MISQ Research Curation on IS Use

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Information systems (IS) use is among the most central constructs in the IS discipline (Straub and del Guidice 2012). It is reported to be the most widely-studied construct in our field (Cordoba et al. 2012), and it is certainly one of the most consequential, for the nature, modalities and extents of information systems use significantly impact outcomes at individual, group, organization, network, society, and country levels.

1. Focus of the Research Curation

This curation focuses on research on IS use published in *MISQ*. IS use refers to an actor's employment of an information system to perform an activity, where an actor refers to the individual, group, organization, or other collective using the system (Burton-Jones and Gallivan 2007). We found 98 articles on IS use published in *MISQ* from the journal's inception through to 3/2017, inclusive.

We faced two main challenges creating this curation. First, authors tend to use the word "use" in many ways in an article other than as a construct (e.g., "we *used* theory x"). Further complicating matters is the fact that authors also use other concepts to refer to use (e.g., adopt, appropriate). Second, almost all effects of information systems depend somewhat on use, so at the extreme, almost every *MISQ* article touches on use, at least indirectly. These challenges meant that we had to be creative in searching for articles, finding all relevant ones, and summarizing them meaningfully.

We used two strategies to address these challenges. First, we distinguished between two time periods, an older period (1977-1999) and a contemporary one (2000-2017). Because scientific ideas naturally accumulate and evolve, we found that rather than reviewing all studies in equal depth, it was more instructive to focus in depth on the contemporary set while reviewing the older set to understand where newer ideas originated and to keep an eye out for older ideas still relevant today. The two periods were split at the year 2000 partly as a natural mid-point between the two periods and partly because it was around that time that more in-depth studies of IS use began to appear (Majchrzak et al. 2000). Such in-depth studies subsequently became more common and led to significant progress in how we conceptualize and study IS use and its effects (as noted below).

Second, we used a broad set of search terms, particularly for the contemporary articles. For the older articles, our search terms were: use, utilize, usage, and utilization. For the contemporary articles, our search terms were: use, utilize, usage, utilization, appropriation, adapt, assimilation, infusion, routinization, implementation, adoption, diffusion, acceptance, continuance, addiction, and trying. Even though some of these keywords do not appear to relate strongly to use, we included them because we were aware of research on IS use that used these terms and we wanted to find all relevant articles. We manually examined the full text of all the articles we retrieved and engaged in several rounds of coding, leveraging our varied backgrounds to triangulate on the most relevant articles on IS use.

Given the large number of studies we retrieved, we necessarily had to exclude some very interesting papers. We used two main criteria for exclusion. First, we excluded articles that did not study actual use of IS, and instead focused purely on users' intentions, attitudes, or beliefs, or on behaviors related to but different from use, such as 'trying to innovate' (e.g., Ahuja and Thatcher 2005). This involved excluding papers motivated by the importance of IS use, but which only studied intentions

to use, as in some Technology Acceptance Model (TAM) papers. However, we still included many TAM studies because IS use is its dependent variable (Davis 1989). Second, we excluded articles that focused on forms of IS misuse, abuse, and addiction (e.g., Turel et al. 2011). While we included some of these concepts in our search string to be sure we did not miss relevant articles, when we then reviewed the articles we retrieved, we concluded that while these constructs were related to use, they are nevertheless fundamentally different from it, with different antecedents, processes and outcomes, thus, requiring a separate analysis. For borderline papers, we used our collective judgment to include or exclude them on an individual basis. For instance, while we excluded papers on misuse, we included one award-winning paper on resistance (Lapointe and Rivard 2005) because we felt that particular paper provided an important perspective on IS use.

Third, we split the articles into three subsets (98 articles in total), each one summarized differently:

1. *Older articles that contributed to our historical understanding of IS use* (see Table 1). This subset includes **20** articles that have proven important (e.g., through citations) or that we believe will prove important in the long run (e.g., because of the originality of their ideas). For each article, we summarize its relevance. We did not include *all* older articles on use in this subset because our aim is to highlight the most important ones.
2. *Contemporary articles that contributed to our understandings of IS use* (see Table 2). This subset highlights **28** articles that contributed to a deeper understanding of IS use itself. That is, rather than take the IS use construct as given (Straub and del Guidice 2012), these articles scrutinized it in depth. We offer detailed summaries of these articles.
3. *Additional contemporary articles that studied IS use* (see Table 3). This subset highlights **50** articles that have contributed towards our understanding of use through studying its relationship with other antecedents or consequences but with less focus on use itself (relative to those in the second set of articles). We summarize these articles briefly.

2. Progression of Research in *MISQ*

MISQ publications on IS use show conceptual stability as well as both revolutionary change and evolutionary change. The publications show stability in that ideas stressed in the earliest articles remain accepted today. For instance, the two earliest studies on IS use in *MISQ* (Hamilton and Chervany 1981; Srinivasan 1985) both stressed the importance and complexity of IS use, given that it is the lynchpin through which systems have their effects. These themes of importance and complexity remain emphasized today (Bayerl et al. 2016; Schmitz et al. 2016). Another stable theme has been that IS use is ultimately a behavior or an activity (Compeau et al. 1999; Srinivasan 1985). While later papers added to this view (as noted below), the behavioral actions or the 'doings' of use are still considered of central importance (Ortiz de Guinea and Webster 2014, Gaskin et al. 2014).

The main revolutionary change involved the development of a robust theory of IT acceptance, bookended by Davis (1989) and Venkatesh et al. (2003), two of the most cited articles in the IS discipline. It is hard to overstate the importance and influence of that work across many fields (e.g., Davis 1989 currently has over 36,000 citations on Google Scholar). As would be expected, the level of conceptual and empirical rigor required to advance this stream became extremely high (see, e.g., Kim 2009), but advances still continue (Venkatesh et al. 2012). The maturation of research on IT acceptance also motivated a switch in focus to what happens after acceptance, often called post adoptive use (Jasperson et al. 2005). Whereas IT acceptance research often conceptualized IS use as a dependent variable only, research on post-adoptive use often examines IS use as part of an ongoing process with the aim of understanding how it is shaped by and in turn shapes a variety of other phenomena at multiple levels of analysis (Jasperson et al. 2005, Burton-Jones and Gallivan 2007, Nan 2011, Gaskin et al. 2014).

The main evolutionary change has involved the gradual increase in sophistication with which researchers define, theorize, and empirically account for the nature of IS use. For many years, researchers treated IS use quite simply (Straub and del Guidice 2012), defining it as a behavior alone (Compeau et al. 1999; Srinivasan 1985). This view gradually gave way to a richer view encompassing users' cognition, emotion, *and* behavior in use (Burton-Jones and Gallivan 2007) and researchers began to consider each of its elements more closely (e.g., users, features, tasks, and time). As Subramani (2004) noted, the behavioral view alone was simply too descriptive and incomplete.

This trend of growing sophistication is evident in the progression of research at the individual level (Bhattacherjee and Premkumar 2004; Goodhue and Thompson 1995; Ortiz de Guinea and Webster 2014), group level (Bartelt and Dennis 2014; Dennis 1996; Sarker and Valacich 2010), organizational level (Iyengar et al. 2015; Massetti and Zmud 1996; Rai et al. 2012), and across levels (Burton-Jones and Gallivan 2007; Lapointe and Rivard 2005; Maruping and Magni 2015). This trend has also been supported by innovative conceptual studies (Barrett et al. 2013; Jasperson et al. 2005; Kappos and Rivard 2008; Ortiz de Guinea and Markus 2009), in-depth case studies (Beaudry and Pinsonneault 2005; da Cunha 2013; Leonardi 2013; Majchrzak et al. 2000; Stein et al. 2015), and new methods (Gaskin et al. 2014; Nan 2011).

Summing up the progression of research on IS use in *MISQ*, it could be said that while interest in the complexity of use has continued through the decades, researchers have gradually devised ways to account for that complexity in both their theoretical and empirical work. They can account for it with theories and methods that are sensitive to longitudinal, multilevel, and multifactorial contexts rather than reducing the reality of IS use into cross-sectional, single-level, and single-theory thinking.

3. Thematic Advances in Knowledge

The first major thematic advance involved the application, refinement, and integration of various social psychological explanations of IT acceptance (Bandura 1977; Fishbein and Ajzen 1975; Triandis 1971). This was a particularly strong theme in the 1990s and early 2000s, spurred on from Davis (1989), and many of the most-cited papers in IS fall into this category. Venkatesh et al. (2003) provides the seminal treatment of this line of work.

The second major thematic advance has involved the development of theories to account for the dynamics of use, whether at a single level of analysis (e.g., at the individual, group, or organizational level) or across multiple levels. By dynamics, we mean that IS use is ill-suited to being studied in binary terms (i.e., as just present or absent). Rather, it is an activity that occupies multiple dimensions in space/time and the key is figuring out how best to capture that activity in a given study. Because of the complexity of these dynamics, researchers have not sought one unifying theory, but instead have used different theories to account for distinctive characteristics of these dynamics in a given context.

For instance, some researchers have focused on characteristics of systems in use, such as emergence (the fact that benefits from use take time to emerge) and interdependence (the fact that use of a given system may be impacted by or relate to other internal or external systems). Such ideas have been tackled using theories of adaptation and affordances at the individual and group levels (Leonardi 2013; Majchrzak et al. 2000; Nevo et al. 2016; Schmitz et al. 2016), theories of sociomateriality at the community and practice levels (Gaskin et al. 2014; Venters et al. 2014), and theories of capabilities at the organizational and plant levels (Banker et al. 2006; Gattiker and Goodhue 2005; Rai et al. 2012; Ray et al. 2005; Subramani 2004).

Meanwhile, other researchers have focused more on the human aspects of use, developing new theory to understand human coping (Beaudry and Pinsonneault 2005), emotion (Stein et al. 2015),

unconscious cognition (Bartelt and Dennis 2014; Limayem et al. 2007; Polites and Karahanna 2013), habit (Ortiz de Guinea and Markus 2009; Polites and Karahanna 2013), culture (Kappos and Rivard 2008), and manifestations of power (Oreglia and Srinivasan 2016), in IS use.

The third major thematic advance has been the development of richer measurement and methodological approaches that allow researchers to capture the complexity of the usage process more accurately and provide a clearer explanation of how IS use relates to a host of other phenomena. This is evident in the use of multiple methods (Gaskin et al. 2014; Ortiz de Guinea and Webster 2014), mediation analyses (Subramani 2004), configurational analyses (Rai et al. 2012), detailed ethnographies (da Cunha 2013), and simulations (Nan 2011).

The fourth major thematic advance has been the continuing expansion of the broader network of constructs of interest in the study of IS use (see, e.g., the studies cited in Table 3). For instance, *MISQ* articles have shown how IS use can affect a wide array of outcomes, from traditional ones such as performance (Kim et al. 2016), to many others such as individual and organizational innovativeness (Gray et al. 2011, Trantopoulos et al. 2017), learning (Leonardi, 2015), community equality (Goh et al. 2016), and national well-being (Ganju et al. 2016). *MISQ* articles have also revealed the expanding universe of antecedents that influence IS use, such as social influence and support (Sykes et al. 2009; Wang et al. 2013), institutional pressures (Chatterjee et al. 2002; Liang et al. 2007), and personality (McElroy et al. 2007), among others. Other articles have improved our understanding of how IS use is embedded in processes in practice (Davidson and Chismar 2007; Levina and Vaast 2005; Serrano and Karahanna 2016; Venters et al. 2014).

Conclusion

IS use has long been a central construct in the field. *MISQ* has published many of the seminal papers on the topic. We expect *MISQ* will continue to take a leadership role in publishing research on IS use. Through the pages of *MISQ*, we have learned the importance and complexity of IS use, how to address these challenges in our research, and seen clues for how to develop these ideas further in the future.

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Table 1: Important Historical Articles that Contributed to our Understandings of IS Use (1977-1999)

Paper	Historically important insight
(Hamilton and Chervany 1981)	Emphasized that IS use is integral to achieving organizational objectives, and highlighted complexities of measurement
(Srinivasan 1985)	Highlighted the presence of mixed results when studying IS use and the need to account for the nature of the system and task
(Watson et al. 1988)	Highlighted how unintended consequences can arise from use when different users have different preferences
(DeLone 1988)	Showed that small businesses use IT more effectively if they have onsite infrastructure and a CEO with greater IT knowledge
(Davis 1989)	The seminal study of IT acceptance; ushered in a new way of theorizing and testing models IS use
(Thompson et al. 1991)	Demonstrated the value of using another theory of behavior (Triandis 1971) to predict IS use rather than the one used in Davis (1989)
(Adams et al. 1992)	One of the first concerted replications of Davis (1989), largely validating its findings
(Lee 1994)	Demonstrated the power of interpretive research by revealing how properties attributed to IT are actually properties of its use
(Boynton et al. 1994)	Used the concept of absorptive capacity to explain how organizations' use of IT depended on their managers' level of knowledge
(Iacovou et al. 1995)	Showed how additional variables are important when studying use of integrated systems, i.e., external forces and internal integration
(Taylor and Todd 1995)	Showed how the relationships in TAM vary substantially when studying experienced vis-à-vis inexperienced users
(Goodhue and Thompson 1995)	Integrated prior discussions of fit and use by devising a new model of the antecedents and outcomes of use and the role of fit
(Compeau and Higgins 1995)	Like Davis (1989) and Thompson et al. (1991), showed the value of applying another social-psychological theory (Bandura 1977) to IS use
(Massetti and Zmud 1996)	Showed how researchers can decompose a firm's overall use of an IS into tactical dimensions that can differentially explain outcomes
(Dennis 1996)	Revealed the importance of distinguishing between the use of the system *per se*, and the use of information from the system
(Gefen and Straub 1997)	Demonstrated how gender influences individuals' use of communication systems (e.g., email) by shaping how they perceive them
(Pinsonneault and Rivard 1998)	Revealed how the impact of IS use in firms can be derailed if managers let it shape their work roles rather than using it mindfully
(Choudhury et al. 1998)	Revealed that theories of the effects of interorganizational IT can be improved by attending closer to how systems are actually used
(Zigurs and Buckland 1998)	Proposed that a key principle of the effective use of group support systems is how well the technology fits the task
(Compeau et al. 1999)	Extended the work of Compeau et al. (1995) to show how individual IT usage can be predicted in longitudinal settings

Table 1A: Links for Articles in Table 1

Authors	Year	Paper
Scott Hamilton, Norman Chervany	1981	Evaluating Information System Effectiveness - Part I: Comparing Evaluation Approaches
Ananth Srinivasan	1985	Alternative Measures of System Effectiveness: Associations and Implications
Richard Watson, Gerardine DeSanctis, Marshall Poole	1988	Using a GDSS to Facilitate Group Consensus: Some Intended and Unintended Consequences
William DeLone	1988	Determinants of Success for Computer Usage in Small Business
Fred Davis	1989	Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology

Ronald Thompson, Christopher Higgins, Jane Howell	1991	Personal Computing Toward a Conceptual Model of Utilization
Dennis Adams, R. Nelson, Peter Todd	1992	"Perceived Usefulness, Ease of Use, and Usage of Information Technology: A Replication
Allen Lee	1994	Electronic Mail as a Medium for Rich Communication: An Empirical Investigation Using Hermeneutic Interpretation
Andrew Boynton, Robert Zmud, Gerry Jacobs	1994	The Influence of IT Management Practice on IT Use in Large Organizations
Charalambos Iacovou, Izak Benbasat, Albert Dexter	1995	Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology
Shirley Taylor, Peter Todd	1995	Assessing IT Usage: The Role of Prior Experience
Dale Goodhue, Ronald Thompson	1995	Task-Technology Fit and Individual Performance
Deborah Compeau, Christopher Higgins	1995	Computer Self Efficacy: Development of a Measure and Initial Test
Brenda Massetti, Robert Zmud	1996	Measuring the Extent of EDI Usage in Complex Organizations: Strategies and Illustrative Examples
Alan Dennis	1996	Information Exchange and Use in Group Decision Making: You Can Lead a Group to Information, but You Can't Make It Think
David Gefen, Detmar Straub	1997	Gender Differences in the Perception and Use of E-Mail: An Extension to the Technology Acceptance Model
Alain Pinsonneault, Suzanne Rivard	1998	Information Technology and the Nature of Managerial Work: From the Productivity Paradox to the Icarus Paradox?
Vivek Choudhury, Kathleen Hartzel, Benn Konsynski	1998	Uses and Consequences of Electronic Markets: An Empirical Investigation in the Aircraft Parts Industry
Ilze Zigurs, Bonnie K. Buckland	1998	A Theory of Task/Technology Fit and Group Support Systems Effectiveness
Deborah Compeau, Christopher Higgins, Sid Huff	1999	Social Cognitive Theory and Individual Reactions to Computing Technology: A Longitudinal Study

Table 2: Contemporary Articles that Contributed Extensively to our Understandings of IS Use (2000-2017)

Paper	Contribution to our understanding of IT use	How use was studied or conceptualized	Theory	Empirical approach
(Majchrzak et al. 2000)	Suggests that technology adaptation is a process of achieving alignment. Adaptations appear to be neither discontinuous nor continuous, but sporadic. Adaptations yield increased alignment, followed by an almost continuous array of discrepant events indicating that new structures are needed.	Focus on adaptation as a process of modifying existing conditions to achieve alignment.	Structuration theory, adaptive structuration theory, models of misalignment	Longitudinal case study of a virtual team over 10 months, using interviews, questionnaires, and observations. Data coded and analyzed thematically.
(Subramani 2004)	Suggests that to understand how firms' use of IT can affect competitive performance, researchers need to identify patterns of use that reflect the firm's strategic intent (rather than use mere descriptive measures). It also highlights the mediated pathways through which use leads to downstream benefits.	Focus on two patterns of use, namely use for exploitation (to improve operational efficiencies) and use for exploration (to explore new possibilities), and how these patterns provide the conditions that enable improved investments and performance.	Resource based theory, theory of learning and action, and transaction cost economics	Matched cross-sectional survey of a large buyer firm and 211 supplier firms. Data analysed with PLS.
(Lapointe and Rivard 2005)	Suggests that use can be negative, as in resistance behaviors, and these behaviors can evolve over time and across levels of analysis.	Focus on the observed usage behavior patterns (from apathy to aggressive resistance) and how they change over time and across levels. At a unit level, the behaviors resemble compilation (independent use) or composition (a convergence across the collective).	Multilevel theory	Three longitudinal case studies, with 43 interviews, several days of observations, and review of documentation. Data analysed using within-case and cross-case analysis with analytical induction.
(Beaudry and Pinsonneault 2005)	Suggests that the antecedents and processes of user adaptations must be considered together (rather than separately as typically done in past research). User adaptation can be viewed as coping with disruptive technology events.	Focus on emotion- and problem-focused adaptation. Emotion-focused adaptation includes self-deception and avoidance, minimization of the consequences of the IT event, selective attention, positive comparison, and passive acceptance. Problem-focused adaptation manages issues associated with the IT event by 1) adapting one's self such as adjusting personal habits, learning new skills, and adjusting work commitment; 2) adapting the work by modifying procedures and routines; and/or	Coping theory	Qualitative case study of account managers in two large North American banks. Data coded qualitatively and chains of evidence identified and analyzed.

Paper	Contribution to our understanding of IT use	How use was studied or conceptualized	Theory	Empirical approach
		3) adapting the IT by changing its functionalities and features.		
(Jasperson et al. 2005)	Suggests that post-adoptive behaviors are influenced by unique factors including use history and work system. Recommends that IT use (post-adoptive) should be studied at the feature level, with feature adoption, use, and extension as distinct stages.	Focus on post-adoptive behavior as the set of feature adoption decisions, feature use behaviors, and feature extension behaviors made by a user after an IT application has been installed and made available for work activities. Examine two levels of analysis: individual's cognitions and behaviors regarding feature adoption, use, and extension, and the organizational context.	Multiple theories	Conceptual paper
(Ray et al. 2005)	Suggests that the benefit of IT for a firm does not stem from the amount of IT used or spent, but rather from how effectively the IT is used in business processes, as this is a valuable, rare, and inimitable capability. This is among the first papers to apply RVB to study performance at the level of a business process.	Focus on amount of IT implemented and spent in particular business processes and the extent to which line managers and IT managers share knowledge about how to best use the potential offered by IT. The authors do not measure use but theorize it strongly.	Resource-based theory and the process view of IT business value	Matched pair survey of line managers and IT managers in the health insurance industry. Data analyzed with OLS regression.
(Burton-Jones and Gallivan 2007)	Suggests that use does not exist separately at different levels of analysis; rather, use is a multilevel phenomenon and researchers need to understand how individual and collective use relate to each other.	Focus on use as a multilevel activity, which involves understanding the function of use, the structure of use (interdependencies-in-use and form of collective use), and the context of use (user, task, system, and time).	Multilevel theory	Conceptual paper
(Limayem et al. 2007)	Suggests that continued use is different to initial use because it involves repeated decisions to use a system and this repetition can engender a habit. Therefore, when habits are strong, the predictors of initial use (such as intention) have less effect on use.	Focus on use as an antecedent (usage comprehensiveness and frequency influence habit formation) and outcome (IS continuance, measured by frequency and duration of use). Emphasize that using many parts of a system for many different purposes is influential in habit formation.	Social psychological theory (reasoned action and habits)	Longitudinal, quantitative survey of voluntary web usage by university graduate students. Data analyzed with PLS.
(Venkatesh et al. 2008)	Suggests that researchers need to move from studying use as a unidimensional construct to viewing it as a multidimensional construct, with its dimensions driven differently by expectations, intentions, and facilitating conditions	Focus on the differences between the duration, frequency, and intensity of individuals' use of systems, and how these three aspects of use are predicted differently by behavioral intention, behavioral	Theory of planned behavior, and related theories	Longitudinal survey of users in one organization, with five waves of data collection. Data analyzed with PLS.

Paper	Contribution to our understanding of IT use	How use was studied or conceptualized	Theory	Empirical approach
		expectation, facilitating conditions, and a set of control variables.		
(Kim 2009)	Suggests that an individual's decision to use a system is largely a product of four mechanisms (reason-oriented action, sequential updating, feedback, and habit). While past research has viewed them mostly independently, they need to be viewed in a unified way because they are all interrelated products of users' memory.	Focus on actual use by individuals, measured over three time-points. Measures included the average number of information queries made by each user and the average hours of use per week by each user.	Theories of cognition	Three secondary data sets examined from prior longitudinal surveys. Analysis performed with LISREL.
(Ortiz de Guinea and Markus 2009)	Suggests that in contrast to the assumptions in most prior research, continued use is not primarily a planned and rational decision-making process. Even though it is goal directed, emotions and habits can play a major and direct role in usage behaviors quite apart from intentions and plans.	Focus on reconceptualizing IT use from a rational, planned and reasoned behavior to an emotional, unplanned and habitual behavior.	Social psychology and alternative perspectives (e.g., practice theory, activity theory, affordance theory)	Conceptual paper
(Sarker and Valacich 2010)	Suggests that use by a group differs from use by a collection of individuals, and so it has different antecedents and consequences, i.e., we cannot assume methodological individualism.	Focus on comparing each group's strength of adoption of the technology to the average of the group members' individual intentions to use the technology.	Several theories of groups	Experiment with university students in 3-person groups. Group discussion method for group-level data collection. Data analyzed with PLS.
(Nan 2011)	Suggests that use is not simple (as assumed and studied in past work) but instead is a complex adaptive system with multiple agents that interact and change over time and levels of analysis.	Focus on use as a complex adaptive system, involving eight elements: agents, attributes, behavioral rules, interaction, connection, flow, environment, and structure.	Complexity theory	Simulation experiment with agent-based modeling. Findings examined for overall patterns.
(Sun 2012)	Suggests that while past research has looked at adaptation of a system as a whole, revisions of system use actually occur at the feature level. Adaptive system use (ASU) includes: trying new features, feature substituting, feature combining, and feature repurposing.	Focus on features in use (FIU), as the basket of system features ready to be used by a user to accomplish his/her tasks. Adaptive system use has two dimensions: revising the content of feature in use (what is used) and revising the spirit of features in use (how they are used).	Adaptive structuration theory plus other related concepts	Quantitative survey of MS Office users. Data analyzed with PLS.

Paper	Contribution to our understanding of IT use	How use was studied or conceptualized	Theory	Empirical approach
(Rai et al. 2012)	Suggests that the implementation and use of IT by a supplier with its buyers can create interfirm logistics capabilities that offer relational value for both parties. This value can increase as more sophisticated IT functionalities are implemented and used (i.e., as the partners' relationship is defined by higher-level capability profiles).	Focus on the implementation and use of progressively more enhanced sets of IT functionalities to manage the flows of physical goods, information, and finances across locations in interfirm logistics processes. More sophisticated IT capabilities are created by implementing and using progressively more advanced IT functionalities to manage interdependencies.	Resource-based theory and the relational view	Integrated data from four archival sources on the relationships between one of the largest logistics suppliers in the world and 2000 of its buyers. Data analysed with OLS regression.
(da Cunha 2013)	Suggests that use is strategic (rather than merely functional); workers use the system to impress others (sprucing desirable data and supressing undesirable data)	Focus on different user groups (employees, managers), how they interact through the system, the practices they engage in to spruce and supress data in the system, and the structuration process that explains why they engage in these practices.	Goffman's dramaturgical theory of interaction	Longitudinal 15-month ethnography, involving 307 days of observation, 104 interviews, 3500 pages of documents. Multi-step data analysis process, iterating between eliciting insights from the field and specifying the conceptual story.
(Polites and Karahanna 2013)	Suggests that continued use of IS over time is a function of habit rather than conscious intentions. IS habits develop within the context of organizational and individual level work routines. Incumbent system habits can also inhibit more effective system use. We need to know how to disrupt these habits and how to foster the development of new habits.	Focus on scripts, routines and habits (incumbent and new system habits) as well as habit disruption and habit development strategies.	Theories of habits and habit formation	Conceptual paper
(Leonardi 2013)	Suggests that a given technology can support multiple affordances that people enact differently, thus organizational level change is hard to predict and result in unintended consequences. We need to attend to how groups of users can converge on the	Focus on individual affordances, collective affordances, and shared affordances. Emphasizes how the use of a new technology within a collective can follow a shared or a configurational structure, and	Affordance theory, multi-level theory	Longitudinal mixed-methods case study of engineers in a large manufacturer, using log data, interviews, and observations. Data

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	enactment of a shared affordance to understand how organizational-level change occurs.	what it takes for shared affordances to be actualized.		analysed with social network methods, statistical analysis, and qualitative analysis.
(Bartelt and Dennis 2014)	Suggests that as group members use a system in a particular context, informal rules (genre rules) emerge which in turn shapes use in a structuration process. These rules can shape outcomes of use even more than the fit of the IT to the task (in contrast to the views of past research which emphasize tool features and task/technology fit).	Focus on the characteristics of different communication tools and their norms for use ('genre rules') that emerge over time.	Structuration theory, adaptive structuration theory, task-technology-fit theory	Laboratory experiment with undergraduate students using a 2*2 design, manipulating type of tool and amount of time pressure. Data analysed with PLS and an analysis of tipping points.
(Ortiz de Guinea and Webster 2014)	Suggests that a more accurate and comprehensive understanding of use can be gained if researchers study use as a pattern (i.e., configuration) of emotion, cognition, and behavior, and if researchers use a combination of methods to study it. Outcomes of use depend on the discrepant events that occur during use and how users respond.	Focus on configurations of use that arise through the values that users experience on emotion (affect and physiological arousal), cognition (computer- and non-computer-related thoughts, and behavior (exploitive and adaptive behaviors).	Coping theory, affect-object paradigm, and automaticity theory	Experience sampling study plus a laboratory experiment with verbal protocol analysis, questionnaire data, physiological measures, and independent performance ratings. Data analyzed with qualitative (thematic) analysis, ANOVA, and PLS.
(Gaskin et al. 2014)	Suggests a new way of studying use as part of an enacted routine. An enacted routine involves multiple actors conducting activities to produce outputs, where these activities involve leveraging the afffordances offered by various tools. New insights can be gained by learning how such routines emerge and evolve.	Focus on conceptualizing the sociomaterial routines, which combine social and material elements for a purpose. The discussion emphasizes that digital technologies are entangled within routines and its variation and appropriated differently in different contexts.	Sociomateriality, routines theory, rational reconstruction.	Methodological paper. New mixed methods approach involving data retrieval, sequence building, sequence analysis, and cluster analysis.
(Stein et al. 2015)	Suggests that use is often driven by emotions and these emotions can have non-uninform rather than uniform effects (e.g., mixed emotions can have positive effects on use)	Focus on how cues trigger individuals' affective responses which in turn trigger different use patterns. These patterns are defined by different aspects of the	Coping theory	Qualitative field study of two sites with 47 interviews plus observational data and

Paper	Contribution to our understanding of IT use	How use was studied or conceptualized	Theory	Empirical approach
		adaptation behavior, including the object of adaptation (task, technology), the adaptation strategy (pure, impure), and the degree of conformance (conforming, non-conforming).		documentary evidence. Qualitative data analysis of individual affective responses and sequences of events linking affective cues, affective responses, and IT use patterns.
(Iyengar et al. 2015)	Suggests that use is undertaken by organizations not only to achieve direct ends, but also to enable organiztional learning, which has additional benefits	Focus on use as an organizational learning mechanism that has structural elements (as per structuration theory) and that enables the storage, collection, and dissemination of information and knowledge. Measured in the study as 'extent of use.'	Organizational learning theories	Survey questionnaire (independent variables), organizational records (dependent variable), and public data (control variable). Data analyzed with confirmatory factor analysis and covariance-based SEM.
(Oreglia and Srinivasan 2016)	Suggests that use need not always occur through direct interaction with a device; instead, use can be mediated by an intermediary and the intermediary can gain power through his/her mediation.	Focus on users as social actors, the social context (including gender roles), the role of individuals as intermediaries in the use process, and the effects of usage practices on power and empowerment.	Theories of gender and empowerment	Ethnography involving interviews, passive observation, and participant observation over 7 years. Gender-focused analysis of the process of use in that setting.
(Leonardi et al. 2016)	Suggests that use involves more than using a system. In complex contexts, where systems have different features, user groups, and social settings, users may engage in multiplex appropriation, which goes beyond appropriating the system to include appropriations of other elements of the ecosystem at the same time (technical, role, usage, social, and policy appropriations).	Focus on appropriations and their many types: technical, role, usage, social, policy. Propose the concept of multiplex appropriation.	Adaptive structuration theory, complexity theory, and inductive elements	Qualitative case study of a Brazilian banking system at the individual and organizational levels, with multiple types of organizations. Data analysed within-cases and across-cases with grounded theory methods.

Paper	Contribution to our understanding of IT use	How use was studied or conceptualized	Theory	Empirical approach
(Bayerl et al. 2016)	Suggests that a group's continued use of a system is provisional because users may decide to change or cease use over time. A group's use is driven not only by the members' attitudes towards the system but also their rationales for using it, and especially the extent to which these attitudes and rationales are aligned across subgroups.	Focus on developing the concept of technology adoption states (TAS). These refer to attitude-rationale configurations among subgroups, where attitude is measured in terms of valence (a group's positive or negative orientation to the system) and rationale reflects the reason for that valence (e.g., two groups might like a system but for different reasons). The article outlines different attitude-rationale configurations and how and why they can change over time.	Inductively-built theory	Longitudinal, qualitative, multiple case study, of production teams in the oil and gas industry. Data analyzed with temporal bracketing and grounded-theory methods.
(Nevo et al. 2016)	Suggests that whereas adaptation involves changing one's use of a system to meet a changed goal or context, reinvention involves changing one's use of a system to achieve a new goal. The paper provides a new theory to explain what reinvention involves and two different patterns of reinvention that users can engage in.	Focused on patterns of temporal agency that describe the psychological and social processes that users engage in as they project themselves into a hypothetical future, imagine future outcomes, and take actions to achieve them. The authors distinguish two types of reinvention patterns: performance-oriented and mastery-oriented.	Temporally-situated theory of agency, and psychological theories of goal achievement	Conceptual paper
(Schmitz et al. 2016)	Suggests that adaptive structuration is a feature of individual use, not just group use. Adaptive structuration at the individual level is defined by the object being adapted (technology or task) and the approach towards the adaptation (exploitation or exploration).	Focus on a topology of adaptation behaviors: exploitive / exploratory technology adaptation, and exploitive / exploratory task adaptation.	Adaptive structuration theory	Quantitative survey of graduate business students in a large university. Data analysed with PLS, with moderation and non-linear relationship analysis.

Table 2A: Links for Articles in Table 2

Authors	Year	Paper
Ann Majchrzak, Ronald E. Rice, Arvind Malhotra, Sulin Ba	2000	Technology Adaptation: The Case of a Computer-Supported Inter-organizational Virtual Team
Mani R. Subramani	2004	How Do Suppliers Benefit from Information Technology Use in Supply Chain Relationships?
Liette Lapointe, Suzanne Rivard	2005	A Multilevel Model of Resistance to Information Technology Implementation

Anne Beaudry, Alain Pinsonneault	2005	Understanding User Responses to Information Technology: A Coping Model of User Adaptation
'Jon (Sean) Jasperson, Pamela E. Carter, Robert W. Zmud	2005	A Comprehensive Conceputalization of the Post-Adoptive Behaviors Associated with IT-Enabled Work Systems
Gautam Ray, Waleed A. Muhanna, Jay B. Barney	2005	Information Technology and the Performance of the Customer Service Process: A Resource-Based Analysis
Andrew Burton-Jones, Michael Gallivan	2007	Toward a Deeper Understanding of System Usage in Organizations: A Multilevel Perspective
Moez Limayem, Sabine Gabriele Hirt, Christy M. K. Cheung	2007	How Habit Limits the Predictive Power of Intention: The Case of Information Systems Continuance
Viswanath Venkatesh, Susan A. Brown, Likoebe M. Maruping, Hillol Bala	2008	Predicting Different Conceptualizations of System Use: The Competing Roles of Behavioral Intention, Facilitating Conditions, and Behavioral Expectation
Sung S. Kim	2009	The Integrative Framework of Technology Use: An Extension and Test
Ana Ortiz de Guinea, M. Lynne Markus	2009	Why Break the Habit of a Lifetime? Rethinking the Roles of Intention, Habit, and Emotion in Continuing Information Technology Use
Saonee Sarker, Joseph S. Valacich	2010	An Alternative to Methodological Individualism: A Non-Reductionist Approach to Studying Technology Adoption by Groups
Ning Nan	2011	Capturing Bottom-Up Information Technology Use Processes: A Complex Adaptive Systems Model
Heshan Sun	2012	Understanding User Revisions When Using Information System Features: Adaptive System Use and Triggers
Arun Rai, Paul A. Pavlou, Ghiyoung Im, Steve Du	2012	Interfirm IT Capability Profiles and Communications for Cocreating Relational Value: Evidence from the Logistics Industry
João Vieira da Cunha	2013	A Dramaturgical Model of the Production of Performance Data
Greta L. Polites, Elena Karahanna	2013	The Embeddedness of Information Systems Habits in Organizational and Individual Level Routines: Development and Disruption
Paul M. Leonardi	2013	When Does Technology Use Enable Network Change in Organizations? A Comparative Study of Feature Use and Shared Affordances
Valerie L. Bartelt, Alan R. Dennis	2014	Nature and Nurture: The Impact of Automaticity and the Structuration of Communication on Virtual Team Behavior and Performance
Ana Ortiz de Guinea, Jane Webster	2014	An Investigation of Information Systems Use Patterns: Technological Events as Triggers, the Effect of Time, and Consequences for Performance
James Gaskin, Nicholas Berente, Kalle Lyytinen, Youngjin Yoo	2014	Toward Generalizable Sociomaterial Inquiry: A Computational Approach for Zooming In and Out of Sociomaterial Routines
Mari-Klara Stein, Sue Newell, Erica L. Wagner, Robert D. Galliers	2015	Coping with Information Technology: Mixed Emotions, Vacillation, and Nonconforming Use Patterns
Kishen Iyengar, Jeffrey R. Sweeney, Ramiro Montealegre	2015	Information Technology Use as a Learning Mechanism: The Impact of IT Use on Knowledge Transfer Effectiveness, Absorptive Capacity, and Franchisee Performance
Elisa Oreglia, Janaki Srinivasan	2016	ICT, Intermediaries, and the Transformation of Gendered Power Structures

Paul M. Leonardi, Diane E. Bailey, Eduardo Henrique Diniz, Dan Sholler, Bonnie A. Nardi	2016	Multiplex Appropriation in Complex Systems Implementation: The Case of Brazil's Correspondent Banking System
Petra Saskia Bayerl, Kristina Lauche, Carolyn Astell	2016	Revisiting Group-Based Technology Adoption as a Dynamic Process: The Role of Changing Attitude-Rationale Configurations
Kurt Schmitz, James T. C . Teng, Kimberly J. Webb	2016	Capturing the Complexity of Malleable IT Use: Adaptive Structuration Theory for Individuals
Saggi Nevo, Dorit Nevo, Alain Pinsonneault	2016	A Temporally Situated Self-Agency Theory of Information Technology Reinvention

Table 3: Additional Contemporary Articles that Made Contributions to Concepts Surrounding IS Use

Articles	Position of IS Use in the Study	Level of Analysis	Approach
(Cooper et al. 2000)	Antecedent	Organization	Qualitative
(Chatterjee et al. 2002)	Outcome	Organization	Quantitative
(Christiaanse and Venkatraman 2002)	Antecedent	Interorganization	Qualitative, Quantitative
(Venkatesh et al. 2003)	Outcome	Individual	Quantitative
(Kohli and Kettinger 2004)	Process, Outcome	Individual, Group	Qualitative
(Bhattacherjee and Premkumar 2004)	Antecedent, Outcome	Individual	Quantitative
(Levina and Vaast 2005)	Process	Individual	Qualitative
(Wasko and Faraj 2005)	Outcome	Individual	Quantitative
(Gattiker and Goodhue 2005)	Antecedent	Plant	Quantitative
(Massey and Montoya-Weiss 2006)	Process, Outcome	Individual, Group	Conceptual
(Karahanna et al. 2006)	Outcome	Individual	Quantitative
(Venkatesh and Ramesh 2006)	Outcome	Individual	Quantitative
(Arnold et al. 2006)	Process	Individual	Quantitative
(Tanriverdi 2006)	Antecedent	Organization	Quantitative
(Banker et al. 2006)	Antecedent	Plant	Quantitative
(Liang et al. 2007)	Outcome	Organization	Quantitative
(Watson-Manheim and Belanger 2007)	Process, Outcome	Individual	Qualitative
(McElroy et al. 2007)	Outcome	Individual	Quantitative
(Davidson and Chismar 2007)	Process	Organization	Qualitative
(Kappos and Rivard 2008)	Antecedent, Process, Outcome	Individual, Group	Conceptual
(Dennis et al. 2008)	Process	Group	Conceptual
(Sykes et al. 2009)	Outcome	Individual	Quantitative
(Beaudry and Pinsonneault 2010)	Outcome	Individual	Quantitative

(Strong and Volkoff 2010)	Process	Organization	Qualitative
(Seddon et al. 2010)	Process	Organization	Qualitative
(Gray et al. 2011)	Antecedent	Individual	Quantitative
(Berente et al. 2011)	Antecedent	Individual	Qualitative
(Venkatesh et al. 2012)	Outcome	Individual	Quantitative
(Wang et al. 2013)	Outcome	Individual	Quantitative
(Barrett et al. 2013)	Process, Outcome	Other	Qualitative
(Seidel et al. 2013)	Process, Antecedent	Individual	Qualitative
(Brown et al. 2014)	Outcome	Individual	Quantitative
(Venters et al. 2014)	Process	Practice	Qualitative
(Tsai and Bagozzi 2014)	Outcome	Individual	Quantitative
(Ou et al. 2014)	Antecedent, outcome	Individual	Quantitative
(Mazmanian et al. 2014)	Process	Practice	Qualitative
(Jones 2014)	Process	Practice	Qualitative
(Maruping and Magni 2015)	Outcome	Individual, Group	Quantitative
(Leonardi 2015)	Antecedent	Individual	Quantitative
(Shen et al. 2015)	Antecedent	Individual	Quantitative
(Tian and Xu 2015)	Consequence	Organization	Quantitative
(Han et al. 2016)	Outcome	Individual	Quantitative
(Kim et al. 2016)	Antecedent	Individual	Quantitative
(Serrano and Karahanna 2016)	Antecedent, Process	Individual	Qualitative, Quantitative
(Ganju et al. 2016)	Antecedent	Country	Quantitative
(Leong et al. 2016)	Process	Community	Qualitative
(Goh et al. 2016)	Antecedent	Individual, Community	Quantitative
(Huang and Zhang 2016)	Antecedent	Individual	Quantitative
(Venkatesh et al. 2016)	Antecedent, Outcome	Individual	Quantitative
(Trantopoulous et al. 2017)	Antecedent	Organization	Quantitative

Table 3A: Links for Articles in Table 3

Authors	Year	Title
Brian L. Cooper, Hugh J. Watson, Barbara H. Wixom, Dale L. Goodhue	2000	Data Warehousing Supports Corporate Strategy at First American Corporation

Debabroto Chatterjee, Rajdeep Grewal, V. Sambamurthy	2002	Shaping Up for E-Commerce: Institutional Enablers of the Organizational Assimilation of Web Technologies
Ellen Christiaanse, N. Venkatraman	2002	Beyond Sabre: An Empirical Test of Expertise Exploitation in Electronic Channels
Viswanath Venkatesh, Michael G. Morris, Gordon B. Davis, Fred D. Davis	2003	User Acceptance of Information Technology: Toward a Unified View
Rajiv Kohli, William J. Kettinger	2004	Informating the Clan: Controlling Physicians' Costs and Outcomes
Anol Bhattacherjee, G. Premkumar	2004	Understanding Changes in Belief and Attitude Toward Information Technology Usage: A Theoretical Model and Longitudinal Test
Natalia Levina, Emmanuelle Vaast	2005	The Emergence of Boundary Spanning Competence in Practice: Implications for Implementation and Use of Information Systems
Molly McLure-Wasko, Samer Faraj	2005	Why Should I Share? Examining Social Capital and Knowledge Contribution in Electronic Networks of Practice
Thomas F. Gattiker, Dale L. Goodhue	2005	What Happens After ERP Implementation: Understanding the Impact of Interdependence and Differentiation on Plant-Level Outcomes
Anne P. Massey, Mitzi M. Montoya-Weiss	2006	Unraveling the Temporal Fabric of Knowledge Conversion: A Model of Media Selection and Use
Elena Karahanna, Ritu Agarwal, Corey Angst	2006	Reconceptualizing Compatibility Beliefs
Viswanath Venkatesh, V. Ramesh	2006	Web and Wireless Site Usability: Understanding Differences and Modeling Use
Vicky Arnold, Nicole Clark, Phillip A. Collier, Stewart A. Leech, Steve G. Sutton	2006	The Differential Use and Effect of Knowledge-Based System Explanations in Novice and Expert Judgment Decisions
Hüseyin Tanriverdi	2006	Performance Effects of Information Technology Synergies in Multibusiness Firms
Rajiv D. Banker, Indranil R. Bardhan, Hsihui Chang, Shu Lin	2006	Plant Information Systems, Manufacturing Capabilities and Plant Performance
Huigang Liang, Nilesh Saraf, Qing Hu, Yajiong Xue	2007	Assimilation of Enterprise Systems: The Effect of Institutional Pressures and the Mediating Role of Top Management
Mary Beth Watson-Manheim, France Bélanger	2007	Communication Media Repertoires: Dealing with the Multiplicity of Media Choices
James C. McElroy, Anthony R. Hendrickson, Anthony M. Townsend, Samuel M. DeMarie	2007	Dispositional Factors in Internet Use: Personality Versus Cognitive Style
Elizabeth J. Davidson, William G. Chismar	2007	The Interaction of Institutionally Triggered and Technology-Triggered Social Structure Change: An Investigation of Computerized Physician Order Entry
Antonio Kappos, Suzanne Rivard	2008	A Three-Perspective Model of Culture, Information Systems, and Their Development and Use
Alan R. Dennis, Robert M. Fuller, Joseph S. Valacich	2008	Media, Tasks, and Communication Processes: A Theory of Media Synchronicity
Tracy Ann Sykes, Viswanath Venkatesh, Sanjay Gosain	2009	Model of Acceptance with Peer Support: A Social Network Perspective to Understand Employees' System Use
Anne Beaudry, Alain Pinsonneault	2010	The Other Side of Acceptance: Studying the Direct and Indirect Effects of Emotions on Information Technology Use

Diane Strong, Olga Volkoff	2010	Understanding Organization-Enterprise System Fit: A Path to Theorizing the Information Technology Artifact
Peter B. Seddon, Cheryl Calvert, Song Yang	2010	A Multi-Project Model of Key Factors Affecting Organizational Benefits from Enterprise Systems
Peter H. Gray, Salvatore Parise, Bala Iyer	2011	Innovation Impacts of Using Social Bookmarking Systems
Nicholas Berente, Sean Hansen, Jacqueline C. Pike, Patrick J. Bateman	2011	Arguing the Value of Virtual Worlds: Patterns of Discursive Sensemaking of an Innovative Technology
Viswanath Venkatesh, James Y.L. Thong, Xin Xu	2012	Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology
Yinglei Wang, Darren B. Meister, Peter H. Gray	2013	Social Influence and Knowledge Management Systems Use: Evidence from Panel Data1
Michael Barrett, Loizos Heracleous, Geoff Walsham	2013	A Rhetorical Approach to IT Diffusion: Reconceptualizing the Ideology-Framing Relationship in Computerization Movements
Sue Brown, Viswanath Venkatesh, Sandeep Goyal	2014	Expectation Confirmation in Information Systems Research: A Test of Six Competing Models
William Venters, Eivor Oborn, Michael Barrett	2014	A Trichordal Temporal Approach to Digital Coordination: The Sociomaterial Mangling of the CERN Grid
Hsien-Tung Tsai, Richard P. Bagozzi	2014	Contribution Behavior in Virtual Communities: Cognitive, Emotional, and Social Influences
Carol X.J. Ou, Paul A. Pavlou, Robert M. Davison	2014	Swift Guanxi in Online Marketplaces: The Role of Computer-Mediated Communication Technologies
Melissa Mazmanian, Marisa Cohn, Paul Dourish	2014	Dynamic Reconfiguration in Planetary Exploration: A Sociomaterial Ethnography
Matthew R. Jones	2014	A Matter of Life and Death: Exploring Conceptualizations of Sociomateriality in the Context of Critical Care
Likoebe M. Maruping, Massimo Magni	2015	Motivating Employees to Explore Collaboration Technology in Team Contexts
Paul M. Leonardi	2015	Ambient Awareness and Knowledge Acquisition: Using Social Media to Learn "Who Knows What" and "Who Knows Whom"
Wenqi Shen, Yu Jeffrey Hu, Jackie Rees Ulmer	2015	Competing for Attention: An Empirical Study of Online Reviewers' Strategic Behavior
Feng Tian, Sean Xin Xu	2015	How Do Enterprise Resource Planning Systems Affect Firm Risk? Post-Implementation Impact
Sang Pil Han, sungho park, Wonseok Oh	2016	Mobile App Analytics: A Multiple Discrete-Continuous Choice Framework
Seung Hyun Kim, Tridas Mukhopadhyay, Robert E. Kraut	2016	When Does Repository KMS Use Lift Performance? The Role of Alternative Knowledge Sources and Task Environments
Christina Serrano, Elena Karahanna	2016	The Compensatory Interaction Between User Capabilities and Technology Capabilities in Infuencing Task Performance: An Empirical Analysis in Telemedicine Consultations
Kartik K. Ganju, Paul A. Pavlou, Rajiv Banker	2016	Does Information and Communication Technology Lead to the Well-Being of Nations? A Country-Level Empirical Investigation
Carmen Leong, Shan Ling Pan, Lili Cui	2016	The Emergence of Self-Organizing E-Commerce Ecosystems in Remote Villages of China: A Tale of Digital Empowerment for Rural Development
Jie Mein Goh, Guodong (Gordon) Gao, Ritu Agarwal	2016	The Creation of Social Value: Can an Online Health Community Reduce Rural-Urban Health Disparities?
Peng Huang, Zhongju Zhang	2016	Participation in Open Knowledge Communities and Job-Hopping: Evidence from Enterprise Software

Viswanath Venkatesh, Arun Rai, Tracy Ann Sykes, Ruba Aljafari	2016	Combating Infant Mortality in Rural India: Evidence from a Field Study of eHealth Kiosk Implementations
Konstantinos Trantopoulos, Georg von Krogh, Martin W. Wallin, Martin Woerter	2017	External Knowledge and Information Technology: Implications for Process Innovation Performance

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