher et al., 2011). Consequently, the present paper begins to open the black box of the interdependencies that *explain how and why trust in technology can lead employees to engage in post-adoptive behaviors*.

One potentially important explanatory factor in this context is computer self-efficacy (CSE), which refers to peoples' beliefs that they can use IT successfully to accomplish their work (Compeau and Higgins, 1995; Marakas et al., 2007). Much like trust in technology, CSE is a cognitive belief about the work environment that alleviates uncertainty perceptions and, thus, can elicit post-adoptive behaviors (Bandura, 1997; Marakas et al., 2007; Teo et al., 2008; Thatcher et al., 2011; Wang and Benbasat, 2008). Hence, CSE is relevant to explaining the process by which trust-related impacts on post-adoptive use might unfold. More specifically, CSE is pertinent to the present study for two reasons. First, CSE is primarily driven by environmental cues, such as trust (Bandura, 2001; Marakas et al., 1998; Wood and Bandura, 1989). Second, self-efficacy is a key factor in judgments of uncertainty and elicitations of behavior (Bandura, 1997). Hence, examining the interdependencies between CSE, trust in technology, and post-adoptive use holds the potential to contribute to developing a more nuanced understanding of the interdependencies that shape technology use within the post-adoption context. Therefore, this paper examines *whether CSE mediates the impact of trust in technology on post-adoptive behaviors*.

The paper proceeds as follows. The next section provides a background on the study context and develops an integrative research model of trust, CSE, and post-adoptive behavior. This integrative model hypothesizes that certain aspects of CSE mediate the impact of trust in certain technological attributes on post-adoptive behaviors. To develop these hypotheses, we introduce the Model of Proactive Work Behavior, focusing on the model's predictions about how the relationships among trust, efficacy, and behavior are structured. The section thereafter provides details on the method employed to test our integrative model and the results obtained from this test. Finally, we discuss the implications of this study for research and practice.

## Background and hypotheses

Most studies examine post-adoptive use, trust in technology, and CSE in isolation (see Fig. 1). Only a few studies look at the intersection of two such areas (for example, McKnight et al. (2011) examined the intersection between post-adoptive use and trust), and no research to date has examined the point at which all three areas intersect. Yet, this intersection holds strong potential for explaining how and why trust impacts post-adoptive behaviors; both constructs trust and self-efficacy are pertinent to the post-adoption context, and they may impact behavior interdependently (Marakas et al., 1998; McKnight et al., 2011; Thatcher et al., 2011). More specifically, understanding these interrelationships is important because trust in technology and efficacy are core elements of the broader nomological net used to predict a range of value-creating, post-adoptive technology usage behaviors such as extended use and innovation.

### *Post-adoptive usage: Deep structure usage and trying to innovate with IT*

Post-adoptive use refers to peoples' interactions with a familiar system (Ortiz de Guinea and Markus, 2009; Venkatesh and Goyal,

[1] Preacher et al. (2007, p. 188), among others, clarify that "Mediation analysis permits examination of process, allowing the researcher to investigate by what means X exerts its effect on Y."

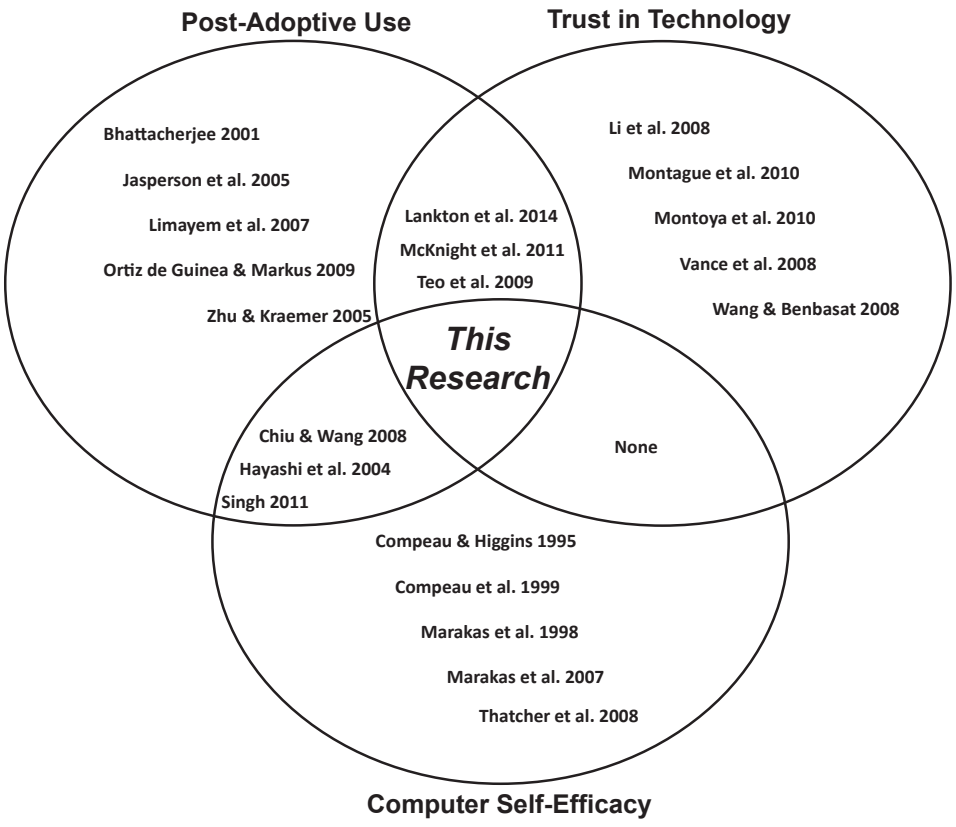


**Fig. 1.** Illustrative studies in the contexts of post-adoptive use, trust in technology, and CSE.

2010). More specifically, after people have adopted a technology, they vary in how extensively they utilize the features of the system and in their willingness to invest time in learning of how to apply the system in new ways to their work (Nambisan et al., 1999). Two salient usage behaviors with a familiar system are deep structure usage (Burton-Jones and Straub, 2006) and trying to innovate with IT (Ahuja and Thatcher, 2005).

The former usage behavior refers to the extent to which individuals utilize the features of a system; it is a rich, sophisticated, and demanding form of usage (Burton-Jones and Straub, 2006). The latter refers to peoples' goals of finding new ways of applying technology to their work (Ahuja and Thatcher, 2005). Together, these behaviors offer a fairly holistic representation of post-adoptive technology usage, since they tap into complementary aspects of the uncertainty and risk inherent in such usage. More specifically, deep structure usage has a high potential for loss of time, mistakes, and errors since it is often related to problem-solving so that its demands are close to users' cognitive capacity; trying to innovate implies similar problems since it requires users to try out something new and to leave their comfort zone. In line with these notions, both usage behaviors may be shaped by outcome expectations about the use of technology (Ahuja and Thatcher, 2005; Burton-Jones and Straub, 2006), implying that trust in technology and CSE may be relevant drivers of them.

*Trust in the context of post-adoptive usage*

*Trust in people versus trust in technology*

IS research has predominantly relied on *trust in people* as a conceptualization of trust, potentially because it might appear more "natural" to trust a human being than to trust a technology (McKnight et al., 2011). For example, Benamati et al. (2010) made a strong contribution to IS researchers' understanding of trust by integrating the concept of trust with technology acceptance in e-commerce environments. These authors focused on trust as a user's perception of an e-vendor. Consistent with this focus, their dependent variable was "intention to use an e-vendor" (Benamati et al., 2010, p. 385). The scale of the dependent variable included items such as "I intend to purchase books from Books-a-million.com in the future." Accordingly, the study was internally consistent in its reliance on the concept of trust in people and its operationalization. The study was fully situated in an e-commerce adoption context, with the trust variable and the dependent variable being people-related (i.e., purchasing from, using, or visiting an e-vendor). Likewise, many other studies in the context of e-commerce have examined trust in relation to e-vendors (e.g., Ba and Pavlou, 2002; Fang et al., 2014; Gefen et al., 2008).

The dominant conceptualization of trust in online vendors goes back to McKnight et al. (2002). Their conceptualization of trust was based on, and consistent with, seminal definitions of trust in the broader management literature, such as Mayer et al. (1995) and

Rousseau et al. (1998). Several recent studies cited McKnight et al. (2002) as a principal source for *trust in people* research in online environments, including the integrative one by Benamati et al. (2010).

While the examination of *trust in people* (or organizations) is highly relevant to IS research, especially in the context of e-commerce and trust in online vendors, recent research has called for more directly examining trust in the IT artifact, such as trust in Microsoft Excel. Gefen et al. (2008) put forth a research agenda on trust, in which they indicated that **the paradigm of "computers are social actors" would clearly delineate the applicability of interpersonal trust theories to the domain of trust in IT artifacts**. These authors' call for a more direct examination of the IT artifact was consistent with Orlikowski and Iacono's (2001) call for more direct examinations of the IT artifact. On the basis of these calls, McKnight and colleagues, the authors of the above-mentioned, widely-adopted conceptualization and measure of trust in e-commerce environments (i.e., McKnight et al., 2002), concluded that **our understanding of trust could benefit from examining trust in the technology itself in addition to trust in people** (McKnight et al., 2011, 12:3): "By distinguishing between trust in technology and trust in people, our work affords researchers an opportunity to tease apart how **beliefs towards a [technology] vendor**, such as Microsoft or Google, relate to **cognitions about features of their products**. By providing a literature-based conceptual and operational definition of trust in technology, our work provides research and practice with a framework for examining the interrelationships among different forms of trust and postadoption technology use."

Be it *trust in people* and organizations or *trust in technology*, trust situations imply risk and uncertainty, which form their **contextual condition**. Trust situations arise when people have to make themselves vulnerable by depending on another person or object, irrespective of the trust object's will or volition (McKnight et al., 2011). In fact, trust is commonly defined as a person's **willingness to depend on another entity due to the characteristics of that entity** (Rousseau et al., 1998). This entity might be an IT artifact. For example, one can trust (or not) Blackberry®'s email system to deliver messages to one's phone (McKnight et al., 2011). In this example, the trustor depends on the Blackberry device to manage emails, and the trustor accepts risks and vulnerabilities linked to network outage or device failures. Similarly, one can trust Windows or statistical software not to break down in the middle of a task, much like one might trust (or not) an old car not to break down in the middle of the road ("even if it's old, my car has always gotten me home; it'll also get me home this time"). Likewise, some people might be afraid of flying because they do not trust pilots, whereas others are afraid of flying because they do not trust airplanes. Psychology research examines the phenomenon of generalized flight anxiety, which refers to the anxiety experienced in connection with aircrafts in general, irrespective of someone's personal involvement in a flight situation (Triscari et al., 2011). Just seeing or hearing airplanes (a technology) can make people feel vulnerable and at risk. On the basis of these examples as well as the preceding analysis grounded in Gefen et al. (2008) and McKnight et al. (2011), we hold that a technology itself and its attributes can be regarded as trustworthy (or not).

It stands to reason that trust in technology might be a particularly useful concept for research on post-adoptive use because it is grounded in users' knowing a system sufficiently well to anticipate how it will respond under different conditions. Furthermore, post-adoption research is primarily concerned with the use of the IT artifact so that trust in technology constitutes an important part of its nomological net (McKnight et al., 2011). Trust in people, such as online vendors, on the other hand, seems especially appropriate for e-commerce research, which is more concerned with economic transactions amongst human entities in a marketplace. Hence, different conceptualizations of trust might be more or less pertinent to different IS phenomena, with trust in technology being particularly relevant to the study of post-adoption (McKnight et al., 2011).

*Trust in technology as the concept of trust used in this study*

Drawing on Gefen et al. (2008) and McKnight et al. (2011), we conceptualize trust as beliefs about the desirable or favorable attributes of a technology, such as MS Excel. This conceptualization of trust as trust in technology is consistent with trust in people/interpersonal trust. According to Mayer et al. (1995), interpersonal trust results from the judgement that another entity is trustworthy, that is, that the entity will perform as expected in risky situations. This judgement is based on perceptions of the ability, benevolence, and integrity of the other entity. Similarly, McKnight et al. (1998) defined trusting beliefs in people as the perception of benevolence, competence, honesty, or predictability of a person. It is the latter definition of trust in people that served as the conceptual foundation for McKnight et al.'s (2011) definition of trust in technology. Specifically, McKnight et al. (2011) mapped their *trust in technology* definition and its different elements to the trust in people definition, firmly grounding their new conceptualization of trust in technology in the existing trust literature (McKnight et al., 2011). Due to our interest in perceptions of the technology itself, we draw on McKnight et al.'s (2011) definition of trust in technology to advance knowledge on post-adoptive technology usage.

Trust in technology refers to certain beliefs about how a technology operates within a work environment; specifically, it refers to peoples' judgement or expectation that a given technology's helpfulness, reliability, and functionality will support them in their work (McKnight et al., 2011; Teo et al., 2008; Thatcher et al., 2011). Trust in helpfulness is defined as the expectation that a system offers support in terms of adequate and responsive aid, including tips, guidance, and help functions (McKnight et al., 2011; Thatcher et al., 2011). For example, Microsoft Excel offers a function called "Microsoft Excel Help," accessible by pressing the F1 key on the keyboard, which assists users by explaining the menu structure and navigation, available formulas, and how to use them. Trust in reliability is defined as the expectation that a system offers support in terms of consistent system behavior that a user can forecast (McKnight et al., 2011; Thatcher et al., 2011). Such system behavior supports users by avoiding undesired surprises (e.g., unpredictable systems crashes); users trust that a system will behave according to accepted principles. For example, if a certain function is used in Excel, the function should always act in the same way and always yield the same results for the same data and parameters.

In contrast to trusting beliefs in helpfulness and reliability, trust in functionality is not related to the support a system offers but relates to beliefs about a system's features. Trust in functionality is defined as the expectation that a system's functions are well-aligned with a user's work responsibilities, implying that the system can do for the user what the user needs to have done (McKnight et al., 2011; Thatcher et al., 2011). For example, if a user's primary work responsibility includes such simple statistical analysis as the

calculation of averages or sums, Excel's functions are well-aligned with the user's responsibilities. This alignment fosters the trusting belief that a technology, in this case Excel, possesses the necessary functionality. However, if the work responsibility includes such complex analyses as hierarchical linear modeling, Excel's functions may be insufficient to do for the user what the user needs to have done. This misalignment may hinder trust in functionality.

To clearly differentiate the two technological attributes related to system support from the one related to system functionality, it is useful to categorize these attributes into non-functional and functional ones (Gebauer et al., 2008; Rodrigues et al., 2005). This categorization anchored to system functionality accounts for Jasperson et al.'s (2005) postulate that a feature-centric view (i.e., a focus on functionality) should be taken to examine the post-adoptive use of technologies. System helpfulness and reliability are non-functional attributes; they relate to the operation of the system in terms of user support, not to what the system is supposed to do (Gebauer et al., 2008; Rodrigues et al., 2005). By contrast, system functionality is a functional attribute, it relates to the different functions a system can perform for the user (Gebauer et al., 2008). Non-functional and functional attributes of trust in technology have been found to shape post-adoption beliefs such as exploration with IT (Thatcher et al., 2011).

We emphasize that this conceptualization of trust in technology is consistent with prior definitions of trust in people, especially the one advanced by McKnight et al. (1998), in that it treats trust as the judgement or expectation (1) that another entity has suitable attributes for performing as expected (2) in a risky situation (3). In accordance with this definition of trust in people, trust in technology implies that employees judge whether a technology has suitable attributes for performing as expected in a risky use situation. Thus, trust in technology has the same three elements, here elucidated in reverse order: post-adoptive usage, such as individual innovation or deep structure use, constitutes a risky use situation due to high potential for loss of time, mistakes, and errors, and employees pass judgements and have expectations about the suitability of a technology's attributes for performing favorably and as expected. Such judgements and expectations could include, for example: "IBM SPSS Statistics provides competent guidance (as needed) through a help function," "IBM SPSS Statistics is a very reliable piece of software," or "IBM SPSS Statistics has the functionality I need."

### *Computer Self-efficacy (CSE)*

Computer Self-efficacy (CSE) refers to peoples' beliefs in their ability to use a computer system successfully in support of their work (Compeau and Higgins, 1995; Marakas et al., 2007). Recent IS research suggests that CSE has two facets, an internal and an external one (Thatcher et al., 2008). External CSE is a belief about one's ability to use a system successfully when it provides support. As such, external CSE directly depends on the support offered by a system, e.g., in terms of helpfulness or reliability. By contrast, internal CSE is a belief about one's ability to use a system successfully on one's own; it reflects the belief that one has the ability to accomplish a work task independently using a computer system (Thatcher et al., 2008). As such, internal CSE directly depends on the functions offered by a system; users can only use a system successfully for their work if the system offers the functions they need, that is, if the system's functions are aligned with work tasks. Across six different technology use contexts, Thatcher et al. (2008) found that internal and external CSE related differently to beliefs about technology.

### *Connecting trust in technology to Post-Adoptive usage via computer Self-efficacy*

To inform understanding of the relationships among post-adoptive behavior, trust in technology, and CSE, we draw on the Model of Proactive Work Behavior (MPWB) (Crant, 2000; Frese and Fay, 2001; Parker et al., 2006) (see Fig. 2). Proactive Work Behavior or proactivity refers to the extent to which an individual takes self-initiated action (Crant, 2000; Griffin et al., 2007; Parker et al., 2006), before being asked to do so (Grant and Ashford, 2008). According to MPWB, all types of behaviors can be carried out proactively (Crant, 2000; Grant and Ashford, 2008; Griffin et al., 2007). Behaviors such as problem-solving, idea implementation, and individual innovation are exemplar cases of proactivity at work (Parker et al., 2006; Scott and Bruce, 1994). Within the domain of Information Systems (IS), MPWB suggests that individuals who use a technology's features more extensively or who use the technology in innovative ways on one's own accord are engaging in proactive behaviors. Overall, MPWB is a useful theoretical framework for the present study since post-adoptive behaviors, such as individual innovation with a technology or the use of a large number of its features (i.e., deep use), are not generally required by organizations but are self-initiated and, therefore, proactive (Jasperson et al., 2005). Since our goal in using MPWB is to better understand the structure of the relationships among trust, efficacy, and behavior, we

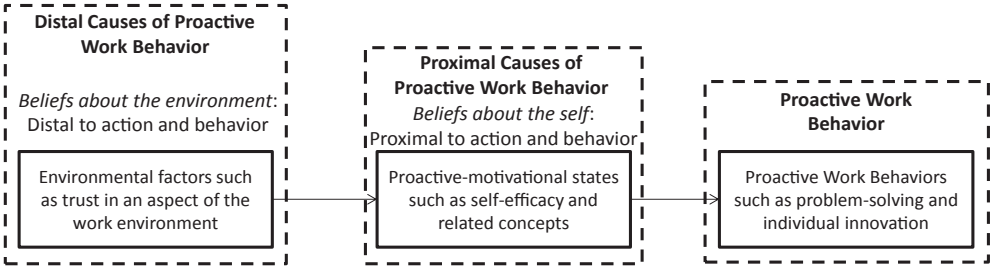


**Fig. 2.** Model of proactive work behavior.
Adapted from Bindl and Parker 2010 and Parker et al. 2006

focus on MPWB's predictions related to these three concepts.

The MPWB is an important model in the organizational behavior as well as the industrial and organizational psychology literature. There is consistent and strong empirical evidence for its claims (e.g., Bindl and Parker, 2010; Clegg et al., 2002; Frese and Fay, 2001; Major et al., 2006; Parker and Collins, 2010; Parker et al., 2006). This evidence has appeared in flagship journals of these disciplines, such as *Academy of Management Journal* (e.g., Griffin et al., 2007; Scott and Bruce, 1994) or *Journal of Applied Psychology* (e.g., Brown et al., 2006; Grant and Sumanth, 2009; Kanfer et al., 2001; Major et al., 2006; Parker et al., 2006). However, since MPWB is an evolving and relatively new model concerned with a recent organizational phenomenon, it has not yet emerged as a complete theory with specific assumptions and tight logical arguments. Hence, we refer to MPWB not as a theory, but as a model. Yet, MPWB is useful for examining our research question given that (1) MPWB advances arguments relevant to unraveling the black box that ties trust in technology to post-adoptive technology usage and (2) MPWB has been empirically validated in various studies that were published in major outlets. Please see Appendix A for a summary of relevant prior research in the area of proactive work behavior.

The MPWB indicates that proactive-motivational states, such as self-efficacy, which diminish uncertainty and psychological risk, predict proactive behaviors (Bindl and Parker, 2010; Frese and Fay, 2001). This view suggests that risk is inherent in proactive work behaviors. For example, post-adoptive IT use behaviors, such as individual innovation and deep structure usage, embody risk because they require that users try out something new (in the case of innovation) or do something demanding and sophisticated (in the case of deep use), with high potential for loss of time, mistakes, and errors (Ahuja and Thatcher, 2005). When considering engaging in a new behavior, individuals engage in deliberate decision-processes to assess the potential of a proactive behavior to yield a positive outcome, implying that the belief that one can successfully perform the behavior is crucial to motivate its performance (Bindl and Parker, 2010; Parker et al., 2006). Consistent with this argument, there is strong and consistent empirical evidence that self-efficacy is positively related to proactive behavior at work (e.g., Bindl and Parker, 2010; Brown et al., 2006; Kanfer et al., 2001; Parker et al., 2006).

In addition to proactive-motivational states, the MPWB suggests that proactive behavior also results from **beliefs about the work environment**, such as trust in an aspect of the work environment (Bindl and Parker, 2010; Parker et al., 2006). Trust can offset the psychological risk involved in proactivity and encourage risk taking because trust builds an environment in which people feel safer and more comfortable to take risks. By contrast, environments perceived as psychologically unsafe (e.g., technologies perceived as unreliable) hinder proactivity (Bindl and Parker, 2010). In line with this argument, there is strong empirical evidence that trust is positively – yet indirectly – related to proactivity at work (e.g., Baer and Frese, 2003; Clegg et al., 2002; Parker et al., 2006).

Consistent with theories of social psychology, the MPWB suggests that there are distal and proximal causes of proactive behavior. Specifically, beliefs about the work environment such as trust are distal predictors (i.e., indirect predictors) of proactive behaviors, while **beliefs about the self** such as self-efficacy are proximal predictors (i.e., they impact proactive behaviors directly) (Bindl and Parker, 2010; Parker et al., 2006; Shrout and Bolger, 2002). Consistent with Fishbein and Ajzen's (1974) insight that the distal trusting beliefs impact proactive behaviors via the more proximal proactive-motivational self-efficacy beliefs, the MPWB suggests that self-efficacy acts as a mediator of trust-related impacts on behavior because it is more action-oriented, more specific, and closer to behaviors than trust (Bindl and Parker, 2010; Frese and Fay, 2001; Parker et al., 2006). Further, self-efficacy results from beliefs about personal vulnerability as well as ability and is, thus, a particularly important factor for motivating risky work behaviors like proactive ones (Bandura, 1997; Bindl and Parker, 2010; Ozer and Bandura, 1990). It is important to note that this insight is consistent with Social Cognitive Theory (Bandura, 1986), which indicates that such personal factors as self-efficacy can mediate the impact of the environment (e.g., an information technology situated in the work environment) on behavior.

Furthermore, we argue for the specific link between trust in technology and CSE on the basis of Marakas and colleagues' work on CSE formation (Marakas et al., 1998, 2007). One aspect of their work that is particularly relevant to our focus on trust is the notion that CSE formation is hindered by emotional arousal, particularly by arousal in the form of anxiety (Bandura, 1977; Marakas et al., 1998). In fact, the negative effects of emotional arousal and anxiety on self-efficacy are well-established in the literature (Kavanagh and Bower, 1985, Lazarus and Folkman, 1984). These effects exist because arousal and anxiety can have informative value about personal competency: people rely on their states of arousal and anxiety when judging their likelihood of success (Bandura, 1977; Marakas et al., 1998). Since high arousal often weakens work performance, people are more likely to expect success when they do not perceive aversive arousal. By contrast, when people are tense and nervous, they are more likely to expect failure (Bandura, 1977; Marakas et al., 1998). Hence, any mechanism that reduces feelings of emotional arousal and anxiety will increase perceptions of self-efficacy (Marakas et al., 1998).

Trust is such a mechanism that can reduce feelings of emotional arousal and anxiety, thus increasing self-efficacy (Kelly and Noonan, 2008). Trust builds feelings of security and safety that reduce anxiety: "I feel secure and safe in my environment, so no reason to worry" (Kelly and Noonan, 2008). In doing so, trust extinguishes negative emotions; it increases self-efficacy through arousal sources of information (Bandura, 1977). Additionally, trusting individuals often feel that they have control over their environment. This feeling of control further dampens anxiety because control provides people with the perception of being able to manage any arising difficulties, which, then, present less of a struggle: "I trust my technology; I am in control of it. So, no need to worry" (Cheung and Tse, 2008).

To summarize the arguments about the specific link between trust in technology and CSE: first, feelings of trust reduce aversive arousal and anxiety. These reductions in negative emotions, in turn, increase self-efficacy (Bandura, 1977; Marakas et al., 1998). Accordingly, one can create the specific link between trust in technology and CSE through arousal and anxiety. The preceding arguments about feelings of arousal and anxiety offer indirect support for the notion that trust in technology and CSE are linked. A more direct test of this view is the objective of the present study.

Based on the above discussion, we conceptualize CSE as a proximal driver of technology use. This approach is consistent with prior work in IS, which suggests that CSE often mediates the effects of distal factors (Thatcher and Perrewe, 2002). For example, Compeau and Higgins (1995) found that CSE mediates the relationship between organizational support and system usage as well as the relationship between computer experience and usage. Consistent with these findings, we suggest that specific forms of efficacy mediate the effects of trust in technology on post-adoption use.

We argue that trust in non-functional attributes (i.e., helpfulness and reliability) may impact post-adoptive behaviors via external CSE. Since trusting beliefs in non-functional attributes are beliefs about the support offered by a system (Gebauer et al., 2008; McKnight et al., 2011) and since external CSE is the belief that one has the ability to perform a work task on a computer with support from the system (Thatcher et al., 2008), trust in non-functional attributes may directly influence external CSE and may, through this influence, indirectly impact post-adoptive behaviors (Bindl and Parker, 2010; Parker et al., 2006). As Thatcher et al. (2008, p. 630) note, external CSE rests on peoples' beliefs about being able to perform a work task when external support seems available, "be it from another person or from the software itself," because external CSE requires a degree of interactivity that allows people to believe that they can perform a work task successfully. For this reason, external CSE is also referred to as "software-supported efficacy" (Thatcher et al., 2008, p. 641). Hence, people who trust the support a system offers in terms of helpfulness and reliability may see themselves as more capable of using the system successfully. For example, people who trust Excel's interactive step-by-step guidance may, as a result of this trusting belief, perceive themselves as likely to perform a work task successfully using Excel (Thatcher et al., 2008). These people may believe that they can use Excel successfully because it offers the support they need (Bandura, 2001).

Compeau and Higgins (1995) also suggested that the interdependency between the support offered to computer users and CSE can impact usage behaviors. These authors noted that the support for computer users inherent in the work environment can influence users' judgments of self-efficacy because they perceive that more resources are available to help them become proficient. Similarly, Marakas et al. (1998) indicated that software support such as the perceived access to help files can impact CSE. Likewise, research on proactive work behavior provided empirical evidence that the support available in the work environment (e.g., climate for initiative), can lead to proactive behaviors via its impact on self-efficacy (e.g., Baer and Frese, 2003). Thus, we hold that the impacts of trust in system helpfulness and reliability on deep structure usage and trying to innovate will be mediated – at least in part – by external CSE.

Recent IS research provided direct empirical evidence in support of the link between CSE and the proactive work behavior *deep structure usage*. Such research has shown that CSE gives rise to the deep structure usage of ERP systems across various industries and functional areas (Liang et al., 2015). Similarly, IS research has shown empirically that CSE impacts deep structure usage in the contexts of BPM systems and word processing systems (Benlian, 2015). As a final example, recent IS research also suggests that CSE might impact the use of feature extensions (that is, deep structure usage) for such office systems as Microsoft Excel (Bagayogo et al., 2014). Given this empirical evidence alongside the conclusions drawn from the model of proactive work behavior, we hypothesize that the impacts of trust in system helpfulness and reliability on deep structure usage will be mediated by external CSE (see Fig. 3a):

**H1.** External CSE will mediate the effect of trust in helpfulness on deep structure usage.

**H2.** External CSE will mediate the effect of trust in reliability on deep structure usage.

Recent IS research also provided direct empirical evidence in support of the link between CSE and the proactive work behavior *trying to innovate*. Such research has shown that CSE is related to innovation behaviors with ERP systems in Chinese organizations (Wang et al., 2013). Another study provided further empirical evidence that CSE gives rise to innovation behaviors with ERP systems across various industries (Liang et al. 2015). Furthermore, recent research has shown that CSE impacts innovation behaviors with mobile phones (Schmitz et al., 2016). CSE has also been shown to impact innovation behaviors in the context of computer-aided design software (e.g., AutoCAD), computer-aided engineering software (e.g., CATIA), and project management software (Deng et al., 2004). Ahuja and Thatcher's (2005) seminal work on trying to innovate also suggests that CSE directly affects peoples' innovation behaviors with technologies. Given this evidence combined with the conclusions drawn from the model of proactive work behavior, we hypothesize that the impacts of trust in system helpfulness and reliability on trying to innovate will be mediated by external CSE (see Fig. 3b):

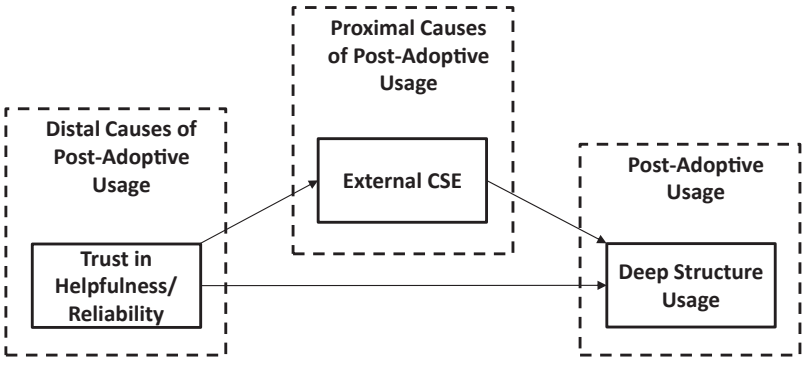


**Fig. 3a.** Impact of trust in non-functional attributes on deep structure usage.

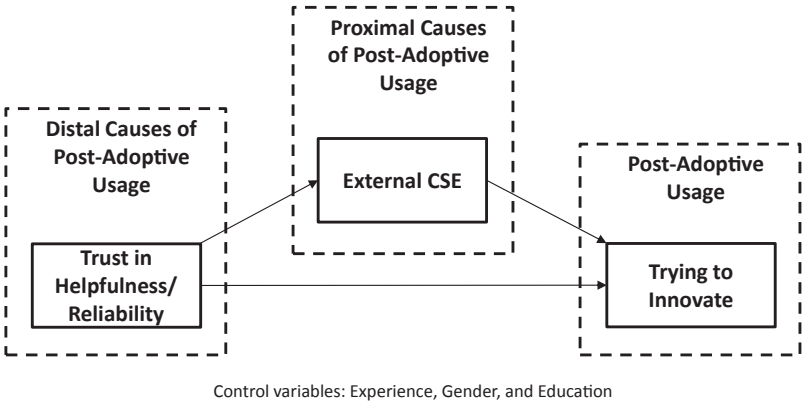


**Fig. 3b.** Impact of trust in non-functional attributes on trying to innovate.

**H3.** External CSE will mediate the effect of trust in helpfulness on trying to innovate.

**H4.** External CSE will mediate the effect of trust in reliability on trying to innovate.

While we expect external CSE to mediate the impact of trust in non-functional attributes on post-adoptive behaviors, we expect internal CSE to mediate the impact of trust in functional attributes on those behaviors. Since trust in functionality represents the belief that a system has the functions required to perform one's job (Gebauer et al., 2008; McKnight et al., 2011) and since internal CSE is the belief that one has the ability to perform one's job on a computer on one's own (Thatcher et al., 2008), trust in functionality can be expected to directly influence internal CSE and indirectly impact post-adoptive behaviors (Bindl and Parker, 2010; Parker et al., 2006). Specifically, people who believe that the functions offered by a system align with their work responsibilities may, in turn, see themselves as capable of using the system successfully on their own. For example, people who trust that Excel offers the functions necessary for the creation of complex market reports may, as a result of this trust, perceive themselves as well able to create such reports successfully using Excel (Thatcher et al., 2008). In this case, peoples' beliefs in their ability to use a system successfully to perform their work responsibilities are rooted, at least in part, on the system offering necessary work-related functionality (i.e., trust in functionality may lead to internal CSE) (Bandura, 2001). By contrast, people who do not believe that the functions offered by a system align with their work responsibilities may view themselves as incapable of using the system successfully for their work. For example, people who do not believe that Excel offers the functions needed to create complex market reports may judge themselves as incapable of using it successfully for the creation of such reports. These people may assume: "if Excel does not give me what I need, how can I use it successfully for my work?" In this case, the lack of trust in system functionality may result in lower levels of internal CSE and, via this impact, it may indirectly lower post-adoptive usage behaviors (Bindl and Parker, 2010; Parker et al., 2006).

At the same time, trust in system functionality may shape beliefs about independence and autonomy at work, since it implies users' trust that the system can empower them to perform their work tasks independently (McKnight et al., 2011; Thatcher et al., 2011). By inducing this perceived independence and autonomy at work, trust in functionality may directly impact internal CSE because such CSE beliefs depend on autonomy (Thatcher et al., 2008). As a result of this impact, trust in functionality may indirectly lead to post-adoptive usage via the proactive-motivational state of internal CSE (Bindl and Parker, 2010; Parker et al., 2006). Consistent with the notion that internal CSE may mediate the impact of trust in functional attributes on post-adoptive behaviors, prior research has shown that job autonomy can affect proactive problem solving and idea implementation via proactive-motivational self-efficacy beliefs (Parker et al., 2006). Thus, we hypothesize that the impact of trust in functionality on deep structure usage and trying to innovate will be due – at least in part – to differences in internal CSE (see Fig. 3c):

**H5.** Internal CSE will mediate the effect of trust in functionality on deep structure usage.

**H6.** Internal CSE will mediate the effect of trust in functionality on trying to innovate.

While one could reasonably assume that trust in helpfulness could predict post-adoption via internal CSE in addition to external CSE, in this paper we do not expect internal CSE to mediate the impact of trust in non-functional attributes on post-adoptive behaviors. We make this case because internal CSE is not reliant on external support to learn about or use technologies (Thatcher et al., 2008). Similarly, we do not expect external CSE to mediate the impact of trust in functional attributes on post-adoptive behaviors since external CSE is not reliant on the specific functions a system can perform for the user (Thatcher et al., 2008). Consistent with these ideas, post hoc analyses examining these relationships yielded non-significant results.

## Method and results

### *Sample*

To test our model, data were collected from 372 undergraduate students enrolled in a core Management Information Systems

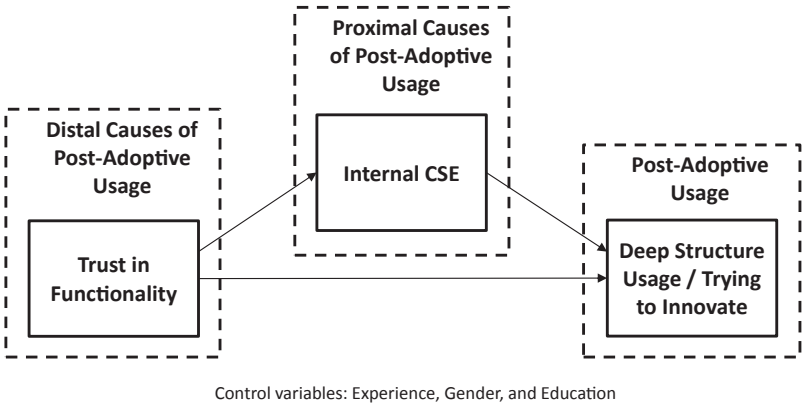


**Fig. 3c.** Impacts of trust in functional attributes.

(MIS) course at a large university in the northwestern United States. Data were collected from participants using an online survey during regular class time as part of the classroom experience. Information on trust in technology beliefs, CSE, and related concepts were collected to assess the quality of the student learning experience. The students were provided nominal course credit in exchange for their participation. If students opted out of participation, they were provided an alternative and equivalent exercise to earn course credit.

In this MIS course, the students **were trained in using Microsoft Excel® for such advanced tasks as analytical modeling**. To perform better, students could **engage in such proactive behaviors as innovation with Excel and deep use of its features** (it is important to note that the students were not explicitly told that such behaviors could lead to better performance; they initiated these behaviors out of their own free will). The participants had also used Excel in several other courses prior to this core MIS course, so they had sufficient experience to have developed CSE as well as to have **moved into post-adoptive use**. Further, the use of Excel in our study context was consistent with prior research (Burton-Jones and Straub, 2006). In addition, the use of student subjects had the advantage of reducing the number of confounding variables (e.g., age), increasing the internal validity of our results (Ahuja and Thatcher, 2005; Appan and Browne, 2012; Polites and Karahanna, 2012). Accordingly, this population of Excel users was appropriate to test our hypotheses connecting trust, efficacy, and post adoptive use.

*Measures*

Respondents were asked to report their trusting beliefs, self-efficacy beliefs, and usage behaviors with Microsoft Excel. All measures were adapted from prior research (e.g., Thatcher et al., 2008; McKnight et al., 2002; McKnight et al., 2011), and a pilot study was performed in which the measures exhibited good reliability and validity. Appendix B details the full scales for our principal constructs. The trusting beliefs in system helpfulness, reliability, and functionality were relatively new constructs with new, yet established, measures. We adopted these measures directly from McKnight et al. (2011). These authors had developed the measures based on trust in people measures that had appeared in influential prior studies (e.g., McKnight et al., 2002). For example, they refined the trusting belief – reliability items by determining synonyms of the terms *consistent* and *predictable* and by adding two items measuring beliefs that the software would not fail. In the process, they completed several rounds of card-sorting exercises. Besides, the definitions for the trusting beliefs were based on the definitions for trust in people. This analysis suggests that McKnight et al.'s (2011) measures, which we adopted, had been developed rigorously based on prior research and that they were consistent with the construct definitions.

In the case of our study, we defined trust in technology as peoples' judgements or expectations related to a given technology's helpfulness, reliability, and functionality. Our measurement items reflected these expectations. For instance, trust in reliability was measured by the expectations that "Excel does not fail me" and that "Excel is extremely dependable," amongst others. Put differently, people judged Excel as dependable (or not). As another example, trust in helpfulness was measured by the expectation that "Excel provides whatever help I need," much like benevolence in the case of trust in people that has been measured by such items as "If I required help, Books-a-million.com would do its best to help me" (Benamati et al., 2010).

Consistent with prior IS research and with prior research on proactive work behavior, we also measured years of experience with Excel, gender, and education as control variables. These variables have been shown to impact technology usage behaviors and to be related to different work requirements, perceptions of a work environment, and adoption patterns of proactive work behaviors (Bindl and Parker, 2010; Grant and Ashford, 2008; Griffin et al., 2007, 2009; Kanfer et al., 2001; McKnight et al., 2011; Parker, 2007; Parker and Collins, 2010; Parker et al., 2010).

*Measurement validation*

Before evaluating our hypotheses using formal tests of mediation, we assessed the quality of our survey instrument by estimating the reliability as well as the convergent and discriminant validity of the construct measures. SPSS version 18 was used to calculate all

**Table 1**
Quality criteria and descriptives of construct measures.

| Construct | Number of items | AVE | AVE non-associated items | Alpha | Mean | SD | Range |
|---|---|---|---|---|---|---|---|
| Trust in Functionality | 3 | 0.77 | 0.00 | 0.92 | 5.07 | 1.13 | 6.00 |
| Trust in Helpfulness | 4 | 0.75 | 0.00 | 0.93 | 4.33 | 1.07 | 6.00 |
| Trust in Reliability | 4 | 0.68 | 0.00 | 0.90 | 5.01 | 1.09 | 6.00 |
| Internal CSE | 3 | 0.69 | 0.00 | 0.86 | 3.92 | 1.40 | 6.00 |
| External CSE | 3 | 0.67 | 0.00 | 0.85 | 5.49 | 1.10 | 6.00 |
| Trying to Innovate | 4 | 0.75 | 0.00 | 0.93 | 3.96 | 1.29 | 6.00 |
| Deep Use | 5 | 0.74 | 0.00 | 0.93 | 4.91 | 1.19 | 6.00 |

AVE = Average Variance Extracted.

statistics, which were obtained through a factor analysis with Maximum Likelihood Extraction (MLE) and Promax rotation.[2] The internal consistency reliability of a block of items is represented by Cronbach's coefficient alpha. Satisfactory values for this criterion exceed 0.70 (Nunnally, 1978). All alphas exceeded this threshold (see Table 1), indicating satisfactory internal consistency.

Construct validity was assessed in several ways. Convergent validity was assessed by estimating the average variance extracted (AVE), which represents the amount of variance a variable captures from its associated items relative to the amount of variance that is due to measurement error. An AVE of at least 0.50, which shows that the construct accounts for the majority of the variance, generally indicates sufficient convergent validity (Fornell and Larcker, 1981). Discriminant validity refers to the degree to which a construct measure discriminates among constructs. The discriminant validity of a construct is commonly regarded as adequate when the square root of the construct's AVE is higher than the inter-construct correlations in the model (Chin, 1998). All AVE values were above 0.50 (see Table 1) and the square root of the AVE for each construct was higher than the correlations between that construct and all other constructs in the model (see Table 2), indicating sufficient convergent and discriminant validity. Moreover, the AVE value for non-associated items, which quantifies the amount of variance a construct measure captures from the items it is not associated with relative to the amount due to measurement error, was lower than 0.01 for each construct (see Table 1). This result further confirmed construct validity (Fornell and Larcker, 1981).

Convergent and discriminant validity were also assessed by inspecting item loadings and cross-loadings. When items load in excess of 0.50 on their associated constructs and when all item loadings within constructs are higher than those across constructs (Chin, 1998), the construct measures are considered convergent and discriminant, respectively. Table 3 presents evidence that our construct measures met these criteria.

The quality of the survey instrument was also assessed using partial least squares (PLS), which is a structural modeling technique that uses a component-based approach to estimation (SmartPLS 2.0 (Ringle et al., 2005) was used for this assessment). However, we reported here the statistics obtained from the previously-mentioned factor analysis with Maximum Likelihood Extraction and Promax rotation for reasons of consistency. Doing so enabled us to use the same data-analytic technique throughout our analyses because structural modeling approaches do not support such advanced, formal tests of mediation as bootstrapping, which we intended to use and which are regression-based (Zhao et al., 2010). Still, it is important to note that the statistics obtained from the factor analysis regarding the quality of our survey instrument in terms of reliability and construct validity were consistent with those obtained from PLS.

We used both procedural and statistical remedies to control for common method bias (Podsakoff et al., 2003). Procedurally, we limited common method bias by protecting respondent anonymity as a means to reduce evaluation apprehension and encourage honest assessments. Statically, we evaluated the significance of common method variance in our data by performing a single factor test through a factor analysis with MLE and Promax Rotation (Podsakoff et al., 2003). In this approach, all items are forced to fit on a single factor representing method effects. Common method variance is considered significant if the model fits the data (Podsakoff and Organ, 1986). In our data, a one-factor model showed substantial misfit ($\chi^2$ [2 9 9] = 4,621.64, $p < 0.001$). We further compared this measurement model to the full model and found that the one-factor model fit the data less well ($\Delta\chi^2$ [1 3 5] = 4,228.71, $p < 0.001$), indicating that common method variance was not found.

*Hypothesis testing*

Since the instrument exhibited good measurement properties, we proceeded with a formal test of our hypotheses using–as recommended by Zhao et al. (2010)–the bootstrapping procedure developed by Preacher and Hayes (2004; 2008). This technique is recommended over the Sobel test (Sobel, 1982) and the Causal Steps Approach (Baron and Kenny, 1986) since it allows for the inclusion of control variables and combines high statistical power with good control over the Type I error rate (MacKinnon et al., 2002, 2004). Additionally, this contemporary mediation test accounts for many of the problematic assumptions inherent in both the

[2] In contrast to the traditional orthogonal rotation methods (e.g., Varimax), oblique rotation methods such as Promax allow the factors to be inter-correlated and are, therefore, generally preferred.

**Table 2**
Interconstruct correlations.

| Construct | Trust in functionality | Trust in helpfulness | Trust in reliability | Internal CSE | Extern-al CSE | Trying to innovate | Deep use |
|---|---|---|---|---|---|---|---|
| Trust in functionality | **0.88** | | | | | | |
| Trust in helpfulness | 0.50 | **0.87** | | | | | |
| Trust in reliability | 0.64 | 0.53 | **0.83** | | | | |
| Internal CSE | 0.49 | 0.51 | 0.37 | **0.83** | | | |
| External CSE | 0.47 | 0.35 | 0.52 | 0.42 | **0.82** | | |
| Trying to innovate | 0.40 | 0.43 | 0.31 | 0.46 | 0.17 | **0.87** | |
| Deep use | 0.55 | 0.44 | 0.48 | 0.42 | 0.37 | 0.37 | **0.86** |

Diagonal elements shown in bold are square roots of the average variance extracted.

**Table 3**
Loadings and cross loadings of measurement items.

| Indicator | Trust in func. (Func) | Trust in help. (Help) | Trust in rel. (Reli) | Int. CSE (ICSE) | Ext. CSE (ECSE) | Trying to innov. (Trying) | Deep use (DU) |
|---|---|---|---|---|---|---|---|
| Func1 | 0.84 | 0.04 | −0.01 | 0.06 | −0.02 | 0.06 | −0.04 |
| Func2 | 0.97 | 0.02 | −0.05 | −0.08 | 0.03 | −0.03 | 0.03 |
| Func3 | 0.82 | −0.02 | 0.09 | 0.02 | −0.01 | 0.02 | 0.01 |
| Help1 | −0.06 | 0.80 | 0.05 | −0.02 | 0.10 | −0.00 | 0.08 |
| Help2 | 0.08 | 0.90 | −0.04 | −0.03 | −0.01 | −0.03 | 0.04 |
| Help3 | −0.03 | 0.87 | −0.00 | 0.09 | −0.07 | 0.02 | −0.05 |
| Help4 | 0.03 | 0.90 | 0.01 | −0.02 | −0.02 | 0.01 | −0.04 |
| Reli1 | 0.11 | 0.04 | 0.75 | −0.05 | 0.03 | −0.06 | 0.08 |
| Reli2 | −0.02 | 0.03 | 0.76 | 0.10 | −0.01 | 0.09 | 0.02 |
| Reli3 | −0.03 | −0.03 | 0.90 | −0.04 | 0.04 | 0.01 | −0.01 |
| Reli4 | −0.03 | −0.01 | 0.89 | −0.01 | −0.02 | −0.02 | −0.07 |
| ICSE1 | 0.06 | −0.08 | 0.04 | 0.91 | −0.09 | −0.01 | 0.00 |
| ICSE2 | −0.08 | 0.05 | −0.03 | 0.91 | −0.09 | 0.04 | −0.00 |
| ICSE3 | −0.01 | 0.08 | −0.04 | 0.64 | 0.20 | 0.02 | −0.01 |
| ECSE1 | 0.02 | 0.03 | 0.01 | 0.36 | 0.51 | −0.09 | 0.02 |
| ECSE2 | −0.01 | −0.00 | 0.01 | −0.05 | 0.96 | 0.03 | −0.03 |
| ECSE3 | 0.00 | −0.02 | 0.02 | −0.09 | 0.91 | 0.01 | 0.01 |
| Trying1 | 0.03 | −0.01 | −0.04 | −0.01 | 0.02 | 0.93 | −0.02 |
| Trying2 | 0.01 | −0.02 | −0.06 | 0.04 | 0.03 | 0.90 | 0.06 |
| Trying3 | 0.00 | −0.04 | −0.01 | 0.01 | 0.00 | 0.95 | −0.01 |
| Trying4 | −0.02 | 0.09 | 0.16 | −0.02 | −0.04 | 0.67 | −0.01 |
| DU1 | 0.09 | −0.05 | −0.03 | 0.02 | 0.06 | −0.01 | 0.82 |
| DU2 | −0.02 | −0.05 | 0.01 | 0.05 | 0.03 | 0.08 | 0.81 |
| DU3 | 0.11 | −0.06 | 0.11 | 0.10 | −0.04 | −0.10 | 0.77 |
| DU4 | −0.07 | 0.02 | −0.02 | −0.08 | 0.00 | 0.00 | 0.98 |
| DU5 | −0.07 | 0.12 | −0.06 | −0.05 | −0.06 | 0.04 | 0.89 |

Sobel test and the Causal Steps Approach (Zhao et al., 2010).[3] Technically, this formal mediation test is a nonparametric re-sampling procedure involving repeated sampling from the data and estimating the indirect effect in all re-sampled data sets (Preacher and Hayes, 2008). The test was conducted using Preacher and Hayes' (2008) standard SPSS macro with a 99% confidence interval and 5000 bootstrap resamples in SPSS version 18, and it included the earlier specified control variables.

The results of our mediation tests showed that the majority of the hypothesized indirect effects were highly significant; since zero was outside the 99% confidence interval for most indirect effects (see Table 4), we can conclude with 99% confidence that these

[3] According to Zhao et al.'s (2010) paper published in the influential *Journal of Consumer Research*, Baron and Kenny's test makes two improper assumptions that the bootstrapping procedure corrects. Both relate to the fact that Baron and Kenny's test is not a direct test of the indirect effect but rather tests the indirect effect indirectly through a number of disparate regression models. First, Baron and Kenny claim that mediation is strongest when there is an indirect effect but no direct effect in Step 3. Yet, the strength of mediation can best be measured by the size of the indirect effect rather than by the lack of a direct effect because mediation is by definition concerned with the indirect effect. For the same reason, a significant "effect to be mediated" in Step 2 is not needed; the only requirement to establish mediation should be that the indirect effect (i.e., the product of the a and b paths) is significant. Further, it is not sufficient to show that the total effect of the independent variable is reduced when the mediator is added to the model as this reduction does not indicate a significant difference between the two models. Similarly, this reduction does not indicate a significant indirect effect in the numerator of Step 4 when evaluated against the standard error of the indirect path in the denominator. Compared to the Sobel test, the bootstrapping test is more powerful since the indirect effect is generally evaluated as the product of two parameters, implying a non-normal sampling distribution of the indirect effect and a non-normal z-value in the Sobel test. Thus, the confidence interval in the Sobel test often improperly includes zero (Zhao et al., 2010) (please also see MacKinnon et al., 2002 and Shrout and Bolger, 2002).

**Table 4**
Test of the significance of the indirect effects.

| Hypothesis | | S.E. | LL 95 CI | UL 95 CI | LL 99 CI | UL 99 CI | Support |
|---|---|---|---|---|---|---|---|
| H1 | Trust in helpfulness leads to deep structure use via external CSE | 0.03 | 0.04 | 0.16 | 0.03 | 0.18 | Supported** |
| H2 | Trust in reliability leads to deep structure use via external CSE | 0.03 | 0.04 | 0.17 | 0.02 | 0.20 | Supported** |
| H3 | Trust in helpfulness leads to trying to innovate via external CSE | 0.02 | −0.02 | 0.07 | −0.03 | 0.09 | Not supported |
| H4 | Trust in reliability leads to trying to innovate via external CSE | 0.03 | −0.03 | 0.11 | −0.05 | 0.13 | Not supported |
| H5 | Trust in functionality leads to deep structure use via internal CSE | 0.03 | 0.03 | 0.14 | 0.02 | 0.17 | Supported** |
| H6 | Trust in functionality leads to trying to innovate via internal CSE | 0.03 | 0.11 | 0.23 | 0.09 | 0.25 | Supported** |

** Indicates significance at the 0.01 level; Number of bootstrap resamples: 5000.

indirect effects were different from zero (Preacher and Hayes, 2004). More specifically, a significant indirect effect was found for the relationship between trust in helpfulness and deep structure use (b = 0.087, Std. Error = 0.027, p < 0.01, LL = 0.031, UL = 0.180), supporting H1. Similarly, a significant indirect effect was detected for the relationship between trust in reliability and deep structure usage as expected (b = 0.094, Std. Error = 0.033, p < 0.01, LL = 0.019, UL = 0.195), supporting H2. Yet, a significant indirect effect could not be found for the relationship between trust in helpfulness and trying to innovate (b = 0.021, Std. Error = 0.021, p > 0.05, LL = −0.015, UL = 0.071), implying that H3 was not supported. Likewise, an indirect effect could not be detected for the link between trust in reliability and trying to innovate (b = 0.030, Std. Error = 0.034, p > 0.05, LL = −0.030, UL = 0.105), implying that H4 was not supported. For H5, we found a significant indirect effect for the relationship between trust in functionality and deep use as expected (b = 0.079, Std. Error = 0.028, p < 0.01, LL = 0.018, UL = 0.168). Further, a significant indirect effect was found for the relationship between trust in functionality and trying to innovate (b = 0.161, Std. Error = 0.032, p < 0.01, LL = 0.088, UL = 0.253), supporting H6. The results also showed that the mediating effects found for H1, H2, H5, and H6 were partial ones such that internal and external CSE explained a significant part of the trust-related impacts. Overall, the results showed that different facets of trust in technology impact post-adoptive usage via internal and external CSE.

We reported the statistics obtained from Preacher and Hayes' (2004, 2008) bootstrapping procedure since this procedure is the most refined, advanced test of mediation (Zhao et al., 2010). Yet, the hypotheses were also assessed using PLS, and it is important to note that the statistics obtained from PLS were consistent with those obtained from the bootstrapping procedure. In PLS, all path coefficients for the indirect effects found through the bootstrapping procedure were also significant (for both the a path [between the independent variable and the mediator] and the b path [between the mediator and the dependent variable]).

## Implications for research

Past research focusing on ***whether*** trust in technology can impact post-adoptive behaviors (i.e., direct effects) has shown that trust is an important factor in the post-adoption context, but it has not offered theoretical explanations for ***how and why*** trust matters in this context (i.e., indirect effects). Thus, to advance knowledge in this area and offer more specific guidance to managers, we examined the process by which trust-related impacts on post-adoptive behaviors unfold through computer self-efficacy.

This study helps post-adoption research ***progress*** from ***general*** explanations about the relationship between trusting beliefs and post-adoptive behaviors toward ***more detailed and specific*** explanations of the causal pathways involved. More specifically, this research shows that trust in the non-functional attributes of a technology impacts deep structure usage in part by increasing external CSE, while trust in the functional attributes impacts both deep structure usage and innovation behaviors by increasing internal CSE. These findings yield a "more sophisticated" understanding of how and why trust matters in post-adoptive use (i.e., such *beliefs about the technology* as trust in technology exert their effects on post-adoptive behaviors in part via such *beliefs about the self* as CSE – see Fig. 4) (MacKinnon and Luecken, 2008, p. S99).

Overall, this study makes five important contributions to IS researchers' understanding of trust, computer self-efficacy, and post-adoption technology use (see Table 5). First, our study helps post-adoption research ***progress*** toward more detailed and specific explanations of the process by which trust-related impacts unfold. Second, this study enriches our understanding of the ***role that CSE plays in the post-adoption context*** by explicitly theorizing CSE's potential to offset the psychological risk and uncertainty that characterize post-adoptive behaviors. Specifically, post-adoptive use behaviors embody psychological risk and uncertainty because they involve a high potential for loss of time, mistakes, and errors (Ahuja and Thatcher, 2005), implying a high perceived risk that negative outcomes occur. CSE can directly offset this psychological risk related to negative outcomes because it leads people to

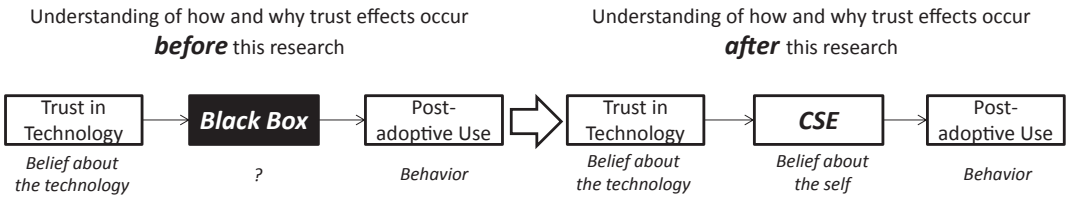


**Fig. 4.** Value-added of this research.

**Table 5**
Value-added of this research.

| Contributions of the present study | State of knowledge before this study | Limit in state of knowledge | Value-added of the present study | Practical implications of the present study | References |
|---|---|---|---|---|---|
| Showing how and why trust impacts post-adoptive use behaviors | Trust was shown to impact post-adoptive behaviors, implying an understanding of ***whether*** trust matters in the post-adoption context | Lack of understanding of the ***causal pathways*** involved in the relationship between trust and post-adoption | Enriched theoretical understanding of ***how and why*** trust impacts post-adoptive behaviors, revealing CSE as a pertinent mediating mechanism | Managers must be aware that trust can serve as a cost-effective and efficient mechanism to build CSE, ultimately enhancing post-adoptive use behaviors | McKnight et al. (2011), Teo et al. (2008), Thatcher et al. (2007) |
| Establishing CSE as a relevant mediator in the post-adoption context | CSE was shown to influence post-adoptive behaviors, often as a ***control variable*** | Lack of understanding of the ***prominent role*** CSE can play in the post-adoption context due to its particular relevance to the post-adoption context | Enriched understanding of the role of CSE in post-adoptive behaviors, shedding light on CSE's capacity to counteract the ***psychological risk and uncertainty*** inherent in post-adoptive behaviors | Managers must be aware of the central role of CSE in eliciting post-adoptive behaviors and its potential to offset perceptions of risk and uncertainty | Bandura (2001), Jasperson et al. (2005), Marakas et al. (1998), Wood and Bandura (1989) |
| Validating the idea that non-instrumental belief constructs are important in the post-adoption context | The importance of ***non-instrumental*** belief constructs such as CSE for post-adoption was described, and some empirical studies included them as control variables | Lack of empirical validation of the ***central role*** of such non-instrumental belief constructs as CSE in post-adoptive use behaviors | ***Empirical validation*** of the previously described pertinence of such non-instrumental belief constructs as CSE for post-adoptive behaviors | Managers must promote non-instrumental beliefs to elicit post-adoptive use behaviors rather than solely relying on such instrumental beliefs as perceived usefulness and ease of use even in the post-adoption context | Agarwal (2000), Bandura (2001), Cooper and Zmud (1990), Jasperson et al. (2005) |
| Organizational Behavior theories such as the Model of Proactive Work Behavior explain the impact of trust and CSE on post-adoptive use behaviors | Theories and constructs ***related to initial adoption and acceptance*** of technologies (including such constructs as perceived usefulness and ease of use) were often used in the post-adoption context | Lack of ***specificity of our research models*** to the post-adoption context, implying a lack of theoretical understanding of the post-adoptive use phenomenon and the interdependencies among the drivers of post-adoptive use behaviors | Improved understanding of the nomological net of post-adoption, ***driven by a theory of high relevance to post-adoptive usage***, implying an enriched explanation, prediction, and analysis of post-adoptive usage | Not applicable | Crant (2000), Griffin et al. (2007), Parker et al. (2006), Thatcher et al. (2011) |
| Introduction of the bootstrapping procedure (Preacher and Hayes 2004, 2008) as a formal test of mediation to IS research | Large reliance on Baron and Kenny (1986) for establishing mediation effects | Lack of knowledge of alternative, ***contemporary*** approaches to mediation analysis, implying the reliance on potentially outdated and inadequate procedures | New guidance on mediation analysis by using a contemporary test that IS researchers can use to provide ***rigorous evidence of mediation*** effects | Not applicable | MacKinnon et al. (2002, 2004), Preacher and Hayes (2004, 2008), Zhao et al. (2010) |

believe that they can attain a positive outcome (Bandura, 2001; Bindl and Parker, 2010; Parker et al., 2006). Third, the present study ***empirically validates*** the idea that such non-instrumental belief constructs as CSE are pertinent to the post-adoption context. Prior research has argued that instrumental belief constructs are key to understanding the initial adoption and acceptance of technology, while non-instrumental constructs should be crucial to understanding post-adoptive usage (e.g., Cooper and Zmud, 1990; Jasperson et al., 2005). However, empirical support for the latter suggestion has been lacking, since research on post-adoption has focused on instrumental belief constructs as drivers of post-adoptive behaviors (e.g., Teo et al., 2008; Thatcher et al., 2011).

Fourth, the study extends prior work on post-adoption that was largely driven by theories and constructs related to the initial adoption and acceptance of technologies (e.g., the technology acceptance model [TAM] including the constructs perceived usefulness and ease of use, the DeLone and McLean model including the constructs information and system quality) (e.g., Teo et al., 2008; Thatcher et al., 2011) by applying a theoretical framework that is more specific to post-adoption: MPWB. Hence, the present study yields an ***enriched explanation and prediction*** of post-adoptive technology usage since more theoretical specificity enables greater precision in explaining and predicting a phenomenon (Bacharach, 1989). Consistent with our study focus on trust, efficacy, and behavior, we used MPWB specifically to understand better how the relationships among these three constructs are structured, and we focused on MPWB's predictions related to these three constructs. Future work might apply MPWB more broadly to post-adoption research to identify related concepts that might predict post-adoptive behaviors (e.g., change orientation, flexible role orientation).

Finally, this study ***demonstrates how to employ a contemporary approach to mediation analysis*** in IS research (i.e., the bootstrapping procedure developed by Preacher and Hayes in 2004). IS scholars can use this current, formal test of mediation as a refined alternative to Baron and Kenny's (1986) causal steps approach. The bootstrapping procedure used here is a more direct test of mediation since it directly assesses the indirect effects between the independent and dependent variable pairs (i.e., the product of the a and b paths) rather than necessitating the specification of a series of disparate and separate regression models (Zhao et al., 2010).

Besides, an important lesson can be learned from the lack of support for Hypotheses 3 and 4. This lack of support points to a systematic difference in the outcomes of the interdependencies between trust in the non-functional and functional attributes of a technology and CSE. While the interdependency between trust in the functional attributes and CSE elicited innovation behaviors, the one between trust in the non-functional attributes and CSE did not. This difference can perhaps be explained with the fact that people who make internal attributions have more confidence in their ability to perform a work task than those who make external attributions (Thatcher et al., 2008). Internal CSE is associated with more control over relevant factors (e.g., putting a technology to effective use) than is external CSE. Hence, an interdependency involving internal CSE may be associated with more risky behaviors than one involving external CSE.

By evaluating interdependencies between trust and CSE, this paper underscores the need for research that further develops our understanding of the nomological network leading to post-adoption use (Bacharach, 1989). Specifically, to further extend our understanding of trust-related impacts on post-adoption, future research can take three interrelated directions:

(1) developing a comprehensive taxonomy of the factors that mediate trust-related impacts,
(2) developing an understanding of for whom these factors act as mediators, and
(3) re-examining "adoption"-focused constructs in the post-adoption context.

*Developing a comprehensive taxonomy of mediating factors*: This study examined internal and external CSE, which are dynamic individual differences, as mediators of trust's effects (Johnson and Marakas, 2000). In future research, studies should examine whether dynamic individual differences mediate the effects of stable individual differences on use behaviors (Thatcher and Perrewe, 2002). For example, future work could consider whether the effect of stable individual differences such as personal innovativeness in IT (PIIT; Agarwal and Prasad, 1998) or Negative Affect (Thatcher and Perrewe, 2002) on post-adoptive use are mediated by feelings of risk or trust (Agarwal and Prasad, 1998). Examining such mediation, which is consistent with MPWB and prior research on post-adoptive behavior, could add explanatory power to models of post-adoptive use.

*Discovering for whom certain factors act as mediators*: This paper found that internal and external CSE explain the impact of trust in technology on post-adoptive behaviors, revealing how and why trust matters. Since research has found that efficacy varies with factors such as age, further insight could result from examining whether these mediating impacts of CSE crystallize for different groups of user (i.e., moderated mediation, Muller et al., 2005). As technologies become increasingly infused in firms, it becomes ever more important to examine what role individual differences, such as age or gender, play in the nomological network surrounding post-adoption beliefs and behaviors (Venkatesh et al., 2012). For example, the mediating impact of CSE may be bound by gender such that it is stronger for females than for males (Marakas et al., 1998). If so, the CSE-related mediating process that intervenes between trust in technology and post-adoptive behavior could be different for male and female users; gender would explain for whom CSE beliefs act as important mediators and for whom they are less relevant. Such insight would contextualize our results, bounding their applicability and furthering our understanding of the interdependencies in the post-adoption context.

*Re-examining "adoption"-focused constructs in the post-adoption context*: While one could argue that this research looks at well-studied constructs, for example, trust and self-efficacy, this study leveraged MPWB to provide an updated conceptualization of how to think about the implications of these constructs in the post-adoption context. More specifically, we used MPWB to integrate recent re-conceptualizations of these constructs (e.g., McKnight et al., 2011; Thatcher et al., 2008) to create a richer understanding of how the interdependencies between certain forms of trust and efficacy impact post-adoptive use. Our hope is that through studies such as this one, which demonstrates the relevance of existing constructs to the post-adoption context and the need for new theoretical lenses such as MPWB to study post-adoptive use, we encourage deeper introspection about the connection from what we know (e.g., adoption) to what remains to be explored in the post-adoption world (e.g., infusion, adaption systems use, contextual factors such as

job design) (Li et al., 2009; Sun, 2012) and how to explore it (e.g., using new theoretical frameworks such as MPWB). For example, we know little about the impacts of contextual factors such as job design on post-adoptive use. To obtain a deeper understanding of the impacts of these contextual factors, MPWB could be leveraged due to its explicit treatment of the work environment.

### Implications for practice

This research offers important implications for organizations struggling with the underutilization of IT. First, it suggests that managers may be well-advised to emphasize high levels of system helpfulness, reliability, and functionality, when they manage the development of proprietary software or place an order for standard software. The trust in technology resulting from this approach may lead to high levels of deep structure usage and individual innovation with technology by fostering employees' positive beliefs about their ability to use the technology successfully. Given the evidence found here and elsewhere (Thatcher et al., 2008) for the salience of internal CSE in driving innovative behaviors, emphasizing functionality beyond helpfulness and reliability may be a particularly suitable avenue for countering the underutilization problem.

Second, this research directs managers' attention to the re-evaluation of user training programs since an increase in employees' CSE often constitutes a major objective of such programs (Thatcher et al., 2008). More specifically, given the high costs associated with training, particularly in large organizations with many potential users, good systems design may be a more cost-effective and efficient avenue to build employees' CSE, an advice not previously given to managers. Indeed, while prior research has predominantly focused on training as a means to promote CSE (e.g., Marakas et al., 1998; Thatcher et al., 2008; Yi and Davis, 2003), we show that good design concerning system helpfulness, reliability, and functionality may be an effective alternative–one that additionally promotes post-adoptive usage. However, in line with prior research in this area suggesting a focus on internal CSE (Thatcher et al., 2008), our results indicate that managers should focus on system functionality over and above helpfulness and reliability to enhance employees' CSE and, subsequently, encourage post-adoptive behaviors.

### Limitations

As with any research, there are a few limitations to our study that should be considered when interpreting our results. First, consistent with prior research (e.g., Ahuja and Thatcher, 2005; McKnight et al., 2011; Thatcher et al., 2011), sampling was limited to students who voluntarily responded to the instruments. While this approach may limit the study's external validity, it was appropriate for the present study given the students' familiarity with the focal technology and the relevance of post-adoptive behaviors to their work. Further, this approach was associated with high internal validity due to the homogeneity inherent in this sample population. Moreover, given that our target technology was Microsoft Excel, which is widely used in organizations (Yi and Davis, 2003), our findings may generalize to a variety of organizational settings.

Second, our study's conceptualization and operationalization of trust as *trust in technology* deviates from much prior trust research in IS that has largely been conducted in the context of e-commerce and has conceptualized and operationalized trust as *trust in people*. The principal difference relates to the object of dependence in that trust in people, but not trust in technology, often includes an element of moral agency (please see McKnight et al., 2011, for further details). On the other hand, trust in technology was developed to be consistent with trust in people and requires the same contextual conditions, that is, risk and uncertainty. Hence, both conceptualizations and corresponding operationalizations of trust can be regarded valid and consistent with previous IS research (McKnight et al., 2011). Furthermore, using both concepts of trust might add to our understanding of trust in IS phenomena. Specifically, we believe that different conceptualizations of trust might be more or less pertinent to different IS phenomena, and we also believe that our conceptualization of trust as trust in technology is relevant to our study context for the reasons explicated in Section 2. Future research could combine trust in people scales with trust in technology scales to lend support to the idea that their respective importance might differ depending on the phenomenon under investigation. We suspect that trust in technology might be more important for phenomena where the dependent variable relates directly to an IT artifact (e.g., post-adoptive use of a specific technology such as Excel), whereas trust in people might have more relevance for phenomena where the dependent variable relates to online vendors and to economic transactions in a marketplace (e.g., using an e-vendor or purchasing from an e-vendor). Future work could lend further support to this idea or disconfirm it. In doing so, such work could further broaden our understanding of trust.

Third, McKnight et al.'s (2011) construct *trusting-belief functionality* might seem similar to Davis' (1989) construct *perceived usefulness*.[4] We hold that both constructs are conceptually and empirically-related in a nomological network, yet distinct. Davis (1989, p. 320) defined perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance." In contrast to perceived usefulness, trusting belief-functionality does not focus on the job performance effects of a technology. It focuses simply on the expected alignment between system and work responsibilities. As such, it is defined as the belief or expectation that a system's functions are well-aligned with a user's work responsibilities. On the basis of this analysis of definitions, one could argue that trusting belief-functionality is a precursor to perceived usefulness. This conclusion is also reflected in the construct operationalizations. For perceived usefulness, the items fall into three main clusters: job effectiveness, productivity/time savings, and importance of the system to one's job (Davis, 1989). Davis' refined measure consisted of the following items: Work More Quickly, Job Performance, Increase Productivity, Effectiveness, Makes Job Easier, and Useful (Davis, 1989, p. 331). All of these items focus on job performance, consistent with Davis' definition for perceived usefulness. By contrast, McKnight et al.'s (2011) measure

[4] We thank an anonymous reviewer for pointing out this important aspect.

focuses simply on the expected alignment between a system and a job, without anticipating performance outcomes. The measure consists of the following items: Excel has the functionality I need, Excel has the features required for my tasks, and Excel has the ability to do what I want it to do.

To conclude this limitation, both constructs seem related. However, they do not appear to be identical, neither in purpose, nor in conceptualization, nor in operationalization. Trusting belief-functionality is defined as expected alignment and measured as such, whereas perceived usefulness focuses on job performance and productivity, which seem downstream of expected alignment. Therefore, one could argue that trusting belief-functionality might lead to perceived usefulness in a nomological network. Future work could lend more support to this idea.

Finally, one could argue that McKnight et al.'s (2011) measure for the three trust in technology beliefs does not measure peoples' willingness to depend on a technology directly. Rather, the measures evaluate judgments about a technology's likelihood to perform as expected, consistent with the construct definition. Future research could develop additional trust measures that evaluate more directly a person's willingness to depend on a technology, such as "I am willing to rely on the system" or "I would bet my next promotion on its use." However, measures of trustworthiness in an entity's ability, benevolence, and integrity are often highly correlated with more direct measures of trust. As a result, measures of trustworthiness and trust are often practically undistinguishable and interchangeable. While this conclusion might not hold true for life-threatening, high-risk trusting situations, such as jumping out of a plane, it likely holds true for situations that entail less risk, such as missing a deadline at work due to slow work progress as well as mistakes and errors in one's work. Thus, we believe that the conclusions drawn from our results hold and that they would not have changed significantly had a more direct measure of trust in the IT artifact been used.

## Conclusion

Past research on post-adoption has established that trust in technology is an important driver of post-adoptive behaviors but has not examined the causal pathways involved in this important relationship, resulting in the need to further knowledge in this area. Based on the model of proactive work behavior and its predictions about trust, efficacy, and proactivity, this paper has examined whether trust in technology impacts post-adoption via CSE. In doing so, this paper has produced a more refined understanding of the process by which trust impacts post-adoption. Accordingly, this study helps post-adoption research progress toward more detailed and specific explanations of how and why trust drives post-adoption. More generally, this study shows that such **beliefs about technology** as trust can impact post-adoptive behaviors via such **beliefs about the self** as CSE (see Appendix C for an alternative way of examining the relationship between trust in technology and CSE, exploring potential interaction effects in the prediction of post-adoptive behaviors). Our findings imply that trust-related research in the area of post-adoption is not yet saturated but that clearer guidance can, and should, be provided to managers in this increasingly important context.

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## Appendix A. Summary of relevant prior research on proactive work behavior

| Source | Purpose | Topic area | Definition of proactive work behavior | Construct classification | Research model | Takeaway for the present study |
|---|---|---|---|---|---|---|
| Bindl and Parker (2010) | Review and synthesis of prior work on proactive work behavior | Proactive work behavior is conceptualized generically, no specific topic area is referenced | Proactive work behavior is defined as self-directed and future-focused action in an organization | Classification of self-efficacy and such environmental factors as trust as proximal and distal causes of proactive work behaviors, respectively. Whereas proximal causes exert direct impacts on proactive work behavior, distal causes exert indirect impacts | Self-efficacy mediates the effects of such environmental factors as trust on proactive work behavior. Distal antecedents affect proactive behaviors via the proximal proactive-motivational states because the latter are closer to action and behavior | Such proximal proactive-motivational states as self-efficacy mediate the effects of such distal environmental factors as trust on proactive work behavior. In the context of the study reported here, this mediating impact of self-efficacy implies that |

| | | | | | | |
|---|---|---|---|---|---|---|
| Crant (2000) | Development of a research agenda for the study of proactive work behavior | Proactive work behavior is conceptualized generically, no specific topic area is referenced | Proactive work behavior is defined as taking initiative to improve current conditions, which implies not to passively adapt these conditions | No classification was put forth | Role breath self-efficacy directly impacts such proactive behaviors as individual innovation | computer self-efficacy may mediate the effect of trust in technology on post-adoptive IT-usage behaviors, such as deep structure usage and individual innovation |
| Frese and Fay (2001) | Development of a model of proactive work behavior | Proactive work behavior is conceptualized generically, no specific topic area is referenced | Proactive work behavior is defined as personal initiative and as self-started behavior that goes beyond assigned tasks. Highlights the self-starting nature of these behaviors | Classification of self-efficacy and environmental factors as proximal and distal causes of proactive work behaviors, respectively. Proximal causes exert direct impacts on proactive work behavior, while distal causes exert indirect impacts | Self-efficacy mediates the effects of environmental factors on proactive work behavior. Distal antecedents affect proactive behaviors via proximal proactive-motivational orientations because the latter are closer to action and behavior | |
| Grant and Ashford (2008) | Development of a framework of the general dynamics of proactive work behavior | Proactive work behavior is conceptualized generically, no specific topic area is referenced | Proactive work behavior is defined as doing things before being asked and inventing new means. Self-initiation is important in proactive behaviors | No classification was put forth | Motivational States and Efficacy mediate the impacts of the task environment on proactivity | |
| Griffin et al. (2007) | Identification of subdimensions of work role performance on the basis of proactive work behavior | Work Role Performance: Positive work behaviors in uncertain and interdependent contexts | Proactive work behavior is defined as the extent to which the individual takes self-directed action to anticipate or initiate change in the work system or work roles | No classification was put forth | Role breath self-efficacy directly impacts individual task proactivity | |
| Parker et al. (2006) | Development of a model of proactive work behavior | Proactive work behavior is conceptualized generically, no specific topic area is referenced | Proactive work behavior is defined as self-initiated and future-oriented action that aims to change and improve the situation or oneself | Classification of self-efficacy and such environmental factors as trust as proximal and distal causes of proactive work behaviors, respectively. Whereas proximal causes exert direct impacts on | Self-efficacy mediates the effects of such environmental factors as trust on proactive work behavior. Distal antecedents affect proactive behaviors via the proximal proactive-motivational states | |

| | | | | | |
|---|---|---|---|---|---|
| | | | | proactive work behavior, distal causes exert indirect impacts | because the latter are closer to action and behavior |
| Parker et al. (2010) | Development of a model of proactive motivation | Proactive Goal Pursuit | Proactive work behavior is defined as self-initiated efforts to bring about change in the work environment and/or oneself | 1. Classification of self-efficacy as a "Can do" motivational state. People engage in proactive work behaviors depending on their answers to the question "Can I do this?" 2. Classification of self-efficacy and such environmental factors as trust as proximal and distal causes of proactive work behaviors, respectively. Whereas proximal causes exert direct impacts on proactive work behavior, distal | Self-efficacy mediates the impacts of environmental factors on proactive work behavior. Distal antecedents affect proactive behaviors via the proximal proactive-motivational states because the latter are closer to action and behavior |

## Appendix B. Measurement items for principal constructs

Trust in Functionality (McKnight et al., 2002, 2011; Thatcher et al., 2011):

Thinking about how you use Excel for class assignments, to what extent do you agree or disagree with the following statements (1 = Strongly Disagree, 7 = Strongly Agree):

Func1: Excel has the functionality I need.
Func2: Excel has the features required for my tasks.
Func3: Excel has the ability to do what I want it to do.

Trust in Helpfulness (McKnight et al., 2002, 2011; Thatcher et al., 2011):

Thinking about the help offered by Excel, please evaluate the following statements (1 = Not at All True, 7 = Absolutely True):

Help1: Excel supplies my need for help through a help function.
Help2: Excel provides competent guidance (as needed) through a help function.
Help3: Excel provides whatever help I need.
Help4: Excel provides very sensible and effective advice, if needed.

Trust in Reliability (McKnight et al., 2002, 2011; Thatcher et al., 2011):

Thinking about how you use Excel to complete class assignments, to what extent do you agree or disagree with the following statements (1 = Strongly Disagree, 7 = Strongly Agree):

Reli1: Excel is a very reliable piece of software.
Reli2: Excel does not fail me.
Reli3: Excel is extremely dependable.
Reli4: Excel does not malfunction for me.

Internal Computer Self-Efficacy (Compeau and Higgins, 1995; Thatcher et al., 2008):

Thinking about using Excel, please rate whether you could complete class assignments if (1 = Not at All Confident, 7 = Totally Confident):

ICSE1: There was no one around to tell me what to do.
ICSE2: I had never used a package like it before.
ICSE3: I had just the built-in help facility for reference.

External Computer Self-Efficacy (Compeau and Higgins, 1995; Thatcher et al., 2008):
Thinking about using Excel, please rate whether you could complete class assignments if (1 = Not at All Confident, 7 = Totally Confident):

ECSE1: I could call someone to help if I got stuck.
ECSE2: Someone showed me how to do it first.
ECSE3: Someone else helped me get started.

Trying to Innovate (Ahuja and Thatcher, 2005):
Thinking about ways you use Excel, please indicate the extent to which you agree or disagree with the following statements (1 = Strongly Disagree, 7 = Strongly Agree):

Trying1: I try to find new uses of Excel.
Trying2: I try to identify new applications of Excel.
Trying3: I try to discover new uses for Excel.
Trying4: I try to use Excel in novel ways.

Deep Structure Usage (Burton-Jones and Straub, 2006):
Thinking about using different Excel features to complete a data analysis task, please evaluate the following statements (1 = Not at All True, 7 = Absolutely True):
When I use Excel, I use features that help me…

DU1: analyze the data.
DU2: derive insightful conclusions from the data.
DU3: perform calculations on my data.
DU4: compare and contrast aspects of the data.
DU5: test different assumptions in the data.

## Appendix C. Post-hoc tests of interaction effects

As an alternative way of examining the relationship between trust in technology and CSE, one could explore possible interaction effects in the prediction of post-adoptive behaviors. Trust in technology and CSE might interact because they can be considered different sources of confidence in using new technologies. In this case, we would not expect a positive, synergistic interaction between trust in technology and CSE in predicting post-adoption. Rather, we would expect a negative interaction effect. Generally, a positive, synergistic interaction means that the combined effect of two predictors is greater than the sum of their individual effects (i.e., the whole is more than the sum of its parts, Cohen et al., 2003). Such effects exist when two objects have dissimilar purposes and functions and when one is of limited value without the other. For example, Microsoft Excel has a different function than does a dataset (the former is a piece of software to store and analyze data, the latter contains data but no software components). Further, Excel is of limited value without a dataset that can be stored and analyzed (what would one do with an empty spreadsheet that contains no data?). By contrast, a negative interaction effect implies that the combined effect of two variables is less than the sum of the individual effects (i.e., the whole is less than the sum of its parts, Cohen et al., 2003). Such effects exist when two objects have similar functions. For instance, Microsoft Excel and Apache OpenOffice Calc are both examples of spreadsheet software that fulfill the same functions; they compensate for one another (much like butter and margarine, one would rarely use both at the same time). Therefore, we only need Excel or Calc but not both at the same time, implying a negative interaction.

Since, at a general level, trust in technology and CSE can both be considered sources of confidence so that they represent similar concepts, they are likely to compensate for one another. Hence, a negative interaction effect of trust in technology and CSE on post-adoptive use may be expected. To provide an initial evaluation of this notion, we conducted post hoc tests of moderation. Following Aiken and West (1991), we tested for interaction effects by specifying a hierarchical regression model. Step 1 included only the control variables, Step 2 included the control variables plus the main effects (main effects model), and Step 3 included the interaction terms in addition. As regards the interaction between trust in helpfulness and external CSE on trying to innovate, the interaction term was negative and significant, as expected ($\beta = -0.756$, $p < 0.05$). Likewise, the interaction effect of trust in helpfulness and external CSE on deep structure usage was negative and significant ($\beta = -0.904$, $p < 0.05$). For the interaction between trust in reliability and external CSE on trying to innovate, the interaction term was negative and significant ($\beta = -0.809$, $p < 0.05$) as it was for the interaction between trust in reliability and external CSE on deep structure usage ($\beta = -0.998$, $p < 0.05$). Finally, the interaction effect of trust in functionality and internal CSE on trying to innovate was in the expected direction but not significant ($\beta = -0.037$, $p > 0.05$), while the interaction effect on deep structure usage was in the expected direction and marginally significant ($\beta = -0.060$, $p < 0.10$). Overall, the evidence suggests that some aspects of trust in technology and CSE may interact in the prediction of post-adoption.

While our post hoc tests lent some initial support to possible interaction effects of trust in technology and CSE on post-adoptive use, our results should not be interpreted as conclusive. The question remains of whether an interaction effect between trust in technology and CSE is theoretically meaningful and what such an effect could mean theoretically. This questions arises because both variables are theoretically and empirically related, whereas a common assumption of moderation analysis is that the independent variable and the moderator variable are not related. If they are related, as in the case of trust in technology and CSE, the moderation effect becomes difficult to interpret. As elucidated by Sharma et al. (1981, p. 294), "if the hypothesized moderator variable turns out to be related to the criterion variable, the moderator effect is not clear because each of the independent variables can, in turn, be interpreted as a moderator. Consequently, a moderator variable in the psychometric literature is constrained to be unrelated to the criterion variable." However, the theoretical ambiguity concerning the independent/moderator variable distinction can be reduced if clarification for a specific variable being the moderator can be provided on theoretical (not empirical) grounds (Sharma et al., 1981). In the context of our study, we are not aware of any theoretical framework that could explain which variable is the independent one and which is the moderator and why. A possible moderator model of trust in technology and CSE remains theoretically unclear for the time being. Hence, more work is needed in this area, and future research could shed more light on the possibility of interaction effects between trust in technology and CSE on post-adoption.

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