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Assimilation of Enterprise Systems: The Mediating Role of Information Integration of Information Impact

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ASSIMILATION OF ENTERPRISE SYSTEMS: THE MEDIATING ROLE OF INFORMATION INTEGRATION ON INFORMATION IMPACT

Research-in-Progress

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Abstract

Firms have invested heavily in information systems that collectively form an enterprise's system. While many senior executives believe their enterprises' systems have been "deployed" successfully they also believe they fall short of their potential informational impact. This research bridges deployment-related and impact-related assimilation research by recognizing the important role information integration plays in achieving significant informational impact from enterprise systems. We define information integration as the extent to which enterprise systems have been integrated to enable delivery of the right information to the right person at the right time and information impact as the extent to which information is utilized to support and enable business strategies and activities. After investigating the relationship between information integration and information impact, we identify and test the antecedents to information integration including external pressure and information systems resources. This research, when completed, will provide an important extension to the assimilation and information research streams.

Keywords: IT assimilation, deployment, information integration, information impact, institutional forces, information systems resources, information management

Introduction

For decades, firms have dedicated substantial financial resources to information systems designed to support specified functions (e.g. accounting, manufacturing), decision making (e.g. decision support systems, executive support systems), and coordination of cross-functional and/or inter-organizational business processes (e.g. supply chain management), which collectively form an organization's enterprise systems (ES). However, organizations often face great challenges in achieving the full potential of their enterprise systems. To explore the causes, researchers have spent substantial effort to investigate the acquisition, implementation, and deployment of enterprise systems (e.g., Grover 1993; Rai and Bajwa 1997; Saunder and Clark 1992). One sub-stream of the information technology (IT) assimilation research focuses on the deployment aspect by investigating the process from an organization's initial awareness of an innovation to large-scale deployment within the organization (e.g., Cho and Kim 2001-2002, Fichman and Kemerer 1997). Alternatively, another sub-stream of IT assimilation research has examined assimilation further along the innovation lifecycle - as the outcome (or impact) of adopting a technology. For example, Armstrong and Sambamurthy (1999) define IT assimilation as "the effective application of IT in supporting, shaping, and enabling firms' business strategies and value-chain activities" (p. 306). Liang et al. (2007) focus on enterprise systems and adopt the definition of assimilation by Purvis et al. (2001) as "the extent to which the use of technology diffuses across the organizational projects or work processes and becomes routinized in the activities of those projects and processes".

We propose that the two sub-streams of assimilation research need to be further connected by considering the integration of information systems in organizations. Because both deployment-related and impact-related assimilation studies have primarily focused on the assimilation of a single IT innovation or IT in general, they tend to assume that technology will integrate well with the existing technologies and systems in organizations. Outcome-related assimilation research such as Armstrong and Sambamurthy (1999) references deployment-related assimilation research but does not explicitly focus on the information link. This study recognizes the need to look beyond the technical artifact of enterprise systems deployment to focus on the information delivered by them; hence, we investigate the use of enterprise systems in the form of information integration, a concept that describes the extent to which ES have been integrated to enable delivery of the right information to the right person at the right time. As depicted in Figure 1, information integration which comes after deployment and is necessary to achieve substantial impact of ES, acts as a critical link between the two sub-streams of assimilation research. Deployment of enterprise systems is representative of a minimum level of assimilation whereby hardware, software, networking and initial data specifications are implemented. Information integration implies a richer level of assimilation whereby the organization implements data delivery that is contextual, meaningful, accurate and appropriate to all individuals resulting in significantly positive impact on processes and activities. As observed in practice, a successful initial implementation does not necessarily lead to information integration or impact. Hence, it is important to focus on information integration as a closer antecedent to the outcome of ES.

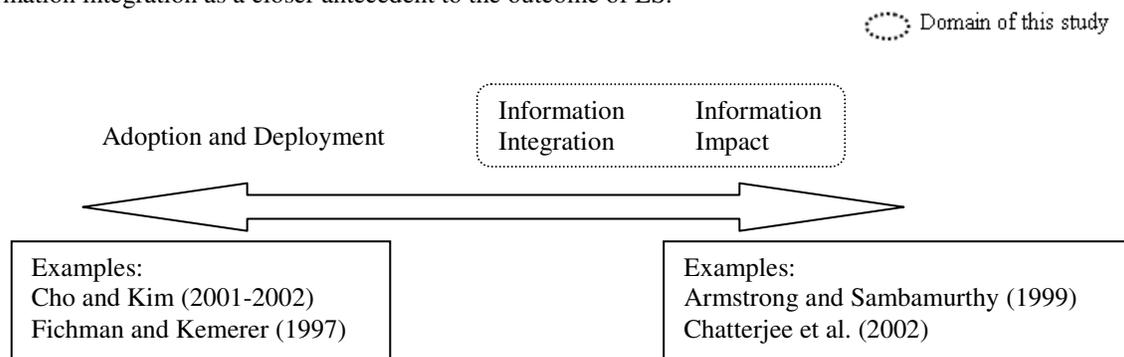


Figure 1. Domain of Study

We define information impact as the extent to which information provided by ES is utilized to support and enable business strategies and activities. The research questions we address in this study include: How does enterprise systems' information integration influence information impact? What are the antecedents to information integration? Next we provide a review of each relevant research stream and develop the research hypotheses. We then propose a methodology to test the hypotheses and discuss the contributions of this research.

Enterprise Systems

In our conversations with senior managers they refer to and assess their enterprise systems as an amalgam rather than a specific application area. This perception of enterprise systems is in part due to the fact that systems today are often provided by various vendors; they may require diverse information formats, computing platforms, programming models, and middleware to tie them together to prevent potential incompatibility. In essence, enterprise systems' components are parsed together with other systems in organizations to form an enterprise systems platform useful to the organization's users. The increasing complexity and the rapid changes in technology products further aggravates the need to deploy ES component parts which are beyond assessment lens of senior managers, except at a high "enterprise systems" level. Surprisingly, even though this is how most general and senior managers view their enterprises systems, little research on deployment-related assimilation and outcome-related assimilation has considered the integration of collective information systems throughout the entire organization. However, we contend it is this amalgam of enterprise systems resources that senior executives are assessing relative to perceived outcome payoffs. Thus, the scope of this study is the entire set of information systems being used by organizations.

Systems Integration

A number of studies focus on the technical aspect of systems integration (e.g., Byrd and Turner 2000; Duncan 1995). They describe systems integration in terms of technology connectivity and compatibility and data transparency, and concentrate on the availability and implementation of network and telecommunication technologies. Recognizing that in order to understand the impact of systems integration the focus should not be restricted to the technical level, other studies explore to what extent the systems in a firm can be integrated to enhance its business performance (e.g., Premkumar et al. 1994; Ramamurthy et al. 1999). Researchers have identified and adopted various dimensions of integration such as internal integration and external integration (Crum et al. 1996; Iacovou et al. 1995; Ramamurthy et al. 1999), and intra-functional, cross-functional, multidivisional/multinational, and inter-organizational integration (Rai et al. 2000). In addition, Barki and Pinsonneault (2005) identify six types of organizational integration: internal-operational, internal-functional, external-operational-forward, external-operational-backward, external-operational-lateral, and external-functional.

Information Integration

While we acknowledge the theoretical and practical value of the prior work on systems integration, in this research we emphasize the need to look beyond the technical and process attributes of the enterprise systems artifacts and to focus on their output – the information itself. We argue that how information is made available throughout enterprise systems to the right person at the right time has more practical relevance to senior executives than how enterprise systems are technically integrated.

According to Ackoff (1989), information is data that has been given meaning. Similarly, Glazer (1991) defines information as data that are organized, placed in context, and provided with meaning. Rouse (2002) identifies information as a collection of data in a form that facilitates communication and use. Information systems are the mechanisms that produce and deliver information; they are the means to an end – the information.

Porter's seminal work points out that information provided by IT is an important asset to organizations and helps organizations gain competitive advantage (Porter 1985). Since then a number of researchers have tried to look beyond technical aspects of IT and information systems to emphasize the role of information usage and management (Glazer 1993; Marchand et al. 2000, 2001; Mithas, Ramasubbu and Sambamurthy 2008). For example, Mithas et al. (2008) propose and test a model that links information management capability with organizations' customer management capability, process management capability, and performance management capability, which lead to improved organizational performance. Besides the aforementioned scholars, senior managers also share a similar view of information in organizations. These managers recognize what organizations value IT the most is its role in managing the information that their organizations rely on regardless of the technologies adopted by IT (Applegate, Austin and McFarlan 2007; Ragowsky, Licker and Gefen 2008). Therefore, when investigating integration of enterprise systems, we propose that how information systems or technologies are technically integrated, while important, may not be as important as how information can be obtained and used throughout organizations as a result of integration.

A review of the information integration literature reveals that prior studies of information integration have been either technical or supply chain oriented. On the technical side, Giachetti (2003) presents an enterprise information integration framework consisting of four levels: systems, data, applications, and processes, and reviews the current and potential technologies of information integration. Bernstein and Haas (2008) provide a review of tools and technologies that can be used to integrate information in the enterprise. A few researchers have also examined information integration in supply chains. Devaraj et al. (2007) investigates the mediating role of production information integration in the supply chain. Their production information integration construct encompasses both customer and supplier information sharing and collaborative efforts that improve information accuracy. Patnayakuni et al. (2006) define information flow integration for supply chain coordination as “the extent to which operational, tactical, and strategic information is shared between a firm and its supply chain partners for supply chain coordination” (p. 22). Rai et al. (2006) examine the relationship between IT infrastructure integration, supply chain process integration, and firm performance. Our study extends the existing literature on information integration by investigating the antecedents and impact of information integration in enterprise systems.

We define information integration as the extent to which enterprise systems have been integrated to enable delivery of the right information to the right person at the right time. In other words, information integration is delivery of data that is contextually meaningful, accurate and timely enough to have the potential of positive informational impact if it is used by the appropriate person at the right time. People and use of information can be positioned both hierarchically and along a process in an organization. Hence, we identify that information integration consists of both hierarchical and process information integration. Figure 2 illustrates this concept adapted from the dimensions identified in Scheer (1994).

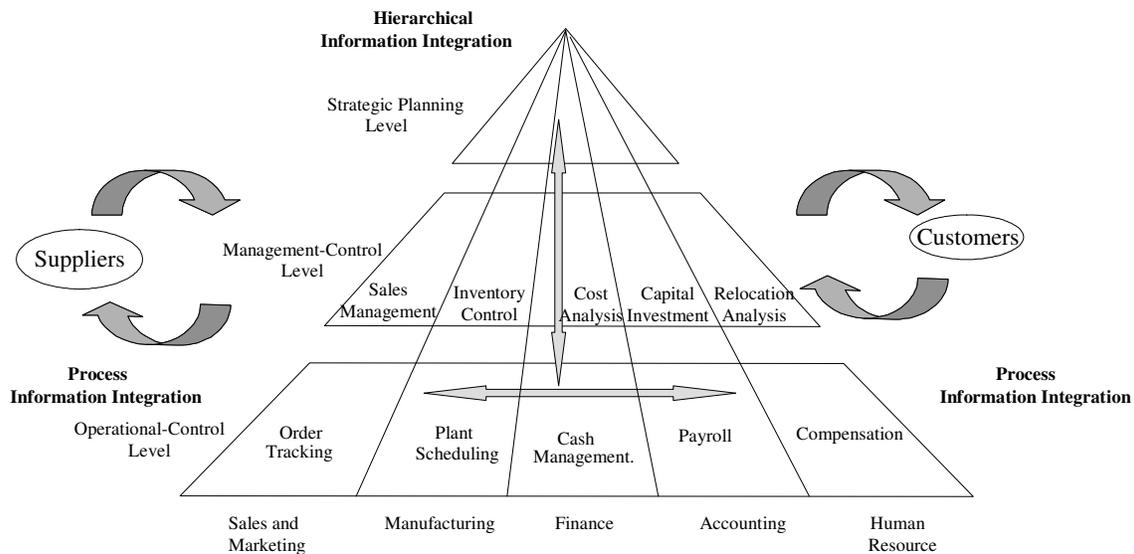


Figure 2. Dimensions of Information Integration (Adapted from Scheer 1994)

The vertical structure in the figure represents hierarchical information integration, representing the extent to which enterprise systems have been integrated to deliver necessary information to individuals at different levels – operational, managerial, and strategic – of organizations. Hierarchical information integration provides managers at every level with timely and relevant information with which decisions are based.

Line managers require useful and accurate information about daily activities to make decisions not only about current operations but also future operations. When a deviation from the target performance occurs in operational activities, managers need to receive timely notification and relevant information that help them analyze the characteristics of the issue and determine the appropriate corrective action to resolve the issue. Planning for future operations also requires timely delivery of the right information to operational managers (Heijnen and Lukszo 2006) (2006). Furthermore, hierarchical information integration can deliver needed information to middle managers to accomplish corporate objectives laid out at the strategic level by effectively allocating the limited resources to the right person at the right time. When systems at the managerial level are integrated, timely and accurate information is available for middle managers to make effective managerial decisions related to budget, sales, and production

planning (Laudon and Laudon 2003). At the executive level, strategic decision making requires timely and relevant information as well. Constantly monitoring information about their organizations from a variety of sources, top executives often need to make strategic decisions that have significant impact on their organizations. The importance of information to strategic decision making has been examined extensively (e.g., Kumar and Palvia 2001; Vandenbosch and Huff 1997).

The horizontal structure of the figure depicts the process aspect of information integration, which represents the extent to which enterprise systems have been integrated to deliver the necessary information throughout business practices within organizations and across their supply chains (Davenport 1998; Kelly et al. 1999; Markus and Tanis 2000). Process information integration reflects the interconnection of the information systems located in different functional areas within organizations and between organizations and their business partners (Iacovou et al 1995; Massetti and Zmud 1996; Rai et al. 2000). As the result of process information integration, people involved in a business process can exchange information with others in the same process. Integration of business processes that occurs across the supply chain allows the focal firm and its trading partners to access each other's information when and where appropriate.

Information Impact

Businesses operate in a competitive setting where they strive to gain competitive advantages by formulating strategies such as reducing production cost, being a low-cost producer, maintaining operational flexibility, enhancing supplier/customer relationships, and offering new products and services (Porter 1980). In the meanwhile, businesses are engaged in value chain activities (Porter 1985). Many studies examine the impact of IT by focusing on its influence on businesses' strategies (e.g., Bakos and Treacy 1986) and value chain activities (e.g., Glazer 1993). Therefore, borrowing from the definition of IT assimilation as "the effective application of IT in supporting, shaping, and enabling firms' business strategies and value-chain activities" by Armstrong and Sambamurthy (1999, p. 306), we define information impact as the extent to which information provided by enterprise systems is utilized to support and enable business strategies and value-chain activities.

According to our definition of information impact, one dimension of the impact is the extent to which information is used to develop and implement corporate strategies for reducing production costs, increasing operations flexibility, providing value-added customer service, and attracting new customers (Armstrong and Sambamurthy 1999; Chatterjee et al. 2002; Porter 1998), which requires accurate and timely information (Dearing 1990; Ramamurthy et al. 1999; Truman 2000). Information is an important asset that helps formulate and execute corporate strategies because it allows the organization to be flexible and agile in planning and incorporating enterprise-wide resources in response to an increasingly complex and turbulent business world (Marchand et al. 2001). Studies by such researchers such as Marchand et al. (2000, 2001) and Mithas et al. (2008) find that proactive information usage in business functions and processes is a dynamic capability driven by people that are well informed. Hence we propose that when enterprise systems are integrated in a manner that relevant information can be effectively delivered to the right person at the right time, the firm has the ability to formulate strategies so as to take advantage of potential opportunities or promptly respond to business needs.

Another dimension of information impact is associated with the extent to which information is used to support business activities. Conducting essential business activities such as those related to supply chain operations require accurate and up-to-date information to facilitate coordination. For example, the supply chain is a process of taking inputs in the form of material, people, and equipment and transforming them into goods and services for customers. This process involves a series of activities that are mutually interdependent with one another. Effective supply chain performance is based on seamless coordination which is the result of the improved information exchanges (Hart and Estrin 1991; Ramamurthy et al. 1999; Rai 2006). Information integration within enterprise systems facilitates the collection, comparison and aggregation of information from various processes in various parts of the organization, leading to a better use of information in operational decision-making and coordination. Therefore, we hypothesize:

H1: The level of information integration in the organization's enterprise systems positively influences the extent of information impact in the organization.

Next, we draw from institutional theory and resource-based view of the firm and identify external pressure and information systems resources as the antecedents of information integration in enterprise systems. In addition, we propose that external pressure to achieve information integration and information systems resources that organizations possess also moderate the relationship between information integration and information impact.

External Pressure

According to institutional theory, organizations operate in an open environment and unavoidably come across various external pressures that constrain their behaviors. These external forces represent socially prescribed norms, values, and expectations to which organizations must conform in order to sustain necessary social resources for their survival (DiMaggio and Powell 1983; Meyer and Rowan 1977). DiMaggio and Powell (1983) identify three institutional pressures: mimetic, coercive, and normative. Mimetic forces arise when an innovation is taken by the leading companies in the industry or by a majority of a firm's competitors (Haunschild and Miner 1997; Oliver 1997). A firm may perceive pressures from what their competitors and leading companies in the industry have done and respond by imitating them. Coercive forces are largely caused by pressures from other organizations on which the focal organization is dependent (Mukhopadhyay and Kekre 2002; Provan 1980). Firms tend to comply with coercive pressures derived from the demands of its important business partners in order to maintain a business relationship. Normative forces stem from a process of professionalization, involving social learning in the network context (Abrahamson 1996; Swanson and Ramiller 1997). Normative forces arise as the organization is heavily exposed to the information distributed by influential third parties such as professional associations, industrial associations, consultants, and vendors. These external sources may influence the organization's perception about a particular innovation and practice. As a result, the organization feels the need to take actions suggested by these parties (Wilson et al. 1994). Empirical studies have shown that institutional pressures influence the way a firm reacts to a certain IT innovation (e.g., Teo et al. 2003).

We define external pressure as the extent to which the organization (through its senior managers' influence) experiences the need to respond to the mimetic, coercive, and normative pressures it perceives. Achieving information integration in enterprise systems often incurs high cost and involves a prolonged and continuing process that requires the organization to devote substantial organizational resources. In addition, information integration often entails substantial changes in terms of organizational structures, culture, and the ways of doing business (Markus et al. 2000). Hence, given the complexity and uncertainty involved in the prolonged process and extensive organizational changes, the organization may not consider enhancing the information integration of its enterprise systems unless it feels the need to react to the external pressures demanding it to do so. Overall, we propose that the extent to which organizations are subject to external pressures is positively associated with the degree of information integration in their enterprise systems. We hypothesize that:

H2: The external pressure to achieve information integration positively influences the extent of information integration in enterprise systems.

Information Systems Resources

It should be recognized, however, that even when organizations face the same amount of mimetic, coercive, and normative pressure from the institutional environment that they operate in, their responses often vary due to the differences in their technical and organizational characteristics (Ang and Cummings 1997, Beck and Walgenbach 2005, Westphal, et al. 1997). In line with the earlier studies examining the organizational contingencies that impact organizational responses to institutional pressures, we argue the extent of information integration in organizations also depends on their internal capabilities, especially information systems resources. According to the resource-based view (RBV) of the firm, a firm's resources include its assets and capabilities available and useful to the firm to detect and react to opportunities or threats (Christensen and Overdorf 2000; Sanchez et al. 1996). Based on a number of conceptual frameworks defining what constitutes IS resources (e.g., Bharadwaj 2000, Samburthy et al. 2003), Wade and Hulland (2004) identify IS resources as the assets and capabilities associated with external relationships management, IS/business partnership, market responsiveness capability, IS planning and change management, IS infrastructure, IS technical skills, IS development, and cost effective IS operations.

Due to the complexity and scope that enterprise systems information integration may involve, a firm needs to have the relevant IS resources to cope with the technical and organizational challenges that information integration may entail. First, IS/business partnerships reflect a firm's ability to manage internal relationships such as the alignment between IS functions and other functional areas or departments. Because information integration in enterprise systems will have organizational-level impacts, the firm needs to shape consensus among managers around the potential opportunities and risks when integrating the information systems in the entire enterprise. IS/business partnerships represent an organizational capability to form such consensus between senior managers in IS and business communities (Armstrong and Samburthy 1999). Secondly, the IS function's capability to rapidly

respond to market changes affects a firm's information integration status. This capability involves the collection of information from sources external to the firm, the dissemination of a firm's market intelligence across departments, and the organization's response to that learning. With this capability, information can be effectively updated since firms know where and to whom the collected information should be delivered. Thus, when a firm can vigilantly respond to market situations, it is likely that enterprise systems can be integrated in such a way that accurate and up-to-date information is effectively delivered. Thirdly, the ability for effective IS planning and change management could have a profound impact on information integration status because information integration requires an overarching plan from which a firm can evaluate and use appropriate technologies to integrate a network of information systems that are dispersed within and across organizations. Fourth, an effective IS operation is critical to achieving a high level of information integration. If the IS function of a firm does not have the capability to provide dependable IS services, the firm cannot make the integrated enterprise systems work as effectively as they are supposed to. Hence, we hypothesize:

H3: The information systems resources that a firm possesses positively influence the extent of information integration in enterprise systems.

Moderating Roles of External Pressure and Information Systems Resources

Although we propose that a higher degree of information integration in ES tends to lead to higher information impact in organizations, we also recognize that making the right information available to the right person at the right time does not necessarily indicate that the person will use that information in his or her decision making.

Marchand (2005) points out business managers often fail to focus on how effectively information is used by individuals in their organizations. Marchand et al. (2000) argue that IT improves business performance only if information is managed effectively and employees have the right behaviors and values for working with information. Whether and how much individuals effectively use the information provided by integrated ES depends on a number of factors, one of which is senior executives' attitude toward effective information use. Having recognized the institutional pressures from the external environment, senior executives perceive it to be important to achieve information integration in their ES and intend to do so. They then act as "the primary human agency that translate external influences into managerial actions such as changing organizational structures and establishing policies based on their perceptions and beliefs of institutional practices" (Liang et al. 2007, p. 63). Senior executives not only need to develop an information strategy that focuses on employee and manager training to properly use information and promotes an "open, action-oriented company culture" (Marchand et al. 2000, p. 73) but also need to reinforce the right information mindset, behaviors and values of employees and managers. The greater external pressure to achieve information integration perceived by senior executives, the more likely they will promote the right information behaviors and values in their organizations and the greater information impact will result from information integration. Furthermore, the IS functional area also plays a key role in cultivating the right information management culture throughout the organization. An organization with slack IS resources is more likely to devote resources to promote effective use of information by employees through training activities and establishing incentive and monitoring mechanisms. IS resources also enable IS function to communicate and work with business units more efficiently to encourage employees' information usage behavior. The greater IS resources possessed by the organization, the more likely it will create the organizational information culture emphasizing effective information usage. Therefore, we propose that:

H4: The external pressure to achieve information integration moderates the relationship between information integration and information impact.

H5: The information systems resources that a firm possesses moderate the relationship between information integration and information impact.

In addition, we identify a set of control variables such as organizational size, industry type, and time since heavy investment in information integration based on the existing IT assimilation literature. Past studies (e.g., Armstrong and Sambamurthy 1999; Liang et al. 2007) recognize that larger organizations have more slack resources that allow them to experiment with innovative practices and absorb the cost of such experimentation more easily than smaller organizations (Damanpour 1987). Industry type may also affect information impact in the organization. For example, for manufacturing industries the role of information may be greater in supporting value-chain activities than in supporting business strategies. Additionally, the time since the organization started investing heavily in achieving information integration in its enterprise systems may also influence information impact because of

organizational learning effect (Fichman 2001). Figure 3 schematically shows the research model consisting of major theoretical constructs and their hypothesized relationship.

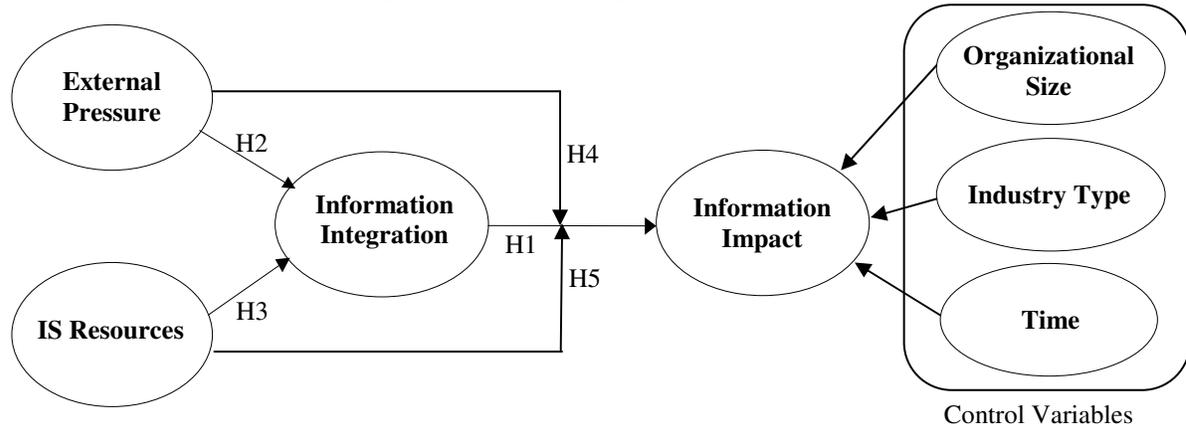


Figure 3. Research Model

Research Methodology

The next step of the research is to empirically test the five hypotheses. The analysis is performed at the organizational level because the major constructs in our research model are associated with organizations. For each construct, we have identified existing measures in the literature and adapted them to our research domain. Then pertinent scales were reviewed by a group of IS experts for their coverage of content and psychometric properties. Examples of construct operationalizations are presented in the appendix. In the next step, the survey instruments are pilot tested on a representative sample of the target population and the instrument is modified based on the feedback from the respondents.

We have conducted a field survey of senior executives for the following reasons. Senior executives who act as key strategic informants in their organizations are better able to have a holistic view of the major constructs in the research model such as the external pressures faced by their organizations, their IS resources, degree of information integration throughout their organizations, and organizational-level information impact. We are currently in the process of analyzing data using PLS statistical package. We will first assess the reliability, unidimensionality, convergence, and divergence of the reflective constructs. Then we will examine the structural model and estimate the relative strength of the relationships between the major constructs. We will also assess the severity of common method bias due to self-reported data (Podsakoff et al. 2003).

Conclusion

This research focuses on information provided by enterprises' information systems and stresses the role played by information in facilitating business strategic and operational activities. Specifically, it examines the influence of information integration on information impact, which represents the informational outcome of using enterprise systems, and hypothesizes that the level of information integration is positively associated with information impact. Furthermore, we identify both external pressure and internal IS resources as two antecedents to information integration in enterprise systems. Finally, we propose that external pressure and IS resources moderate the relationship between information integration and information impact.

This study, when completed, will provide an important extension to the assimilation and integration research streams. By targeting integration within enterprise systems from an informational perspective, it contributes to the assimilation literature by focusing on a critical link between deployment-related assimilation research and outcome-related assimilation research. It also extends the integration literature by studying the information aspect of integration and identifying its influence on the outcome of integration. Future research may examine internal pressure as well as personal information behavior as additional antecedents of information integration. It will also be interesting to obtain objective data capturing individual usage of information to better understand the link between information integration and information impact at the individual level.

References

- Abrahamson, E. "Management Fashion," *Academy of Management Review* (21:1), January 1996, pp. 254-285.
- Ackoff, R. L., "From Data to Wisdom", *Journal of Applied Systems Analysis* (16), 1989, pp. 3-9.
- Applegate, L., Austin, R., and McFarlan, F. *Corporate Information Strategy and Management*. McGraw-Hill Irwin, New York, 2007.
- Armstrong, C. P. and Sambamurthy, V. "Information Technology Assimilation in Firms: The Influence of Senior Leadership and IT Infrastructures," *Information Systems Research* (10:4), December 1999, pp. 304-327.
- Bakos, J.Y. and Treacy, M.E. "Information Technology and Corporate Strategy: A Research Perspective," *MIS Quarterly* (10:2), June 1986, pp. 107-119.
- Barki, H. and Pinsonneault, A. "A Model of Organizational Integration, Implementation Effort, and Performance," *Organization Science* (16:2), 2005, pp. 165-179.
- Bernstein, P.A. and Haas, L.M. "Information Integration in the Enterprise," *Communications of the ACM* (51:9), September 2008, pp. 72-79.
- Bharadwaj, A. S. "A Resource-Based Perspective on Information Technology Capability and Firm Performance," *MIS Quarterly* (24:1), March 2000, pp. 169-198.
- Bouchard, L. "Decision Criteria in the Adoption of EDI," in *Proceedings of the Thirteenth International Conference on Information Systems*, Orlando, FL, December 1993, pp. 365-376.
- Byrd, T. A. and Turner, D. E. "Measuring the Flexibility of Information Technology Infrastructure: Exploratory Analysis of a Construct," *Journal of Management Information Systems* (17:1), Summer 2000, pp. 167-208.
- Chatterjee, D., Grewal, R., and Sambamurthy, V. "Shaping Up for E-Commerce: Institutional Enablers of the Organizational Assimilation of Web Technologies," *MIS Quarterly* (26:2), June 2002, pp. 65-89.
- Cho, I. And Kim, Y. "Critical Factors for Assimilation of Object-Oriented Programming Languages," *Journal of Management Information Systems* (18:3), Winter 2001-2002, pp. 125-156.
- Cooper R. B. and Zmud, R. W. "Information Technology Implementation Research: A Technological Diffusion Approach," *Management Science* (36:2), February 1990, pp. 123-139.
- Crum, G., Premkumar, G., and Ramamurthy, K. "An Assessment of Motor Carrier Adoption, Use, and Satisfaction with EDI," *Transportation Journal* (35:4), Summer 1996, pp. 44-57.
- Dearing, B. "The Strategic Benefits of EDI," *The Journal of Business Strategy* (11:1), January/February 1990, pp. 4-6.
- Devaraj, S., Krajewski, L., and Wei, J.C. "Impact of eBusiness Technologies on Operational Performance: The Role of Production Information Integration in the Supply Chain," *Journal of Operations Management* (25:6), November 2007, pp. 1199-1216.
- DiMaggio, P., and Powell, W. "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields," *American Sociological Review*, 48, 1983, pp. 147-160.
- Duncan, N. B. "Capturing Flexibility of Information Technology Infrastructure: A Study of Resource Characteristics and Their Measure," *Journal of Management Information Systems* (12:2), Fall 1995, pp. 37-57.
- Fichman, R. G. and Kemerer, C. F. "The Assimilation of Software Process Innovations: An Organizational Learning Perspective," *Management Science* (43:10), October 1997, pp. 1345-1363.
- Floyd, S. W. and Wooldridge, B. "Dinosaurs or Dynamos? Recognizing Middle Management's Strategic Role," *Academy of Management Executive* (8:4), November 1994, pp. 47-57.
- Giachetti, R.E. "A Framework to Review the Information Integration of The Enterprise," *International Journal of Production Research* (42:6), 2004, pp. 1147-1166.
- Glazer, R. "Marketing in an Information-Intensive Environment: Strategic Implications of Knowledge as an Asset," *The Journal of Marketing* (55:4), October 1991, pp. 1-19.
- Glazer, R. "Measuring the Value of Information: The Information-Intensive Organization," *IBM Systems Journal* (32:1), 1993, pp. 99-110.
- Grover, V., "An Empirically Derived Model for the Adoption of Customer-based Interorganizational Systems," *Decision Sciences*, 24, 3 (1993), pp. 603-40.
- Hart, P. and Estrin, D. "Inter-Organization Networks, Computer Integration, and Shifts in Interdependence: The Case of The Semiconductor Industry," *ACM Transactions on Information Systems* (9:4), October 1991, pp. 370-398.
- Hauschild P. R. and Miner, A. S. "Modes of Interorganizational Imitation: The Effects of Outcome Salience and Uncertainty," *Administrative Science Quarterly* (42:3), September 1997, pp. 472-500.

- Heijnen, P. and Lukszo, Z. "Continuous Improvement of Batch Wise Operation – A Decision Support Framework," *Production Planning & Control* (17:4), June 2006, pp. 355-366.
- Hendricks, K. B., Singhal, V. R., and Stratman, J. K. "The Impact of Enterprise Systems on Corporate Performance: A Study of ERP, SCM, and CRM System Implementations," *Journal of Operations Management* (25:1), 2007, pp. 65-82.
- Hitt, L.M., Wu, D. J., and Zhou, X. "Investment in Enterprise Resource Planning: Business Impact and Productivity Measures," *Journal of Management Information Systems* (19:1), 2002, pp. 71-98.
- Iacovou, C.L., Benbasat, I., and Dexter, A.S. "Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology," *MIS Quarterly* (19:4), December 1995, pp. 465-485.
- Irani Z., Themistocleous, M. and Love, P. "The impact of Enterprise Application Integration on Information System Lifecycles," *Information and Management* (41:2), 2003, pp. 177-187.
- Kraatz, M. "Learning by Association? Inter-Organizational Network and Adaptation to Environmental Change," *Academy of Management Journal* (41:6), 1998, pp. 621-643.
- Kumar, A. and Palvia, P. "Key Data Management Issues in Global Executive Information Systems," *Industrial Management & Data Systems* (101:3/4), 2001, pp. 153-164.
- Kwon T.H. and Zmud, R.W. "Unifying the Fragmented Models of Information Systems Implementation," in *Critical Issues in Information Systems Research*, Boland, R.J. and Hirschheim, R.A. (Ed.), John Wiley & Sons, 1987.
- Laudon, K.C. and Laudon, J.P. *Essentials of Management Information Systems*, 5th edition, Upper Saddle River, New Jersey: Prentice Hall, 2003.
- Markus, M. L., Axline, S., Petrie, D., and Tanis, C. "Learning from Adopters' Experiences With ERP—Successes and Problems," *Journal of Information Technology* (15: 4), December 2000, pp. 245-265.
- Marchand, D. A. "Reaping the Business Value of IT," *Business and Economic Review* (51:4) 2005, pp 21-24.
- Marchand, D. A., Kettinger, W. J., and Rollins, J. D. "Information Orientation: People, Technology and the Bottom Line," *Sloan Management Review* (41:4) 2000, pp 69-80.
- Marchand, D. A., Kettinger, W. J., and Rollins, J. D. *Making the Invisible Visible: How Companies Win with the Right Information, People and IT*, London and New York: John Wiley and Sons, 2001.
- Meyer, A. D. and Rowan, B. "Institutionalized Organizations: Formal Structure as Myth And Ceremony," in Powell W.W and DiMaggio, P.J. (eds.) *The New Institutionalism in Organizational Analysis*, Chicago: The University of Chicago Press, 1977, pp. 41-62.
- Mithas, S., Ramasubbu, N., and Sambamurthy, V. "Information Technology Infrastructure Capability and Firm Performance: An Empirical Analysis," Working Paper, Robert H. Smith School of Business, University of Maryland, College Park, 2008.
- Mukhopadhyay, T. and Kekre, S. "Strategic and Operational Benefits of Electronic Integration In B2B Procurement Processes," *Management Science* (48:10), October 2002, pp. 1301-1313.
- O'Callaghan, R., Kaufmann, P.J., and Konsynski, B.R. "Adoption Correlates and Share Effects of Electronic Data Interchange Systems in Marketing Channels," *Journal of Marketing* (56:2), April 1992, pp. 45-57.
- Oliver, C. "Sustainable Competitive Advantage: Combining Institutional and Resource-Based Views," *Strategic Management Journal* (18:9), October 1997, pp. 697-713.
- Patnayakuni, R., Rai, A., and Seth, N. "Relational Antecedents of Information Flow Integration for Supply Chain Coordination," *Journal of Management Information Systems* (23:1), Summer 2006, pp. 13-49.
- Podsakoff, P., MacKenzie, S., Lee, J., and Podsakoff, N. "Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies," *Journal of Applied Psychology* (88:5), 2003, pp. 879-90
- Porter, M. E. *Competitive Advantage: Creating and Sustaining Superior Performance*. The Free Press: New York. 1998.
- Porter, M.E., and Millar, V.E. "How Information Gives You Competitive Advantage," *Harvard Business Review* (63:4), 1985, pp 149-160.
- Premkumar, G., Ramamurthy, K., and Nilakanta, S. "Implementation of Electronic Data Interchange: An Innovation Diffusion Perspective," *Journal of Management Information Systems* (11:2), Fall 1994, pp. 157-186.
- Provan, K.G. "Recognizing, Measuring, and Interpreting the Potential/Enacted Power Distinction in Organizational Research," *Academy of Management Review* (5:4), 1980, pp. 549-559.
- Purvis, R.L., Sambamurthy, V., and Zmud R.W. "The Assimilation of Knowledge Platforms in Organizations: An Empirical Investigation," *Organization Science* (12:2), March-April 2001, pp. 117-135.
- Ragowsky, A., Licker, P. S., and Gefen, D. "Give Me Information, Not Technology," *Communications of the ACM* (51:6), June 2008, pp. 23-25.

- Rai, A. and Bajwa, D.S. "An Empirical Investigation into Factors Relating to the Adoption of Executive Information Systems: An Analysis of EIS for Collaboration and Decision Support," *Decision Science* (28:4), Fall 1997, pp. 939-974.
- Rai, A., Patnayakuni, R., Seth, N. "Firm Performance Impacts of Digitally-Enabled Supply Chain Integration Capabilities," *MIS Quarterly* (30:2), 2006, pp. 225-246.
- Rai, A., Ponce de Leon, J.A., and Melcher A.J. "Enterprise Process Innovation: Strategies and issues," in Grover V. and Kettinger, W.J. (eds.) *Process Think: Winning Perspectives for Business Change in the Information Age*, Hershey PA: Idea Group Publishing, 2000.
- Ramamurthy, K., Premkumar, G., and Crum, M.R. "Organizational and Interorganizational Determinants of EDI Diffusion and Organizational Performance: A Causal Model," *Journal of Organizational Computing and Electronic Commerce* (9:4), 1999, pp. 253-285.
- Ross, J.W., Beath, C.M., and Goodhue, D.L. "Develop Long-Term Competitiveness through IT Assets," *Sloan Management Review* (38:1), Fall 1996, pp. 31-39.
- Rouse, W.B. "Need to Know – Information, Knowledge, and Decision Making," *IEEE Transactions on Systems, Man, and Cybernetics* (32:4), November 2002, pp. 282-292.
- Sambamurthy, V., Bharadwaj, A., and Grover, V. "Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology In Contemporary Firms," *MIS Quarterly* (27:2), June 2003, pp. 237-263.
- Sanders, G. L. and Courtney, J. F. "A Field Study of Organizational Factors Influencing DSS Success," *MIS Quarterly* (9:1), 1985, pp. 77-93.
- Scheer, A. *Business Process Engineering: Reference Models for Industrial Enterprises*, 2nd edition, Berlin, Germany: Springer-Verlag, 1994.
- Swanson, B. E. "Talking the IS Innovation Walk," in Wynn, E. H., Whitley, E. A., Myers, M. D., and DeGross, J. I. (Eds.), *Global and Organizational Discourse about Information Technology*, Dordrecht: Kluwer, 2003, pp. 15-31.
- Swanson, B. E. and Ramiller, N. C. "The Organization Vision in Information Systems Innovation," *Organization Science* (8:5), 1997, pp. 458-474.
- Teo, H.H., Wei, K.K., and Benbasat, I. "Predicting Intention to Adopt Inter-Organizational Linkages: An Institutional Perspective," *MIS Quarterly* (27:1), 2003, pp. 19-49.
- Truman, G. "Integration in Electronic Exchange Environments," *Journal of Management Information Systems* (17:1), Summer 2000, pp. 209-244.
- Vandenbosch, B. and Huff, S.L. "Searching and Scanning: How Executives Obtain Information from Executive Information Systems," *MIS Quarterly* (21:1), March 1997, pp. 81-107.
- Wade, M. and Hulland J. "Review: The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research," *MIS Quarterly* (28:1), March 2004, pp. 107-142.
- Weill, P. "The Relationship between Investment in Information Technology and Firm Performance: A Study of the Valve Manufacturing Sector," *Information Systems Research* (3:4), 1992, pp. 307-331.
- Wilson, F., Desmond, J., and Roberts, H. "Success and Failure of MRP II Implementation," *British Journal of Management* (5:3), September 1994, pp. 221-240.
- Xue, Y., Liang, H., Boulton, W. R., and Snyder, C. A. "ERP Implementation Failures in China: Case Studies with Implications for ERP Vendors," *International Journal of Production Economics* (97:3), 2005, pp. 279-295.

Appendix: Construct Operationalization

Construct	Sample Operationalization	Sources
Information Integration	<p>Process Information Integration (PII1): Information systems in our firm are linked in such a manner that information captured in one part of a business process is available to other parts of the process.</p> <p>Hierarchical Information Integration (HII1): Information systems in our firm are linked in such a manner that information is available for top executives to form corporate strategies and policies.</p>	Scheer 1994
Information Impact	<p>Our firm is successful in applying information to support the business strategy of being a low-cost producer.</p> <p>Our firm is successful in applying information to execute inbound logistics activities.</p>	<p>Armstrong and Sambamurthy 1999</p> <p>Chatterjee et al. 2002</p>
External Pressure	<p>Please indicate the extent to which you agree with the following statement:</p> <p>We perceive pressures to integrate our enterprise systems because many companies that we compete with have integrated their enterprise systems.</p>	<p>Hauschild and Miner 1997</p> <p>Kraatz 1998</p>
IS Resources	<p>Our IS function has the ability to effectively build strong partnerships with other areas within the firm.</p>	Wade and Hulland 2004