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A Meta-Analytic Review and Extension of the Organizational IT Assimilation Literature

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ABSTRACT

This study uses meta-analytic techniques to review and extend key insights regarding the existing research on organizational IT assimilation. Our analysis of 53 studies shows that organizational support, propagating institutions, extent of coordination, and IT infrastructure sophistication are strongly related to IT assimilation. We also adopt Swanson's (1994) IT innovation typology to investigate whether the strength of relationships between key factors and IT assimilation depends on innovation type. Our results show that the relationship between three antecedents – environmental pressure, organizational support, and related knowledge – and IT assimilation is moderated by the type of IT innovation under investigation. Building on the findings from our analysis, we discuss implications for research and practice.

Keywords

IT assimilation, IT innovation, diffusion, meta-analysis

INTRODUCTION

The potential business value of information technology (IT) innovations cannot be fully realized until they are extensively assimilated in an organization's processes and routines (Armstrong and Sambamurthy 1999, Purvis et al. 2001). As a result, scholars have devoted considerable time and effort toward discovering the factors that impact organizational IT assimilation (Fichman 2000). Yet despite the wealth of research to date on IT assimilation, there is no systematic review of the topic for collective understanding. Such a review is important if we wish to understand the technological, organizational, and social factors that truly play a critical role during the IT assimilation process. To remedy this, our first research objective is to conduct a meta-analytic approach to review and assess our accumulated knowledge on IT assimilation, with the goal of providing future research directions to deepen our understanding of IT innovation phenomena. We chose meta-analysis because this technique mathematically accounts for differences among studies, thereby reducing the impact of subjective bias resulting from narrative reviews.

Researchers have examined the assimilation of a diverse range of organizational IT innovations, such as CASE tools, Electronic Data Interchange, Enterprise Resource Planning, e-procurement, and data warehouses (Fichman 2000). Since the assimilation process may unfold differently for different innovations (Zmud 1984), the role and strength of assimilation antecedents may depend upon the type of IT innovation at hand. For example, the organization-wide impact of Enterprise Resource Planning (ERP) systems signals that top management support may be more critical to the successful assimilation of ERP than to assimilation of an IT innovation with lower impact, such as object-oriented programming (OOP) within the information systems (IS) unit. However, researchers often bound their investigation to a single innovation, thereby making it difficult to compare the effects of certain factors on assimilation across different classes of innovations (for an exception see Grover et al. 1997). Thus, our second research objective is to determine the extent to which innovation type impacts the relationship between key factors and IT assimilation.

Our manuscript proceeds as follows. We first describe IT assimilation and various types of IT innovations. We then propose our research model and hypotheses. Following this, we describe our research method, analysis and results. Finally, we discuss implications for research and practice.

THEORETICAL BACKGROUND

IT innovation is defined as innovation in the organizational application of digital computer and communications technologies (Swanson 1994). A primary question in IT innovation research is what it means for an organization to be "innovative" with respect to emerging technologies (Massetti and Zmud 1996, Zmud and Apple 1992). Researchers have developed several measures of innovativeness, such as earliness of adoption (Grover et al. 1997), frequency of adoption (Grover and Goslar 1993), assimilation (Fichman and Kemerer 1997), infusion (Cooper and Zmud 1990), and routinization (Zmud and Apple 1992). Since IT post-adoption behaviors can vary considerably across organizations (Jasperson et al. 2005), substantial attention has been paid to IT assimilation as a measure of IT innovativeness (Fichman and Kemerer 1997, Purvis et al. 2001).

IT assimilation is defined as the degree to which the use of technology diffuses across organizational work processes and becomes routinized in the activities of those processes (Purvis et al. 2001). Assimilation captures the extent to which a firm has progressed through stages of innovation deployment – from initial awareness and adoption to general deployment or routinization (Fichman 2001). There is a clear distinction between adoption of an innovation and its degree of routinization. A firm may adopt an innovation but fail to routinize it due to various technological, organizational and environmental factors (Fichman and Kemerer 1999). This suggests that the antecedents of assimilation can be different from the antecedents of innovation adoption. Furthermore, the nature of the innovation is likely to play a role as assimilation may unfold differently for different innovations (Zmud 1984). As noted earlier, the assimilation of ERP systems requires greater resources (e.g., consultants, training) than the assimilation of OOP technologies. Hence, it is important to note types of IT innovations.

Daft (1978) proposed a dual-core model of innovation, wherein he distinguishes between innovations that focus on the technical core and innovations that focus on the administrative core. Swanson (1994) extended this dual-core model to the study of IT innovation. IT spans both the technical and administrative cores and is therefore unlikely to be characteristic of innovation local to either. IT also provides the ability to share information resources in both the technical and administrative cores. These effects can pervade beyond the IS unit, stimulating innovation in the broader organization. As a result, Swanson proposed the addition of the functional IS core to the dual-core model to link the technical and administrative cores.

Swanson's tri-core model distinguishes three fundamental types of IT innovations. Type 1 innovation is closest to the functional core involving the IT products themselves (e.g., object-oriented programming, visual programming languages). Type 2 and Type 3 innovations extend IT innovation beyond the boundaries of the IT function into the organization. Specifically, Type 2 innovations apply new IT products and services to the administrative core of the business (e.g., procurement applications, payroll processing). Likewise, Type 3 innovations apply new IT products and services to the core business technology (e.g., enterprise resource planning, supply chain management).

RESEARCH MODEL

Figure 1 depicts our research model. Reviews of IT innovation research identify several factors that impact organizational IT assimilation (Fichman 2000, Gallivan 2001). Using these reviews as a starting point, we discovered a number of similar factors in our literature review. Furthermore, since there is no single theory of innovation (Fichman 2000), we built our research model from a diverse set of theories and perspectives. In the following sections we describe how each of the factors depicted below is related to IT assimilation, as well as how some of these relationships may be moderated by innovation type.

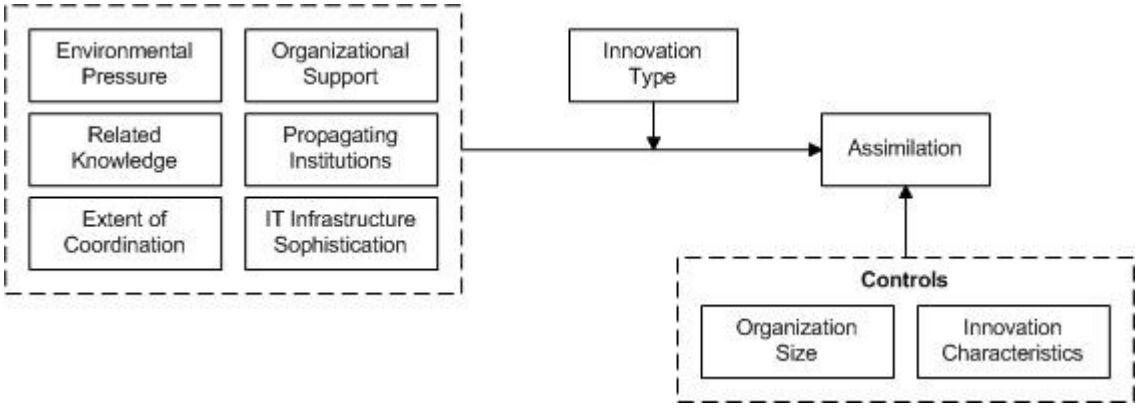

Figure 1. Research Model

The institutional perspective asserts that organizational behavior is driven more by the need for organizational legitimacy than by competition and efficiency (DiMaggio and Powell 1983). As a group of organizations emerge as an industry, they develop a set of organizational forms and behaviors that define the environment in which they operate. Organizations that violate shared ideas of appropriate structures and behaviors may call into question their legitimacy and hinder their ability to secure resources and external support. As industries mature, organizations operating within an institutional environment become more similar to each other (Scott 2001). This institutional isomorphism results from three specific types of institutional pressures faced by organizations: coercive, mimetic and normative. When applied to an IT innovation context, the institutional perspective holds that organizations may be coerced by suppliers, mimic successful competitors, or pressured by professional associations to assimilate certain IT innovations. Hence, consistent with prior research (Liang et al. 2007, Wang 2008), we propose that *environmental pressure* positively influences IT assimilation.

H1: Environmental pressure is positively related to IT assimilation.

A delivery system supports and manages the assimilation process for a particular IT innovation (Leonard-Barton 1988). One important component of such a delivery system is *organizational support* for IT assimilation. For example, top management championship defines organizational norms and values regarding how managers should engage in arranging actions related to a particular IT innovation (Chatterjee et al. 2002). Through their beliefs and actions, top management can offer visions and guidelines to business unit managers about the opportunities and challenges in assimilating technologies. Top management championship also occurs through expressed commands, reward systems, or other actions that signal their commitment to the technology (Leonard-Barton and Deschamps 1988). Other organizational support factors that positively influence assimilation include IT project champions (Beath 1991), training (Purvis 1994), and resource allocation (Ramamurthy et al. 1999). Following this, we hypothesize:

H2: Organizational support is positively related to IT assimilation.

High absorptive capacity in a particular domain increases an organization's ability to assimilate innovations in that domain (Cohen and Levinthal 1990). Likewise, a key antecedent of absorptive capacity – related knowledge – will also predict innovativeness (Fichman and Kemerer 1997). *Related knowledge* is defined as the extent of abstract knowledge, know-how, and skills possessed by the organization in areas related to the focal innovation (Fichman 2001). Related knowledge lowers the knowledge barriers erected by complex IT innovations (e.g., data warehouses, ERP systems). Knowledge barriers arise because the technological and managerial knowledge required to successfully deploy complex technologies extends beyond simple awareness of the innovation and its potential benefits (Fichman and Kemerer 1999). The know-how and technical knowledge associated with such technologies is tacit and relatively immobile, and it has to be recreated by users via processes of learning by using (Attewell 1992). Hence, related knowledge facilitates assimilation by making it easier for organizations to acquire new knowledge related to the focal innovation (Fichman 2001, Liang et al. 2007).

H3: Related knowledge is positively related to IT assimilation.

Although some IT innovations emerge as more complex, costly, and incompatible than others, these assimilation barriers can be lowered by institutions seeking to propagate these innovations (Swanson and Ramiller 1997, Wang and Ramiller 2009). *Propagating institutions* include technology vendors, supply chain partners, consulting firms, and user groups. These institutions help to determine the level of resources applied to the task of communicating, promoting, and improving a technology and can therefore have a substantial impact on the rate of technology assimilation. For example, vendor collaboration and business partner participation are positively related to the assimilation of vertical e-business standards (Mendoza 2006). Thus, propagating institutions positively influence the assimilation of IT innovations.

H4: Propagating institutions is positively related to IT assimilation.

Research on organizational coordination suggests that managerial decisions and actions across the organization can be linked through the use of a range of coordination mechanisms, such as standard operating procedures, liaison roles, and cross-functional teams (Galbraith 1973). *Coordination* is defined as managing dependencies between activities (Malone and Crowston 1994). Organizations frequently leverage a combination of coordination mechanisms (e.g., cross-functional interfaces, job rotation) to manage dependencies between their work activities (Van de Ven et al. 1976). Coordination is required to synthesize business and IT knowledge as well as the knowledge residing in different organizational sub-units (Grant 1996). Studies of IT assimilation point to the significant role of business and IT knowledge integration and partnerships between managers across the firm (Armstrong and Sambamurthy 1999, Boynton et al. 1994, Chatterjee et al. 2002). Hence, the extent of coordination is positively related to IT assimilation.

H5: Extent of coordination is positively related to IT assimilation.

IT infrastructure refers to an organization's arrangement of shared IT platforms and software applications (Weill 1993). *IT infrastructure sophistication* refers to "the extent to which a firm has diffused key information technologies into its base foundation for supporting business applications" (Armstrong and Sambamurthy 1999, p. 309). The sophistication of a firm's IT infrastructure is often described in terms of its reach and richness (Keen 1991). Reach determines the number of locations that the infrastructure can access and connect to, and richness describes the depth of information that can be seamlessly shared across systems and applications. By increasing competitive degrees of freedom, a sophisticated IT infrastructure can provide firms with the ability to innovate and respond quickly to business opportunities (Weill et al. 2002). A sophisticated IT infrastructure also allows firms to develop higher levels of technical knowledge that, in turn, facilitates IT assimilation (Damanpour 1991). A well-developed stream of research finds that IT infrastructure sophistication is positively related to IT assimilation (Armstrong and Sambamurthy 1999, Premkumar and Ramamurthy 1995, Reardon and Davidson 2007).

H6: IT infrastructure sophistication is positively related to IT assimilation.

The Moderating Role of IT Innovation Type

We propose that IT innovation type (based on Swanson 1994) will moderate some of the relationships in our research model. Type 1 innovations are restricted to the functional IS core; hence, they usually exert less impact on the host organization than Type 2 and 3 innovations. Increased organizational impact implies that Type 2 and 3 innovation activity is more likely to be noticed by external entities, such as customers, competitors, and suppliers. Increasing levels of Type 2 and 3 innovation activity often trigger an organizing vision for the IT innovation (Swanson and Ramiller 1997), which in turn creates pressure on organizations to adopt and assimilate these "popular" innovations (Wang 2010). Also, Type 2 and 3 innovations often impact external stakeholders. For instance, a powerful supplier may coerce its customers into adopting and assimilating a particular supply chain management system. This implies that organizations will often face greater environmental pressure to assimilate Type 2 and 3 innovations than Type 1 innovations. Following this, we hypothesize:

H7: The relationship between environmental pressure and assimilation will be stronger for Type 2 and Type 3 innovations than for Type 1 innovations.

As noted earlier, Type 2 and 3 innovations exert a greater impact on the adopting organization than Type 1 innovations (Swanson 1994). Consider the assimilation of object-oriented programming (OOP) methodologies (Type 1) and ERP systems (Type 3). OOP affects the work routines and behavior of those working in the IT function. However, ERP systems affect most – if not all – organizational members and work processes. As a result, successful ERP assimilation often requires a significant level of resources, such as consultants, training, and vendor support (Markus and Tanis 2000). Thus, IT innovations that impact the entire organization will require greater levels of organizational support during the assimilation process than IT innovations that impact only the functional IT core.

H8: The relationship between organizational support and assimilation will be stronger for Type 2 and Type 3 innovations than for Type 1 innovations.

Control Variables

We included two additional variables for descriptive (control) purposes. A well-established stream of research finds that innovations possessing favorable characteristics (e.g., relative advantage, compatibility, low complexity) tend to be more attractive and easier to adopt and therefore tend to diffuse more rapidly than those with less favorable characteristics (Fichman 2004, Rogers 2003). Thus, we expect (positive) *innovation characteristics* to be positively related to assimilation. We also include *organization size*, a variable which has shown mixed effects on organizational innovativeness (Damanpour 1992) and organizational IT adoption in particular (Lee and Xia 2006).

METHOD

We used meta-analysis to mathematically cumulate the results of previous studies on organizational IT assimilation (Hunter and Schmidt 1990, 2004). Meta-analysis enables the mathematical correction of certain types of research design flaws and methodological factors (Hunter and Schmidt 2004) that may have obscured the relationships with assimilation. Specifically, meta-analysis provides a means for examining sampling error, facilitates the correction of measurement reliability, and "enables the quantitative examination of the impact of moderator variables on the results" (Stewart and Roth 2001, p.47). Thus, we suggest meta-analysis provides a rigorous approach to cumulating the empirical results of organizational IT assimilation studies so that researchers can draw conclusions from, and resolve inconsistencies in, this literature (for an in-depth discussion of meta-analysis techniques see Glass 1981, Hunter and Schmidt 2004, Lipsey and Wilson 2001).

Sample

Following recommended guidelines (Hunter and Schmidt 2004, Webster and Watson 2002), we began our literature review using a keyword search in various electronic databases (e.g. Science Direct, Web of Science, Academic Search Premier, Business Source Premier, Computer Science Index) to identify a complete list of studies on organizational IT assimilation published through March 2010. In an effort to avoid bias towards higher effect sizes typically associated with published journal articles (Rosenthal 1979), we collected AIS conference proceedings and dissertations/theses. We also used Harzing's Publish or Perish and the Web of Science Cited Reference Search to identify more articles. Finally, we searched "in press" articles for the AIS "Basket of 8" journals[1] to capture forthcoming articles. To capture all relevant articles on assimilation, we systematically searched these databases using keywords such as assimilation, innovation, innovativeness, diffusion, infusion, routinization, and implementation.

We used three criteria for inclusion of data in our meta-analysis. First, organizational IT assimilation had to be measured in an empirical study (i.e. zero-order correlation coefficients or data to calculate such coefficients were provided in the study or were made available by the authors[2]). Second, the study's unit of analysis had to be at the firm or IT functional unit level. Finally, the article had to report independent correlations (i.e. the data could not be used in more than one paper to be included in our analysis). However, one journal article could contribute more than one set of correlation coefficients if independent samples were used (e.g. Barczak et al. 2008 included two studies, one with a sample size of 212 and the other with 118). After completing our review, we found 53 individual studies of organizational IT assimilation for inclusion in our analysis (see Appendix A).

Measurement of Variables

We coded a number of variables in order to perform the meta-analysis with the Schmidt-Le program (Schmidt and Le 2005)[3]. First, we coded the sample size and correlation coefficients for all relationships. Second, we coded the internal consistency measures of reliability for all variables included in the study. Finally, we coded innovation type as a moderator. We used Swanson's (1994) typology to classify the innovation in each study (e.g. Type I=OOP, Type II=CASE, Type III=ERP). Due to the small number of studies available, we did not sub-divide these types. We used innovation type to split the studies into groups (Hunter and Schmidt 2004). After meta-analyzing each innovation type separately, we compared the individual set of statistics for the different groups to determine if innovation type accounted for differences among the studies. Two of the authors coded all the fields with an inter-reliability of 97.7%. Coding disagreements were resolved prior to running analyses.

RESULTS

Table 1 details results for the meta-analysis of bivariate correlations separated by innovation type (see Appendix C for moderator analyses for all antecedents). Our results show that, except for organization size, the credibility intervals for each of the variables did not have a value of zero in their range. This suggests that, for organization size, the correlations could include negative or zero values, whereas the other correlations reflect standardized relationships at the population level. We also found that, as expected, innovation characteristics is positively related to IT assimilation ($\rho^4 = 0.38$).

Variable	ρ	k[5]	N	Var.	80% CRI	PVA
Environmental Pressure	0.58	12	1,865	0.034	0.34–0.81	46%
Innovation Type 1	0.41	1	105	0	0.41-0.41	100%
Innovation Type 2	0.70	2	287	0	0.70-0.70	100%
Innovation Type 3	0.59	8	1,353	0.032	0.36-0.82	47%
Organizational Support	0.59	25	3,806	0.003	0.52–0.66	94%
Innovation Type 1	0.26	1	98	0	0.26-0.26	100%
Innovation Type 2	0.53	10	1,562	0.036	0.29-0.77	52%
Innovation Type 3	0.66	13	1,993	0	0.66-0.66	100%
Related Knowledge	0.53	29	6,166	0.029	0.41–0.75	46%

[1] http://home.aisnet.org/displaycommon.cfm?an=1&subarticlenbr=346

[2] We contacted the authors of 27 papers. From these e-mails, we received 2 additional correlation tables for inclusion in our analysis.

[3] See Appendix B for a complete list of all the variables we coded.

[4] ρ reflects the corrected population correlation estimate. It is not meant to reference significance values (i.e. p-values) here or throughout the paper.

[5] According to Switzer et al. (1992), k-values less than 10 should be interpreted with caution. However, low k-values for moderator analyses are typical for firm-level studies (e.g. Lee and Xia 2006).

Propagating Institutions	0.34	7	1,098	0.000	0.34–0.34	100%
Extent of Coordination	0.66	10	1,890	0.004	0.57–0.74	93%
IT Infrastructure Sophistication	0.56	19	5,192	0.022	0.37–0.75	53%
Innovation Characteristics	0.38	17	3,070	0.022	0.19–0.57	42%
Organization Size	0.31	24	6,972	0.118	-0.13–0.75	14%
ρ = corrected population correlation estimate; k = number of studies; N = number of observations; Var. = variance of true score correlations; CRI = credibility interval; PVA = percent of variance in observed correlations attributable to all artifacts[6]						

Table 1. Meta-Analysis of the Antecedents of IT Assimilation

Environmental Pressure

Hypothesis 1 states that environmental pressure will be positively related to IT assimilation. As expected, we found a positive corrected population correlation estimate (i.e. the ρ-value) of 0.58. Therefore, hypothesis 1 is supported.

Hypothesis 7 states that the relationship between environmental pressure and IT assimilation will be stronger for Types 2 and 3 innovations than for Type 1. As expected, we found the strongest relationships were for Types 2 and 3. The corrected population correlation estimates (i.e. the ρ-value) for the Type 2 and 3 innovations were 0.70 and 0.59, respectively. The ρ-value for Type 1 innovations was 0.413. Therefore, hypothesis 7 is supported.

Organizational Support

Hypothesis 2 states that organizational support will be positively associated with IT assimilation. As expected, we found a positive relationship between these two variables (ρ=0.59). Thus, hypothesis 2 is supported.

Hypothesis 8 states that the relationship between organizational support and IT assimilation will be stronger for Types 2 and 3 innovations than for Type 1. As expected, we found the strongest relationships were for Types 2 and 3. The ρ-value for the Type 2 and 3 innovations were 0.53 and 0.66, respectively. The ρ-value for Type 1 innovations was 0.263. Thus, hypothesis 8 is supported.

Related Knowledge

Hypothesis 3 states that the relationship between related knowledge and IT assimilation will be positive. As expected, we found respectively positive relationship between the variables with a corrected population correlation estimate of 0.53. Therefore, hypothesis 3 is supported.

Propagating Institutions

Hypothesis 4 states that the relationship between propagating institutions and IT assimilation will be positive. As expected, we found the aggregated analysis of propagating institutions to IT assimilation was explained without further moderator analysis (as indicated by the variance of zero across the studies). This value, in addition to the 100% in the PVA column, indicates 100% of the variance across the studies testing this relationship is due to sampling and measurement error. Hence, further moderator analysis of the innovation types is not necessary. This indicates that hypothesis 4 is supported.

Extent of Coordination

Hypothesis 5 states that the extent of coordination will be positively related to IT assimilation. As expected, we found a positive corrected population correlation estimate of 0.66. Our finding that 93% of the variance across studies testing this relationship is due to sampling and measurement error provides tentative support for a constant relationship between coordination and assimilation.

IT Infrastructure Sophistication

Hypothesis 6 states that IT infrastructure sophistication will be positively associated with IT assimilation. As expected, we found the corrected population correlation estimate is 0.56. Therefore, hypothesis 6 is supported.

[6] The term "artifact" refers to sampling and measurement error.

DISCUSSION

Our meta-analytic results provide greater understanding into the magnitude of relationships between organizational IT assimilation and its existing antecedents. Specifically, our results show that, after correcting for sampling error and measurement error, three factors greatly facilitate organizational IT assimilation: organizational support, propagating institutions, and extent of coordination (see PVA column in Table 1).

The results of our moderator analyses also provide further insight on sources of inconsistencies in findings across different studies of assimilation. We found that the relationship between three variables (environmental pressure, organizational support, and related knowledge) and IT assimilation is moderated by innovation type. Both environmental pressure and organizational support have a stronger effect on assimilation of Type 2 and 3 innovations than Type 1 innovations, yet related knowledge has a stronger effect on assimilation of Type 1 innovations than Type 2 and 3 innovations (see Appendix C). Moreover, the relationships between our remaining variables (propagating institutions, extent of coordination, and IT infrastructure sophistication) and IT assimilation are relatively similar across all types of IT innovations.

Limitations

Before discussing the implications of our results, we note several limitations in our study. One limitation concerns the coverage of sampled papers. Although the sampling procedure was thorough, we did not search all possible databases and may have failed to find some articles. However, given the overall large number of sampled studies, adding a few studies would be unlikely to alter the conclusions.

Our moderator analyses show that the impact of some factors on IT assimilation depends on the type of IT innovation. However, we interpret some of these results with caution due to low k-values. For instance, we found only one study that tested the relationship between environmental pressure and assimilation of Type 1 innovations. In fact, many of the relationships we examined had low k-values for Type 1 innovations. Future research should consider the inclusion of more Type 1 innovations to gain a more complete picture of IT assimilation.

Implications

The findings of our study have several implications for research. While researchers have identified and investigated a range of factors that impact IT assimilation, our findings suggest that – after correcting for sampling and measurement error – certain factors are strongly tied to IT assimilation. In particular, our meta-analysis shows that organizational support and propagating institutions positively impact IT assimilation. Thus, future research should consider adding these two factors as control variables when predicting IT assimilation (if not already part of the research model). Also, while our results provide tentative support for a stable relationship between coordination and IT assimilation, future research should investigate how coordination mechanisms impact the assimilation of IT innovations. In particular, we know little regarding how coordination affects assimilation of Type 1 innovations.

The weak relationships between our remaining antecedents – environmental pressure, related knowledge, and IT infrastructure sophistication – and IT assimilation suggests that further work is needed in these areas. Environmental pressure derives from the institutional perspective, a perspective which has been promoted (Fichman 2004) and recently adopted (Liang et al. 2007, Teo et al. 2003) by IT innovation researchers. Further empirical work on the relationship between environmental pressure and IT assimilation will give us greater insight into how each of these pressures – coercive, mimetic, and normative – impact the IT assimilation process in different ways.

Despite substantial attention given to the relationship between related knowledge and IT assimilation (29 empirical studies), our findings suggest that further work is needed to give us more precise insight in this area. One potential avenue for future research is to expand our view of related knowledge from an "asset" perspective to a "capability" perspective. Most studies[7] view related knowledge as simply "what does the assimilating entity know regarding the focal innovation ." While many of the related knowledge studies adopt Attewell's (1992) concept of knowledge barriers, the notion of related knowledge is tied to absorptive capacity. Absorptive capacity is the ability to identify, assimilate, and apply valuable external knowledge (Cohen and Levinthal 1990). Prior related knowledge is one of the primary antecedents to absorptive capacity (Van den Bosch et al. 1999). Shifting the focus from related knowledge as an asset to more of an absorptive capacity perspective (i.e., as a capability) should provide greater understanding into how knowledge-based mechanisms impact IT assimilation. For example, absorptive capacity might mediate the relationship between related knowledge and IT assimilation.

[7] Post-hoc analysis shows that related knowledge is conceptualized and measured as "what the entity knows" (versus how well the entity identifies, assimilates and applies external knowledge to the IT assimilation process) in 95% of our collected studies.

Our results also suggest that further attention is needed concerning the relationship between IT infrastructure sophistication and IT assimilation. One reason for the inconsistent findings may be that researchers often invoke a broad view of IT infrastructure (e.g., Bhatt and Grover 2005). However, IT infrastructure itself encompasses virtually all of an organization's IT components (Weill 1993), and it may be that some firms are more sophisticated in certain areas of IT infrastructure than other firms. These varying levels of sophistication within IT infrastructure may impact IT assimilation in different ways (more so depending on the type of IT innovation). Hence, future research should take a deeper look at how certain aspects (and areas) of IT infrastructure sophistication impact the assimilation of various IT innovations.

Although researchers often take into account the nature of the IT innovation when conducting assimilation studies, the results of our moderator analyses reinforce the importance of delineating the type of IT innovation under investigation and how certain contextual factors impact assimilation. Despite conceptual and methodological challenges, researchers should attempt to study the assimilation of multiple IT innovations in a single setting. Doing so would provide further insight into how various technological, organizational and social forces shape IT assimilation in competing and complementary ways. Future empirical work might also examine IT assimilation using an extended version of Swanson's tri-core model (Grover 1997).

CONCLUSION

This study reviews and extends prior research on organizational IT assimilation. Using meta-analytic techniques, we rigorously assess the impact various organizational, technological and environmental factors have on IT assimilation. Our inclusion of innovation type as a moderator of these relationships provides further insight into the nature of IT assimilation phenomena. We hope that our study provides a foundation for future research in this important area.

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APPENDIX A. STUDIES THAT CONTAINED DATA USED IN THE META-ANALYSIS

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APPENDIX B: COMPLETE LIST OF CODED VARIABLES

Authors
Journal Name
Year of Publication
Theory (e.g. Innovation Diffusion Theory, RBV, Institutional Theory)
Unit of Analysis (organization vs. IT department)
Firm Size
Industry
Country
Assimilation Definition
Assimilation Type (effectiveness vs. extent of use of IT)
Assimilation Measure (Likert, Index, Guttman)
Absorptive Capacity (prior related knowledge vs. capability)
Innovation Studied (e.g. e-commerce, CASE, ERP)
Innovation Type (Swanson's Types I, II, or III)
Respondents
Sample Size
Variables
Reliabilities
Correlations

APPENDIX C. DETAILED RESULTS OF MODERATOR ANALYSES

Variable	Innovation Type	ρ	k	N	Var.	80% CRI	PVA
Environmental Pressure	1	0.41	1	105	0	0.41-0.41	100%
	2	0.70	2	287	0	0.70-0.70	100%
	3	0.59	8	1,353	0.032	0.36-0.82	47%
Organizational Support	1	0.26	1	98	0	0.26-0.26	100%
	2	0.53	10	1,562	0.036	0.29-0.77	52%
	3	0.66	13	1,993	0	0.66-0.66	100%
Related Knowledge	1	0.75	3	1,321	0	0.75-0.75	100%
	2	0.34	12	2,629	0.019	0.16-0.52	45%
	3	0.59	11	1,657	0	0.59-0.59	100%
Propagating Institutions	(aggregated)	0.34	7	1,098	0	0.34-0.34	100%
Extent of Coordination	1	0.32	1	105	0	0.32-0.32	100%
	2	0.68	3	644	0.054	0.38-0.98	52%
	3	0.68	4	702	0	0.68-0.68	100%
IT Infrastructure Sophistication	2	0.56	7	1,491	0.008	0.45-0.67	78%
	3	0.53	10	3,369	0.019	0.35-0.70	54%
Innovation Characteristics	(aggregated)	0.38	17	3,070	0.022	0.19–0.57	42%
Organization Size	(aggregated)	0.31	24	6,972	0.118	-0.13–0.75	14%