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Changes in Post-Adoption Use of Information Systems

Vanesa Tennant
University of Canterbury, vanesa.tennant@canterbury.ac.nz

Annette M. Mills
University of Canterbury, annette.mills@canterbury.ac.nz

Wynne W. Chin
University of Houston, wchin@uh.edu

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Vanesa Tennant
Department of Accounting and
Information Systems
University of Canterbury
vanesa.tennant@canterbury.ac.nz

Annette M. Mills
Department of Accounting and
Information Systems
University of Canterbury
annette.mills@canterbury.ac.nz

Wynne W. Chin
Department of Decision and Information Sciences
C.T. Bauer College of Business
University of Houston
wchin@uh.edu

Abstract

As organizations continue to invest heavily in Information Systems (IS) to support business processes, the under-utilization of such IS is a key concern that challenges efforts to exploit its benefits. What is most desirable is for users to engage in forms of deep use that effectively leverage the features of the IS for work tasks. But, too often users minimize their interactions with the IS. Yet for users how they use an IS often changes over time to become progressively deeper as the IS is embedded more in the performance of various tasks. To understand how IS use changes over time, this research-in-progress paper draws on principles of evolutionary change, that is, Generalized Darwinism, and reports the findings from a series of case studies.

Keywords: Post-adoption, Use, Evolution, Change, Trigger, Enabler

Introduction

Organizations today spend millions of dollars on Information Systems (IS). To gain returns on investments, researchers have highlighted that while people tend to emphasize the technology (not its use) in allocating funds, attention, and measures, it is critical to acknowledge that "technology per se can't increase or decrease the productivity of workers' performance", but instead "only use of it can" (Orlikowski, 2000, p. 425).

Individual use of IS ranges from limited interactions (to the minimum extent possible) to leveraging more fully, the features of an IS to support work tasks (Loraas & Diaz, 2009). Even in mandatory settings, although individuals have no choice in their use of the IS, it is often optional how they use, adopt, extend, expand and in essence leverage the IS features for value enhancement (Jasperson, Carter, & Zmud, 2005; Loraas & Diaz, 2009). What is most desirable is for users to proactively revise their IS use by applying best-suited features. But, too often users engage in surface-level use minimising their interactions with the IS. There is therefore concern that IS under-utilization by individuals (Jasperson et al., 2005) is hindering efforts to exploit its benefits and infuse it into workplace practices.

Thus given the significance of IS and its under-utilization, it is paramount to understand the intricacies of post-adoption usage, so as leverage the effective utilization of IS in organizations (Saeed & Abdinnour-Helm, 2008). Failure to examine what actually happens during the use of IS may further result in researchers and practitioners overlooking key insights into how users interact with the IS and the resulting outcomes (Orlikowski, 2000). To obtain a deeper understanding of continued and deeper use of IS, it is critical to understand the changing nature of individual IS use (Kim & Malhotra, 2005), the enablers, triggers, and the consequences.

This research-in-progress paper reports on a study aimed at investigating how individual use of IS changes over time. The current study assumes that IS 'use' as a behavior can change, so the aim of this research is to provide a comprehensive yet parsimonious explanation of how post-adoption IS use changes over time. To understand how use changes, an evolutionary perspective on change in how IS is used to support work routines will be used, with the aim of this study being to investigate (i) how does an individuals' use of IS change over time, (ii) the key factors that trigger and enable change in use, and (iii) the outcome of change.

From a theoretical perspective, the results are expected to add to the IS literature on post-adoption use providing insights into how IS use changes over time, and the triggers and enablers that impact change. From a practical perspective, the findings are also expected to shed light on opportunities for organizations to foster changes in IS use by understanding the rationale behind user actions and implementing strategies that encourage users to explore, adopt and extend their use of the system.

Literature Review

Change is a part of life; it is "a phenomenon of time. It is the way people talk about the event in which something appears to become, or turn into, something else, where the 'something else' is seen as a result or outcome" (Ford & Ford, 1994, p. 759). Thus in the context of IS use it is likely that use will change over time such that how an IS is used today may not be the same as how it was used in the past or may be used in the future. This literature review will therefore examine post-adoption use and the relevance of a change focus, followed by the role of IS use in work routines, and the evolutionary framework that underpins this study.

Post-Adoption Use: Change Focus

Use of Information Systems is 'critically important', and is arguably the "most crucial variable in the repertoire of empirical and behavioral studies pinpointed at the intersection of computing and human beings" (Straub & del Guidice, 2012, p. ii). The concept of system use has a long history in the IS field (Burton-Jones & Straub, 2006), however post-adoption use has received relatively little attention (Dewett, Whittier, & Williams, 2007; Jasperson et al., 2005). Post-adoption use can be defined as a

'myriad of feature adoption decisions, feature use behaviours, and feature extension behaviours made by an individual user after an IT application has been installed, made accessible to the user, and applied by the user in accomplishing his/her work activities' (Jasperson et al., 2005).

Evidence suggests that most users under-utilize the 'functional potential' of IS in organizations, operating at low levels of feature use and rarely extending their use of the available features (Jasperson et al., 2005). A resonating question is: 'How can organizations leverage IS use among employees to better realize the benefits of IS?' Utilization is therefore not a simple matter of 'yes' or 'no', as while users may not have the opportunity to choose the system they use (Lamb & Kling, 2003), there is some choice in the extent of use, i.e. how they interact with it (Marler, Fisher, & Ke, 2009).

Post-adoption use of IS varies from surface-level use to deeper levels of use, where deep use makes greater use of the features of an IS to support their work (Schwarz, 2003). While research into deep use behaviors (such as infusion) are instrumental in advancing our understanding, the emphasis has been on 'what factors' are important (Shaw & Jarvenpaa, 1997) as opposed to "how" they shape outcomes (Newman & Zhao, 2008).

Drawing from work on appropriation (DeSanctis & Poole, 1994) and enactment (Orlikowski, 1996) there is continuous adjustments and improvisations in use, as users actively select how 'technology' structures are applied. Both appropriation and adaptation construe selective changes in the use of IS (Barki, Titah, & Boffo, 2007) reaffirming that users are not 'passive takers' of technology, but active agents that shape their use of the IS (Sun & Zhang, 2006). Hence an infinite number and variety of use-oriented behaviors are likely as users selectively apply certain features, and make modifications to how and for what purpose they use the system.

A change focus is valuable as the features used by individuals change over time, and it is the "specific features in use at any point in time that influence and determine work outcomes" (Jasperson et al., 2005, p. 529). Yet few studies have empirically examined change in use, even though research has found that feature selection varies over time (Al-Natour & Benbasat, 2009). Understanding change in use, that is, how individuals revise their use of the IS features, is paramount in advancing the post-adoption agenda (Sun, 2012).

To better appreciate how changes in use come about and what is important, this study draws on an 'evolutionary perspective' to understand and explain the evolving nature of individuals' IS use as they perform work routines.

The next section of the literature review will discuss the evolutionary framework used that is, 'Generalized Darwinism' and how it can be applied within the context of IS use in work routines.

Evolutionary Change: Generalized Darwinism

Evolutionary change entails a continuous cycle of variation, selection and retention among entities in a designated population (Van de Ven & Poole, 1995). The triumvirate of variation, selection and retention mechanisms of Darwin's Biological Evolution theory has also been applied to non-biological disciplines to understand the change process of a phenomenon (Devezas, 2005). Scholars have recognized the value of using evolutionary theory to guide their work (Goetz & Shackelford, 2006), with the theory being used to describe more than 95% of organizational changes (Burke, 2010). Likewise, this study will utilize an evolutionary perspective to understand change in use.

Geoffrey Hodgson and associates proposed a meta-theoretical framework, that is, "Generalized Darwinism", for describing and understanding change by applying a generalization of the basic Darwinian concepts of variation, selection and retention (or replication/inheritance) to the socio-economic domain (Aldrich et al., 2008; Hodgson & Knudsen, 2006). Generalized Darwinism argues that Darwin's theory of evolution can be applied to all evolutionary processes, that is, the "broad class of systems and populations of entities, including all feasible manifestations of development and change" (Hodgson & Knudsen, 2006). With this in mind, Generalist Darwinists further argue that "under some minimal conditions" ongoing change in systems is inevitably Darwinian, as it must involve Darwinian principles (i.e. variation, selection, retention).

Variation is an essential part of the process, and is often dubbed the 'raw material for evolution, as if there is no variation, then there are no alternatives to select from (Mayr, 1991). In a general sense, applied to non-biological domains, variation can be defined as "any departure from routine or tradition" (Aldrich, 1999, p. 22), or "where individuals or groups of them generate a set of ideas on how to approach old problems in novel ways or to tackle relatively new challenges" (Zollo & Winter, 2002, p. 343) or the "generation of new ways of doing things" (Furneaux, 2012). Selection refers to forces that differentially select or eliminate certain types of variations, while in retention, selected variations are then preserved, duplicated, or otherwise reproduced (Aldrich, 1999).

Generalist Darwinists argue that the Darwinian framework has a high degree of generality, which provides a meta-theoretical structure of over-arching principles that can be used to frame and explain change (Hodgson & Knudsen, 2006). Although the abstract principles (i.e. variation, selection and retention) do not themselves provide full or complete answers regarding change, "nevertheless they must be honoured, for otherwise the explanation of evolution will be inadequate" (Aldrich, et al., 2008).

Thus using Generalized Darwinism as a meta-theory, along with complementary theories and key themes from IS research, this study will use the generalized concepts of variation, selection to understand and examine change in IS use, that is, the variations that occur in an individual's use of the IS, the triggers/enablers of the variations and the mechanisms guiding selection and retention. The outcome of 'change' in IS use is also of examined.

Studying IS use in Work Routines

All theories of change are concerned with change over time. In applying Generalized Darwinism to this research, it is critical to discuss what is the fundamental element that actually changes (or evolves). This section will therefore discuss the concept of routines, and how this relates to changes in how an IS is used to support ones' work routines.

It is widely accepted that routines is a collective rather than an individual-level phenomena (Nelson & Winter, 1982), however there have been calls for understanding the role of individuals in routines (that is, the micro-foundation of routines) (Felin, Foss, Heimeriks, & Madsen, 2012).

Definitions of organizational routines involve multiple actors (or individuals) and emphasize the interdependence of their actions (Breslin, 2011; Felin & Foss, 2004). For example, an often cited definition refers to routines as 'repetitive, recognizable patterns of interdependent actions, carried out by multiple actors' (Feldman & Pentland, 2003, p. 95).

With regards to multiple participants, Feldman and Pentland (2003) note that organizational routines entail "coordination of multiple organization participants", and are "not just individual routines that are performed in the context of an organization". Given that multiple individuals are involved this introduces diversity in the information, interpretive schemes, and goals of the participants (Feldman & Pentland, 2003). Definitions of routine also make mention of 'interdependent actions' thus individuals must adjust to each other's actions, such that individuals cannot just do as they wish (Feldman & Pentland, 2003). However, by the same token, due to the improvisatory nature of performing organizational routines (Pentland & Feldman, 2005), individuals do play a role in determining their actions and the extent to which they partake in various processes (Feldman & Pentland, 2003). Given that IS is often used to support the individual enactment of work processes (routines) even in mandated use settings (excluding settings where use is strictly chauffeured) it is likely that how they use the IS to support their work can change.

Understanding the role of individuals in routines resonates in the call for a micro-foundation outlook, which argues that routines (although a collective phenomena) should be grounded in explanatory mechanisms that involve individuals' action, interaction, endowments, intentions, desires, expectations, goals and motivation (Felin & Foss, 2004). Hence individuals (in organizations) are more than just a 'cog in the wheel', but have a variety of a priori predispositions, experiences, characteristics and abilities (Felin & Foss, 2004) that impact their work and their use of IS to support their work routines.

Feldman and Pentland (2003) developed an 'influential theoretical account' (Parmigiani & Howard-Grenville, 2011) of routines that involves two elements: an 'ostensive' aspect and a 'performative' aspect. The ostensive aspect refers to the description or abstract of the routine, that is, the routine in 'practice';

while the performative aspect is the actual enactment of the routine, that is, performance by specific individuals at specific times in specific places (Feldman & Pentland, 2003).

This research focuses on the 'performative' element of the routine which is reflected in an individuals' use of the IS - the emphasis is on their enactment in carrying out organizational routines. In organizations, individuals will typically select 'a particular routine for each task' and subsequently 'enact the routine', which results in a 'set of actions' (Breslin, 2011). Since the focus is on individual work routines, it is the individual actions in relation to their use of the IS that are examined, where actions refer to 'the things that actors do' and the processes in accomplishing organizational tasks (Pentland, Feldman, Becker, & Liu, 2012). Organizational routines are accomplished by individuals using tools, in this case the IS, to carry out tasks (Bapuji, Hora, & Saeed, 2012). Since performances enact the ostensive aspect of the routine, a focus of the performative aspect emphasizes the role of individual in 'creating and shaping' routines, and the importance of agency and subjectivity in the use of IS. Thus the agenda regarding a micro-foundation view of routines posits that it is essential to understand the micro entities that make up the 'collective', which includes the individuals, processes and interactions in the organizations (Felin, Foss, Heimeriks, & Madsen, 2012). An individual's use of an IS in performing their routines underscores the role of human agency, as users can apply the IS minimally, invoke it individually or collaboratively, and improvise, innovate, and change their work routines over time (Boudreau & Robey, 2005; Orlikowski, 1996). Thus focusing on the performative aspect of the routine, this study seeks to understand how changes in IS use come about as individuals perform in their work routines, and the factors that impact such change.

This study assumes that IS 'use' as an action may change over time. Hence, how an IS is used today may not be the same as how it was used 'yesterday' or how it will (or can) be used in the future, with such use being shaped and reshaped by elements such as change in user goals, environmental conditions, and the technology (Beaudry & Pinsonneault, 2005). Generalized Darwinism is therefore used in this study to understand and explain how individuals' use of an IS in terms of the performative routine, changes over time.

Research Method

This research uses a mixed-method approach to examine change in use. Phase 1 is exploratory in nature and applies a qualitative mode of enquiry, while Phase 2 (forthcoming) is confirmatory and uses a quantitative mode of enquiry. This research-in-progress paper will report the findings from Phase 1 of the project.

Phase 1 uses case studies to investigate how use changes within a 'real life' context. This approach is particularly appropriate for research questions related to 'why 'and 'how' (Yin, 2002). Data was collected primarily through semi-structured interviews; supporting materials (e.g. training and process documents) were also reviewed.

Users of an IS often include basic, intermediate and advanced users, with these categories of users tending to differ in the way they use the features of an IS (Munro, Huff, Marcolin, & Compeau, 1997). For example, advanced users tend to have a more than an encyclopedic grasp of the features and capabilities of the IS, and find new or unusual and especially effective ways of using the IS, while basic users tend to use a narrow set of IS features in performing work tasks (Munro et al, 1997). To ensure a cross section of user participants (i.e. basic, intermediate and advanced users), purposeful sampling was used to select the participating organizations, the focal system and the users that were interviewed. Definitions for each user category were adapted from Munro et al. (1997) and provided to organizational contacts to identify participants. Complex IS (e.g. ERP, CRM systems) were targeted in this study as these afford greater opportunities for use to vary.

For the user interviews, the Critical Incident Technique (CIT) (Flanagan, 1954) was used to guide the data collection as it facilitates the investigation of significant occurrences (e.g. events, incidents, processes) identified by the respondent, the way they are managed, and the outcomes. Users were asked to relate incidents or events that describe changes from their initial use to their current use. As respondents related their 'journey' of how their use had changed (or not) over time, probing questions were asked to understand the 'how' and 'why' of such changes. Interviews were audio-recorded and fully transcribed.

Data analysis included exploration of the data by reading through the transcripts, coding the data by segmenting and labeling the text and extracting key themes, then connecting the themes (Miles & Huberman, 1994).

Qualitative data was collected from three (3) large organizations in New Zealand. The first organization is a large supplier of fertilizer products and implemented a Customer Relationship Management System to manage their growing customer base and improve the quality of service provided. In total, 19 users were interviewed, 3 basic, 7 intermediate, and 9 advanced users. The second company focuses on radio communications, providing computerized data and voice communication products and services, including automated fleet management system and mobile data solutions for the transportation industry. They implemented a Collaboration System to enable greater communication, document sharing and management, and other forms of collaborative work; 11 users were interviewed: 2 basic, 5 intermediate, and 4 advanced users. The third organization is a large energy generator, and had implemented an Information Technology Service Management to integrate and automate service management and quality control of the IT services that the firm depends on. Nine (9) users were interviewed: 3 basic, 2 intermediate, and 4 advanced users. In total, 39 users were interviewed.

Results

Using the Generalized Darwinism as an overarching framework and findings from the qualitative study, this section discusses the three elements of change (i.e. variation, selection and retention) and the triggers and enablers of such change.

Variation

Variation is defined as change from current routines (Aldrich, 1999). Variation, in this context introduces alternatives in how the IS can be used to accomplish work routines, and represents a departure from how one currently performs a routine (i.e. actions) using an IS.

The findings showed that actions situated within variation included 'trying new features', 'refining use of current features', 'substituting features', and 'using features in new or innovative ways'. Trying new features (Sun, 2012) has a feature exploration focus and involves the use of features that have not been used before. A similar concept in prior research is feature exploration (Ke, Tan, Sia, & Wei, 2013). Refining use of current features involves 'fine-tuning' and revising use of already used features to improve efficiency and/or outcomes. This is similar to refinement (Levinthal & March, 1981) and exploitation (March, 1991). Substituting features refers to replacing currently used feature(s) with other features with similar functions (Sun, 2012). Lastly, innovating with the IS relates to finding new uses or especially innovative (i.e. very unusual) ways of using IS features (Ahuja & Thatcher, 2005). Altogether, considering these varieties of use, this study defines variations in how an IS is used, as experiments with different ways of using the System to support one's work.

Enablers and Triggers of Changes in Use

In this study, the findings showed that the factors enabled and/or triggering variations included intrinsic motivation, extrinsic motivation, learning from peers, IS support (e.g. training), and domain-related knowledge.

Motivation was a recurring theme across all three organizations, that is, both intrinsic and extrinsic motivation. Intrinsic motivation can be defined as the "doing of an activity for inherent satisfaction rather than for some separable consequence" (Ryan & Deci, 2000) and was a particularly salient enabler. The study showed that intrinsic motivation was a key factor that helps determine change and depth of use of a system, particularly when extending one's use of the IS is voluntary. Advanced users in particular were more self-driven in their learning, seeking out new and different ways to use the system in their work and to overcome obstacles to use, which are characteristic of persons who are intrinsically motivated. These observations are consistent with prior research which suggests that intrinsic motivation may be manifest in different types of intrinsic motivation, such as IM-to-know, IM-to-accomplish and IM-to-experience

stimulation (Vallerand, 1997), and that these sub-types may be positively associated with post-adoption use such as routine use and innovative use (Li, Hsieh, & Rai, 2013).

Extrinsic motivation on the other hand refers to doing an activity for some separable outcome, such as its instrumental value (Ryan & Deci, 2000). This has been shown to impact use behaviors such as innovative use and routine use (Li et al., 2013). In this study, extrinsic motivation was evident in the form of mandated use or directives from management (e.g. to use specific features of the IS). These served as external regulators of change and triggered change in use. There was also evidence of these regulations being internalized, where persons came to recognize the instrumental value of using the system to support their work (e.g. integrated motivation) (Ryan & Deci, 2000).

Learning from peers was another key enabler of changes in use. The findings suggest that peer learning can improve individuals' use of an IS and enrich ones' skills and ability to further leverage the features of the IS. Prior research suggests that support from organizational peers is important in facilitating use (Sykes, Venkatesh, & Gosain, 2009). The case studies suggested that for task-specific uses and improvements, peers were one of the key sources of ideas and encouragers of changes in use (Amabile, 1996).

Another important enabler was having a helpful and responsive IS support team (or individual) to guide individuals' use, handle queries on how to use IS to perform work task(s) and provide tips on feature use. This constitutes 'facilitating conditions', which includes the availability of training and support for the use of the IS (Amabile, 1996; Karahanna & Straub, 1999). In organizations that had formal on-going training, this facilitated adaptations and helped shape and reshape individuals' use of the IS, especially if the training was considered 'good quality'. While on-going training enabled changes in use, users also spoke of inadequate training which hindered their use and thus change in use.

Domain-related knowledge including knowledge of the features of the IS and work processes were also instrumental in enabling changes in IS use (Deng & Chi, 2012), with prior research showing that domain-related knowledge is key in changing behavior (Jones, Zmud, & Clark Jr, 2008). At the same time, insufficient knowledge of the IS features available and how these can be used to support ones' work routines as well as limited understanding of work processes were shown to inhibit change.

Selection and Retention

Variations provide the raw materials for selective systems to operate on. Selection provides the basis for a repertoire of features, which individuals then select from. Selection emphasizes the "differential elimination of certain types of variations" in which some variants are chosen and others are rejected, while retention represents the case where "selected variants are preserved, duplicated or otherwise reproduced" (Aldrich, 1999). In this study the process of selection and retention are examined together (rather than as distinct elements) to provide insights into what causes individuals to 'turn a variation into part of their story' about how they perform their work routines (Feldman & Pentland, 2003).

The case study findings showed that individuals' choices were governed by selectively applying features that were considered useful, that is they leveraged the synergies offered by the fit between the task and IS features that seemed likely to produce the desired outcome (e.g. performance improvement). The study further found that users retained feature(s) for continued use (i.e. retention) if they were satisfied with how it performed in achieving work goals (e.g. improving performance). The case studies also suggested that the greater one's perception of the usefulness of the variation and their satisfaction with it, the greater the likelihood of these being included in one's work routine, resulting in greater (overall) change in IS use.

Outcome of Change

As noted earlier, retention within routines occurs when an individual turns a variation into part of the story about how they accomplish a work task (or process) (Feldman & Pentland, 2003), which generates change. As changes occur over time, the case findings revealed that retained variants resulted in more deeply ingrained use behaviors. For example, it was evident from the cases that retention resulted in individuals using more of the IS features in order to accommodate a more comprehensive set of work

tasks (i.e. extended use), using the IS to accomplish work tasks that were not feasible or recognized prior to the application of the IS within one's work system (i.e. emergent use), and/or using the IS to establish or enhance linkages among tasks (i.e. integrative use) (Saga & Zmud, 1994). In essence, as retention occurred and users came to use previously unused features, already-used features at higher levels of use, or different aspects of the IS in new or innovative ways as part of their routine in enacting organizational tasks, their use of the IS deepened and became more embedded (infused) in their work routine (Jones, Sundaram, & Chin, 2002; Sundaram, Schwarz, Jones, & Chin, 2007).

Next Stage

For Phase 2 (forthcoming), findings from the case studies together with key themes from the evolutionary perspective of Generalised Darwinism, supporting theories (e.g. motivation theory) and insights from IS research will be used to frame the research model for further analysis. The model will then be tested using data from a field survey and analysed using the PLS approach to structural equation modelling. Figure 1 provides a high-level representation of the research framework that will be evaluated in Phase 2 of the study.
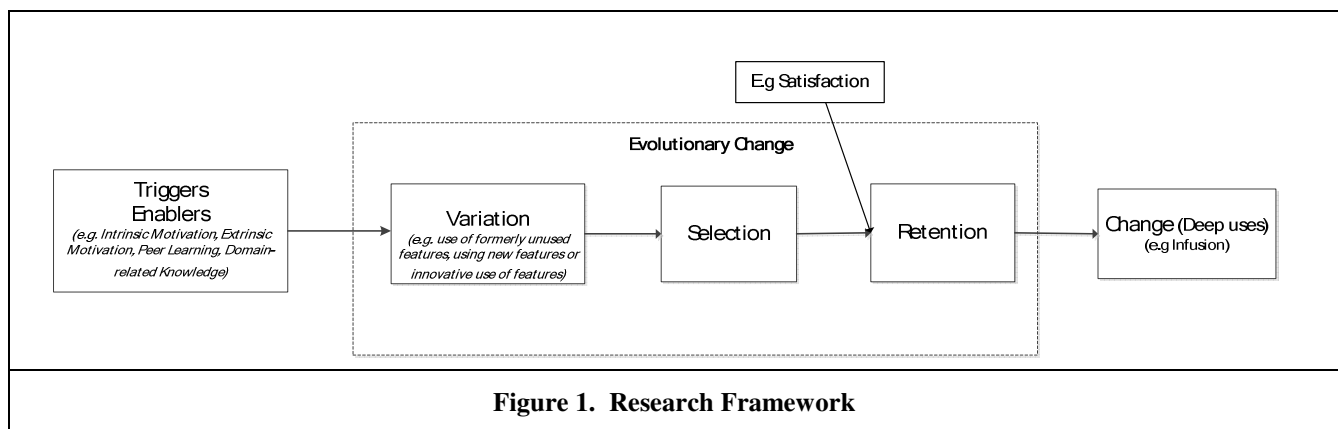

Figure 1. Research Framework

Discussion and Conclusion

"Recognizing that the possibility to change technology structures is inherent in every use of technology allows us to understand when, where, how and why people choose to reinforce, ignore, enhance, undermine, change, work around or replacing their existing structures of technology use"(Orlikowski, 2000, p. 424). The aim of this research is to provide a comprehensive yet parsimonious explanation of how post-adoption IS use changes over time using an evolutionary framework. It therefore applies a Generalized Darwinism using the tripartite lens of variation, selection and retention to examine changes in IS use. In general, the changes made at the individual level and by extension the organization as a collective, resulted in deeper uses of the IS for enhancing work practices, performance and outcomes. The findings are instrumental for identifying mechanisms that can encourage deeper post-adoption use of IS by individuals.

Variation is often dubbed the 'raw material' for evolution, and is instrumental in the evolution process, as without a rich variation, selection processes have no material to work on. The case findings revealed that variations occurred as individuals experimented with different ways of using the System to support their work. This resulted in a range of post-adoption behaviors such as use of formerly unused features, modifying use of currently used features (such as improvement or refinement in existing), use of alternate features to perform a task (i.e. substitution of features), or finding new or innovative ways of using the IS. These findings corroborate prior research which suggests that to achieve success in IS use, it is pivotal that users selectively appropriate IS features (Ke et al., 2013) and revise their use of the IS (Sun, 2012),

In this study, the factors that factors that enabled and/or triggered variations included intrinsic motivation, extrinsic motivation, learning from peers, IS support (e.g. training), and domain-related knowledge.

Intrinsic motivation was particularly salient. The findings showed that compared with basic users, more advanced users tended to be intrinsically motivated to use the IS in new and different ways, seeking ways to overcome obstacles to use, and engaging in deeper uses of the IS. Intrinsically motivated individuals are more likely to also expend energy exploring the IS (Cooper & Jayatilaka, 2006). This suggests that whether the overall setting is one that mandates IS use (or not) since performing variations is most often a voluntary behavior, intrinsic motivation may be key to encouraging persons to use their initiative to engage in actions geared at creating variations. On the other hand, while external motivators such as organizational directives can encourage variations that are specified by management, they may not promote the type of user-driven engagement that leads to deeper uses of the IS (e.g. using formerly unused features, using current features in a novel or innovative manner, and integrating the IS with other technologies to 'maximize the technology').

Learning (whether through formal IS support or informal peer learning) played a role in triggering and enabling variations. Training (especially on-going training), for example, is an important post-implementation intervention, yet researchers and practitioners often overlook its importance (Jasperson et al, 2005). Peer learning is also important in facilitating use, and has been shown to have a strong impact in the initial stages after adoption and in the advanced stages of IS usage (Saeed & Abdinnour, 2011). As individuals' use of an IS evolve, peers (colleague or subordinate) are instrumental as a typical form of help in navigating the IS (Bullen & Bennett, 1991). Thus, it is important for managers to continue to maintain appropriate resources (e.g. IT support & training) in the post-adoption stage that will enable variations, and to create and/or promote an environment that promotes and facilitates learning from peers. Knowledge of the IS features was another important factor in facilitating variations, with prior research showing that as users' software understanding increases, the assimilation of its features also increases (Jones et al., 2008).

Findings from the case studies suggested that variations are more likely to be retained (as exhibited through continued use of the variant), when users are satisfied with variations (Bhattacherjee, 2001). Further, the greater the likelihood of retention the more likely the variation would be incorporated into one's routine, leading to changes in IS use. For such changes to come about, however, it is important for users to have opportunities to experiment with and try different ways to use the IS in their work routines. Over this time, some variations may be deemed unsatisfactory (e.g. they do not meet work goals or require too much effort to maintain), while others are incorporated into the work routine. This suggests that managers will need to balance the need for efficiency with the gains that can be made through experimentation to gain longer term benefits from increased use of the IS.

Results also revealed that retention was positively associated with deep uses of the IS, such as extended, integrative and emergent use. Indeed, prior research suggested that these three (3) use behaviors are instrumental in leveraging the full potential, that is, infusing the IS into one's work practice (Saga & Zmud, 1994). This is an important finding as it suggests that encouraging changes in use (via retention of useful variants) are key to addressing the problem of under-utilization. Hence it is important to understand that factors that facilitate variations in IS use and by extension selection and retention, as a means to promote deep use forms such as infusion.

Finally, there are some limitations in the study design that should be noted. In particular, it would be ideal to examine changes in post-adoption use in a longitudinal study, but this was not feasible due to time constraints. However, it should be noted that in the research design for both the interview and the survey phases, individuals are asked to 'think back' on how their IS use has changed over time in an attempt to capture change retrospectively. Also, by capturing data from different user types (i.e. from basic to advanced users), this also allowed the capture of varying perspectives at different stages of the 'IS use journey'. Collectively these enabled reflection on key aspects of change over time even if these were not captured directly through longitudinal study. At the same time, it is recognized that elements such as poor recall, and respondent bias may impact findings. Other elements of the research design that may also impact the findings include constraints related to purposeful selection of the participating firms, focal systems and interview participants, which was aimed at uncovering the phenomenon, and may therefore not be representative of the wide population of organizational contexts, systems and users.

In summary, this research responds to calls that "urge researchers to develop and apply richer and more complex research models in examining the variation within and across individuals' post-adoptive behavior" (Jasperson et al, 2005, p. 543). It seeks to understand changes in use using Generalized Darwinism as a meta-theory, supported by complementary theories and prior research on IS use. Although the factors examined in this study are not exhaustive, the findings provide useful insights that further our understanding of post-adoption IS use, in particular the mechanisms by which IS use changes (and can be changed) over time.

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