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Development and Implementation of IT-Enabled Business Processes: A Knowledge Structure View

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of the requirements for the degree of
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ABSTRACT

As competitive pressures mount, organizations must continue to evolve their business processes in order to survive. Increasingly, firms are developing new IT-enabled business processes in response to rising competition, greater customer expectations, and challenging economic conditions. The success rate of these projects remains low despite much industry experience and extensive academic study. Managerial and organizational cognition represents a potentially fruitful lens for studying the design and implementation of IT-enabled business processes. This view assumes that individuals are information workers who spend their days absorbing, processing, and disseminating information as they pursue their goals and objectives. Individuals develop cognitive representations, called knowledge structures, to represent their complex informational environment. Knowledge structures in turn help individuals to assimilate and process a bewildering flow of informational cues. Given the large degree of communication and information sharing required during the design and implementation of new business processes, it follows that knowledge structures likely play a large role in the success of these projects.

This dissertation, organized as three essays, attempts to address this gap by investigating the influence of knowledge structures on the successful design and implementation of IT-enabled business processes. Essay 1 utilizes a case study method to observe the evolution of knowledge processes and the role of knowledge structures across three large-scale IT projects occurring over a ten-year period at a Fortune 100 company. Essay 2 investigates the knowledge building potential of business process models for both individual- and group-level knowledge. Essay 3 develops an individual-level model of business process appraisal by incorporating constructs from the job/role literatures into a popular IT appraisal mechanism. The resulting business process appraisal model is then tested as an early indicator of project success. Essay 2 and 3 hypotheses were tested using a field study in an organization which recently implemented a new purchasing and receiving process as part of a larger ERP project. Results suggest support for the proposed models. Important implications for research and practice are discussed.

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DEDICATION

Dedicated with love and gratitude to

my wife Lucretia and my kids Taylor, Michael, and Jarrett,

for all that you've sacrificed and for your unwavering support

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CHAPTER 1

INTRODUCTION

Organizational goals and objectives are achieved through an intricate weave of routines and processes enacted by organizational members. Often the success of an organization depends upon their ability to leverage rare and valuable internal resources and processes (Barney 1991; Eisenhardt and Martin 2000; Simonin 1999; Teece, Pisano et al. 1997). In response to increased competition, greater customer expectations, and challenging economic conditions, firms must continue to evolve their own internal business processes in order to survive. Increasingly, firms are deploying information technology-based solutions to digitize business processes in order to achieve advanced capabilities not otherwise available. One such technology, enterprise systems (ES), consists of a comprehensive set of software, which integrates all the business functions within an organization (Shehab, Sharp et al. 2004). It is estimated that as many of 88% of U.S. firms have implemented or are implementing an ES (Liang, Saraf et al. 2007). ES projects are expensive endeavors with costs reaching $500 million for large international firms (Hitt, Wu et al. 2002; Shehab, Sharp et al. 2004). Unfortunately however, ES projects achieve only a 10% success rate (Bajwa, Garcia et al. 2004), with nearly one in five projects scrapped and considered a total failure (Somers, Nelson et al. 2003). Some attribute these failures to the challenges involved in the redesign of business processes spanning multiple functional areas (Hitt, Wu et al. 2002). Firms often change their business processes to align with the "best practices" around which the ES system is developed (Somers, Nelson et al. 2003), as it is often easier to fit the firm to the software than to fit the software to the firm (Shehab, Sharp et al. 2004). The high failure rate and great cost of business process digitization makes this an important area of research.

This problem is rooted within the theoretic traditions of competitive advantage research, which asks the simple question, "how does one firm gain competitive advantage over another" (Penrose 1959; Schumpeter 1934). One influential theoretical framework, the resource-based view of the firm (RBV), describes firms as bundles of resources, and suggests that resource heterogeneity among firms can lead to differences in firm performance (Barney 1991; Mahoney and Pandian 1992). It states that firms realize competitive advantage when they configure new value-creating strategies from internal resources which are "valuable, rare, inimitable, and nonsubstitutable" (Eisenhardt and Martin 2000, p. 1105). RBV has a rich history in the IT literature (e.g., Jarvenpaa and Leidner 1998; Santhanam and Hartono 2003; Wade and Hulland 2004). Building upon the traditions of RBV, researcher are beginning to investigate the processes or routines employed by the firm to integrate, reconfigure, gain, and release resources (Eisenhardt and Martin 2000; Teece, Pisano et al. 1997). These so called *dynamic capabilities* are "specific and identifiable" business processes which create value through effective use of firm resources in value-creating strategies (Eisenhardt and Martin 2000. p. 1105). IT researchers have leveraged the concept of dynamic capabilities in the study of performance-driving aspects of IT solutions (e.g., Banker, Bardhan et al. 2006), in the conceptualization of the role of IT in firms (Sambamurthy, Bharadwaj et al. 2003), and elsewhere.

In addition to a firm's internal resources and processes, the management and strategy literature has also investigated the way its members interpret their informational environment and subsequently make business decisions. Managerial and organizational cognition suggests that individuals are "information workers" whose time is spent "absorbing, processing, and disseminating information about issues, opportunities, and problems" (Walsh 1995, p. 280). Because their information environment is often bewildering and complex, individuals organize their knowledge into structures to give the environment form and meaning. These knowledge structures assist in the assimilation of new information (i.e. learning) and facilitate effective decision making. ES projects require extensive communication and knowledge sharing among project team members and others throughout the organization. It would seem that knowledge structures play an important role in the design and implementation of new IT-enabled business processes. This has received little attention in the IT literature.

This dissertation, organized as three essays, attempts to address this gap by investigating the influence of knowledge structures on the successful design and implementation of IT-enabled business processes. Essay 1 utilizes a case study method to observe the evolution of knowledge processes and the role of knowledge structures across three large-scale IT projects occurring over a ten-year period at a Fortune 100 company. Essay 2 investigates the knowledge building potential of business process models for both individual- and group-level knowledge. Essay 3 develops an individual-level model of business process appraisal by incorporating constructs from the job/role literatures into a popular IT appraisal mechanism. The resulting business process appraisal model is then tested as an early indicator of project success. Essay 2 and 3 hypotheses were tested using a field study in an organization which recently implemented a new purchasing and receiving process as part of a larger ERP project. Results suggest support for the proposed models. Important implications for research and practice are discussed.

CHAPTER 2

ESSAY 1

DEVELOPMENT OF IT-ENABLED BUSINESS PROCESSES: TEN YEARS OF KNOWLEDGE PROCESS EVOLUTION AT A FORTUNE 100 COMPANY

ABSTRACT

As competitive pressures mount, organizations must continue to evolve their business processes in order to survive. Increasingly, firms are developing new IT-enabled business processes in response to rising competition, greater customer expectations, and challenging economic conditions. These projects require individuals to acquire, interpret, evaluate, and assimilate new business process information, resulting in new or augmented knowledge structures. Prior research indicates that organizations improve their ability to develop IT-enabled business processes through a variety of learning mechanisms, but the role of knowledge structures in these projects has not been adequately addressed. This study employs a case study method to examine the role of knowledge structures and the evolution of knowledge processes across three transformational IT projects conducted over a 10-year period at Flavorful Foods, a Fortune 100 manufacturing firm. The results suggest that Flavorful Foods determined their knowledge processes on each project based on assessments of prior project successes and failures, assessments of the project team's business process knowledge, and current design capabilities. In addition, the study indicates the importance of convergent knowledge processes in the identification of disruptive knowledge structures, which can lead to business process misspecification.

INTRODUCTION

One may view organizations as collections of routines and processes acting in concert to meet organizational goals and objectives. As competitive pressures mount, organizations must continue to evolve their processes in order to survive. Increasingly, organizations are digitizing business processes as they seek competitive advantage. These IT-enabled processes offer advanced IT capabilities which help organizations respond to increasing competition, greater customer expectations, and challenging economic conditions.

Organizations commit a great deal of time, money, and resources to IT-enabled business process projects as they chase benefits such as inventory reductions, cycle time reductions, improved customer satisfaction, and improved decision making. An ERP project may cost $15 million for a typical implementation, while large international firms may spend as much as $300 to $500 million (Hitt, Wu et al. 2002; Shehab, Sharp et al. 2004). The expected benefits are not easily attained, however. Enterprise systems projects see a dismal 10% success rate (on time, on budget, as planned) (Bajwa, Garcia et al. 2004) with nearly one in five projects scrapped and considered a total failure (Somers, Nelson et al. 2003). Some failures have even lead firms to bankruptcy (Shehab, Sharp et al. 2004). ERP critical success factor research often attributes project failure to the challenges involved in changing business processes. These projects frequently require the simultaneous redesign of multiple business processes spanning multiple functional areas within a firm (Hitt, Wu et al. 2002). Organizations often find it easier to change their business processes to match the "industry best practices" around which the ERP software was developed, rather than the other way around (Somers, Nelson et al. 2003).

Past research provides much insight into the successful development and implementation of IT-enabled business processes. Sambamurthy, et al. (2003) suggest that IT capabilities (including IT-based business processes) provide digital options which enable firms to capitalize on competitive opportunities. Firms create organizational IT capabilities through entrepreneurial alertness and realize competitive advantage through entrepreneurial actions. Feeney and Willcocks describe the need for a "two-way strategic alignment between business and technology" (1998, p. 10). Organizational IT capabilities emerge on the one hand by leveraging technology in the support of business strategy, and on the other hand by enabling new business strategies through the use of technology. Less is understood however concerning the role of knowledge structures in the development of IT-enabled business processes. Individuals create knowledge structures to help process informational cues and to make decisions (Walsh 1995). Knowledge structures, it would seem, are key components in the implementation of enterprise-wide change efforts which require high levels of resource coordination and communication. Accordingly, I use a knowledge structure lens to examine IT-enabled business process development of three large-scale and transformation IT projects occurring over a ten year period at a Fortune 100 food manufacturing firm. The results suggest that the company, hereafter called Flavorful Foods[1], determined their knowledge processes on each project based on assessments of prior project successes and failures, assessments of the project team's business process knowledge, and current design capabilities. In addition, the study indicates the importance of convergent knowledge processes in the identification of disruptive knowledge structures, which can lead to business process misspecification.

[1] The real company name is withheld for confidentiality reasons

THEORETICAL BACKGROUND

Digitized Business Processes

For decades now researchers have sought answers to a simple question, "how does one firm gain competitive advantage over another" (e.g., Penrose 1959; Schumpeter 1934). One influential theoretical framework, the resource-based view of the firm (RBV), describes firms as bundles of resources, and suggests that resource heterogeneity among firms can lead to differences in firm performance (see Barney 1991; Jarvenpaa and Leidner 1998; Mahone and Pandian 1992; Mahoney and Pandian 1992; Nelson 1991; Oliver 1997; Peteraf 1993; Prahalad and Hamel 1990; Priem and Butler 2000; Teece, Pisano et al. 1997; Wade and Hulland 2004; Wernerfelt 1984, 1995). RBV states that firms realize competitive advantage when they configure new value-creating strategies from internal resources which are "valuable, rare, inimitable, and nonsubstitutable" (Eisenhardt and Martin 2000, p. 1105). Competitors find such resources difficult to imitate due to path dependencies, embeddedness, causal ambiguity, and time diseconomies of imitation.

Building on the traditions of RBV, researchers are beginning to investigate the processes or routines employed by the firm to integrate, reconfigure, gain, and release resources (e.g., Eisenhardt and Martin 2000; Teece, Pisano et al. 1997). These so called *dynamic capabilities* are "specific and identifiable" business processes which create value through the effective use of firm resources in value-creating strategies (Eisenhardt and Martin 2000, p. 1105). At a high-level many competitors may appear to share dynamic capabilities, leading one to question their role in value creation. However, competitive advantage is found in the way in which a firm configures and leverages its own resources to carry out a dynamic capability. In other words, there may be multiple ways to execute a particular dynamic capability, but firms which employ "industry best practices" to leverage valuable, rare, inimitable, and nonsubstitutable resources are more likely to achieve real competitive advantage. Therefore, firms should consider dynamic capabilities "necessary, but not sufficient" components for realizing competitive value (Eisenhardt and Martin 2000, p. 1106).

The psychology literature suggests that business processes evolve over long periods of time as organizations learn from experience and subsequently create, retain, and transfer knowledge (Argote 1999). Processes may evolve through practice, codification of experience, mistakes, pacing of experience, and the ordering of implementation of other dynamic capabilities (see Argote 1999; Eisenhardt and Martin 2000; Zander and Kogut 1995). Path-dependent histories of evolution at individual firms result in unique detailed implementations of dynamic capabilities (Teece, Pisano et al. 1997). At the functional-level, however, processes and routines may exhibit commonalities across competitors, demonstrating equifinality in outcome as different firms may arrive at similar functionality through firm-specific experiences.

Increasingly, organizations are "digitizing" business processes in response to increasing competition, greater customer expectations, and challenging economic conditions. Technologies such as enterprise systems enable firms to streamline the integration of functional areas through seamless integration of information (Davenport 1998) and provide a holistic view organizational operations through a common platform (Gable 1998). Digitization of organizational work processes leads to the automation and integration of critical dynamic capabilities such as customer capture, order fulfillment, and product innovation (Davenport 1993). Investments in IT-enabled business processes create *digital options* which firms can leverage as competitive opportunities present themselves (Sambamurthy, Bharadwaj et al. 2003). Digital options may be conceptualized in terms of their reach and richness (Evans and Wurster 2000). Process reach describes the extent to which IT-enabled processes integrate functional areas within the firm and facilitate communication with trading partners outside the firm. Reach also addresses the accessibility of business processes by other technologies and solutions. Richness refers to the amount of and quality of information collected about business transactions, as well as the level of accessibility of that information to other processes and systems. Highly rich IT-enabled processes offer greater advantages through better decision modeling and analytics (Evans and Wurster 2000; Sambamurthy, Bharadwaj et al. 2003).

Shared Knowledge Structures

Individuals possess limited cognitive resources for the assimilation and recall of information (Neisser 1976). To cope with these limitations, individuals organize information into meaningful knowledge structures that facilitate the processing of incoming stimuli and speed information retrieval. This sort of metadata can range from simple heuristics that facilitate quick decision making to complex categorizations that organize information within an information domain (Schwenk 1986)[2]. Knowledge structures may be very complex, representing relationships between core or super-ordinate concepts with less salient peripheral concepts (Rosch 1973) and are considered "of equal or greater importance" than the information itself (Day, Winfred Jr. et al. 2001, p. 1022). Individuals evolve their own knowledge structures through an information process of assimilation, assessment, and subsequent encoding or rejection (Tyler and Gnyawali 2009; Walsh 1995). The effectiveness and efficiency of this encoding/filtering process depends upon the content of existing knowledge, and the existing linkages between them (Walsh 1995). In the early stages of knowledge structure formation,

[2] In a competing view, knowledge structures are dynamic representations constructed in working memory (Daniels, de Chernatony et al. 1995; Daniels, Johnson et al. 2002; Langield-Smith 1992).

individuals actively attend to assimilation and assessment of new information. Later, as knowledge structures mature, attentive actions yield to a more automated or mindless approach (Moors and De Houwer 2006; Walsh 1995). Knowledge structures have also been referred to as *schemas, mental models, knowledge sets, pictorial representations,* and *conceptual frameworks* (Dorsey, Campbell et al. 1999; Kuhn and Corman 2003; McNamara, Luce et al. 2002; Tyler and Gnyawali 2009).

Knowledge structures as described thus far represent an individual-level construct unique to each individual person. Knowledge is shared as individuals interact to achieve group and organizational goals. One may consider group-level knowledge as the aggregate of individual-level knowledge structures among group members. Accordingly, the construct of *shared knowledge structures* describes a level of shared understanding or knowledge consensus among group members (Walsh 1995). At any point in time group members will not possess identical knowledge structures (Kabanoff and Brown 2008). Instead, a group's level of shared knowledge may be thought of as a fluid measure that changes over time. This convergence and divergence of shared knowledge structures is due to the continued evolution of individual knowledge, knowledge sharing activities among individuals, and changes in group membership (Kuhn and Corman 2003). In addition to the term shared knowledge structures, this ebb and flow of shared knowledge has been referred to as *dynamic knowledge structures, knowledge structure homogeneity vs. heterogeneity, collective cognitive maps, team mental models, knowledge communality vs. diversity, collective cognition* and *collective knowledge* (Axelrod 1976; El Louadi 2008; Klimoski and Mohammad 1994; Kuhn and Corman 2003; Langield-Smith 1992).

Group performance is often highly dependent upon the success of the collaborative processes that members employ to share knowledge among group members (Lewis, Lange et al.

2005). These processes must effectively extract individual knowledge and communicate it to other members within the group so that it may be used to meet group and organizational goals (Alavi and Lieidner 2001; Nonaka 1994). Liu, et al. (2010) categorize these processes into codification vs. network approaches. In the codification approach, which works well for explicit knowledge, knowledge is codified into repositories that are made accessible to group members. The network approach, which works well for tacit knowledge, facilitates knowledge sharing through social interactions of individuals. Interestingly, they find support that under certain conditions of knowledge sharing potential, the use of both approaches simultaneously can lead to a breakdown of the collaborative process. Okhuysen and Eisenhardt (2002) found that in general formal interventions of managing time, questioning others, and sharing information improved knowledge integration when members possess specialized knowledge. Finally, Lewis, et al. (2005) describe the process of encoding, storing, retrieving, and communicating group knowledge as a dynamic process where subprocesses emerge and then evolve over time as the group performs subsequent tasks. In other words, knowledge processes not only facilitate the sharing of knowledge within the group, but also help improve the knowledge sharing process itself.

RESEARCH METHODOLOGY

Following the case study approach of Eisenhardt (1989), I investigate the development of IT-enabled business process implementation through the lens of shared knowledge structures. This method affords the opportunity to observe the phenomenon within the real-life context of large-scale, transformational IT projects. The results will allow generalization to theoretical propositions concerning how and why knowledge structures evolve in during IT-enabled business process development. Case study research is beneficial when relatively little prior research is available and theory building is required (Benbasat, Goldstein et al. 1987). Many of the key participants on the IT projects are still available for interview and a rich collection of archival documents is available for review. In the guidance of Eisenhart, I am careful to begin our study with "no theory under consideration and no hypotheses to test" (1989, p. 536) .

Data collection and analysis

This researcher has worked for Flavorful Foods in a variety of IS leadership positions since the early 1990's and participated on each of Flavorful's three projects in various managerial capacities. My roles with Flavorful Foods have provided direct hands-on experience in the design, development, and implementation of large-scale IT-enabled business process projects. Coming into this study, I was already familiar with each of these projects, including who in Flavorful Foods filled critical roles, the business processes they hoped to improve, and the archival record available for each.

After receiving permission from Flavorful's CIO, I began by first collecting over 3,000 archival documents across the three projects. These documents included status meeting notes, presentations, design documents, project websites, and many others. Each was then reviewed to determine its creation date so that the archive could be studied in the proper chronological order of events (Miles and Huberman 1994). I then collected other company documents such as annual reports and financial statements that could provide historical environmental context to project decisions. Further, I reviewed the trade press for articles written about the three projects over the years. Flavorful took a very open position on sharing their project experiences, especially in the early years of the study timeframe. Targeted interviews with key project participants ensured that relevant documentation was found. A research database (Yin 1994) helped to track the discovery of pertinent information relevant to shared knowledge structures and shared knowledge processes. Additional interviews were conducted as required to clarify and confirm findings. The entire analysis was highly iterative and involved moving back and forth among the data, existing literature, and emerging concepts. The process continued until it was possible to explain the aspects of shared knowledge structures across the three projects and no additional data were being collected, developed, or added (Glaser and Strauss 1967).

CASE STUDY SITE

Flavorful Foods and its subsidiaries produce a wide range of fresh, value-added, frozen, and refrigerated food products. These products are marketed and sold to grocery retailers, grocery wholesalers, distributors, warehouse club stores, military commissaries, industrial food processing companies, chain restaurants or their distributors, international export companies and domestic distributors. Flavorful Foods employs over 100,000 team members at more than 300 facilities and offices around the world. FY2011 sales exceeded $30 billion.

Late in 2001, Flavorful acquired a large supplier of premium fresh beef and pork products. In the year prior, the acquired company had reached over $15 billion in sales and operated 60 production sites in North America. They also operated joint ventures in China, Ireland, and Russia. At time of acquisition, they employed approximately 50,000 people. While Flavorful Foods had nearly doubled its annual sales in the decade preceding the acquisition, the new combined organization would achieve over three times Flavorful's annual sales, pushing them into the Fortune 100. The scale of the new company led to great synergies in branding, distribution, and customer service. From an IT point of view however, the picture was not as good. Flavorful now owned several redundant applications running on a wide array of hardware. Understanding the limitations that this would have on creating additional synergies for a unified Flavorful Foods, the executive team embarked on a multi-year effort to streamline their application portfolio, simplify its technology base, and migrate to “world class” business processes. The result was a series of projects, large and small, over the decade that followed. This study reviews three of the largest projects (in terms of committed time and resources), which transformed the way Flavorful Foods operated (see Figure 1). I label these projects A, B, and C in the discussion that follows.

INSERT FIGURE 1 ABOUT HERE

Project A

FamousBrands Inc.[3], a subsidiary of the acquired company, consisted of 17 independent operating companies and represented $3 Billion of the acquired company’s total revenue. Over the years, the acquired company had grown FamousBrands through the acquisition of smaller independent food companies but did little to integrate their systems and processes. The result was a collection of homegrown and packaged applications with redundant functionality running on many different platforms from different vendors. In response, Flavorful Foods launched a multimillion-dollar process and system integration project aimed at bringing all 17 independent companies onto Flavorful Foods systems. The project also included infrastructure changes such as linking FamousBrands locations to Flavorful Foods’ data center over frame-relay circuits, updating PCs to a common operating system release level, and from migrating Lotus Notes email to Microsoft Exchange in many locations. Project complexity forced Flavorful Foods to drop its original plan for a single project encompassing all 17 companies. They opted instead to implement each company individually. They also decided to treat infrastructure conversion

[3] The real company name is withheld for confidentiality reasons

separately from process change projects. The integration, which was filled with difficult challenges, finished in August 2003 on time and on budget.

Several main principles guided the early integration efforts for the new Flavorful Foods, including to quickly achieving "back-office" integration and savings that do not impact customer relationships. This guiding principle led to the objective of reviewing all applications and selecting a "best of breed" portfolio. Many of these were existing Flavorful Foods applications, but care was given to consider the appropriateness of existing FamousBrands applications for use by other Flavorful Foods business units. By and large, Project A involved the migration of the 17 FamousBrands companies to existing Flavorful Foods applications and business processes. The project was staffed primarily from within IT and various Flavorful Foods departments. After much discussion, Flavorful Foods decided to divide the project into two concurrent threads of work. One thread would address non-business application related technology standardization such as email and other forms of communication and connectivity. This also included standardization of desktop computers, phone systems, etc. The second thread addressed the migration of business applications and business processes to the "best of breed" portfolio. This thread was dived into four main phases as described below.

INSERT FIGURE 2 ABOUT HERE

Phase 1 – Fact Bases "A Mile Wide and an Inch Deep"

In order to be successful, the project leadership team felt that project design team members must gain a broad understanding of each of the 17 FamousBrands companies. Without this knowledge the team would be ineffective in their efforts to migrate these companies to Flavorful Foods' systems and business processes. The leadership team commissioned a database of facts to be created for each company. Once completed, these *fact bases*, as they called them, would contain between 50 and 100 pages of high-level company information. Their mantra for the fact base exercise was “A mile wide, and an inch deep,” suggesting that only a high-level understanding was required across the breadth of business processes for each company. The team first developed a fact base template to encourage consistency and usability. The template contained the following sections. A company profile provided a 1-2 page overview of the company including a summary of their products, customers, and go-to-market strategy, financial performance, investments, distribution models, and inventory storage. A systems section provided space to document each of the company’s systems, their functionality, and connectivity to other systems. Another section mapped existing systems to business processes. The largest section of the fact base was devoted to documenting high-level facts concerning business processes. These processes included order to cash, sales and operational planning, purchase to pay, production, human resources, financial planning/management/reporting, and costing. Each of these high-level processes was further divided into sub-processes. Sub-process details included a free-form discussion of key points, including critical roles and role assignments. An IT and infrastructure section documented aspects of vendor management, IT accounting, hardware/software leasing, capital spending, infrastructure, data and voice telecommunications, systems, data center operations, support services, web technology, and data warehousing/decision support systems. Five small teams were formed to complete the fact bases. The teams spent at least two days at each of the 17 FamousBrands companies interviewing key contacts and documenting their findings. These fact base served as inputs to the remaining phases of the application migration thread and to the technology migration thread. Most of the fact bases were developed over a three-month period.

Phase 2 – Detailed As-Is "An Inch Wide and a Mile Deep"

Concurrent with fact base development, the project team developed detailed documentation of current Flavorful Foods business processes and system maps. Sub-teams were formed to document processes for specific functional areas of finance and accounting, human resources, production, sales and operational planning, order to cash, and purchase to pay. Their mantra was to document "an inch wide and a mile deep", indicating that each functional would be described in great detail. These teams were staffed with dedicated resources from both IS and from the business, and staffed separately from the fact base teams. After completing the as-is process and system documentation, and after the first few fact bases were complete, the project team briefed all key project stakeholders and solicited feedback and direction for integration planning.

Phase 3 – Integration Planning

The overall integration effort was managed as a program of multiple integration projects. Projects were to be organized by FamousBrands company and have functional sub-components (e.g., HR, manufacturing, finance, etc.) within. As with earlier phases, the team was made of team members from both the business and IS. In addition, site leader roles were filled with FamousBrands team members which helped coordinate onsite activities, facilitate meetings, and participate in data collection. Detailed project plans and scope were managed for each company. Integration planning began with a meeting of key process owners and other stakeholders at a given company. This was to share the objectives of the merger, guiding principles, information gathered in each company's fact base, and the integration goals of the executive team. Over the next two months each project team utilized the company-specific fact bases and the detailed as-is process models to plan detail integration activities.

Phase 4 – Integration Projects

The final phase was comprised of a program of integration projects. Project managers and several key project participants were relocated to a central location to form a program war room. A large conference room was gutted and reconfigured with long tables, computers, phones, and various other office equipment. One end was left open to for status meetings and other impromptu gatherings of project team members. These meetings were often standing room only. Each project member's work area consisted of a small section of a table. This configuration allowed for fast and efficient communications. Additional project team members were located within functional areas of the company and within the information systems department. Standing status meetings were held every Monday and Wednesday morning. These meetings were fast paced with participants giving quick and informative status updates. Some meetings were organized functionally, with functional leaders providing an update of each individual integration project for each company. Other meetings were company-focused. This was especially helpful as an individual company was close to going live with new processes and systems. Most status meetings included a review of key tasks completed and upcoming, major issues and potential resolutions, as well as important dates and communication events. Periodically throughout the program, IS and project leadership team members would inform key stakeholders and the executive team of progress and seek their input on key issues. The integration projects were completed in approximately seven months of intense work. The entire effort was completed on time and on budget, but it wasn't easy. The CIO described the project as the most difficult tasks he had encountered in 17 years at Flavorful Foods.

Project B

Following the FamousBrands integration project, Flavorful Foods inked a deal with SAP AG to move its multiple back-end systems, many of them homegrown, to a unified SAP backbone. They selected SAP to facilitate the adoption of industry best practices business processes and to optimize efficiencies across operations. This would be a far-reaching project covering business processes such as trade promotion management, the complete order to cash cycle, materials management, financials, team member management, manufacturing, and purchasing. They embarked on an effort to develop a clean, integrated set of master data for their chart of accounts, products, customers, and vendors. They also launched a notable change management effort and hired a vice president of organizational change to deal with the cultural and process changes that this project would entail. Flavorful Foods would be one of the first companies to adopt SAP's new service-oriented architecture.

INSERT FIGURE 3 ABOUT HERE

In late 2002, Flavorful Foods' executive leadership and key business leaders conducted three strategic visioning workshops and developed what they called the "How we will win" vision for the future. Beginning in early 2003 and lasting for seven months, team members from across the company collaborated to create recommendations for Flavorful Foods' future business processes, systems, and organization, based on the strategic vision. They held more than 300 design workshops with hundreds of Flavorful Foods team members to complete the end-state design phase of the project. In two rounds of challenge sessions, business leaders reviewed the design of the new Flavorful Foods and provided suggestions as appropriate. With high-level business process design now compete, project B was split into three waves; 1) legacy Flavorful Foods, 2) the remaining processes from the acquired company, and 3) foreign operations. Each wave would be comprised of core projects for each of the following functional areas; order to cash, manufacturing, procurement, financials, account management and planning, trade spending, and product retrieval. In addition, separate "off-cycle" projects with their own timelines would address functionality within human resources systems, manufacturing, plant maintenance, and accounts payable. In august of 2003, the executive steering committee gave approval to proceed with the waves 1 & 2 projects and several of the off-cycle projects.

In the "detailed design" phase, which began in January 2004, Flavorful Foods added several new business and IS team members to the project and began to transform the end-state vision into a detailed process, system, and organizational design. They created detailed process flows of how Flavorful Foods team members would work with new business processes and systems. They conducted hundreds of design sessions over the months that followed, with a goal of culminating in August 2004 in a two day review session where the new designs would shared with a broad group of business leaders. In April 2004, during this phase, the project team began to discuss an alternate design. Scenario 2, as it was dubbed, would leave many legacy systems in place and interface them back to SAP. This reduced the extent to which the SAP software would be deployed. The project team felt this would greatly reduce project risk by limiting the number of systems being replaced at one time. Scenario 2 also represented a large reduction in functional and technical scope for Project B. Its planning began with a small number of team members in an almost covert fashion, but soon grew to encompass the entire project team.

Designers were asked to provide detail designs for both the original scope and scenario 2. In June 2004 the project leadership team was reorganized to better align with the scenario 2.

The build phase, beginning in October 2004, saw the project team implement process changes, install necessary hardware, and configure/develop new applications. The team documented business process procedures or BPPs, which were used to communicate with the business and served as the foundation for training materials. The team also worked with the business to cleanse and enrich all master data to be converted into the new systems. They developed scenarios for testing relevant configuration and development for a given part of a business process. In February 2005, the functional scope was again reduced. The wave 1 functionality would now include only the financial, procure to pay, and plant maintenance business processes. Wave 1 would also include a smaller set of new master data. Many of the off-cycle projects remained. A new team was formed to review functionality not included in wave 1. The "Pit Crew", as it was called, was staffed by a small number of experienced team members and carefully reexamined each piece of functionality based on its business benefits and cost. Based on their analysis, the Pit Crew made recommendations for future projects. In May 2005, the first announcement went out to the company for the restructured project B. The newly appointed CIO sent an email to all Flavorful Foods team members explaining that the project B steering team had determined that adjustments to priorities and personnel were required in order to maintain the original vision and implementation of common processes and systems to support Flavorful Foods. He went on to explain that a smaller project team, composed of Flavorful Foods team members and a now limited number of consulting partners, would focus on implementing wave 1 and off-cycle projects. In June 2005 a re-kickoff meeting was held for the now smaller wave 1.

Beginning in August 2005 the project team moved into the integration testing phase of the project. Here, the project team completed an integrated test of new processes and systems using real data. Testing in this phase was more comprehensive than the scenario testing from earlier phases. Testing was further expanded to include various legacy systems. This phase also included many business readiness activities such as curriculum and courseware development, business readiness road shows, and system demos. Toward the end of the phase attention shifted to acceptance testing and business approvals. This phase concluded in late December and the new processes and systems went live during the first week of January 2006.

Project C

As mentioned earlier, Flavorful Foods formed a small team called the Pit Crew to reexamine the business value of functionality dropped from the original scope of Project B. This effort resulted in some functionality being dismissed altogether. All remaining functionality deemed valuable was documented and prioritized for future projects. One such project (subsequently to be called Project C here) focused on improving Flavorful Foods' processes and systems for managing inventory. A presentation to the project steering committee explained the project's as one that would greatly improve tracking of and visibility into product development and logistics. This would require the implementation of a new real-time inventory system, systematic batch management from ingredients to finished goods, process order management, systematic hold/release management, and the use of technology to support data capture and handling of products. Additional coordination would be required with concurrent projects addressing changes to production costing methods and product data management.

INSERT FIGURE 4 ABOUT HERE

Once approved by the Pit Crew, a project leadership team was formed. This team first reexamined and validated all known requirements. They then created a project approach and work plan for review and approval by the executive steering committee. After obtaining approval to begin, the project entered a five month design cycle. During the first part of design, a small core team of experienced business and IS team members were sequestered to a remote location where they formed the initial high-level business process design. This was an intense time filled with long meetings. After just a few weeks the core team emerged after reaching agreement on the basic design. Next, each of the core team members was assigned sub-team leadership responsibility for creating a detailed design for a piece of the overall high-level design. Sub-team leadership assignments were made according to each team member's experience and expertise. Additional business and IS team members were staffed to each sub-team, which over the next few weeks created a detailed design for their piece of the process. During this time the original core team would periodically meet to address issues and answer questions for the sub-teams. In this way the core team remained informed of design decisions made on the sub-teams, which helped ensure consistency across the entire detailed design. By the end of 2008, the design was complete and ready for approval by the steering committee.

The build phase began in 2009 and lasted for most of the year. The work consisted of several different concurrent development threads which were managed through a central project leadership team. Other than a small delay that resulted from a few technical challenges, the build phase went according to plan. Testing began in late 2009 and concluded in February 2010. Flavorful Foods decided to first implement the solution in as a pilot in one facility. The pilot was complete and successful in September 2010. Since that time Flavorful Foods has continued to roll out the solution to additional locations and plans to continue this approach into the foreseeable future.

Business Councils

Another interesting development occurred in mid 2005 that fundamentally changed the way Flavorful Foods initiates, manages, and communicates projects. As mentioned earlier, a new CIO was put in place during Project B. Prior to his arrival there was growing discontent among those in the business with the direction of Project B and the fact that it seemed to consume IS resources at the expense of other business sponsored projects. During his first few days in the position, the CIO talked with several key business leaders to assess concerns and determine opportunities. He then worked with the Pit Crew to develop a new process for better managing business expectations concerning IS projects and services. The resulting process was called the *Business-Driven, Value-Oriented Implementation Strategy*. Foundational to the strategy was putting the project prioritization and selection process in the hands of key business leaders. Three business councils were formed to represent major areas of the business. The Sales and Marketing council represented all selling-related activities across all selling channels. The Operations council represented all manufacturing and plant operations. The Shared Services included all remaining business functions such as human resources, financial accounting, and purchasing. Anywhere from five to ten key executive business leaders comprise each council board. IS was already organized with a Vice President of Application Development for each of the three areas, and each VP also sat on the board of their respective council.

Sometime earlier Flavorful Foods began utilizing a project tracking system which allowed the business to initialize projects and for IS to manage project documents and communicate project status. The councils adopted this system for managing council priorities. Each project request (called a service request) was first entered with no priority. During monthly council meetings, project managers of the top 20 projects would provide a quick status update and discuss any issues that required a decision from the council. As top 20 projects were completed, new projects would be selected by the board for inclusion in the top 20. IS then managed their effectiveness at meeting business demands by the percentage of IS time spent working on top 20 projects. Each meeting began with a review of completed service requests and suggestions for moving into the top 20. Steering committees were assigned to larger projects. In the time period from mid 2005, Project B gradually evolved from one large project to a series of smaller projects prioritized by the councils. Project C has been managed by no less than 15 separate service requests to date and will undoubtedly require several more before rollouts are complete. Flavorful Foods IS performs periodic effectiveness assessments by surveying those in the business. Internal measures of satisfaction have improved since adopting this strategy.

DISCUSSION

Over the 10-year period, Flavorful Foods shaped it business processes through a series of transformational IT projects (see Table 1). Project A focused on the integration of 17 FamousBrands companies with Flavorful Foods' existing business processes and application portfolio. Little to no new business process design was required. Instead, project efforts focused on the migration of FamousBrands operations from each individual company's business processes to Flavorful Foods' business processes. All existing business processes were in scope. The business process migration team was small and staffed almost entirely with experienced

Flavorful Foods team members. In the end almost all business processes were migrated, the few exceptions being those FamousBrands processes of which Flavorful Foods did not have an existing business process in place. The project was completed on time and is generally considered a success.

INSERT TABLE 1 ABOUT HERE

Project B began as a very aggressive business process improvement project focusing on the design and implementation of new "world class" ways of conducting business. Initially all business processes were in scope, as were all lines of business. Over the first 1.5 years, the project team developed high-level and detail-level process designs for the new Flavorful Foods. While partially staffed with experienced Flavorful Foods team members, the design team relied heavily on consultants for business process design options. Business process design was heavily influenced by process templates provided by a consulting firm, and by consultant experiences at other companies. Growing discontent with the project eventually led the executive steering committee to reduce scope significantly and to reorganize the project team. The new project focused on the build and implementation of a smaller set of business processes. Business processes and functionality that fell out of scope were given to another group, which Flavorful Foods called the Pit Crew, to reevaluate in terms of business value, feasibility, and cost/benefits. Consulting was also greatly deemphasized at this point. The now smaller project B moved through the build, implementation, and testing phases according to plan, and the new systems went live 1.5 years after the project reorganization.

Project C, which was spawned by the Pit Crew, was a business process agility effort aimed at improving Flavorful Foods' inventory management capabilities. It involved extensive business process changes, as well as, an increased focus on data collection, integration, and quality. An initial high-level design team was staffed with a small number of experienced Flavorful Foods team members, which developed a high-level design within a matter of weeks. The design team was then expanded to focus on detail-level designs. After gaining approval from the executive steering committee, the project moved through the development and testing phases. It went live with its first pilot locations on schedule and with little complications. Project C is generally considered a success at Flavorful Foods.

Triggered Evolution of Knowledge Sharing Capabilities

A goal of this research is to gain insight into the role of knowledge structures in the evolution of a firm's business process design capabilities. In each of the three projects, Flavorful Foods adapted its knowledge capabilities in order to produce better process designs. This evolution occurred in response to perceived knowledge shortcomings or based on failures with previous approaches. At a high-level, each evolutionary change followed the same basic pattern. 1) An episodic event occurred which acted as an enabling condition, or trigger, for the evolution to take place. 2) This was followed by an assessment of current knowledge pertaining to the project domain, and a plan to fill perceived knowledge gaps. 3) Each plan consisted of divergent infusions of new knowledge, 4) followed by convergent socializing of the new knowledge. These divergent and convergent processes varied greatly from one project to the next. Detailed explanations follow with a summary provided in Table 2.

INSERT TABLE 2 ABOUT HERE

Facilitating conditions

Each of the three Flavorful Foods projects were preceded by a significant and strategic event. Prior to Project A, Flavorful Foods acquired a company twice its size. The resulting hodgepodge of redundant processes and systems was inefficient. Flavorful Foods' executives understood that in order to maximize synergistic opportunities of the company's new found scale, these redundancies had to be eliminated. This drove the need to spread knowledge of FamousBrands processes to others in the Flavorful Foods organization and to help the FamousBrands companies understand how Flavorful Foods operated. Project B arose because of Flavorful Foods' executive leadership's vision of a world class organization with world class business processes and systems. As a result, the CEO authorized expenditures for a multi-year, company-wide overhaul. Without this level of support the convergent/divergent knowledge processes could not have taken place. A main goal of Project C was to improve Flavorful Foods' ability to respond in the face of product recalls. This is functionality they hope will never be used, but the capability to track products anywhere through the supply chain would provide both competitive advantage, and risk mitigation should the need arise. A recommendation from the Pit Crew and approval by the project steering committee enabled the project to proceed.

The rally of organizational resources in the pursuit of business value is often not cheap. Many times there are more opportunities to create value than there are resources available. Large scale efforts are often justified through devices such as return on investment and compliance mandates. The strategy literature calls this positioning and explains how a firm's assets enable the pursuit of competitive advantage (Teece, Pisano et al. 1997). In each of these projects, Flavorful Foods' executive leadership maintained that a business process project would help them to achieve their strategic vision for the firm, and subsequently made important enabling resources available to the project team.

Knowledge assessment

The three Flavorful Foods projects began with an assessment of one or more of the following: 1) the project team's relevant business process knowledge, 2) the project team's business process design capabilities, or 3) applicability of business process design processes used on prior projects. In Project A the project leadership team believed that prior to planning the integration of 17 FamousBrands companies it would be critical to first improve the design team's knowledge of each company's existing business processes. Likewise, the project leadership knew that at some point it would be critical to communicate existing Flavorful Foods business process knowledge to FamousBrands team members. In Project B one influential assessment came prior to starting the project. The executive leadership team decided to bring in a new CIO experienced at enterprise-wide business process transformation projects, and to elevate the CIO position to report directly to the CEO. The new CIO would then be responsible acquiring additional contractor and permanent team members who also had prior experience with these types of projects, particularly those with experience designing business processes that could leverage Flavorful Foods' ERP software. This knowledge of ERP-enabled business process capabilities paired with decades of Flavorful Foods business experience appeared to be a great combination of resources. By the time of Project C, Flavorful Foods had become very well versed in the capabilities offered by the ERP software. The project leadership felt that the design team's knowledge was sufficient. Very few consultants were brought in, and those were only to fill specific technical knowledge gaps and to augment development staff. For all three projects, these knowledge assessments served to guide the determination and selection of appropriate knowledge processes to employ. The ability to assess knowledge position and to coordinate subsequent actions and resources will often influence firm performance (Teece, Pisano et al. 1997). It follows then that the ability to sense knowledge gaps and to effectively initiate the correct knowledge processes to fill these gaps is critical to project success.

Divergent infusion of new knowledge

In order for a group's shared knowledge to evolve, it is often necessary for a few individuals to first engage in divergent knowledge processes to pioneer new ways of thinking about an information domain. This was apparent within Flavorful Foods' three projects. The project leadership team of Project A, as mentioned above, determined that the design team required a deeper understanding of the existing business processes for each FamousBrands company. Sending the entire design team to all 17 FamousBrands companies was not feasible. Instead, a small number of interview teams were created to travel to each company and subsequently document relevant business process information for the rest of the project team. This information was compiled into a 50+ page document for each FamousBrands company. Similarly, it was not feasible to bring representatives from the various FamousBrands companies to Flavorful Foods to participate in the integration planning sessions. Planning was conducted at Flavorful Foods by the project team and then communicated out to each location. Project B relied heavily on the knowledge of consultants and newly hired team members to guide the design of business processes. Process designs were modeled from industry "best practices" supplied by a consulting firm. They were further influenced by consultants with ERP experience gained from implementations at other firms. Experienced Flavorful Foods team members also participated in the design to help surface potential pitfalls. The entire project design team was located at a remote location away from the target user base. As will be discussed later, this infusion of external business process knowledge proved to be problematic in the end. Project C housed its design team in the same location as Project B. However, this team was much smaller and was only staffed with experienced Flavorful Foods team members. One of the difficult challenges for this project was felt when moving from high-level to detailed level design. The detailed design phase added several more team members who had not participated in the high-level design sessions. New group members did not possess the same level of understanding of the decisions which led the high-level team the current design, and as a result the level of consensus among the group diminished.

With divergent processes individuals acquire new information and subsequently alter their own knowledge structures. These activities effectively lower the level of shared knowledge within associated knowledge groups of which the individual is a member. In their organizational learning framework, Crossan et. al (1999) explain that individuals shape understanding through intuition and interpretation. Intuiting is the preconscious recognition of patterns and possibilities for informational cues within their stream of personal experience. Interpretation is a process of making sense of these cues in relation to existing knowledge. It is through this process that individuals develop the "language" of the information domain and evolved their own cognitive maps (Crossan, Lane et al. 1999; Huff 1990). This codification process improves the transferability of knowledge structures between individuals (Argote, McEvily et al. 2003). The degree of knowledge structure agreement among a group is influenced by changes in group membership over time (Kuhn and Corman 2003; Rentsch and Klimoski 2001).

Convergent processing of new knowledge

Shared knowledge structures may be considered a kind of knowledge consensus among group members (Kabanoff and Brown 2008; Walsh 1995). This collective knowledge changes over time as convergent and divergent knowledge processes influence each individual's personal knowledge structures (El Louadi 2008). Specific individual circumstances dictate that it is very unlikely the group will ever achieve total knowledge structure convergence (Kabanoff and Brown 2008) Fortunately, this is not required for effective group decision making (Tyler and Gnyawali 2009). Groups must effectively socialize knowledge among group members in order to raise performance levels (Lewis, Lange et al. 2005), and to meet group and organizational goals (Alavi and Lieidner 2001; Nonaka 1994).

In Project A, the Fact Books were used by the integration design team to quickly socialize knowledge of the existing FamousBrands business processes. Flavorful Foods business process documentation and training was made available to FamousBrands team members to equip them to operate in the new environment. Both of these devices facilitated the development of business process knowledge structures in individuals associated with the project. The project team also used a "War Room" approach to more efficiently communicate with each other concerning integration challenges. Project B facilitated hundreds of design sessions among the design team to establish high-level and detailed business process designs. Each major design phase culminated in multi-day challenge sessions with end users and key stakeholders, which increased their level of understanding of new business process designs. Various process modeling notations were used to pictorially represent business process design. Large poster versions were hung at various locations throughout the design team's location. Process design methods were institutionalized into methodological artifacts, which facilitated efficient diffusion of design expectations across the project. Project C developed a unique approach to refining and socializing new diffusion process designs. They constructed a two-dimensional representation of a manufacturing plant floor, which included areas for processing incoming row ingredients, manufacturing of products, and management of inventory. A magnetic board depicted the plant floor area with physical objects representing plant equipment and fixtures to be placed on the floor in various configurations. This allowed people to better visualize the new process and to interact with a process prototype. It even allowed them to test new suggestions "on the fly" by simply moving the pieces around. This proved to be a very successful way to quickly communicate process design to a large number of people. Prototyping was also evident in Project B as "conference room pilots" were used to help people understand process designs.

Convergent knowledge processes are often social information exchanges which attempt to accelerate the learning process across the target knowledge group. This integration (Crossan, Lane et al. 1999) or transfer (Argote, McEvily et al. 2003) requires interaction and continuous conversations among group members in order to reach a collective mind (Weick and Roberts 1993). In their organizational learning framework, Crossan et al. (1999) use the term "feed forward" to describe the process of moving from individual knowledge to group knowledge and beyond . Knowledge structures are fluid and continue to evolve during this time as group members share information and refine the language of the domain. This may be seen in all manners of knowledge structures including knowledge of organizational routines, and through approaches such as the rapid learning techniques of prototyping and early testing (Eisenhardt and Martin 2000). Large-scale prototyping often requires many individuals to bring their own knowledge and experience together to "test out" a larger informational context and quickly spread the resulting knowledge throughout the target knowledge group.

Another way that Flavorful Foods' project teams synchronized knowledge structures was by building knowledge into the routines of target knowledge groups. This approach reduces the reliance on individuals in the evolution of shared knowledge structures by forming organizational memory (Eisenhardt and Martin 2000) of routines and enhancing the predictability of process outcomes (Nelson and Winter 1982). By institutionalizing knowledge structures (Crossan, Lane et al. 1999) firms can protect, at least to some degree, the collective structures of the target knowledge group by externalizing them into stated behavioral expectations. Institutionalizing was especially prevalent with project-related knowledge structures on all three projects.

Corrective Action

By looking at Flavorful Foods' three projects, which occurred in sequence over a ten year period, this study is able to investigate both in-project path-related aspects as well as long-term learning across projects. Over the ten years, Flavorful Foods' use of externally developed business process knowledge moved from practically none, to heavy reliance, and then back to practically none. Project A was staffed primarily with internal Flavorful Foods with considerable company experience. There was one senior-level consultant on the project leadership team. However, this particular individual had worked with Flavorful Foods on previous projects and had come to be considered a trusted confidante of the IT management team. When asked what made Flavorful Foods successful on this project, the CIO indicated that while the scale of this effort was very large, Flavorful Foods had acquired companies in the past and over time they had become very effective at this type of work.

Project B was a large-scale business process change project standardizing on SAP. Flavorful Foods' executive leadership elevated the CIO position to report directly to the CEO, and filled the position with an external candidate with an extensive background in ERP implementations. In addition, this new CIO created new vice president positions for the project management office (PMO), organizational change, business process change, and master data. The positions were also filled from the outside with people with extensive experience in these areas. The prior CIO moved into a vice president position for technology. A team member from the acquired organization was named vice president over application development. Senior-level consultants were hired to assist at all levels of the project, including consultants to assist each of the VPs.

Consultants were added to the project for two reasons. One was to augment staff where there simply weren't enough people to get work done. The second reason was primarily one of knowledge paths. The general consensus of the new IT leadership was that Flavorful Foods alone did not have the experience-based knowledge to be successful in a project such as this. After all, Flavorful Foods had never attempted a company-wide business process transformation project before. After a bidding process with multiple consulting firms, the IT leadership selected two firms; one with which the new CIO and some of the newly hired IT management team had worked in the past, and another which had experience working on Flavorful Foods projects. These two firms would partner to staff most of the consulting needs of Project B. Consultants helped develop the methodology for Project B and carry out PMO responsibilities. Consultants were staffed among the business process design teams and helped design new business processes in areas such as order to cash, manufacturing, and financials. These had experience with large-scale SAP implementations in the area for which they were assigned, and since this was an SAP projects, they also ensured that the business processes designed would indeed work with SAP.

Midway through Project B company leadership decided that changes needed to be made to the project. Organizational feedback helped them to understand that the project was not achieving the desired results. The issue came to a head during a meeting of the executive steering committee. In that meeting the project leadership presented unresolved design issues that were impeding completion of the detailed design phase. One major point of contention was with the way inventory would be managed, tracked, and valued. Some of the high-level business process designs proposed earlier in the project were now being challenged by important stakeholders in the business and by the design team itself. To sum up the issue, the consultants were proposing a method of inventory management which those with Flavorful Foods experience were now arguing would not work for Flavorful Foods. Conversely, the consultants were saying that SAP could not be configured to operate in the way the Flavorful Foods team members wanted. This created a great impasse for the project.

Soon after the executive steering committee meeting, a new CIO was named and the project was restructured. The new CIO was a longtime Flavorful Foods team member with a history of helping troubled organizations within the company. It was during this time that most of the scope reduction occurred. A prominent project team member described two factors that were instrumental in driving the change. One was that the project had lost touch with the business during the project because they were housed in a remote location away from the mainstream of business activities. This team member summed it up by saying "how can we expect the business to trust what we are doing when they can't see what we are doing." The other factor was that there was too much reliance on consultants with no Flavorful Foods experience to develop new business processes. The now smaller Project B was led to completion with an IS leadership team with long-term Flavorful Foods experience. The inventory management functionality in question was cut from scope and given to the Pit Crew for further study. The revised Project B went live on time and with few issues.

Knowledge Path Differences

Why did the Project B as originally scoped fail while the revised Project B, as well as Projects A and C, succeed? It would be easy to simply blame the consultants involved or the use of consulting partners in general. By looking deeper into the case of Project B, I suggest that the problem was one of business process knowledge diffusion, and more specifically an issue of business process knowledge transfer. Knowledge transfer represents “the communication of knowledge from a source so that it is learned and applied by a recipient” (Ko, Kirsch et al. 2005, p. 62). The combination of Flavorful Foods’ Project B consulting partnership, the pairing of Flavorful Foods-experienced team members, SAP-experienced consultants, and consultant-supplied industry best practice process models was expected to produce Flavorful Foods’ vision of a “world class company.” Knowledge processes among the process design team were expected to produce greater levels of shared knowledge (as in Palanisamy 2007-2008; Walsh 1995), which in turn should have driven out business process misspecification. In Projects A and C, valid process designs were arrived at within a matter of weeks. In the original scope of Project B, the defects within the business process designs in question remained undetected for over a year. Figure 5 depicts this phenomenon. The bold horizontal lines represents a given business process design for each of the three projects. The narrow lines on either side of the bold business process design line indicate the rate at which knowledge convergence appeared to occur. Early in the projects the gap between these lines is larger, indicating a lower level of shared knowledge and a greater potential for disruptive knowledge structures to negatively influence business process design. As the projects progressed, knowledge converged through knowledge processes and the lines are therefore closer together. For Project B this convergence was slow to occur, ultimately leading to a decision to reduce the project's scope down to those business processes that were well understood by the design team.

INSERT FIGURE 5 ABOUT HERE

Past research has shown that knowledge transfer improves when the parties involved in the transfer share similar knowledge structures (Ko, Kirsch et al. 2005; Palanisamy 2007-2008; Rico, Shanchez-Manzanares et al. 2008). Similarities in knowledge experiences (i.e. knowledge paths) help to remove transfer barriers (Krauss and Fussell 1990). Knowledge paths represent the states through which an individual or firm passes on its knowledge evolution journey. This notion indicates that where a one can go next is to a large degree a function of where one has been (Teece, Pisano et al. 1997). Indeed, a foundational assumption to learning is that individuals assess new information against existing knowledge structures (Argote 1999; Walsh 1995). Over time, learning represents an evolution of one's knowledge structures, modified as relevant information cues are encountered. An individual's ability to recognize relevant cues and to make concept connections depends on the sophistication of their knowledge structures at a given point of time. Evolution may result from many triggers such as repeated practice, codification, making mistakes, pacing of experience, and order of implementation (Eisenhardt and Martin 2000).

To help identify business process misspecification Flavorful Foods' business users evaluated design proposals against the backdrop of their own Flavorful Foods experience. It is not uncommon for both users and consultants to play important roles in the implementation of large, complicated IT implementations (Swanson 1994). ERP critical success factor research indicates that asymmetric knowledge structures between users and consultants create knowledge barriers which must be overcome (Ko, Kirsch et al. 2005). Knowledge sharing processes lower these barriers (Walsh 1995). In most projects it is the users that must transfer business knowledge to the consultants (Rus and Lindvall 2002). In Flavorful Foods' project however, the consultants would present "best practice" business process templates to the Flavorful Foods-experienced design team members and to key project stakeholders. Those with Flavorful foods experience were to then evaluate the appropriateness of each design option.

So, why did it take so long for Flavorful Foods to determine that the inventory management process design recommendations were inappropriate? The evidence suggests inefficient knowledge processes. Enterprise systems, especially ERP systems, represent some of the largest and most complex applications of IT (Scott and Vessey 2002; Somers, Nelson et al. 2003). ERP applications can manage and integrate all business functions within an organization (Boykin 2001; Chen 2001; Shehab, Sharp et al. 2004; Yen, Chou et al. 2002), supporting highly integrated business processes (Kim, Lee et al. 2005). Likewise, a firm's existing business processes, having evolved though years of continual refinement, may be equally complex (Argote 1999; Eisenhardt and Martin 2000; Zander and Kogut 1995). It follows then that knowledge structures which accurately represent ERP-supported business processes or a firm's existing business processes are complex as well. Research indicates that the success of enterprise systems projects is due in large part to effective knowledge transfer between consultants and those within the firm (Ko, Kirsch et al. 2005).

In Flavorful Foods' situation this meant that consultants needed to understand Flavorful Foods' existing business processes, and that the design team needed to have detailed knowledge of the implications of the consultant's recommended design. This requirement goes beyond a simple knowledge of work tasks and task sequencing. The evaluation and selection of proper design alternatives requires one to have insight into the history, experiences, and past decisions that shaped this knowledge in order to place it within the proper context. In order for the

Flavorful Foods business process design team to accurately recommend valid design solutions they first had to effectively socialize these complex knowledge structures among the Flavorful Foods team members and consultants. A plausible explanation for why it took so long to identify business process misspecification then is an inability to reach the proper level of knowledge structure convergence to support the given process design.

The importance of knowledge convergence to business process design is illustrated in Figure 6. Assume for discussion purposes that a business process design team consists of one member of the firm and one consulting partner. Together, these two individuals are to recommend a new business process design. In the diagram, the oval above each individual represents that person's unique set of knowledge structures. The objects within the ovals represent specific knowledge structures that each individual will use to evaluate and propose process design alternatives. These knowledge structures evolved over time through the individual's experiences (Walsh 1995). The shaded overlap between the ovals represents the knowledge shared by the two individuals. Prior to any knowledge convergent processes, the size of this overlap is determined by the historical path similarities of the individuals. In other words, those with similar experiences are more likely to possess similar knowledge structures (Ko, Kirsch et al. 2005; Walsh 1995). The solid squares represent knowledge structures of the external design team member (i.e. consultant) which will help lead the team to the correct design. I label these *constructive knowledge structures*. The hollow triangles represent *disruptive knowledge structures*, which in this situation will lead to an invalid design decision. Similarly, the figure depicts the internal team member's constructive knowledge structures with a solid star, and their disruptive knowledge structures with a hollow circle. The rectangle represents a solution design collectively recommended by both individuals. The objects within the rectangle represent knowledge structures held by the design team members which in their mind justify the design choice.

INSERT FIGURE 6 ABOUT HERE

Assume, for this example, that the consultant, based on their own unique experiences and limited understanding of the firm, proposes a new business process design. The internal member then evaluates this design using the framework of their own knowledge structures. If the internal member fails to identify the consultant's disruptive knowledge structures upon which the proposal was based, then they may unknowingly approve a faulty design. Likewise, the internal member may maintain faulty knowledge structures, such as incorrect assumptions about ERP capabilities, which negatively influence their ability to evaluate a design. The top half of Figure 6 illustrates a situation where disruptive knowledge structures have led to an invalid business process design choice. The bottom half of Figure 6 depicts that knowledge convergent activities have improved the level of shared knowledge, effectively eliminating many of the disruptive knowledge structures for both individuals. The resulting business process design is more appropriate and less prone to failure.

Flavorful Foods' project methodology included several convergent knowledge processes aimed at improving the level of shared knowledge among the design team. For example, Flavorful Foods made a considerable investment in SAP training for its team members. Many attended offsite training following SAP's recommended training curriculum. Research indicates that such training is critical to enterprise systems success (Aladwani 2001; Amoako-Gyampah 2004; Bingi, Sharma et al. 1999; Kim, Lee et al. 2005; Markus and Tanis 2000; Schaaf 1999). Training typically involves a novice who builds new knowledge by observing an expert perform operational aspects of an application and through subsequent practice and reinforcement activities (Yi and Davis 2003). Effective training programs build knowledge of an application's commands and features, task collaboration, and business context (Sharma and Yetton 2007). Applications commands and tasks are easily demonstrated in the generic training classes attended by Flavorful Foods' internal design team members early in the project. However, these vendor-supplied classes are developed to serve multiple customers and are built around a hypothetical business context. At best, this training can only help students develop a high-level understanding of the business process supported by the application. Building knowledge structures representing the more detailed nuances of Flavorful Foods' new business process must come from experience with the process itself. Early in the project, consultants can only make business process design recommendations based on the business context they have learned with other clients. Even after attending training, the Flavorful Foods team members did not possess the contextual knowledge required to properly evaluate the consultant recommendations. The design team had to assume the consultant recommendations were correct. Many months passed until the Flavorful Foods-experienced team members developed their knowledge to the point that they could identify the consultant's disruptive knowledge structures.

Flavorful Foods' methodology also included activities to help the consultants improve their Flavorful Foods-specific knowledge. For example, one early design task was to document existing Flavorful Foods business processes, a monumental task. By better understanding Flavorful Foods' current business processes, the consultants should have been better equipped to select appropriate process design options. To limit the amount of time required to complete this task, the project management office (PMO) instructed the team to look for existing business process documentation instead of creating new documentations in a consistent format. A very short amount of time was allocated to this work relative to the number of business processes to document. The PMO developed a diagnostic system (Crossan, Lane et al. 1999), in this case a project dashboard, which helped them to measure project plan adherence and to report progress. Unfortunately this dashboard only tracked task completion and did little to reflect the quality of work. In the end the team paid little attention to the quality of the existing documentation found and did little to leverage it in the design of to-be processes. In short, a task which was meant to synchronize as-is process knowledge structures among design team members, instead was an exercise of checking tasks as complete, and in turn limited important learnings. As a result, the as-is business process documentation was less effective at educating the consultants about key contextual elements of Flavorful Foods' past. Research suggests that formalized procedures can fail to engage group member's attention sufficiently so that they learn from the experience of following the process (Eisenhardt and Martin 2000). Optimal organizational learning requires a balance between exploiting existing knowledge structures and allowing new knowledge structures to form (Crossan, Lane et al. 1999; March 1991). Institutionalized routines can swing this balance by limiting evolution.

CONCLUSION

This study examines the development of IT-enabled business processes through the lens of shared knowledge structures, a view which has received little attention in the literature. Over a ten year period, Flavorful Foods conducted three such projects which were very large and transformational. The projects varied in terms of business process design needs, extent of business process scope, design team composition, project length, and internal perceptions of success. However, each project followed a similar pattern of evolution of knowledge sharing capabilities, as shown in Figure 7.

INSERT FIGURE 7 ABOUT HERE

Each project began with a facilitating condition which justified the need for the project. These were impactful, enterprise-level events that would shape the direction of the firm for years to come. This was quickly followed by an assessment of the project team's relevant business process knowledge, its business process design capabilities, and the applicability of business process design approaches utilized in prior projects. In all three projects Flavorful Foods designed new knowledge processes in response to shortcomings found in the assessment. Following the assessment, each project progressed through a series of divergent and convergent knowledge processes aimed at filling knowledge gaps. First, a divergent infusion of new knowledge was necessary to promote new ways of thinking about the information domain. A small number of individuals carried out activities which evolved their own knowledge structures in ways not understood by the rest of the team. This new knowledge was then shared through convergent knowledge processes, which facilitated integration and transfer of the new knowledge among group members. New knowledge was also synchronized by building knowledge into group routines.

Research suggests that enterprise systems projects often fail due to consequences resulting from changing the way firms operate (Hitt, Wu et al. 2002; Somers, Nelson et al. 2003). Efficient team communication and process knowledge transfer are critical design skills required by business process design teams (Kim, Lee et al. 2005; Ko, Kirsch et al. 2005). Based on observations of Flavorful Foods projects, I suggest that a project team's ability to recognize shortcomings in the design team's business process knowledge and knowledge processes, and the ability to make effective adjustments to those knowledge processes are equally important to project success. Further, in order to effectively change the design team's collective knowledge and/or knowledge processes, it is first necessary to infuse new knowledge through divergent methods, followed by effective diffusion of new knowledge among design team members. This knowledge convergence identifies disruptive knowledge structures and thereby removes their influence on business process design. Business process misspecification does not occur by choice, but rather by reliance on faulty assumptions based on prior experiences. Corrective action may be necessary when knowledge fails to efficiently converge.

CHAPTER 3

ESSAY 2

THE INFLUENCE OF PROCESS MODELS ON ACTUAL AND PERCEIVED BUSINESS PROCESS KNOWLEDGE

ABSTRACT

Today's large-scale enterprise systems projects transform organizations through the implementation of new IT-based business processes. Difficulties associated with business process change is an oft-cited cause of enterprise systems complexity and project failure (2002; Lucas, Walton et al. 1988). A new information system, no matter how well implemented, will be flawed if developed to support a flawed business process. Contemporary software methodologies and frameworks, such as the Capability Maturity Model Integration (SEI 2006b, 2007) and IBM's Rational Unified Process (Kruchten 2004), now recommend using business process models (BPMs) to communicate process design to key project stakeholders very early in the project lifecycle. Their feedback can then serve as a valuable resource for the early identification of inadequate business process design. While the IS literature is rich with business process frameworks and modeling notations to help organizations build BPMs, we understand very little concerning the way in which BPMs influence an individual's business process knowledge structures. This research examines the knowledge building influence of BPMs during the implementation of a new purchasing and receiving process at a subsidiary of a Fortune 100 manufacturer. BPMs were found to effectively build process knowledge in individuals and in groups. Conversely, a popular knowledge transfer method, hands-on system training, did neither. Furthermore, the influence of BPMs and hands-on system training on perceived process knowledge was mediated by both actual process knowledge and perceived procedure knowledge, respectively. This research contributes to our understanding of how

knowledge structures evolve during the implementation of new IT-enabled business processes by focusing on the knowledge generating aspects of BPMs. Specifically, it provides support that BPMs offer an effective tool for building business process knowledge in individuals, an important precursor to early identification of business process misspecification.

INTRODUCTION

Firms continue to invest millions of dollars into large-scale enterprise systems projects in hopes of improving their competitive position (Shehab, Sharp et al. 2004). Moreover, these projects require the design and implementation of new IT-enabled business processes, introducing a tremendous amount of process change to the firm (Kremers and van Dissel 2000). Communication of business process design to major stakeholders becomes critical to the success of the project as a result (Kim, Lee et al. 2005; Ko, Kirsch et al. 2005). Business process modeling is a popular method for expressing business process design.

The literature provides extensive guidance in the development of business process models (BPMs) through many frameworks and modeling notations. For example, the *Process Structures* framework (Raghu, Chaudhury et al. 1998) places personal agency at the forefront by explicitly describing a business process in terms of the goals and objectives of both the people who operate the process and of the process itself. The *Situation and Process* frameworks (Lundeberg 1993) allow process modelers to consider business processes from different reviewer vantage points and different points of evolution. A large number of modeling notations exist (see Recker, Indulska et al. 2009 for a comparitive analysis) from simple flowcharting techniques (ANSI 1970) to the rigorous and expressive Business Process Modeling Notation (BPMN) (White and Miers 2008). In addition, contemporary software development frameworks and methodologies, such as the Capability Maturity Model Integration (SEI 1995, 2006a, b, 2007) and IBM's Rational Unified Process (Kruchten 2004), recognizing the importance of business process change, now direct project teams to iteratively refine new business process designs through modeling and gathering feedback from key project stakeholders. This feedback represents valuable insight concerning the appropriateness of business process design. It has been well documented that the longer design misspecifications remain undetected through the project lifecycle, the more expensive and time consuming they are to correct (Boehm and Papaccio 1988; Jones 1994, 1996). Since project teams can develop BPMs in the very early stages of enterprise systems projects, it follows that they may serve as early indicators of project success or failure. Despite the wealth of information concerning the representation of business processes, however, very little is understood concerning the way BPMs actually build knowledge.

What we do understand is that individuals organize what they know into knowledge structures, which serve to both store knowledge and to facilitate knowledge retrieval when necessary (Schwenk 1986; Walsh 1995). An individual evolves their knowledge structures through a process of assimilation, assessment, and subsequent encoding or rejection of incoming informational cues (Tyler and Gnyawali 2009). Knowledge is socialized as individuals interact to achieve group and organizational goals. One may consider group-level knowledge as the aggregate of individual-level knowledge structures among group members. The construct of shared knowledge structures describes the level of shared understanding or knowledge consensus among group members (Walsh 1995). We also understand that actual and perceived knowledge, while closely associated, are not always synchronously related. Decision making research has shown that the quantity of informational cues available to an individual can create the illusion of knowledge, even if the cues are redundant or of poor quality (Davis, Lohse et al. 1994; Hall, Ariss et al. 2007).

This research examines the knowledge building influence of BPMs during the implementation of a new purchasing and receiving process at a subsidiary of a Fortune 100 manufacturer. Specifically, it asks three questions. First, does viewing a BPM lead individuals to build accurate business process knowledge structures concerning a new business process? Second, are BPMs effective at developing shared business process knowledge structures among a group of individuals? Third, does viewing a BPM influence an individual's perceived understanding of a new business process? Further, this research compares the knowledge building effectiveness of BPMs to that of hands-on system training, a popular knowledge building technique occurring late in the project lifecycle.

THEORETICAL BACKGROUND

Basic Elements of Business Processes

This research conceptualizes business processes as a series of work tasks and the roles responsible for executing the tasks (see Figure 8). Work tasks represent the actual work activities of a business process, and are comprised of three lower-level elements: *tasks*, *sequencing*, and *information*. A task is arguably the most fundamental element of a business process. The business process literature identifies tasks with various labels such as *process elements* (Curtis, Kellner et al. 1992), *activities* (Datta 1998; Raghu, Chaudhury et al. 1998; Raghu, Jayaraman et al. 2004), *work items* (Stohr and Zhao 2001), and *tasks* (Basu and Blanning 2000). In the structured analysis and design literature, tasks appear as *processes* in data flow diagrams and as *steps* or *activities* in use cases (Dennis and Wixom 2000). The job design and work motivation literature provides similar conceptualizations of tasks such as *pieces of work* in the Job Characteristics Model (Hackman and Oldham 1980), *work activities* in job analysis and design (Dessler 1997), and *actions* within Agency Theory (Karake 1992).

INSERT FIGURE 8 ABOUT HERE

Multiple tasks within a process flow operate in some logical ordering. Some tasks must execute in sequence, while other may execute concurrently. A flow may include complex decisions and branching to control when certain tasks start and/or terminate. In general, a *task sequence* may be thought of as the coordination or the choreography of task execution. Many business process frameworks provide for the sequencing and control of task execution (e.g., Curtis, Kellner et al. 1992; Jablonski and Bussler 1996; Raghu, Chaudhury et al. 1998; Raghu, Jayaraman et al. 2004). The object-oriented analysis and design literature also refers to the flow of individual tasks within use cases (Dennis and Wixom 2000; Pressman 2001).

Tasks within a business process may consume, manipulate, or produce *information*. Information may also assist in the control of task sequencing. There are three broad classes of information: *data*, *documents*, and *signals*. Data represent the individual elements of information such as a number, an image, or an icon. Documents are logical collections of data elements representing some larger whole, such as reports, database records, etc. Signals are observable, instantaneous occurrences of significance to a business process. Signals often indicate the beginning and ending of tasks, and are sometimes referred to as *events* (Datta 1998). Many process frameworks (e.g., Curtis, Kellner et al. 1992; Jablonski and Bussler 1996) provide for information to be consumed or produced by tasks, as well as data, documents, or signals transported between roles and other tasks (Stohr and Zhao 2001). Others describe the controlling aspects of information (e.g., Lundeberg 1993). Within structured development, data flow diagrams clearly specify information inputs and outputs of tasks. Use case diagrams use the concept of a *trigger* (i.e. event) to determine when a particular set of tasks should begin. Triggers may be the result of the work in other other tasks (an external trigger), such as receiving a purchasing request. Triggers may also occur at certain times (a temporal trigger), such as a credit card payment being 30 days past due (Dennis and Wixom 2000). In object-oriented development, sequence diagrams present information messages transmitted between objects (Pressman 2001).

Roles specify ownership and responsibility of tasks and information. *Actors* are the individuals or automated agents who assume these roles, and physically execute tasks as a unit of functional responsibility. Many actors may assume a given role, and a given actor may assume multiple roles (Curtis, Kellner et al. 1992). This distinction is important for two reasons. First, defining task and information responsibility at the role level isolates the process from actor reassignment and turnover. Second, a separation between role and actor facilitates load balancing in a process when bottlenecks occur (Stohr and Zhao 2001). The business process literature can best be described as inconsistent with regard to specifying roles and actors. Some use the terms interchangeably, while others make a distinction. Sometimes the same framework or modeling notation will use both terms in their specification. The systems analysis and design literature typically presents the behavioral aspects of tools as role interactions. This is particularly true within the object oriented approach where class diagrams represent people with abstract and concrete classes (Dennis and Wixom 2000; Pressman 2001). Even though use case diagrams and sequence diagrams include a construct called an actor, their usage is closer to that of a role. The Job Characteristics Model (Hackman and Oldham 1980) is focused on the individual and their own job. A job may be made up of multiple roles in the same manner that an actor may have many roles. In job analysis (Dessler 1997), work activities may be specified at the task level or at the role level. The decision is up to the HR specialist or the hiring manger that is creating the description. Finally, agency theory (Karake 1992), describes the "agency problem" where an actor's goals are not aligned with that of the organization or process. If a role is considered part of the overall business process, then it follows that agency theory acknowledges the distinction between role and actor. I define role as the ownership of specific tasks and information within a business process. I define actor as a specific person assigned to a role within a business process. This distinction acknowledges that roles are part of a business process and that actors enact a business process. Therefore it is the role, not a specific actor, which is important when describing a business process.

Business Process Models

A model by definition is an abstracted view of reality. It represents its creator's view of relevant aspects of the domain and serves to communicate these aspects to others. Automobile designers build clay models to represent new styling ideas. Software developers write pseudo code to demonstrate software logic and execution. Police investigators develop small-scale models of crime scenes to test the plausibility of different crime scenarios. In each of these examples the model contains just enough detail to communicate or educate the viewer about the represented domain. Similarly, the purpose of a business process model is to communicate important aspects of a business process. Specifically, business process modeling is an approach for visually representing how a business operates (Bandara, Gable et al. 2005). The concept of a business process model should not be confused with a company's business model, which describes a firm's value-generating capabilities in terms of its products, customers, infrastructure, and financial structure (Osterwalder, Pigneur et al. 2005). Business process models depict the actual work processes employed by a firm to create value. These terms are often used interchangeably in the in the literature. Figure 9 provides a simplified version of the purchasing and receiving business process model used in this study[4]. The horizontal sections (called swim lanes) of the BPM represent tasks performed by a given role (e.g. purchaser, approver, vendor, etc.). Work tasks are represented by boxes (tasks), arrows and decisions (sequencing), and the information implied in the task descriptions.

INSERT FIGURE 9 ABOUT HERE

Many process modeling techniques have been developed over the last 50+ years (for reviews see Mili, Jaoude et al. 2003; Recker, Indulska et al. 2009). These techniques, or notations as they are sometimes called, come in a variety of forms and serve many different purposes. One classification arranges business process modeling techniques into one or more of three categories based on their overall purpose: 1) describing a process, 2) analyzing a process, or 3) enacting a process (Ould 1995). Those that describe intend to educate the human viewer about important aspects of the business process. Notations that help analyze are capable of mechanically examining a business process for executional efficiencies. Those that enact a process actually simulate business processes enabling observation of their execution. In this study, the ability of the BPM to describe the business process is of most importance. Curtis et al. (1992) identify four aspects or views important to notations that describe business processes. *The functional view* presents business process tasks and their dependences. *The behavioral view*

[4] The complete business process could not be included for confidentiality reasons. The actual BPM employed during the company's project includes the same roles, but a more detailed set of tasks.

describes the sequencing and control of task execution. *The informational view* describes the inputs and outputs of tasks. *The organizational view* describes who is responsible for executing a task. These four views align perfectly with the business process framework presented in Figure 8.

Actual Business Process Knowledge

Individuals possess limited cognitive resources for the assimilation and recall of information (Neisser 1976). To cope with these limitations, individuals organize information into meaningful knowledge structures that facilitate the processing of incoming stimuli and speed information retrieval. This sort of metadata can range from simple heuristics that facilitate quick decision making to complex categorizations that organize information within an information domain (Schwenk 1986). Knowledge structures may be very complex, representing relationships between core or super-ordinate concepts with less salient peripheral concepts (Rosch 1973) and are considered “of equal or greater importance” than the information itself (Day, Winfred Jr. et al. 2001, p. 1022). Individuals evolve their own knowledge structures through an information process of assimilation, assessment, and subsequent encoding or rejection (Tyler and Gnyawali 2009; Walsh 1995). The effectiveness and efficiency of this encoding/filtering process depends upon the content of existing knowledge, and the existing linkages between them (Walsh 1995). In the early stages of knowledge structure formation, individuals actively attend to assimilation and assessment of new information. Later, as knowledge structures mature, attentive actions yield to a more automated or mindless approach (Moors and De Houwer 2006; Walsh 1995). Knowledge structures have also been referred to as *schemas, mental models, knowledge sets, pictorial representations,* and *conceptual frameworks*

(Dorsey, Campbell et al. 1999; Kuhn and Corman 2003; McNamara, Luce et al. 2002; Tyler and Gnyawali 2009).

Knowledge structures as described thus far represent an individual-level construct unique to each individual person. Knowledge is shared as individuals interact to achieve group and organizational goals. One may consider group-level knowledge as the aggregate of individual-level knowledge structures among group members. Accordingly, the construct of *shared knowledge structures* describes a level of shared understanding or knowledge consensus among group members (Walsh 1995). At any point in time group members will not possess identical knowledge structures (Kabanoff and Brown 2008). Instead, a group's level of shared knowledge may be thought of as a fluid measure that changes over time. This convergence and divergence of shared knowledge structures is due to the continued evolution of individual knowledge, knowledge sharing activities among individuals, and changes in group membership (Kuhn and Corman 2003). In addition to the term shared knowledge structures, this ebb and flow of shared knowledge has been referred to as *dynamic knowledge structures, knowledge structure homogeneity vs. heterogeneity, collective cognitive maps, team mental models, knowledge communality vs. diversity, collective cognition* and *collective knowledge* (Axelrod 1976; El Louadi 2008; Klimoski and Mohammad 1994; Kuhn and Corman 2003; Langield-Smith 1992).

Perceived Business Process Knowledge

The job role literature explores how well workers understand what is expected of them on the job, the alignment of expectations between the job and individual, and the appropriate level of effort required to meet these expectations. *Role ambiguity,* defined as "uncertainty about what actions to take to fulfill a role" (Fields 2002, p. 145), is conceptually similar to the construct I call perceived business process knowledge. Both are concerned with one's knowledge of how to perform work tasks and the consequences of work results. Fields (2002) provides an excellent overview of the job role literature, which I use to summarize the seminal works of role ambiguity.

One of the first measures of role ambiguity appears in Rizzo, House, & Lirtzman (1970). The authors define role ambiguity as a lack of necessary information regarding role expectation for a given organizational position. Their six item measure demonstrated reliability (coefficient alpha) ranging from .71 to .95 across many later studies (see Adkins 1995; Bauer and Green 1994; Dobbins, Cardy et al. 1990; Fisher and Shaw 1994; Fortunato, Jex et al. 1999; Fried, Ben David et al. 1998; Fried and Tiegs 1995; Gregersen and Black 1992; Hemmingway 1999; Jex 1999; Morrison 1997; Netemeyer, Burton et al. 1995; Pearson 1992; Schaubroeck, Ganster et al. 1992; Seigall 1992; Zellars, Perrewe et al. 1999). Some researchers have criticized the content validity of the Rizzo, et. al measures (King and King 1990; Smith, Tisak et al. 1993). In response to criticisms of the "comfort wording" of early role ambiguity items, House, Schuler, and Levanoni (1983) developed an eleven item measure containing a mixture of stress/comfort and self/other worded items. This measure of role ambiguity was found to correlate positively with role conflict, employee uncertainty, psychological strain, turnover intentions, job dissatisfaction, and employee psychological distress (O'Driscoll and Beehr 1994; Westman 1992). Zohar (1997) developed a measure which captures the disruptiveness of specific incidents of role ambiguity, role conflict, and role overload within the last two weeks. This was to address the concern that role measures that simply ask the extent to which conditions are present in a job fail to reflect the rate at which resources (both emotional and physical) are replenished in the face of stressful events. The hassles ambiguity subscale (five items) was found to correlate positively with exhaustion, depersonalization, and reduced accomplishment.

Peterson, et.al (1995) developed a five item measure of role ambiguity to address issues of translated scales used in cross-national studies.

Reviews of the job role literature have called for study of components of role ambiguity (Jackson and Schuler 1985; VanSell, Brief et al. 1981). In response, Sawyer (1992) developed two subscales of *goal clarity* and *process clarity*, tested a structural model of their antecedents and consequences, and tested the relationship between the two new constructs. Goal clarity was defined as "the extent to which the outcome goals and objectives of the job are clearly stated and well defined" (Sawyer 1992, p. 134). Process clarity was defined as "the extent to which the individual is certain about how to perform his or her job" (Sawyer 1992, p. 134). These are conceptually similar to Kahn et. al.'s (1964) rights, duties, and responsibilities (goal clarity) and means-ends knowledge (process clarity). Goal and process clarity were found to demonstrate discriminant validity, supporting the need to investigate multiple subscales of role ambiguity (i.e., Jackson and Schuler 1985; VanSell, Brief et al. 1981). Further, goal clarity was found to fully mediate the influence of process clarity on satisfaction, demonstrating the relationship between the two subscales.

MODEL DEVELOPMENT

Research Framework

The goal of this research is to determine the knowledge building potential of BPMs at both the individual and group levels. The research framework (see Figure 10) is divided horizontally to depict that the research will be carried out in two parts. One part for individual-level analysis and another for group-level analysis. At the group level, this influence is conceptualized as the degree to which shared knowledge structures develop among group members. In addition, the influence of BPMs will be compared to that of hands-on system training, a knowledge building technique often employed just prior to the implementation of a new system (Sharma and Yetton 2007). Finally, this study will examine the influence of BPMs and hands-on system training on an individual's actual and perceived process knowledge.

INSERT FIGURE 10 ABOUT HERE

BPMs versus Hands-on System Training

A firm's existing business processes likely evolved through learning mechanisms such as practice, codification of experience, mistakes, pacing of experience, and order of implementation of other business processes (see Argote 1999; Eisenhardt and Martin 2000; Zander and Kogut 1995). Past research suggests that such evolution occurs over long periods of time as organizations learn from experience and subsequently create, retain, and transfer knowledge (Argote 1999). Individuals form this business process knowledge into knowledge structures in order to give it form and meaning, and to enable subsequent interpretation and action (Kabanoff and Brown 2008; Walsh 1995). In the initial stages, knowledge structure development requires active attention in order to process incoming stimuli. Later, as knowledge structures are refined, active attention gives way to a more automatic type of cognitive processing (Kabanoff and Brown 2008; Moors and De Houwer 2006; Walsh 1995). Knowledge transfer methods such as BPMs and hands-on system training help individuals to recognize new and relevant business process information and should therefore promote learning.

This research proposes that BPMs and hands-on system training do not equally promote the recognition of business process informational cues to individuals. The reason is a matter of where the individual's attention lies during the learning process. I offer the following example to aid in the discussion. Using the purchasing and receiving business process in Figure 9, consider the role of an Accounts Payable clerk, which is responsible for releasing payment to the Vendor for goods received. Payment cannot be released until there is a three-way match between the original purchase order (submitted by the Purchaser), the invoice (submitted by the Vendor), and the goods receipt (submitted by the Receiver). If these three documents do not match then it is up to the Accounts Receivable Clerk to resolve the differences by working with the other parties involved in the transaction. When the three documents agree then the Accounts Receivable Clerk can release the payment and the Vendor gets paid for the goods delivered. The BPM in Figure 9 very clearly depicts that the Accounts Payable Clerk is responsible for determining if these three documents match, and responsible for resolving problems if they do not match. By tracing the task sequencing, the Clerk can also determine which roles are responsible for creating the three documents that must match.

Now consider the situation where the Accounts Payable Clerk receives hands-on system training. This form of training typically consists of instructor-led facilitation of the technical features of a system (Yi and Davis 2003). In the case of a new system, the students may be considered novice to the system, but not necessarily to the business processes of which the system enables. The students acquire new knowledge through cognitive activities resulting from instruction, demonstration, and use of the actual system (Gallivan, Spitler et al. 2005). The types of knowledge derived from hands-on systems training encompass 1) system commands, menu navigation, and other operational concepts (i.e. procedural knowledge) and 2) the way with which various roles will use the system to achieve work tasks (i.e. process knowledge) (Kang and Santhanam 2003-04). Here the Accounts Payable Clerk will receive instruction on how to operate the new system to determine if a purchase order, invoice, and goods receipt match.

Instructors demonstrate various procedural aspects such as how to navigate to the correct screens, how to enter appropriate data when searching for documents, and how the system indicates a document match. The training may also include a time of hands-on usage where students work hypothetical cases typical of what they will encounter after system implementation. The goal of this kind of training is to help end-users learn to use new applications effectively (Attewell 1992; Rogers 1995). For the Accounts Payable Clerk, hands-on system training will provide actual experience with using the system menus and screens match purchase orders, invoices, and good receipts.

We know that individual learning effectiveness depends upon the individual's ability recognize relevant informational cues from the learning environment (Kabanoff and Brown 2008; Walsh 1995). This study suggests that during attentive scanning individuals will tend to recognize informational cues that support their identified actions, and they will tend to ignore informational cues that do not. Identified action represents what the individual believes he/she is doing. *Action Identification Theory* (Vallacher and Kaufman 1996; Vallacher and Wegner 1985, 1987; Wegner and Vallacher 1986; Wegner, Vallacher et al. 1986; Wegner, Vallacher et al. 1984) holds that individuals maintain various identities for their actions and that they select a given identity based on three factors: 1) the context in which the action takes place, 2) the difficulty in carrying out the action, and 3) the individual's experience with the action (Vallacher and Wegner 1987). In other words, when an individual is asked what they are doing, their answer is guided by these three factors. For example, someone driving a car may identify their action as driving home from work, as navigating a detour, or as manipulating the steering wheel depending on the level of difficulty they are encountering at that particular time.

Action Identification theory also holds that an individual's identities for a given action are maintained in a cognitive hierarchy (Wegner, Vallacher et al. 1986). Lower-level identities tend to indicate how the action is carried out, while higher-level identities indicate why or with what effect the action is done. In general, a given identity A is higher in level than identity B if "it makes sense to say that one does A *by* B" (Wegner, Vallacher et al. 1986, p. 19). Further, individuals tend to identify an action by the highest level identity possible while still maintaining the action. Individuals will shift to a lower-level identity in the face of difficulty with maintaining the action. Once the difficulty is removed then identification will shift back to a higher level identity.

This fluid movement between higher and lower level identities in the face of difficulties should have implications to development of business process knowledge from BPMs and hands-on system training. As discussed earlier, roles and work tasks are important components of business process knowledge (Figure 8). They specify what work is to be done and who is responsible, but they do not describe the procedures with which the work will be done. The example BPM provided (Figure 9) makes reference to an information system, but does not describe the actual workings of the system. Hands-on system training, on the other hand, presents the methods by which work tasks are carried out. In this study this type of knowledge is termed business procedure knowledge. Following the reasoning of Action Identification Theory then we can say that business processes are enabled *by* business procedures. Accordingly, business process knowledge represents a higher-level representation than business procedure knowledge. The informational cues offered by BPMs align well with business process knowledge, while the cues offered by hands-on system training align well with business procedure knowledge. Accordingly, I suggest that viewing BPMs will lead individuals to develop business process knowledge, but not business procedure knowledge since BPMs do not contain procedural information. As individual's develop more accurate knowledge, the quality of shared knowledge should also improve since each individual is moving closer to the same knowledge target. Hands-on system training, on the other hand, should lead individuals to develop business procedural knowledge, but at a cost to the development of business process knowledge. As individuals attentively pursue procedural-based information cues, their attention will be drawn away from scanning for process-related cues. Therefore, fewer of these cues will be considered relevant by the individual and business process learning will weaken.

I also expect a difference in the influence of BPMs and hands-on system training on actual knowledge versus perceived knowledge. Decision making research indicates that in general, increasingly available information leads decision makers to be more confident in their decisions (Hall, Ariss et al. 2007). As information increases, individuals develop an "illusion of knowledge", which serves to decrease the stress caused by a lack of understanding. Even redundant and irrelevant information can increase decision making confidence without improving an individual's actual knowledge (Davis, Lohse et al. 1994). This suggests that while they are related, actual and perceived knowledge are not synchronized. If we consider that perceived knowledge is to some degree influenced by the quantity of available informational cues, then the streamlined BPMs are at a disadvantage. Therefore, an individual's actual business process knowledge should be positively associated with their perceived business process knowledge, but the influence of BPMs on perceived business process knowledge should be lower. Further an individual's perceived business procedure knowledge should positively influence their level of perceived business process knowledge. Following the premise of action identification, as individuals become more confident in their lower-level procedure knowledge they should begin to shift toward building confidence in higher level process knowledge. Finally, the information-rich content of hands-on system training should result in greater perceived business procedure knowledge. BPMs will likely not generate perceived business procedural knowledge since they do not contain procedural cues. The following hypotheses will be used to test the preceding discussion.

INSERT TABLE 3 ABOUT HERE

METHOD

This study was conducted at a subsidiary of a Fortune 100 manufacturer located in the United States. The subsidiary, hereafter called *the company*, is headquartered near the parent company and operates a few remote facilities geographically dispersed throughout the southern and eastern U.S. The company implemented a market leading ERP system as part of a larger business process improvement and legacy system replacement project. This study focuses on their implementation of a new purchasing and receiving process. Prior to the implementation, the company did not have a standard process for purchasing items such as supplies, equipment, materials, etc. Instead, each location and department was free to conduct purchasing and receiving in whatever method they believed was best. As a result, the company had very little insight to their purchasing activities, making it difficult to measure performance and to make improvements. The decision was made to standardize the purchasing and receiving process at all locations and to manage that process using an ERP system. The standard process would be modeled after the process utilized by the parent company. The parent company assisted in the project by providing ERP project management, business process change, ERP configuration, and technical expertise.

Participants and Data Collection

The sampling frame consisted of 169 employees trained on the new system. 155 (92%) employees responded to the survey. Respondents reported an average age in the range of 35 to 44 years. The average company experience of respondents was 10.3 years (s.d. = 7.5 years), and they were 58% male.

Data was collected from three groups: process preview, system preview, and control. The process preview group received via email a link to an online survey containing a BPM created by the project team. The BPM was a more detailed version of the one shown in Figure 9. It was similar in that the same five roles appeared (requestor, purchaser, approver, accounts payable, and vendor). However, the swim lanes were slightly more complex, containing a total of 17 tasks, 8 sequencing decisions, and 5 informational components. In order to improve the strength of the treatment, respondents were asked to study the BPM and then specify which role most closely matched their own. The survey then presented the remaining items. The mean BPM viewing time was 196 seconds (s.d. = 86 seconds). The system preview group received a day-long hands-on training course. Training was held at three different locations and taught by the same instructors. The training was developed by a dedicated training team within the parent company. Since the new purchasing and receiving process was essentially identical to the one used by the parent company, the training team was able to leverage existing materials and curriculum. Participants in the *control* group did not view a process model or receive training prior to completing the survey. All groups were informed that the survey was part of an academic research project and that participation was voluntary and confidential.

Measurement

An individual's *Actual business process knowledge* was captured by collecting relatedness ratings for key concepts found within the company's business process model. The researcher, the project leader, and two process designers developed the list of concepts in a group discussion by identifying features and activities important to the overall purchasing and receiving process. To align with the basic framework of business processes, each concept was constructed as a role performing a task to a positive outcome. The project leader and process designers then ranked each concept according to its importance to the overall business process. All ranking differences were discussed and resolved. The nine highest ranking concepts (see Table 4) were then paired [n(n – 1) / 2 = 36 pairs]. For each pair of concepts, respondents were asked to indicate the extent to which they were related by using a 7-point Likert-type scale ranging from 1 (*not related at all*) to 7 (*highly related*). The Pathfinder Scaling Algorithm (Schvaneveldt 1990) was then used to transform the relatedness ratings to a network structure for each respondent. Additionally, an expert network structure was created by collecting relatedness ratings from the two process designers. Their ratings were averaged prior to transforming to an expert network structure. Previous Pathfinder research has shown that the statistical average of multiple expert judgments yields stronger criterion-related validity compared to searching for the best individual expert structure (Acton, Johnson et al. 1994; Day, Winfred Jr. et al. 2001). Closeness (C) (Goldsmith and Davenport 1990) was then calculated for by comparing each individual network structure to the expert network. The C statistic measures the similarity of two networks having the a common set of nodes (Goldsmith, Johnson et al. 1991). Specifically, C examines the degree to which the same network node is surrounded by a similar group of nodes. The results are then averaged across all nodes to compute an overall index of similarity. The value of C ranges from zero (no similarity) to one (complete similarity). The closeness rating for each respondent to the expert represents the accuracy of the respondent's business process knowledge. *Shared process knowledge* was determined by first averaging the individual relatedness ratings for each respondent within each group (process preview, system preview, control) and then comparing these aggregate knowledge structures to the expert model.

INSERT TABLE 4 ABOUT HERE

Perceived business process knowledge was measured using six items from Sawyer's (1992) role clarity constructs (see Table 5). Items were selected based on their alignment to the business process framework (Figure 8). Specifically, goal clarity items 1-4 relate to work tasks and task ownership while process clarity items 6-7 address task sequencing. *Perceived business procedural knowledge* was measured using items 8-10, which represent an individual's understanding of the procedures used to carry out one's work tasks. Item number 5, not used, includes a performance measurement aspect not included in process or procedural knowledge as defined in this study.

INSERT TABLE 5 ABOUT HERE

The *Process Preview* and *System Preview* conditions were dummy coded with (0,0) representing the control group. Finally, *age*, *gender*, and *company experience* were entered as control variables. It is possible that experienced individuals have codified key learings about purchasing and receiving over time (Argote 1999; Eisenhardt and Martin 2000; Zander and Kogut 1995). Company experience was collected using a two-part question asking for years and months of service.

RESULTS

I analyzed the individual-level model using partial least squares (PLS) with SmartPLS (Ringle, Wende et al. 2005), and the group-level model using the Pathfinder scaling algorithm (Schvaneveldt 1990). PLS is appropriate when the purpose of the model is to predict (Chin, Marcolin et al. 2003; Gefen, Rose et al. 2005). Observations with very low coherence scores were dropped from the analysis. Pathfinder's coherence score reflects consistency within the relatedness ratings themselves. According to Pathfinder documentation, a coherence score of less than around .2 indicates that the respondent was either unwilling or unable to accurately relate the given concept pairs. Sixty six observations provided acceptable coherence scores.

Individual-Level Results

Following the procedures of Gefen and Straub (2005), I test convergent validity of the latent constructs by first bootstrapping to 500 resamples and then examining the t-values of the outer model loadings (Table 6). All indicators were significant at the .001 level, denoting convergent validity. An additional test of convergent validity is that the average variance extracted (AVE), or the variance explained by the latent constructs for the variance observed in their measurement model, should be .50 or higher (Fornell and Larcker 1981). Table 7 indicates that the AVE for each construct was .71. Both of these tests indicate a high degree of convergent validity.

INSERT TABLE 6 ABOUT HERE

INSERT TABLE 7 ABOUT HERE

To evaluate discriminant validity, the cross-loadings of measurement items on latent constructs were examined. As shown in Table 8, the items load more highly on each intended construct than on the other by at least .10, as recommended by Gefen and Straub (2005). Additionally, the square root of the AVE for each construct was compared to the correlations of the latent variables (Table 9). To demonstrate discriminant validity, the square root of a given construct's AVE should be larger than any correlation of the given construct with any other construct in the model (Chin 1998). The results of both tests demonstrate strong discriminant validity.

INSERT TABLE 8 ABOUT HERE

INSERT TABLE 9 ABOUT HERE

SmartPLS was used to demonstrate measurement reliability, indicated by Cronbach's alpha and composite reliability scores. Table 7 indicates that the constructs exhibited reliability well over the .60 threshold for exploratory research (Nunnaly 1967). Finally, to rule out the possibility of a common method bias (Bagozzi and Yi 1991), the construct correlation matrix was examined to determine if any constructs correlate extremely high (more than .90) as specified by Pavlou et al. (2007). Table 9 indicates that no constructs are so correlated, suggesting that common method bias is not an issue.

Figure 11 presents the significant paths identified by SmartPLS. All but one hypothesis (H2a) tested as expected. Individuals who viewed a BPM (i.e. process preview) did increase their actual business process knowledge (H1a), while support was not found that hands-in system training (i.e. system preview) led to increased actual business process knowledge (H1b). Contrary to expectations, viewing a BPM did not directly influence an individual's perceived business process knowledge (H2a). The total effect of BPM on perceived business process was also nonsignificant (t = .24, NS). Hands-on system training did not directly influence perceived process knowledge (H2b), nor did it influence in total (t = 1.08, NS). Viewing a BPM did not promote perceived business procedure knowledge in individuals (H3a), but hands-on system training did improve perceived business procedure knowledge (H3b). Finally perceived business process was positively influenced by both actual business process knowledge (H4a) and by perceived business procedure knowledge (H4b). None of the control variables were found to significantly influence perceived business process knowledge (R^2 = .59).

INSERT FIGURE 11ABOUT HERE

Group-Level Results

Two popular methods for examining group-level knowledge using Pathfinder are as follows. In method one, individual similarity scores are computed in Pathfinder and then averaged to determine a group-level similarity score (e.g., Lim and Klein 2006). This approach is useful for comparing the overall knowledge structure accuracy of individuals with respect to their given group, and comparing the overall accuracy between groups. In the second method, individual relatedness ratings are averaged across each group prior to loading into Pathfinder (e.g., Clariana and Wallace 2007). One advantage of this method is that it provides for a richer analysis of network nodes and paths of shared knowledge structures. This study used the later method to analyze network similarity.

INSERT FIGURE 12 ABOUT HERE

The results of network comparisons are shown in Figure 12. There were 25 individuals in the process preview group, 22 in the system preview group, and 19 in the control group. Individual relatedness rankings were mechanically averaged across individuals according to their treatment group, resulting in three separate mental models. Each model was then compared using Pathfinder to determine their similarity to the expert model. The relatedness of two nodes within a knowledge network is depicted by how closely they are linked (Goldsmith, Johnson et al. 1991). Pathfinder searches through the nodes of the network and only adds direct links between nodes if the closest indirect path between two nodes is greater than the proximity value for them. The expert model contained 12 direct links, while the control, process preview, and system preview models contained 11, 8, and 9 links respectively. Examining the similarities reported in Figure 12, we see that only the process preview model is statistically similar to the expert model ($C = .43$, $p = .008$). Six of the eight direct links found in the process preview model were also found in the expert model. The system preview was not statistically similar ($C = .24$, p = NS). Thus, as expected, support is found for H5a but not for H5b.

DISCUSSION AND IMPLICATIONS

The objective of this study is to investigate the influence of business process modeling on the ability of individuals to learn business process concepts and to be confident in what they know. While much is currently understood concerning the representation of business process models (BPM) (e.g., Basu and Blanning 2000; Curtis, Kellner et al. 1992; Datta 1998; Raghu, Chaudhury et al. 1998; Raghu, Jayaraman et al. 2004; Stohr and Zhao 2001), we still know relatively little concerning the effectiveness of BPM-enabled learning. To that end, this study investigates the influence of business process modeling on two dependent variables: actual business process knowledge and perceived business process knowledge.

Theoretical Implications

This research builds upon a rich history of business process modeling literature by leveraging insights from the job role and decision making literatures to improve our understanding of BPM-based learning in individuals. We know that a firm's current business processes are the result of ongoing, experiential-based learning, which over time shapes and reshapes the way a firm operates (Argote 1999; Eisenhardt and Martin 2000; Zander and Kogut 1995). Individuals are able to learn the business processes in which they play a role by actually performing the processes themselves. In contrast, ERP projects introduce new and sometimes radically different business processes to an organization in a very short amount of time (Kremers and van Dissel 2000), necessitating a much quicker approach for transferring business process knowledge to individuals. This study demonstrates that business process modeling is an effective tool for building business process knowledge in individuals.

Actual business process knowledge was determined in this study by measuring the mental model of the new business process held by the subjects. These mental models were then compared to those of business process experts, which in this study were the two designers of the new purchasing and receiving process. The mental models of those who did not view the business process model were quite different than those held by the experts. Conversely, the mental models of those who did view the business process models aligned well with the process experts. The relatively short time spent reviewing the model by those in the model only group suggests that new business process knowledge structures were built very quickly and with little effort. It would appear that BPM-enabled learning is very efficient.

Hands-on system training was not effective at building business process knowledge. A possible explanation may be found in the action identification literature (see Kozak, Marsh et al. 2006; Vallacher and Wegner 1987; Wegner and Vallacher 1986; Wegner, Vallacher et al. 1986; Wegner, Vallacher et al. 1984). The theory states that individuals describe their actions with respect to a hierarchy of identities ranging from high to low. Higher level identities describe actions in terms of why or with what effect the action is done. Lower level identities describe actions in terms of how an action is done. In a simple example of driving a car, an individual might express their actions at a high-level as driving home from work. At a low-level, an individual might describe the same actions as navigating traffic. At an even lower level of identification, the same actions might be expressed as putting the car in gear, pushing the accelerator, and breaking to avoid other cars. As a rule, individuals will maintain the highest level of action identity possible. Identifications move lower in the face of adversity to a level that can be easily maintained, and remain at that level until barriers to higher levels are removed. Expanding on the driving example, a person may indicate that they are driving home until they encounter a detour. At that point their identification may shift lower to describe finding an alternate route. Identification will likely stay at that level until the individual is confident that they have successfully navigated around the obstacle.

One may consider business processes and system-level operations on a similar continuum of actions. The purchasing and receiving business process is made of activities such as filling out a purchase requisition, finding a preferred vendor, and approving the purchase. At the system level, individuals learn how to look up information, fill out required fields, and send documents through workflows. At an even lower level, they must learn about menu navigation, shortcut keys, and transaction codes. One explanation for the lack of business process learning during hand-on system training is that detailed, usage-based training pulls an individual's attention to lower-level procedural-level informational cues, resulting in less attention paid to business process cues. Since the initial stages of knowledge structure formation require active attention to incoming stimuli (Kabanoff and Brown 2008), such distractions likely limit learning of higher-level knowledge.

Process clarity, or the certainty to which an individual understands how to perform his/her job, is found to be an important determinant in work-related attitudes and performance (Fields 2002; Jackson and Schuler 1985; Spreitzer 1996). It follows then that techniques for communicating new process designs which fail to promote clarity of one's roles and expectations are less likely to receive accurate feedback from reviewers. In addition to developing actual business process knowledge in individuals, these techniques need to also help individuals to believe that they understand what is required of them. It would seem each method, BPM and hands-on system training, would each improve perceptions concerning the knowledge level for which they are aligned. That is, BPMs should lead to greater perceived business process knowledge and hands-on system training should lead to greater perceived business procedural knowledge. This study finds support only for the latter. Why? One explanation is that perceptions are less about actual knowledge gained and more about the amount of new informational cues processed during learning. The decision making literature describes the "illusion of knowledge" phenomenon where individuals derive comfort from excessive information, even when that information is redundant or irrelevant (Davis, Lohse et al. 1994; Hall, Ariss et al. 2007). It is possible that the BPMs used in this study, while containing a sufficient quality of information to build accurate business process knowledge, did not provide a sufficient quantity of information to reduce the stress caused by the process change. Those attending the hands-on system training were flooded with an additional eight hours of new informational cues. This abundance of available cues may have led trainees to a greater level of comfort, which in turn, lead to higher perceptions of knowledge.

From a theoretical perspective, these results are important because they further our understanding of business process modeling and resulting knowledge structure development. Large scale ERP projects often introduce significant process change to organizations (Kremers and van Dissel 2000), resulting in the need to communicate new process design. This study improves our understanding of the effectiveness of contemporary process knowledge building techniques for building both actual and perceived business process knowledge in individuals. Specifically, BPMs are effective at building actual knowledge, but fall short at developing perceived knowledge. Additionally, hands-on system training improves perceived business procedural knowledge, but may actually degrade or block the development of process-related knowledge structures.

Limitations and Suggestions for Future Research

This work represents just a first step in research on the knowledge-building influence of business process models for individuals. Many questions remain and my hope is that this line of inquiry spurs further investigation that builds upon the basic framework proposed here. It may also be possible to improve the level of business process knowledge delivered by the BPM itself. This study used a business process model developed by the study site. The content of the model was selected by the process designers based on their own interpretation of the process and their own opinions on what content would be sufficient to communicate important process information. The business process modeling literature describes many different process modeling notations (see Recker, Indulska et al. 2009 for a detailed comparitive review). Many of the newer notations, such as the Business Process Modeling Notation (BPMN) (White and Miers 2008), are capable of expressing much more contextual information than the simple process model utilized in this study. It is quite possible that a more expressive process model will lead to greater perceived business process knowledge.

Another fruitful line of research would be to uncover the true nature of the way hands-on system training seems to deter the development of actual business process knowledge. Does hands-on system training distract individuals and thereby impede learning by reducing the level of attention paid to process-related informational cues? Or, does system-level training lead individuals to evolve their process-level knowledge structures to a different level of understanding? Learning theory (Kabanoff and Brown 2008; Walsh 1995) would seem to support both possibilities.

An additional limitation found in this study is that it investigates only one business process change within one company. Future studies should attempt to replicate these finding across other business process domains and within other organizations. To many firms, the purchasing and receiving process is very basic and limited in configuration. In these organizations, purchasing is considered non-strategic and firms are limited in their ability to find strategic advantage. Other firms may be positioned to implement processes which derive strategic value from unique relationships with suppliers and others in the supply chain. The increased complexity of such processes will certainly demand more from business process models. Business processes found in other areas of the firm may prove to be interesting in their own right. Other organizations may also provide an opportunity to study this phenomenon with a larger sample size than was achievable at this firm.

An additional limitation is that study parameters imposed by the company did not allow random assignment within the study design. Due to time constraints, the company only allowed one round of data collection at the time of training. In order to collect data for the control and process preview conditions it was therefore necessary to send the surveys through email a few days prior to class. There was concern that sending the control and process preview surveys to individuals from the same location might lead to treatment contamination since there would be no way to ensure that respondents in the process preview condition did not share the BPM with those in the control condition. Therefore, participants were assigned to control or process preview groups based on their assigned training facility. All participants from a given company location were trained a single training facility. Therefore, by balancing the assignment of control and process preview surveys to training facilities it was safe to assume that those viewing process models would be much less likely to share the process model with members of the control group. Surveys for the hands-on system training group were then taken from those who attended training and were not represent in the other two groups. An anova found no differences in the three groups in terms of their company experience, age, and gender. However, the findings of this study should be interpreted accordingly given the lack of opportunity for random assignment.

Practical Implications

Contemporary software development frameworks and methodologies promote the use of business process modeling in the design of new business processes. For example, the Capability Maturity Model Integration (CMMI) (SEI 1995, 2006a, b, 2007) suggests that all software artifacts, including business process models, should be iteratively designed with continuous feedback from project stakeholders. IBM takes this notion to an extreme in their Rational Unified Process (RUP) (Kruchten 2004) by devoting a large portion of their methodology to business process design and development. Clearly, the software industry is convinced that business process modeling is helpful. This study provides support for these beliefs. This study indicates business process models can be an effective tool for building actual business process knowledge. Further, hands-on system experience is not required to build this knowledge, and may even be detrimental. Process models require considerably fewer resources to develop and to consume than does system training. The result is that firms can reduce their investment in knowledge building activities and even increase the number of times business users can review process designs and provide valuable feedback. Firms should be advised however that process models are not as effective at developing perceived business process knowledge in individuals. Simply relying on process models alone, may result in additional stress in business users due to feelings of uncertainty of what is expected of them. This uncertainty may lead to incorrect emotional-based responses and negatively impact feedback. Additional empirical work is needed to improve this situation.

CONCLUSIONS

Many organizations are turning to IT-enabled business processes to transform the way in which they operate. Large scale and transformational process change is often blamed for enterprise system complexity and project failure. Many in the software industry suggest that business process modeling (BPM) is a technique that organizations can use to communicate new business process designs to interested parties within the firm. The IS literature provides a wealth of knowledge concerning the representation of business processes in model form. This study builds upon this base by investigating the knowledge-building influence of BPMs for individuals. Specifically, this study found evidence that viewing a BPM can efficiently build new business process knowledge structures. This resulting knowledge was found to be at least as good as knowledge formed through hands-on system training, possibly even better. Other the other hand, BPMs did not appear to help individuals to form perceived knowledge of their responsibilities within a business processes. Organizations should strive to build both actual and perceived business process knowledge in its individuals. My hope is that this line of inquiry will encourage additional research which seeks to improve our understanding of the knowledge generating aspects of BPMs.

CHAPTER 4

ESSAY 3

APPRAISING BUSINESS PROCESS DESIGNS: THE INFLUENCE OF PERCEIVED OPPORTUNITIES, THREATS, AND CONTROL ON SATISFACTION

ABSTRACT

The challenge associated with changing business processes as part of enterprise systems projects has long been considered a critical contributor to project failures. Most people generally accept that no matter how well implemented, a system configured to support a flawed business process design will fail to deliver the level of advantage expected. While a great amount of IS research focuses on the user acceptance of information technologies and systems, little attention has been given to the appraisal of business process designs early in the project lifecycle. This paper proposes that end-users are capable of assessing new business process designs prior to hands-on experience, and that these appraisals are predictive of those measured after hands-on experience. A business process appraisal model was studied by surveying individuals at a subsidiary of a Fortune 100 manufacturing firm that was implementing a new purchasing and receiving process. Prior to receiving hands-on system training, process satisfaction was positively influenced by anticipated task significance and anticipated method control. After hands-on system training, process satisfaction did not significantly change, but the influence on process satisfaction shifted to perceived role overload (negative) and organizational commitment (positive). In addition, the results show that viewing a business process model increased both pre- and post-training process satisfaction. This paper represents an important step in furthering our understanding of end-user appraisals of new business process designs.

INTRODUCTION

One may view organizations as a set of routines and processes working in concert to achieve organizational goals and objectives. Successful firms must continually evolve their routines in order to remain competitive and grow their business. Increasingly, many firms are deploying information technology-based solutions in the digitalization of business processes in order to achieve advanced capabilities not otherwise available. These capabilities help firms respond to increased competition, greater customer expectations, and challenging economic conditions. Enterprise systems (ES) are one such technology to which many companies turn in their quest to digitize business processes. It is estimated that as many an 88% of U.S. firms have implemented or are considering implementing an ES (Liang, Saraf et al. 2007). ES project costs range from $15 million for typical implementations to as much as $300 to $500 million for large international firms (Hitt, Wu et al. 2002; Shehab, Sharp et al. 2004). Unfortunately however, ES projects achieve only a dismal 10% success rate (Bajwa, Garcia et al. 2004), with nearly one in five projects scrapped and considered a total failure (Somers, Nelson et al. 2003). Catastrophic ES project failures have even lead firms into bankruptcy (e.g., Shehab, Sharp et al. 2004). The high failure rate and great cost of business process digitization makes this an important area of research. Some attribute failure of ES projects to the challenges involved in the redesign of business processes spanning multiple functional areas (Hitt, Wu et al. 2002). Firms often change their business processes to align with the "best practices" around which an ERP system is developed (Somers, Nelson et al. 2003), as it is often easier to fit the firm to the software than to fit the software to the firm (Shehab, Sharp et al. 2004).

Figure 13 depicts the lifecycle of a typical enterprise systems project, through a popular research framework (i.e., Markus and Tanis 2000) and through a visualization of SAP's

“Accelerated SAP” (ASAP) methodology (see Narayanan 2008). Business process designs represent some of the earliest project deliverables and form the foundation upon which the new system will be configured (indicated by “T1” in Figure 13). Enterprise systems, no matter how well configured, will suffer if the underlying business process is specified incorrectly. The cost of correcting process misspecification increases dramatically after configuration begins. Depending on how late the misspecification is discovered, the effect can be devastating to the project in terms of expensive rework and time delays. It is common for many misspecifications to be discovered, and their impact realized, during the shakedown phase (indicated by “T2” in Figure 13), where rework will cause the firm’s productivity to decline and other major business disruptions may occur (Markus and Tanis 2000). It is therefore critical for project success that an enterprise system be configured to a correctly specified business process design that meets the requirements of the firm. Many contemporary software development frameworks and methodologies, such as the Capability Maturity Model Integration (SEI 2006b, 2007) and IBM’s Rational Unified Process (Kruchten 2000), now recognize the importance of business process change, and direct project teams to iteratively refine new business process designs through the feedback of those in the business who will eventually be responsible for executing the new processes. This activity may be considered a sort of business process prototyping, where end-users and other key stakeholders can review and provide feedback as to the appropriateness of business process designs. Process prototypes may be developed quickly, and enable the project team to receive feedback on many alternative designs prior to configuring any software.

INSERT FIGURE 13 ABOUT HERE

Unfortunately, existing software development frameworks and methodologies provide little direction in terms of specific feedback to be gathered from end-users. They offer little guidance for measuring this feedback in a way that allows business process designs to be compared and ranked. Instead, this aspect of business process prototyping is left to the imagination of the project team. The academic literature has given considerable attention to the development enterprise systems critical success factors (e.g., Amoako-Gyampah 2004; Bajwa, Garcia et al. 2004; Esteves and Pastor 2001; Nah, Lau et al. 2001; Somers and Nelson 2001), including those relating to aspects of business processes (e.g., Kim, Lee et al. 2005). The business process modeling literature provides a variety of modeling notations with varying degrees of expressiveness and richness of content (see Recker, Indulska et al. 2009 for a review). However, neither literature stream offers prescriptive advice for gathering and processing end-user feedback concerning new business process designs. Antecedents of system use have been found in the perceptions, beliefs, and emotions of individuals resulting from exposure to new information technology (Beaudry and Pinsonneault 2010; Compeau, Higgins et al. 1999; Davis 1989; Davis, Bagozzi et al. 1992; Rogers 1995; Taylor and Todd 1995; Venkatesh, Morris et al. 2003). However, the study of end-user responses during early pre-implementation phases of IT projects have been "left largely unexplored" (Beaudry and Pinsonneault 2010, p. 693). One recent exception found that usage intention measured after exposure to simple screen mockups and narratives (i.e. pre-experience) predicts post-implementation system usage (Davis and Venkatesh 2004). This is encouraging, but only moves our understanding back to the "realization" phase (see Figure 13) of an ES project. In order to move even further back in the lifecycle, our focus needs to shift from gathering feedback about IT systems to gathering feedback concerning the business processes around which the systems are built.

This study poses four important questions: 1) How do individuals appraise and respond to business process designs, 2) Is this appraisal mechanism different at pre- vs. post-experience timeframes, 3) Are pre-experience appraisals predictive of post-experience appraisals, and 4) Does viewing a business process model (BPM) prior to hands-on system experience alter individual appraisals. To address questions 1-3, this paper builds upon the IT appraisal model of Beaudry and Pinsonneault (2005, 2010) by incorporating work-related constructs from the job role and work motivation literatures. The resulting business process appraisal model was tested during a firm's implementation of a new purchasing and receiving process, both prior to (T1) and after (T2) hands-on experience with the new process. The results suggest certain work-related aspects played heavily in the appraisal of new business process designs by individuals at this firm, and that these aspects influenced satisfaction differently at T1 and T2. Further, appraisals made at T1 strongly predicted those made at T2. Question 4 was addressed by examining the influence of viewing a BPM prior to training. The results suggest that process satisfaction beliefs formed after viewing a BPM are different than when no BPM was viewed, and that the effect carries through to post-training process satisfaction. The following sections provide details of the study and discuss implications to the implementation of enterprise systems.

THEORETICAL BACKGROUND

Appraising Un-Experienced Job Situations

A fundamental assumption underlying the appraisal mechanism is that individuals must be able to imagine themselves operating in an as yet un-experienced job situation with enough realism and vividness to allow them to accurately assess how the situation will affect them both personally and professionally. Support is found for this assumption in the Psychology and

Neuropsychology literature. Humans have a unique ability to mentally relive past events (Tulving 2002) and to project themselves into future scenarios (Szpunar, Watson et al. 2007). The phenomenon has been called episodic memory (Tulving 1972, 1991, 1993), recollective memory (Brewer 1996), autobiographical memory (Baumgartner, Sujan et al. 1992), and episodic future think (Szpunar, Watson et al. 2007), among others. This ability is considered one of the major neurocognitive memory systems and is closely related to semantic memory. Individuals use semantic memory to register and store knowledge, enabling them to represent objects, situations, and relationships. Episodic memory, on the other hand, enables an individual to relive their own past experiences (Tulving 1993) and to envision themselves enacting future situations (Szpunar, Watson et al. 2007). In a sense, individuals use this memory system to perform a sort of "mental time travel" (Tulving 2002, p. 2), based on knowledge stored in semantic memory. This type of conscious awareness is different from ordinary awareness of our current environment. Only in certain cases of mental illness do individuals have difficulty separating current reality from mental time travel. The term *Autonoetic Awareness* (or *Autonoesis*) is used to refer to this special kind consciousness that allows us to imagine in subjective time (Tulving 2002).

Research has shown that the episodic memory system is capable of storing emotions along with vivid imagery of events (Baumgartner, Sujan et al. 1992). Brewer (1988) used a random alarm to trigger affective feelings in subjects over time. The subjects were better able to recall past events when they were accompanied by strong emotions. Additionally, affective thoughts appeared to be an important component of the subject's recorded experience. Robinson (1976) examined the use of affective words in the recall of past events. In this study, affect was explicitly mentioned or could be assumed for most subjects' responses, leading to the conclusion that affect is an integral part of reliving experiences. White (1982) and Wagenaar (1986) found in separate studies that past episodes where more easily recalled when attached to pleasant affect than when attached to unpleasant affect.

The Job Recruitment literature provides additional support for this assumption, specifically in a recruitment method called Realistic Job Preview (RJP). RJP is a recruitment technique where potential job candidates are shown both positive and negative aspects of a job. RJP enjoys a rich history of study, with the first study appearing in 1956 (i.e., Weitz) and followed by many reviews and meta-analyses (e.g., Breaugh 1983; McEvoy and Cascio 1985; Meglino, Ravlin et al. 2000; Phillips 1998; Premack and Wanous 1985; Reilly, Brown et al. 1981; Wanous 1977, 1980, 1992; Wanous and Premack 1984). In general, research has shown that RJPs have a desirable influence on post-acceptance job outcomes such as job satisfaction, organizational commitment, performance, and reduced turnover.

RJPs are thought to operate through one or more of three mechanisms. 1) RJPs help to set a job candidate's initial expectations regarding a potential job (Guion and Gibson 1988; Meglino, Ravlin et al. 2000). Recruits often hold overly optimistic expectations of new jobs (Wanous 1980, 1992) leading them to future disappointment after job acceptance, becoming a greater risk for leaving voluntarily (Moberly, Griffeth et al. 1979). RJPs help job candidates to develop expectations more in line with the reality of the job. Once on the job, candidates who received an RJP are expected to experience greater job satisfaction (Meglino, Ravlin et al. 2000). 2) The "reality shock" of the negative aspects shown in RJPs is thought to prompt potential candidates to activate coping defenses (Meglino, Ravlin et al. 2000). These coping strategies often involve the "devaluing" of concerns for negative aspects in order to relieve discomfort in the individual (Meglino, DeNisi et al. 1993). 3) RJPs provide an opportunity for job candidates to “self-select” out of the job recruitment process (Breaugh and Starke 2000; Meglino, Ravlin et al. 2000). RJPs are thought to reduce post-acceptance job turnover because they provide a realistic job picture against which the candidate may assess the fit of their own needs to what the job can provide (Wanous 1980, 1992). They allow for a more informed choice by the applicant of whether to accept or reject a job offer (Meglino, DeNisi et al. 1993; Wanous 1973).

Work in the two literature streams mentioned above suggest that humans are “hard-wired” with the capability for imagining themselves in as yet un-experienced job-related situations. Further, this imagining can produce affective responses much like those produced during actual work experience. Positively or negatively charged emotions resulting from appraisals tend to influence subsequent appraisals for as long as the emotion-eliciting event remains in place (Han, Lerner et al. 2007; Lerner and Keltner 2000). Therefore, appraisals of business process designs made prior to hands-on experience will likely carry through to the post-implementation timeframe as long as the design remains unchanged.

Appraising IT Events

A goal this research is to explore the cognitive mechanism by which individuals appraise new business process models and to understand how individuals affectively respond. I propose that the introduction of a new digitized business process is a disruptive event, which can cause stress and/or excitement in individuals who are expected to operate the within the new process. The Cognitive Model of User Adaptation (Beaudry and Pinsonneault 2005) suggests that users exhibit certain coping behaviors resulting from their appraisal of significant information technology events (see Figure 14). Relevant to this current research is that individuals appraise the IT event based on two dimensions called the *Primary* and *Secondary Appraisal*s (Lazarus and Folkman 1984). During the primary appraisal, an individual anticipates how the IT event will affect them both personally and professionally. These anticipated consequences may be considered as opportunities and/or threats (Chattopadhyay, Glick et al. 2001; Dutton and Jackson 1987; Jackson and Dutton 1988; Milbern, Schuler et al. 1983). For example, an individual may view a new digitized business process as an opportunity if it helps them to be more productive or brings greater visibility to their contributions. They may view it as a threat if the new process reduces their status within the firm.

INSERT FIGURE 14 ABOUT HERE

In the secondary appraisal, individuals determine how much control they have over the IT event (Beaudry and Pinsonneault 2005). Within the context of new business processes, I use the control construct to reflect the level of autonomy individuals believe they have over their jobs. It is quite possible that enterprise systems will dramatically alter control perceptions due to the highly integrated nature of the underlying business transactions and data (Davenport 1998).

MODEL DEVELOPMENT

In addition to explaining the selection of coping behaviors, the appraisal mechanism has been used to explain other interesting linkages relating to IT implementation. Recently, Beaudry & Pinsonneault (2010) developed a framework for classifying emotions based on primary (opportunity vs. threat) and secondary (low control vs. high control) appraisals of new IT. They found that resulting emotions are related to IT usage, but through different paths depending on the type of emotion generated. It is likely then that emotion mediates the relationship between IT appraisals and coping behaviors (as found in Beaudry and Pinsonneault 2005). Similarly, business process appraisals are likely to elicit positive or negative emotions, prompting end-users to provide feedback in alignment with their coping response.

In the job role and work motivation literatures, the *Job Satisfaction* construct embodies this idea in the post-experience context, and is generally defined as an employee's affective reactions to a job (Fields 2002). Early works considered the domain of job satisfaction to include all characteristics of a job and the job environment that a person considers positively (rewarding, fulfilling) or negatively (frustrating, lacking) (Churchill, Ford et al. 1974; Locke 1976). Over several decades, many antecedents and consequences of job satisfaction were explored though the categories of work outcomes, individual differences, role perceptions, supervisory behaviors and job/task characteristics (Brown and Peterson 1993; Fields 2002). Much attention has been given to the relationship between job satisfaction and performance. Meta-analyses suggest that performance is antecedent to job satisfaction with a modest positive association (Brown and Peterson 1993; George and Jones 1997). Recent work finds performance to be an important mediator in the work effort/job satisfaction relationship (Christen, Iyer et al. 2006). At the organization level of analysis, firms with higher average levels of job satisfaction are thought to outperform firms with lower average levels (Ostroff 1992).

Business Process Satisfaction

Figure 15 presents the research framework. Consistent with the Coping Model of User Adaption (CMUA) (Beaudry and Pinsonneault 2005), I suggest that individuals will utilize a two-component system for appraising new business process models by considering both the consequences resulting from the business process itself, and perceptions of control over the new process and their new work. Furthermore, positively or negatively charged appraisals will generate affective responses in these individuals concerning their anticipated satisfaction of working within the new business process. I select *business process satisfaction* as the dependent variable and base it *job satisfaction* because of its rich history in the literature.

INSERT FIGURE 15 ABOUT HERE

Task Significance

Individuals should appraise a new business process designs in accordance with the perceived impact to their personal and professional well-being (Beaudry and Pinsonneault 2005). Further, perceptions of opportunities and/or threats will likely influence the level of affect held by the individuals concerning the new process (Beaudry and Pinsonneault 2010). Perceived opportunities for enhancing well-being should improve process satisfaction, while perceived threats should do the opposite. The work motivation literature suggests that job satisfaction will improve when employees feel their job is meaningful and important with respect to their own value system (Hackman and Oldham 1975; Johns 2010; Pierce, Jussila et al. 2009). *Task significance* represents individual "judgments that one's job has a positive impact on other people" (Grant 2008, p. 108), and is generally considered an important aspect of job design to individuals (Colby, Sippola et al. 2001; Turban and Greening 1997), and organizations (Brickson 2005; Thompson and Bunderson 2003). Job designs which demonstrate higher perceptions task significance also enjoy higher experienced meaningfulness, leading to greater job satisfaction (Humphrey, Nahrgang et al. 2007; Oldham and Hackman 2010). Task significance is defined here as the extent to which an individual believes their job impacts others. I expect individuals who anticipate higher levels of task significance within a proposed business process design will also express greater process satisfaction with the new process. The following hypotheses test this relationship in the pre- and post-training conditions.

Hypothesis 1a (H1a): An individual's perception of task significance of a business process will positively influence business process satisfaction prior to hands-on system training

Hypothesis 2a (H2a): An individual's perception of task significance of a business process will positively influence business process satisfaction after hands-on system training

Role Overload

Role theory states that every organizational position should have a clear set of responsibilities and expectations that will provide individuals with direction, and that will hold them accountable for their performance (Fields 2002). Job roles are rarely specified in advance within organizations. Instead, role-sender and role-receivers participate in episodic role-making exchanges, which shape employee understanding of job roles (Schaubroeck, Ganster et al. 1993). When implementing new business processes however, BPMs may be used to provide role definition to individuals. I expect individuals to use this role information during their primary appraisal of a new business process. Research has shown that prolonged exposure to role stressors can cause individuals to exert greater cognitive effort to "cope and neutralize" the stressors (Fields 2002, p. 145). This results in fewer available resources for effectively performing one's duties (Fried, Ben David et al. 1998). When individuals are no longer able to cope with stressful role demands, their work attitudes and level of performance are apt to decline (Erera-Weatherley 1996). In the experience-based role literature, *role overload* has been found to have a negative effect, or correlate negatively with job satisfaction (Jackson and Schuler 1985; Netemeyer, Burton et al. 1995; O'Driscoll and Beehr 1994; Peterson, Smith et al. 1995; Rizzo, House et al. 1970). In the pre-experience context of reviewing new business processes, I expect individuals who anticipate high levels of role stress (i.e. role overload) in a new business process design will express lower levels of expected satisfaction of the work for which the role is responsible. I define role overload as inconsistency between activities or tasks demanded of an employee and the time or other resources available for completing these tasks (Bacharach, Bamberger et al. 1990). The following hypotheses test this relationship in the pre- and post-training conditions.

Hypothesis 1b (H1b): An individual's perception of role overload of a business process will negatively influence business process satisfaction prior to hands-on system training

Hypothesis 2b (H2b): An individual's perception of role overload of a business process will negatively influence business process satisfaction after hands-on system training

Method Control

Individuals make secondary appraisals of IT events in terms of perceived control over work, control over self, and control over technology (Beaudry and Pinsonneault 2005). In the context of new business processes, control represents the amount of choice one has in deciding which work tasks to perform and how to execute them. This is conceptually similar to the definition of *Autonomy* from the Job Characteristics Model (JCM) (Hackman and Oldham 1980), which describes an employee's discretion to choose how and when work gets done. The JCM predicts that job designs with greater levels of autonomy are typically more satisfying to employees. Jackson, et al. (1993) found that timing and method control correlated positively with job satisfaction. Frese, et al. (1996) found that individuals who perceive low levels of control are less likely to persist in the face of setbacks. Dwyer and Ganster (1991) developed a work control construct, which includes control over the variety of tasks performed, the order of task performance, the pace of tasks, task scheduling, task procedures, and arrangement of the physical environment. They found that work control moderated the relationship of workload with work satisfaction. In alignment with the appraisal mechanism proposed by Beaudry and

Pinsonneault (2005, 2010), I propose that control perceptions will influence process satisfaction. I define method control as the degree to which an individual has the freedom to determine how to carry out his or her own work tasks. In general, greater perceptions of control should lead to greater process satisfaction. The following hypotheses test this relationship in the pre- and post-training conditions.

Hypothesis 1c (H1c): An individual's perception of method control of a business process will positively influence business process satisfaction prior to hands-on system training

Hypothesis 2c (H2c): An individual's perception of method control of a business process will positively influence business process satisfaction after hands-on system training

Organizational Commitment

In general, an individual's commitment to an organization has long been shown to reflect positively on desired work-related attitudes and behaviors. A recent meta-analysis describes three distinct commitment constructs commonly found within the literature (Meyer, Stanley et al. 2002). Affective commitment represents an emotional attachment to, identification with, and involvement in the organization. Normative commitment represents an individual's obligation to remain in the organization. Continuance commitment represents the perceived costs associated with leaving an organization. Continuance commitment is unique among the three in that it sometimes promotes negative work-related behaviors. Within the context of this research, affective commitment is important due to its emotional connection to job satisfaction found within the literature (Fields 2002; Meyer, Stanley et al. 2002). Interestingly, causality in the affective commitment/job satisfaction relationship is still a question (Meyer 1997). At best, the two constructs can be described only as correlates. The correlation between them can be quite strong and it is therefore recommended that affective commitment be considered in efforts to better understand job attitudes (Meyer, Stanley et al. 2002). The following hypotheses test this relationship in the pre- and post-training conditions.

Hypothesis 1d (H1d): An individual's perception of organizational commitment of a business process will be positively correlated with business process satisfaction prior to hands-on system training

Hypothesis 2d (H2d): An individual's perception of organizational commitment of a business process will be positively correlated business process satisfaction after hands-on system training

Early Prediction of Post-Experience Business Process Satisfaction

Contemporary software methodologies and practices such as the Capability Maturity Model Integration (SEI 2006b, 2007) and IBM's Rational Unified Process (Kruchten 2000) encourage project teams to solicit feedback on project deliverables, including business process models, as early in the project lifecycle as possible to improve the chance of detecting misspecifications in system and process designs. A major assumption is that individual responses to these models will approximate those found after post-implementation experience. Stated in the context of this study, an individual's business process satisfaction measured after viewing a business process model needs to predict satisfaction measured after hands-on process experience. In a similar line of inquiry, recent IS research indicates that end-users are capable of accurately assessing the usefulness of information systems after viewing system prototypes (Davis and Venkatesh 2004). Measurements of system usefulness taken after viewing screen printouts and reading command descriptions did indeed predict usefulness measures taken after hands-on system training and actual system use. Similarly, I suggest that measures of pre-experience business process satisfaction will predict post-experience satisfaction.

Hypothesis 3 (H3): Business process satisfaction measured prior to hands-on system training will be highly predictive of business process satisfaction measured after hands-on system training

Improving Business Process Satisfaction with Business Process Models

The job role literature explores how well workers understand what is expected of them on the job, the alignment of expectations between the job and individual, and the appropriateness of the level of effort required to meet these expectations. Several constructs have been proposed to represent various aspects of "understanding" of one's role and the influence it has on work related attitudes and behaviors. The names are generally plays on the words ambiguity or clarity (see Fields 2002 for an overview). In general, research has shown that the greater the understanding an individual has concerning workplace expectations, the more likely they are to evaluate their job positively (Adkins 1995; Bauer and Green 1994; Guimaraes and Igbaria 1992; Igbaria and Greenhaus 1992; Jex and Bliese 1999; Rizzo, House et al. 1970; Rutner, Hardgrave et al. 2008). BPMs convey information cues concerning business process design. When viewing BPMs, individuals should process these business process cues into knowledge structures in order to give them form and meaning, and to enable subsequent interpretation and action (Kabanoff and Brown 2008; Walsh 1995). As a result, their overall understanding of what will be expected of them should also increase, along with their anticipated business process satisfaction. Therefore, I propose the following:

Hypothesis 4a (H4a): Viewing a BPM prior to hands-on system training will improve business process satisfaction, as compared to not viewing a BPM

Hypothesis 4b (H4b): Viewing a BPM prior to hands-on system training will improve business process satisfaction measured after training, as compared to not viewing a BPM

METHOD

This study was conducted at a small subsidiary of a Fortune 100 manufacturing company located in the United States. The subsidiary, hereafter called *the company,* implemented a standard purchasing and receiving process across its many locations. Prior to this, the company allowed purchasing and receiving to occur in an ad hoc and uncontrolled fashion. As a result, the company had very little insight to their purchasing activities, making it difficult to measure performance and to make improvements. The company implemented a market-leading ERP system and mandated its use at all locations. The parent company provided project management, process design, and ERP implementation, and training expertise. The standard purchasing and receiving process was modeled after that of the parent company, which had been in place for several years.

Participants and Data collection

The sampling frame of this study included 169 employees who were selected to receive training on the new ERP system. Training was held at two remote locations and at the parent company's corporate headquarters. The same trainers were used in each training session. Each participant attended an eight-hour training session that included an overview of the new purchasing and receiving process and hands-on system training. In the system training, participants were shown how to execute transactions in the ERP system in response to mock purchasing and receiving scenarios.

Data was collected prior to (T1) and following (T2) hands-on training of the new ERP system. Approximately two weeks prior to training, each subject received an email containing a link to an online survey. They were informed of the academic nature of the study, that their company encouraged their participation, and that completion of the survey was voluntary and confidential. Respondents received the same questionnaire at both T1 and T2. The T2 questionnaire was administered at the end of hands-on ERP training. At T1, respondents were divided into treatment and control. In addition to the survey, the treatement group was presented with a business process model developed by the company's process designers. The BPM consisted of rows, or swim lanes, each representing a different role within the process. Within each swim lane were work tasks and additional task sequencing information shown in graphical form similar to a process flowchart. To increase the strength of the treatment, each participant was asked to review the BPM and choose from a list of roles the one that most closely aligned with their own role. An individual's training location assignment was made by the company according their own geographic locations. All individuals located at the same company location attended training at the same training location. Treatment group assignment therefore was made according to training location in order to minimize the chance for the treatment to be compromised by people sharing the BPM with members of the control group. A total of 86 responses at T1 and 125 at T2 were received. Since this study looks at the change in appraisals over time, it was necessary to limit the data to those participants providing responses at both T1 and T2. In total, 57 participants provided responses at both times. An independent sample analysis was performed to determine if differences existed between those submitting both surveys versus those only submitting a response at T2. No significant differences were found for any constructs measured. The average age of the participants was in the range of 35-44 years and they were 44% male. The average experience with the company was 10.3 years (SD 7.5).

Measurement

Constructs were measured using well-validated scales from the job-role literature with slight wording changes to place them in the context of a pre-experience job situation. The dependent variable, *process satisfaction*, was based on Morris and Venkatesh's (2010) 3-item measure of job satisfaction. *Role overload*, defined as an inconsistency between activities or tasks demanded of an employee and the time or other resources available for completing these tasks, was based on the Bacharach, et. al (1990) 5-item measure of the same name. *Task significance,* defined as the degree to which an employee's work affects the work of others, was based on Idasazak and Drasgow's (1987) 3-item measures of the same name. *Method control*, defined as the degree to which an individual has the freedom to determine how to schedule and carry out his or her own work tasks, was comprised of items from Jackson, et al.'s (1993) 6-item measure of the same name. Organizational commitment, defined as the extent to which one is involved in, and identifies with, one's organization, was measured using Ahuja et al.'s (2007) 5-item measure of the same name. All items were measured on a 7 point Likert-type scale (1=Strongly Disagree to 7=Strongly Agree).

Several control variables were also obtained. *Company experience* was measured using a two-part item which allowed the respondent to indicate their total number of years and months of experience. The number of years was multiplied by 12 and added to the months to obtain the total number of months of experience. *Age* and *gender* were each measured using a single item, with gender coded as a dummy variable (1 = male).

RESULTS

I analyzed the model using partial least squares (PLS) with SmartPLS (Ringle, Wende et al. 2005). PLS is appropriate when the purpose of the model is to predict (Chin, Marcolin et al. 2003; Gefen, Rose et al. 2005). Following the procedures of Gefen and Straub (2005), I test convergent validity of the latent constructs by first bootstrapping to 500 resamples and then examining the t-values of the outer model loadings (see Table 10). All indicators were significant at the .001 level, except for task significance measured at T2. Item TSI1 did not load significantly and was therefore dropped from the analysis for both T1 and T2. With fewer than three items remaining, analysis of task significance should be made with caution. An additional test of convergent validity is that the average variance extracted (AVE), or the variance explained by the latent constructs for the variance observed in their measurement model, should be .50 or higher (Fornell and Larcker 1981). Table 11 indicates that AVE for the constructs ranged from .58 to .90. Both of these tests indicate a high degree of convergent validity.

INSERT TABLE 10 ABOUT HERE

INSERT TABLE 11 ABOUT HERE

To evaluate discriminant validity, the cross-loadings of measurement items on latent constructs were examined. As shown in Table 12, the items load more highly on each intended construct than on the other by at least .10, as recommended by Gefen and Straub (2005). The one exception was T2 MCO4. MCO4 was subsequently dropped from the analysis for T1 and T2. Additionally, the square root of the AVE for each construct was compared to the correlations of the latent variables (Table 13). To demonstrate discriminant validity, the square root of a given construct's AVE should be larger than any correlation of the given construct with any other construct in the model (Chin 1998). The results of both tests demonstrate strong discriminant validity.

INSERT TABLE 12 ABOUT HERE

INSERT TABLE 13 ABOUT HERE

SmartPLS was used to demonstrate measurement reliability, indicated by Cronbach's alpha and composite reliability scores. Table 11 indicates that the constructs exhibited reliability well over the .60 threshold for exploratory research (Nunnaly 1967). Finally, to rule out the possibility of a common method bias (Bagozzi and Yi 1991), the construct correlation matrix was examined to determine if any constructs correlate extremely high (more than .90) as specified by Pavlou et al. (2007). Table 13 indicates that no constructs are so correlated, suggesting that common method bias is not an issue.

A manipulation check variable, *perceived process transformation*, was included in the survey at both T1 and T2 to test for the degree of change over the old process (or lack of process in this case) perceived by the subjects. This variable was derived from Morris and Venkatesh's (2010) 4-item perceived change measure. The mean (SD) scores of the manipulation check were 5.0 (1.2) and 5.3 (1.2) at T1 and T2 respectively, suggesting that employees perceived a substantial change in the purchasing and receiving process. Figure 16 presents the path analysis found using SmartPLS. R^2 for process satisfaction was measured at .45 and .55 for T1 and T2 respectively. The effect of the control variables company experience, age, and gender were all non-significant. At T1, support was found for H1a and H1c, but not for H1b or H1d. Both task significance and method control positively influenced process satisfaction. Role overload and organizational commitment did not. The opposite was true at T2 where support was found for H2b and H2d, but not for H2a or H2c. Here, role overload negatively influenced process satisfaction while the relationship with organizational commitment was positive. Note that the model was tested with a causal link from organizational commitment to process satisfaction. This is not to imply that a causal link exists. In agreement with the literature, H2d is only meant to test for a positive correlation. Pre-training process satisfaction predicted post-training satisfaction, supporting H3. A paired sample test was performed to analyze the differences in construct significance from T1 to T2. The results are shown in Table 14. All construct pairs were correlated and most means were not significantly different between T1 and T2. The one exception was role overload, which increased at T2. Finally, an independent sample test was performed to analyze the impact to the appraisal mechanism from viewing a business process model prior to attending hands-on system training. The results shown in Table 15 indicate that viewing a BPM increased both T1 and T2 process satisfaction, thus supporting H4a and H4b. All other constructs were not significantly changed.

INSERT FIGURE 16 ABOUT HERE

INSERT TABLE 14 ABOUT HERE

INSERT TABLE 15 ABOUT HERE

DISCUSSION

These findings help us to better understand the mechanism by which end-users appraise new business process designs. Today's large-scale and transformational enterprise systems projects often make sweeping changes to the way businesses operate. The success of software development and/or configuration during these projects depends heavily upon the correct specification of business process design. While the software development industry encourages the review of potential process designs early in the requirements definition phase (see Figure 13), the academic literature provides little insight concerning end-user responses during pre-implementation phases of these projects (Beaudry and Pinsonneault 2010). The present research presents one of the first attempts to quantitatively measure end-user appraisals of business process designs, and to better understand the appraisal mechanism itself. This study builds upon recent technology appraisal studies (Beaudry and Pinsonneault 2005, 2010) by incorporating constructs into the appraisal model from the job role and work motivation literatures.

These results indicate that approximately half of the variance of business process satisfaction is explained by perceptions of four main constructs: task significance, role overload, method control, and organizational commitment. Task significance is a measure of the felt importance of one's work to the organization. Role overload is a measure of perceived fit between an individual's work demands and available resources. Method control is a measure of freedom to choose how work is accomplished. Organizational commitment is a measure of an individual's emotional attachment and identification with an organization.

Prior to hands-on system training, individuals at this company appeared to be most concerned with task significance and method control in relation to process satisfaction. Then, post-training concern shifted to role overload. This company was moving from having no standard purchasing and receiving process to one that was heavily standardized and rigidly controlled by ERP software. Although the ERP software had been running at the parent company for several years, this project represented the first ERP implementation for this subsidiary. The shift in appraisal mechanism from T1 to T2 might be explained by the fact that prior to hands-on system training these individuals did not have experience with, or an understanding of, the executional requirements of this ERP package. Role overload was low prior to training, but increased significantly after training (Table 14). Without referent knowledge concerning the amount of work required by the software, these individuals appear to have been more aware of their perceived level of importance to the organization and the degree of freedom they would have in the way work would be performed. During hands-on training these individuals likely developed a more accurate understanding of the work required to perform within the new business process. Afterword the stress induced by the understanding of increased work demands likely became more salient as concerns of organizational importance and control faded into the background. In the face of this new threat, an individual's commitment to the organization likely helped to offset the negative impact to process satisfaction.

These findings are also highly encouraging about the viability of capturing stable and predictive process appraisals during early phases of enterprise systems projects. Process satisfaction measured prior to hands-on process experience (T1) predicted post-experience process satisfaction (T2). Further, task significance, method control, organizational commitment, and process satisfaction measured after viewing a prior to hands-on process experience (T1) were highly correlated with, and not significantly different from the same measures taken after hands-on process experience (T2). Only role overload changed from T1 to T2 as individuals gained procedural knowledge of the new process. These results suggest that individuals are capable of making accurate early appraisals of large-scale process changes. However, more work is warranted in this area. An alternative interpretation is that most individuals have a basic understanding of this particular process. For many companies the purchasing and receiving business process is not a strategic differentiator. Efficiency and accuracy are important for executing the process well, but the purchasing and receiving process is not one that typically defines a company. Of course there are likely exceptions to this rule.

However, this particular company is a manufacturer of finished products with purchasing and receiving representing a supporting process. Even though the measured perceived process change was consistent and high at T1 and T2, it is possible that the actual amount of change was not great enough to influence the predictability of the early process satisfaction measure. Future research should investigate the boundary conditions of early process satisfaction predictability.

Finally, this study provides important support for the notion that end-users are capable of accurately assessing an as yet un-experienced job situation depicted in a business process model, and that viewing a BPM influences process satisfaction. Table 15 indicates that individuals who viewed a BPM demonstrated higher process satisfaction at T1 prior to hands-on system training and that this influence carried through to T2. Prior to hands-on training viewing the BPM likely increased process clarity, which in turn lead to greater process satisfaction. This is in line with the experience-based job literature where role clarity is found to positively influence job satisfaction (Fields 2002).

Theoretical Contribution

Prior work has called for more research concerning appraisals made very early in the design phase (Beaudry and Pinsonneault 2010) and within the context of large-scale process change projects (Davis and Venkatesh 2004). One of the first deliverables to emerge early in an enterprise systems project is the business process design (Markus and Tanis 2000). According to enterprise systems critical success factor research, the way in which organizations deal with challenges relating to business process design can determine project success (Kim, Lee et al. 2005). To date, the IS literature has largely ignored end-user appraisals of pre-implementation artifacts (Beaudry and Pinsonneault 2010). In a notable exception, Davis and Venkatesh (2004) found that perceptions of system mockups and narratives (i.e. system design artifacts) helped to predict post-implementation system usage. Pushing the envelope even further upstream into the project lifecycle, this study represents one of the first to explore appraisals of pre-system-design artifacts. The proposed model extends current IT appraisal theory (Beaudry and Pinsonneault 2005, 2010) by incorporating constructs from the experience-base job/role literature.

Practical Implications

These results have important practical implications as well. Firms continue to invest heavily in the digitization of business processes as they chase new opportunities for competitive advantage. Critical success factor research tells us that in many situations large-scale enterprise systems projects fail to achieve desired results due to complications associated with changing business processes. Further, most process design problems are not realized until late in the project lifecycle when design changes can be detrimental to the project and/or the firm. The software industry promotes the early review and evaluation of business process design as a method for driving out process design misspecification. Unfortunately however, they provide little direction for measuring end-user appraisals. This study provides one of the first attempts to identify an appraisal metric and test its stability over time. Enterprise systems project teams can use this study's measure of process satisfaction in their pursuit of correct process specification. Additionally, the identification of important determinants of process satisfaction should guide project teams to create process models which clearly articulate process characteristics that will resonate with end-users during their appraisal.

Limitations and Opportunities for Future Research

Some limitations and opportunities for future research should be noted. This study examined the implementation of a new purchasing and receiving process at a single firm. At a functional level, business processes such as this one may exhibit commonalities across firms. However, over the years an organization's business processes evolve through firm-specific experiences and opportunities for change (Teece, Pisano et al. 1997). As employees persist through this evolution their coping responses to change likely shape their own work value systems in unique ways. Therefore, certain aspects of a changing business process may be more salient to individuals within certain firms, but less salient to those in others. Future studies should examine business process appraisals in other organizations and with other business processes.

It is likely that additional role stressors and work opportunities will be important determinants of process satisfaction in other contexts. The job role and work motivation literatures provide a wealth of motivational antecedents to job satisfaction. Many of these influences are likely to extend into the pre-experience context of process appraisals such as *job routinization and formalization* (Bacharach, Bamberger et al. 1990), *monotony* (Melamed, Ben-Avi et al. 1995), *role ambiguity* (Rizzo, House et al. 1970; Sawyer 1992), and *procedural justice* (Sweeney and McFarlin 1997). My hope is that this research encourages others to explore new avenues such as these.

In addition to motivational characteristics found within process designs, other forms of perceived opportunities and threats may lie in the social context of a particular firm. In general, social considerations are found to positively or negatively influence job satisfaction in direct accordance with their positive or negative nature. Future studies should determine the ability of individuals to consider these constructs in the pre-experience context. Examples include *perceived organizational support* (Eisenberger, Cummings et al. 1997), *social support* (Caplan, Cobb et al. 1980), *supervisory support* (Greenhaus, Parasuraman et al. 1990) and *political perceptions* (Kacmar and Ferris 1991).

Another important avenue for future research is to expand the inquiry of commitment. Commitment related factors are found to correlate positively with job satisfaction and may extend into the pre-experience context. As mentioned previously, organizational commitment has been studied with respect to its affective, normative, and continuance aspects. Commitment can be related to the linking of a person's identity to the organization, the congruence of organizational and individual goals, perceived rewards associated with continued participation in an organization, costs to an individual for leaving an organization, and normative expectations within an organization (Fields 2002). Potential commitment constructs for future study include *psychological attachment* (O'Reilly and Chatman 1986), *career commitment* (Blau 1989), and *supervisor-related commitment* (Becker, Billings et al. 1996). In addition to satisfaction, commitment-related constructs may provide additional insights into business process appraisals.

Finally, additional work outcomes should also be explored. In addition to emotional responses, IS research has noted that appraisals lead to certain coping behaviors according to perceptions of opportunities/threats and control (Beaudry and Pinsonneault 2005). Additional behavioral outcomes such as *citizenship* (Moorman 1993; Williams and Anderson 1991), *ingratiation* (Kumar and Beyerlein 1991), *helping* (Van Dyne and LePine 1998), and *anti-social behaviors* (Robinson and O'Leary-Kelly 1998) might also arise from appraisals of new business process designs. These behaviors may positively or negatively affect enterprise systems projects in unexpected ways.

CONCLUSION

This study posed four important questions: 1) How do individuals appraise and respond to business process designs, 2) Is this appraisal mechanism different at pre- vs. post-experience timeframes, 3) Are pre-experience appraisals predictive of post-experience appraisals, and 4) Does viewing a business process model (BPM) prior to hands-on system experience alter individual appraisals. Process satisfaction was introduced as an appraisal measure for process design. Individual perceptions of task significance, role overload, method control, and organizational commitment played heavily in an individual's process appraisal. The appraisal mechanism was found operate differently pre-system training vs. post-system training. However, pre-training process satisfaction was a stable predictor of post-training satisfaction. Business process models were shown to increase process satisfaction at both times. These results are encouraging and support what the software methodology industry has been saying for some time now. Namely that the review of business process designs early in the project lifecycle can help organizations to drive out business process misspecification and thereby drive out risk in enterprise system projects.

CHAPTER 5

CONCLUSION

This dissertation examines the business process design activity through the lens of organizational and managerial cognition. It had five main objectives: (1) to explore the evolution of business process design procedures over time; (2) to understand the influence of knowledge structures in successful business process design; (3) to determine if business process models enhance knowledge structure development; (4) to identify knowledge structure categories relevant to business process design; and (5) to predict business process design success very early in the IT project lifecycle. To achieve the first two objectives, in essay 1, I performed a case study of three large-scale and transformation IT projects at a Fortune 100 company. To achieve the third objective, in essay 2, I measured the influence of business process models on individual- and group-level knowledge structures. To achieve objectives four and five, in essay 3, I developed an appraisal model for business processes, and used it to predict post-experience process satisfaction.

In the first essay, I performed an archival analysis of three IT projects that occurred over a ten-year period. The archives included project communications, status meeting notes and reports, management presentations, etc. I discovered a pattern of evolution across these projects for this firm's business process design activities. The pattern includes starting with a facilitating condition, followed by an initial assessment of the firm's existing knowledge, existing knowledge processes, and past successes and failures. This is followed by a series of divergent and convergent knowledge processes which either reduce or increase shared knowledge among the team. I also found that disruptive knowledge structures may be present in individuals that can prevent the team from reaching an appropriate business process design. Disruptive knowledge structures are eliminated through effective knowledge processes. In the second essay, I tested the effectiveness of business process models (BPMs) for building both actual and perceived business process knowledge. I found that viewing a BPM did lead to increased accuracy of process knowledge at the individual- and group-levels. It did not result in higher levels of perceived knowledge in individuals. In the third essay, I developed an individual appraisal model for business processes. The model contains four key antecedents to business process satisfaction: role overload, task significance, method control, and organizational commitment. Surprisingly, the influence of these antecedents on process satisfaction behaved differently in the pre- vs. post-experience timeframe. I also found the pre-experience process satisfaction strongly predicted post-experience process satisfaction.

This dissertation has important implications for theory and practice. First, it represents one of the first attempts examine the business process design activity through the lens of managerial and organizational cognition. The results demonstrate the importance of knowledge structures to process business process design. It would seem that the ability to recognize shortcomings in the processes and in existing knowledge structures are critical to business process design success. Second, design teams evolve group knowledge structure through a series of divergent activities aimed at the assimilation of new knowledge structures, and convergent activities aimed at knowledge diffusion. It is these convergent processes that help identify and eliminate disruptive knowledge structures that lead to business process misspecification. Third, a specific knowledge building tool, business process modeling (BPM) is shown to effectively develop business process knowledge structures in both individuals and groups. The software methodology industry as long supported the use of BPM for improving the development of IT-enabled business process. Until now, little has been done to test validity of their claims. Forth, this dissertation represents one of the first attempts to quantifiably capture an end-user's satisfaction with a business process. It further explains the underlying perceptions salient to this satisfaction. Fifth, these results support that appraisals measured early in the project lifecycle are highly predictive of appraisals collected after hands-on exposure to the new process. This holds great promise for an early indicator for business process misspecification. Early detection of business process design flaws will potentially save firms much in terms of costly redesign and rework.

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APPENDIX A – FIGURES, DIAGRAMS, TABLES, AND CHARTS

Figure 1 – Timeline for three projects

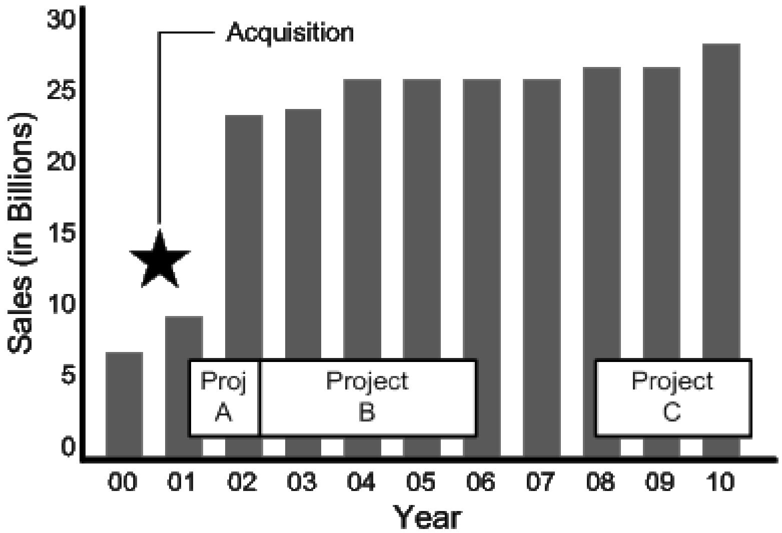


Figure 2 – Project A Timeline

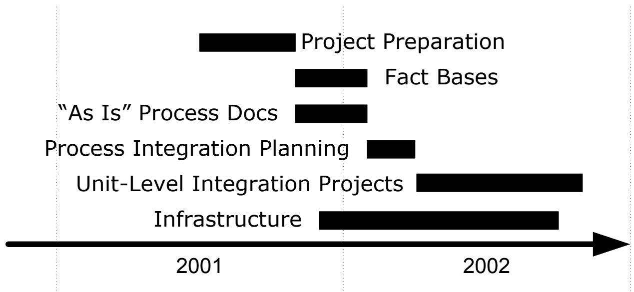


Figure 3 – Project B Timeline

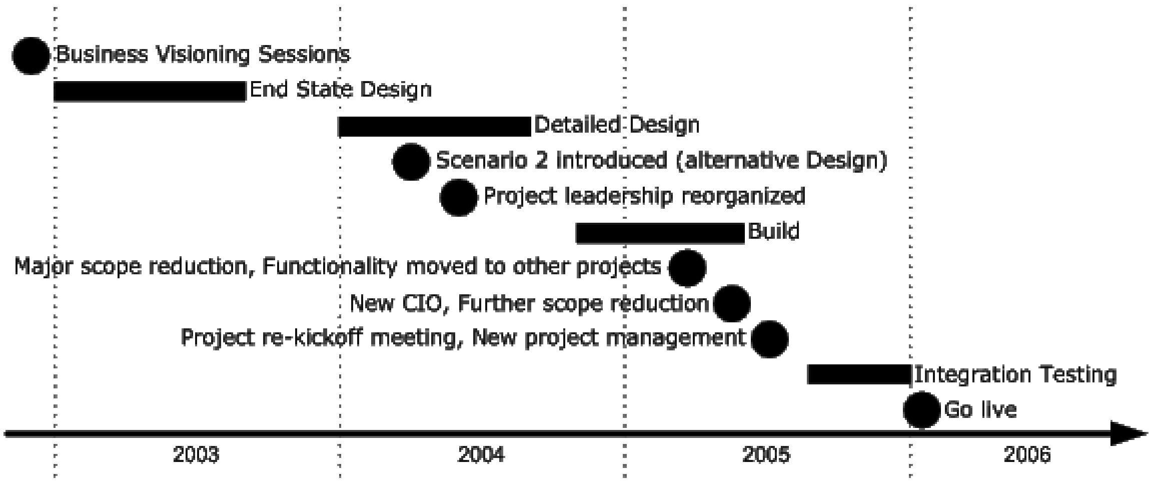


Figure 4 – Project C Timeline

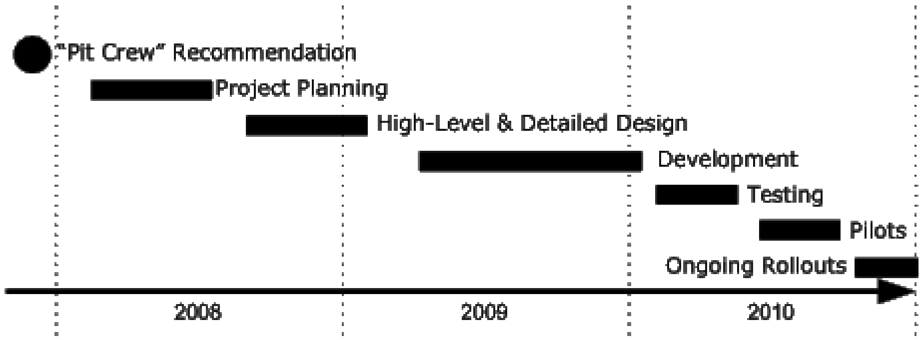


Figure 5 – Reducing disruptive knowledge structures

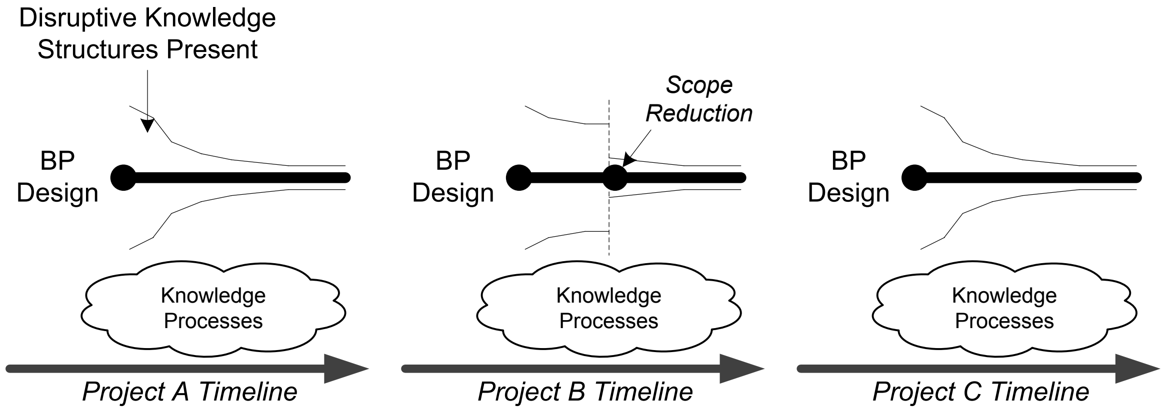


Figure 6 – Effects of knowledge sharing on solution design

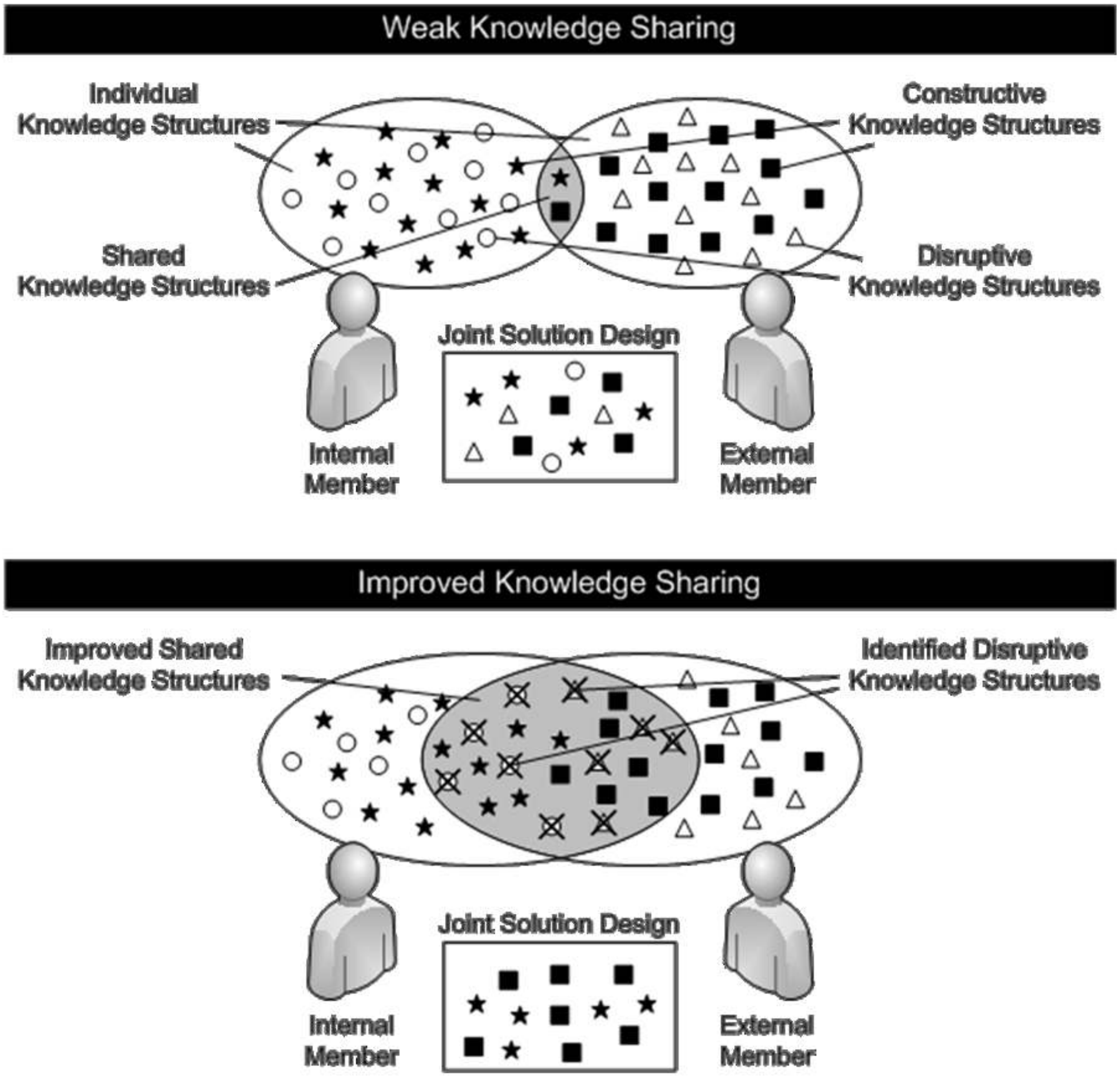


Figure 7 – Knowledge process evolution

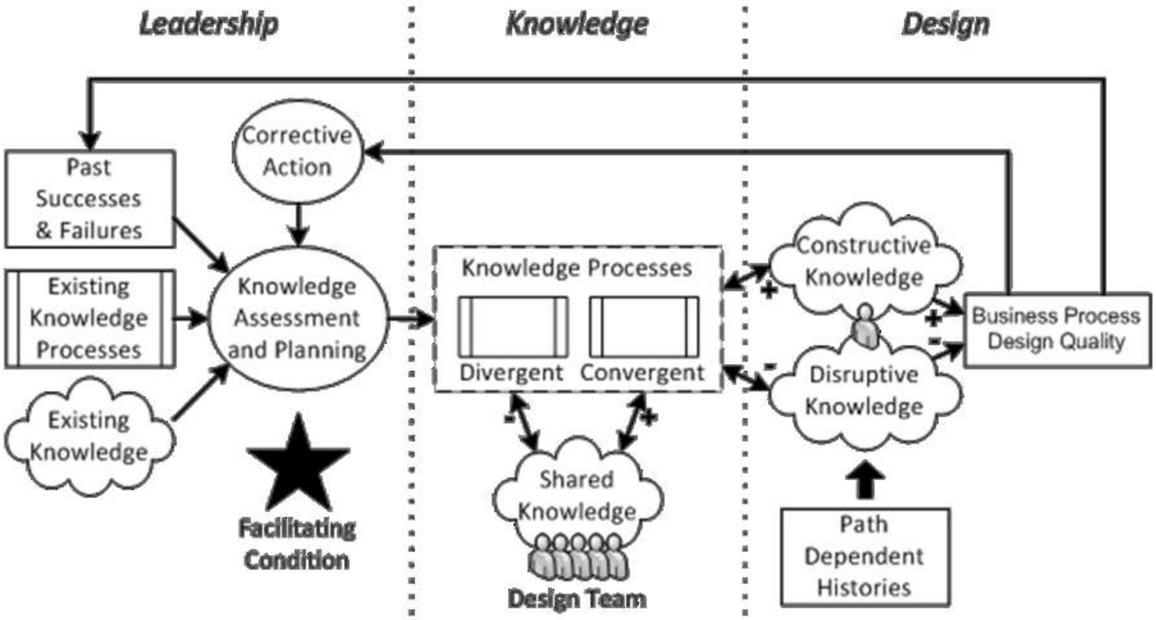


Figure 8 – Basic framework of a business process

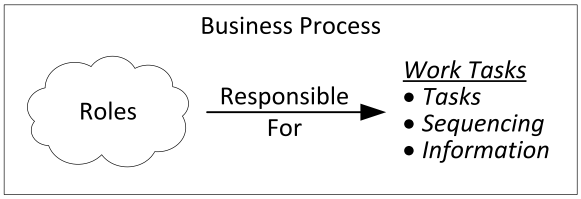


Figure 9 – Simplified purchasing & receiving business process model

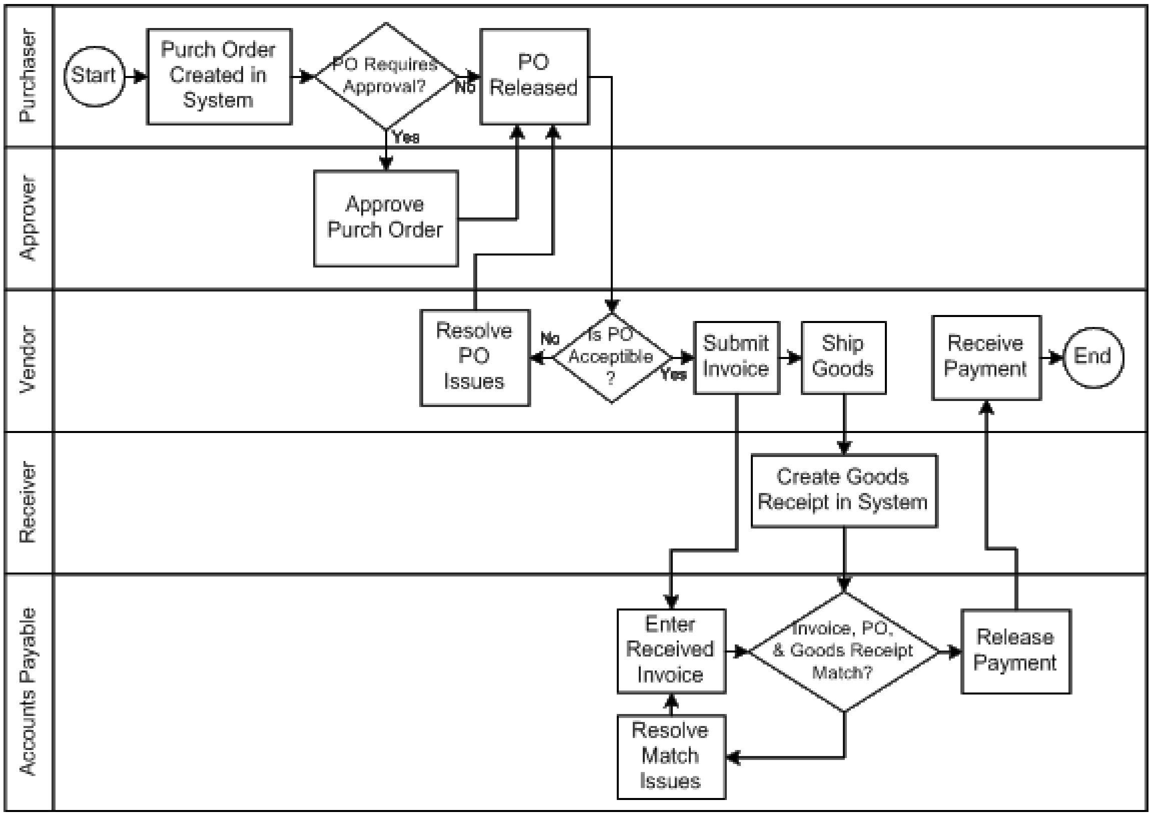


Figure 10 – Research framework

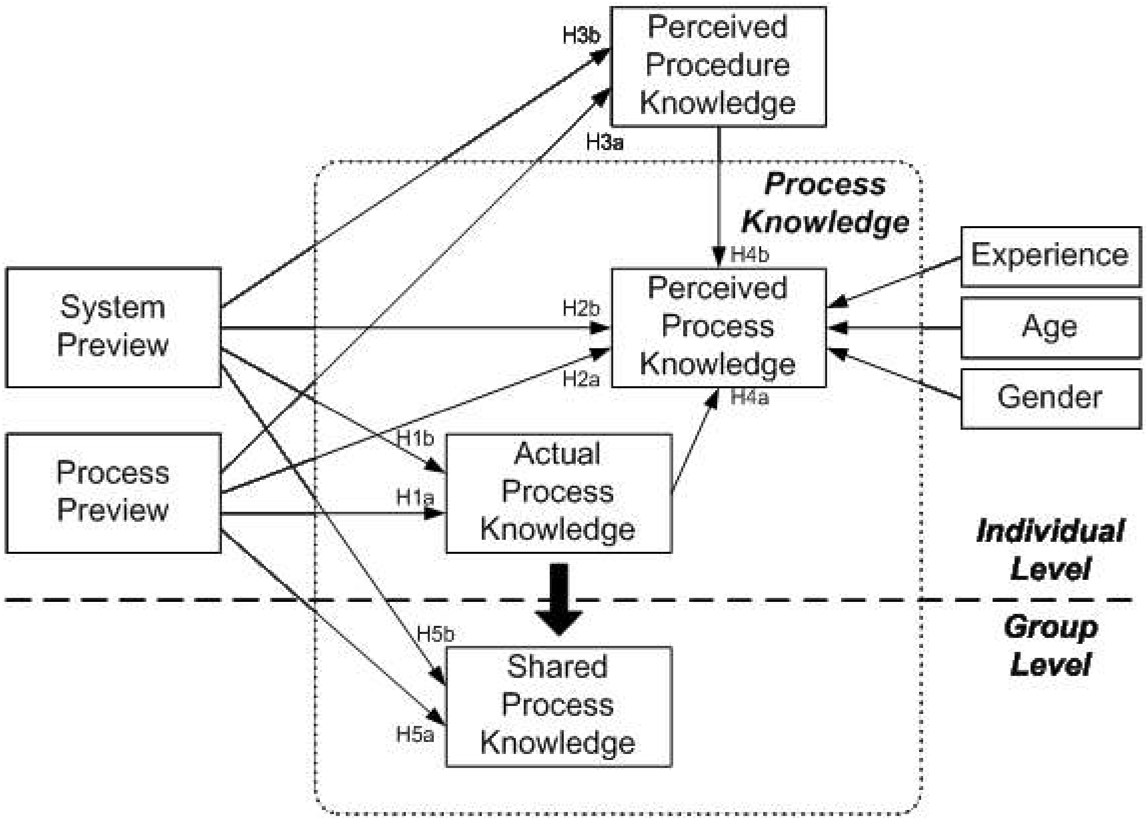
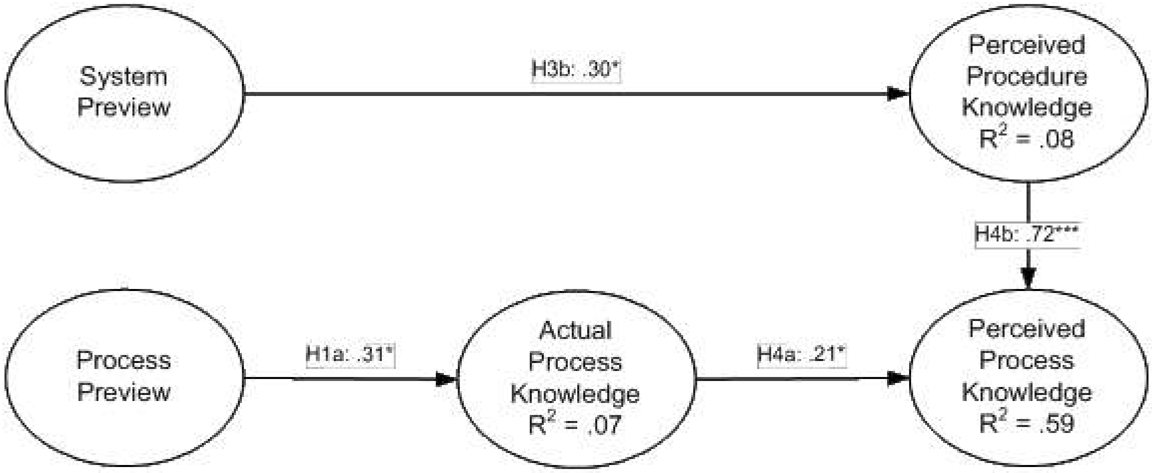


Figure 11 – PLS results (Essay 2)



*p < .05; **p < .01; ***p < .001
Nonsignificant paths and control variables removed for readability

Figure 12 – Similarity of networks (Essay 2)

Expert vs. Control

	1	2	3	4	5	6	7	8	9
1									
2	E								
3	■	C							
4		C	E						
5	C	C	C	E					
6				■					
7	E								
8						E	■		
9		E		C	■	E	■	E	

Similarity (C) = 0.28, p = n.s.
Proximity Correlation = 0.12

Network Nodes
1) Approver approves PO's in timely manner
2) Vendor works with Purchaser to resolve PO issues in a timely manner
3) Approver quickly approves PO changes when necessary
4) Vendor ships an accurate number of goods in timely manner
5) Vendor quickly submits an accurate invoice for goods shipped
6) Receiver systematically creates an accurate goods receipt
7) AP systematically enters invoice receipts in a timely manner
8) Accounts Payable pays invoices within payment terms
9) Vendor receives timely payment for goods

Expert vs. Process Preview

	1	2	3	4	5	6	7	8	9
1									
2									
3	■								
4			E						
5				E					
6			P	E					
7	E								
8						■	E		
9		■		P	■	E	■	■	

Similarity (C) = 0.43, p = 0.008
Proximity Correlation = 0.65

Control vs. Process Preview

	1	2	3	4	5	6	7	8	9
1									
2									
3	■	C							
4		C							
5	C	C	C						
6			P	C					
7									
8						P	C		
9		P		■	■		■	P	

Similarity (C) = 0.27, p = n.s.
Proximity Correlation = 0.14

Links in Common

	Exp	Con	Pro	Sys
Exp	12			
Con	5	11		
Pro	6	4	8	
Sys	4	4	4	9

Expert vs. System Preview

	1	2	3	4	5	6	7	8	9
1									
2									
3	E								
4	S		E						
5		S	S	E					
6				E					
7	E			S					
8						■	E		
9		■		S	■	■	E	E	

Similarity (C) = 0.24, p = n.s.
Proximity Correlation = 0.43

Control vs. System Preview

	1	2	3	4	5	6	7	8	9
1									
2									
3	C	C							
4	S	C	C						
5	C	■	■	C					
6									
7				S					
8						S	C		
9		S		■	■	S	C		

Similarity (C) = 0.25, p = n.s.
Proximity Correlation = 0.06

Process vs. System Preview

	1	2	3	4	5	6	7	8	9
1									
2									
3	P								
4	S								
5		S	S						
6			P						
7				S					
8						■			
9		■		■	■	S	P	P	

Similarity (C) = 0.31, p = n.s.
Proximity Correlation = 0.48

Notes
1 Shading indicates links in common between two knowledge structure networks
2 Single letters indicate a link is found in one knowledge structure network but not the other
E = Expert, C = Control, P = Process Preview, S = System Preview

Figure 13 – Lifecycle of an enterprise systems project

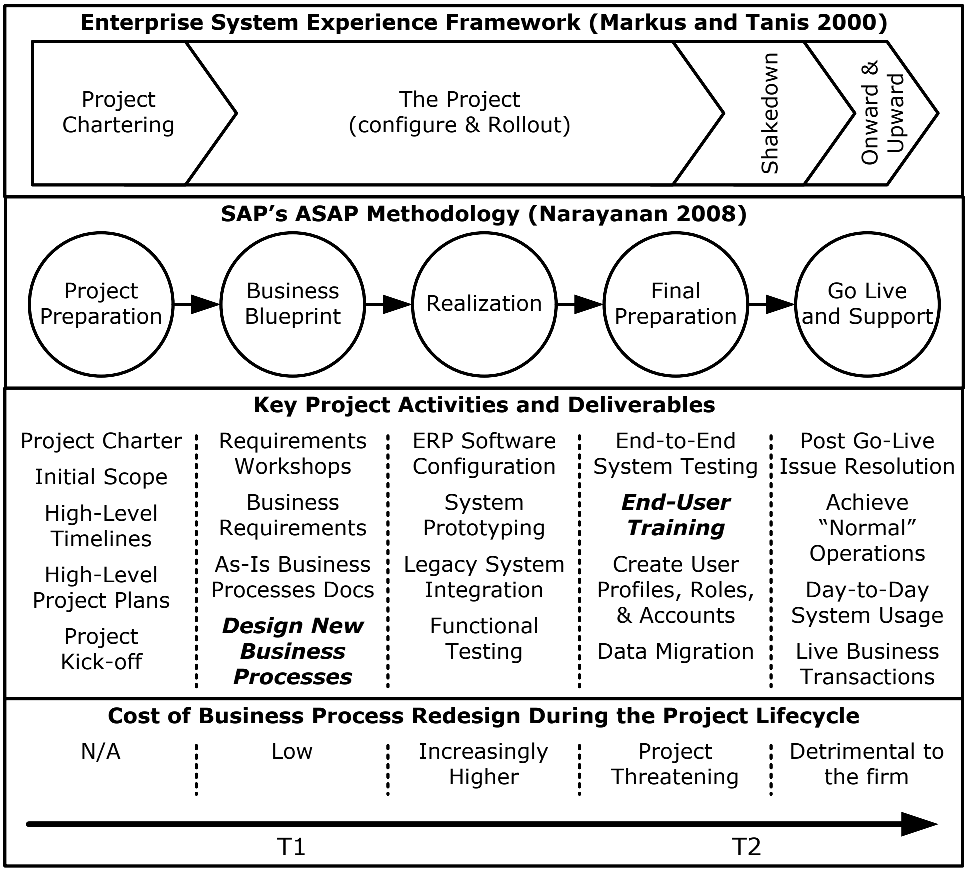
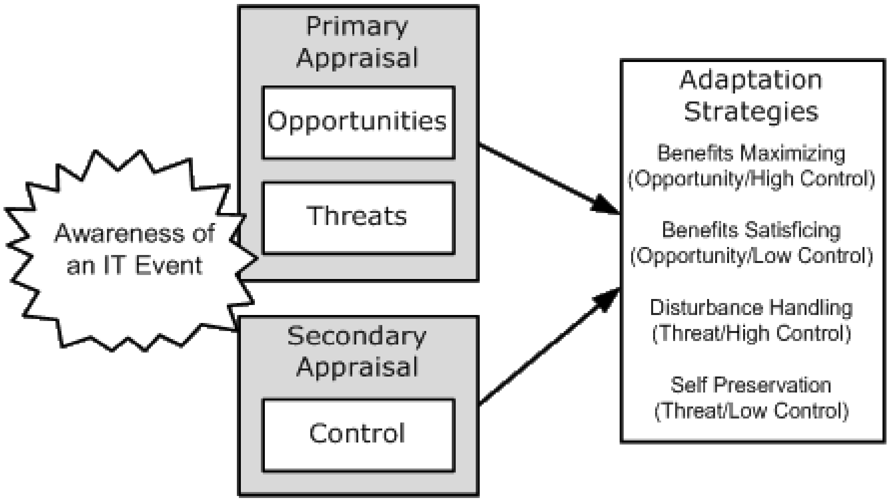


Figure 14 – Cognitive model of user adaptation



Adapted from Beaudry and Pinsonneault (2005)

Figure 15 – research framework (Essay 3)

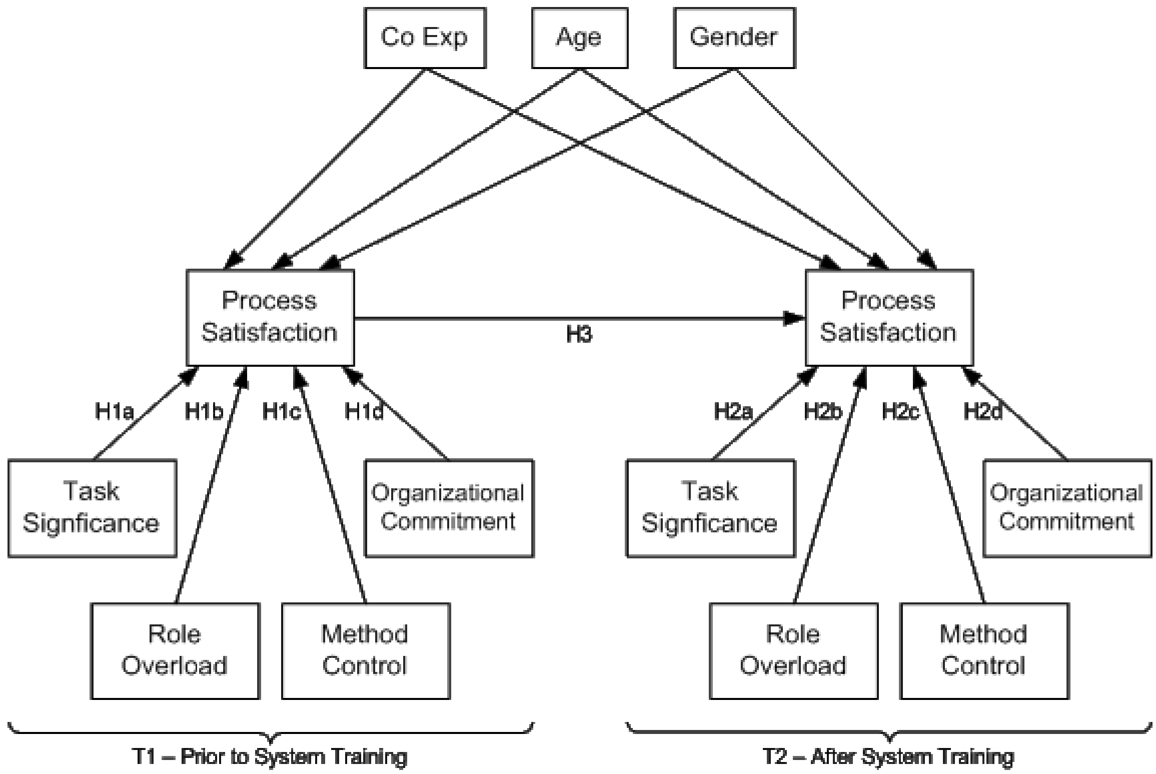


Figure 16 – PLS results (Essay 3)

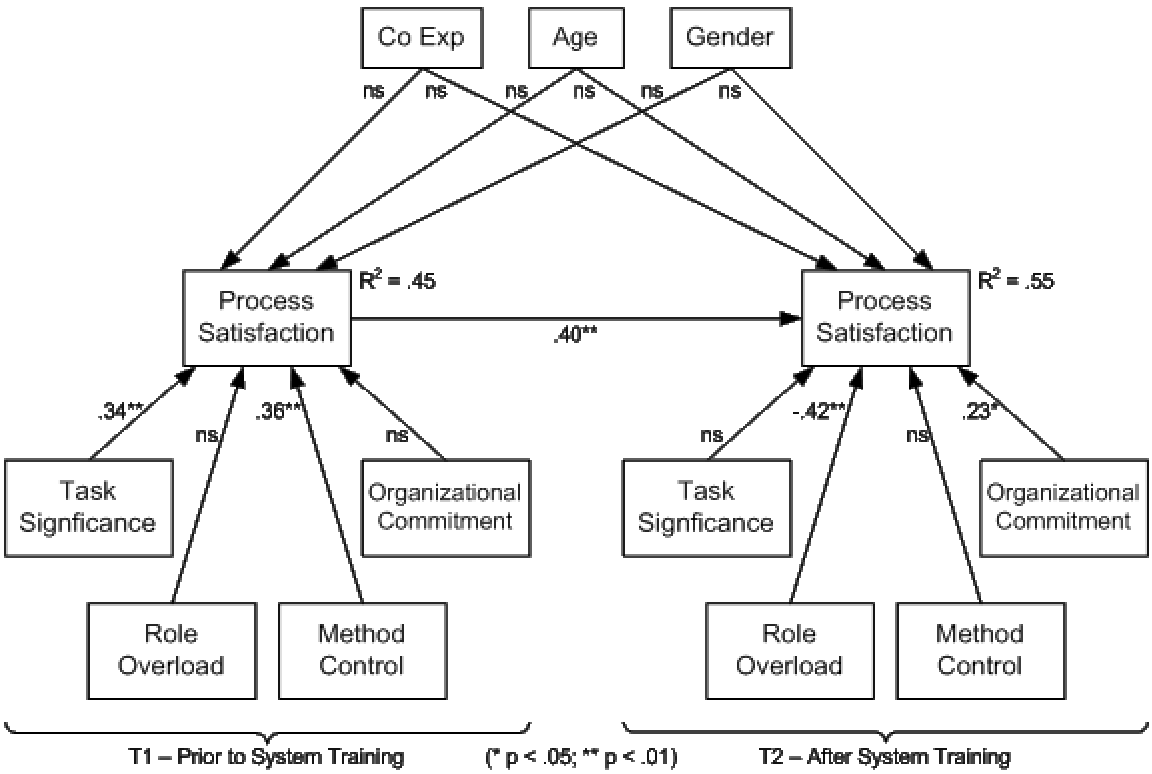


Table 1 – Project summary

Category	Project A	Project B	Project C
Project type	• Business processes integration	• Business Process improvement	• Business process agility
Focus of process design efforts	• Converting 17 FamousBrands companies to existing Flavorful Foods process	• Designing new business processes	• Designing new business process
Business process scope	• All business processes	• All business processes	• Inventory management processes
Size of design team	• Small	• Large	• Small
Design team composition	• Experienced Flavorful Foods team members	• Experienced Flavorful Foods team members, • Heavy use of consultants	• Experienced Flavorful Foods team members
Design team approach	• Quick assessment of existing FamousBrands business processes • Detailed specification of existing Flavorful Foods processes • Create an integration roadmap for each FamousBrand company	• Little focus on existing business processes • Leverage business process templates supplied by consulting firm • Leverage consulting experiences • Create high-level design and review with stakeholders • Create detailed-design and review with stakeholders	• Quickly develop and gain consensus of high-level design • Develop and gain consensus of detail-design
Project length	• 1+ years	• 3+ years	• 3+ years
Project timing	• Project preparation (4 months) • Assessment of existing processes (3 months) • Integration planning (2 months) • FamousBrands conversion efforts (10 months)	*Initial Scope* • High-level design and stakeholder review (12 months) • Detailed Design and stakeholder review (10 months) *Revised Scope* • Project	• Project planning (5 months) • High-level and detail-level design (5 months) • Development (10 months) • Testing (4 months) • Pilots (3 months)

		reorganization (2 months) • Build (7 months) • Testing (4 months)	
Perception of success	• Success	*Initial Scope* • Failure *Revised Scope* • Success	• Success

Table 2 – Pattern of knowledge process change

Evolutionary Step	Project A	Project B	Project C
Episodic events	• Acquisition of new company (incl. FamousBrands) and recognition of synergistic opportunities across lines of businesses	• Development of "How We Will Win" corporate strategy, which specified the desire to implement "World Class" business processes	• Pit Crew & steering committee recommendation for enhancing Flavorful Foods' inventory management capabilities
Knowledge assessment	• Project team needed better understanding of existing business processes for all FamousBrands companies • FamousBrands team members needed better understanding of Flavorful Foods business processes	• Project team does not understand the business process options made available though ERP software • Need a better project methodology to guide business process design for an firm-wide effort	• Internal knowledge of inventory management and ERP software capabilities sufficient for design of new business processes • Project B design processes were inadequate
Divergent infusion of new knowledge	• Small team sent to each FamousBrands company to study existing business processes • Design activities with little representation from individual FamousBrands companies	• Use of "best practice" business process models supplied by consulting firm • Project team located at remote location away from user base • Heavy reliance on consultant knowledge gained with other clients • Heavy external influence on design of new project methodology	• Small design team sequestered to remote location to quickly develop high-level business process design • Adding several additional design team members when moving to detailed business process design stage
Convergent processing of new knowledge	• Development of "Fact books" which document relevant business process knowledge for each FamousBrands company • Business process-	• Use of various process modeling notations to document business process models • Large posters created to depict business process	• Hands-on business process demonstrations with two-dimensional prototype • On-boarding meetings when design teams needed

	focused teams ensure business process consistency across company migrations • Documentation and training on existing Flavorful Foods business processes • Bi-weekly status meeting in the project "War Room"	design • End-of-phase design challenge sessions with process owners and stakeholders • Institionalization of business process design methods and diagnostics • Hands-on training sessions	to expand • Implementations at pilot locations

Table 3 – Hypotheses (Essay 2)

Num	Hypothesis	Expect to find support
H1a	Viewing a BPM will improve the accuracy of an individual's actual business process knowledge	Yes
H1b	Hands-on system training will improve the accuracy of an individual's actual business process knowledge	No
H2a	Viewing a BPM will improve an individual's perceived business process knowledge	Yes
H2b	Hands-on system training will improve an individual's perceived business process knowledge	No
H3a	Viewing a BPM will improve an individual's perceived business procedure knowledge	No
H3b	Hands-on system training will improve an individual's perceived business procedure knowledge	Yes
H4a	An individual's perceived business procedure knowledge will be positively related to their perceived business process knowledge	Yes
H4b	An individual's actual business process knowledge will be positively related to their perceived business process knowledge	Yes
H5a	Viewing a BPM will develop accurate shared business process knowledge structures	Yes
H5b	Attending hands-on system training will develop accurate shared business process knowledge structures	No

Table 4 – Purchasing and receiving concepts (Essay 2)

Concept	Description
1	Approver approves PO's in timely manner
2	Vendor works with Purchaser to resolve PO issues in a timely manner
3	Approver quickly approves PO changes when necessary
4	Vendor ships an accurate number of goods in timely manner
5	Vendor quickly submits an accurate invoice for goods shipped
6	Receiver systematically creates an accurate goods receipt
7	A P systematically enters invoice receipts in a timely manner
8	Accounts Payable pays invoices within payment terms
9	Vendor receives timely payment for goods

Table 5 – Clarity items used for perceived knowledge constructs (Essay 2)

Indicate the degree of certainty about each of the following items:	Sawyer (1992) Construct	Present Study Construct
1) My duties and responsibilities	Goal Clarity	Perceived Business Process Knowledge
2) The goals and objectives for my job	Goal Clarity	Perceived Business Process Knowledge
3) How my work relates to the overall objective of my work unit	Goal Clarity	Perceived Business Process Knowledge
4) The expected results of my work	Goal Clarity	Perceived Business Process Knowledge
5) What aspects of my work will lead to a positive evaluation	Goal Clarity	N/A
6) How to divide my time among the tasks required of my job	Process Clarity	Perceived Business Process Knowledge
7) How to schedule my work day	Process Clarity	Perceived Business Process Knowledge
8) How to determine the appropriate procedures for each work task	Process Clarity	Perceived Business Procedure Knowledge
9) The procedures I use to do my job are correct and proper	Process Clarity	Perceived Business Procedure Knowledge
10) Considering all your work tasks, how certain are you that you know the best way to do these tasks	Process Clarity	Perceived Business Procedure Knowledge

Table 6 – T-statistics for convergent validity (Essay 2)

Construct	Indicator	T Statistics
Perceived Business Process Knowledge	CL01 <- PCVProcessKnow	21.56***
	CL02 <- PCVProcessKnow	30.88***
	CL03 <- PCVProcessKnow	15.09***
	CL04 <- PCVProcessKnow	19.40***
	CL06 <- PCVProcessKnow	10.06***
	CL07 <- PCVProcessKnow	10.01***
Perceived Business Procedure Knowledge	CL08 <- PCVProceduralKnow	31.44***
	CL09 <- PCVProceduralKnow	16.19***
	CL10 <- PCVProceduralKnow	6.83***

*** p < .001

Table 7 – AVE and reliability Scores (Essay 2)

Construct	AVE	Composite Reliability	Cronbach's Alpha
Perceived Business Process Knowledge	0.71	0.88	0.80
Perceived Business Procedure Knowledge	0.71	0.93	0.92

Table 8 – Cross loadings of measurement items to latent constructs (Essay 2)

Construct	Item	1	2
1) Perceived Business Process Knowledge	CL01	**0.88**	0.77
	CL02	**0.91**	0.64
	CL03	**0.83**	0.48
	CL04	**0.88**	0.60
	CL06	**0.78**	0.63
	CL07	**0.77**	0.54
2) Perceived Business Procedure Knowledge	CL08	0.74	**0.87**
	CL09	0.60	**0.87**
	CL10	0.47	**0.79**

Table 9 – Correlation of the latent variable scores with the square root of AVE (Essay 2)

Construct	Mean	SD	1	2	3	4	5	6	7	8
1) Actual Process Knowledge	.11	.23	NA							
2) Age	4.15	1.07	-0.16	NA						
3) Experience With Company (months)	105.7	80.9	-0.11	0.34	NA					
4) Gender	.59	.50	0.13	0.09	-0.12	NA				
5) Perceived Procedural Knowledge	5.16	1.21	0.04	-0.07	-0.27	-0.02	**0.84**			
6) Perceived Process Knowledge	5.49	1.16	0.22	-0.14	-0.26	0.02	0.74	**0.84**		
7) Process Preview	.38	.49	0.23	-0.29	-0.19	0.08	-0.13	-0.11	NA	
8) System Preview	.33	.48	-0.02	0.17	0.25	-0.13	0.28	0.17	-0.55	NA

Note: Diagonals represent square root of AVE

Table 10 – T-statistics for convergent validity (Essay 3)

Construct	Indicator	T Statistics
T1 Method Control	T1_MCO1 <- T1_MCO	7.32***
	T1_MCO2 <- T1_MCO	8.70***
	T1_MCO3 <- T1_MCO	4.24***
	T1_MCO4 <- T1_MCO	4.43***
	T1_MCO5 <- T1_MCO	9.67***
	T1_MCO6 <- T1_MCO	14.04***
T1 Organizational Commitment	T1_OCM1 <- T1_OCM	10.64***
	T1_OCM2 <- T1_OCM	13.47***
	T1_OCM3 <- T1_OCM	8.61***
	T1_OCM4 <- T1_OCM	9.53***
	T1_OCM5 <- T1_OCM	7.24***
T1 Process Satisfaction	T1_PSA1 <- T1_PSA	27.95***
	T1_PSA2R <- T1_PSA	12.30***
	T1_PSA3 <- T1_PSA	6.01***
T1 Role Overload	T1_ROV1 <- T1_ROV	7.13***
	T1_ROV2 <- T1_ROV	31.96***
	T1_ROV3 <- T1_ROV	13.30***
	T1_ROV4 <- T1_ROV	19.30***
	T1_ROV5 <- T1_ROV	21.62***
T1 Task Significance	T1_TSI1 <- T1_TSI	5.90***
	T1_TSI2 <- T1_TSI	5.97***
	T1_TSI3 <- T1_TSI	5.59***
T2 Method Control	T2_MCO1 <- T2_MCO	3.72***
	T2_MCO2 <- T2_MCO	3.36***
	T2_MCO3 <- T2_MCO	3.70***
	T2_MCO4 <- T2_MCO	4.43***
	T2_MCO5 <- T2_MCO	9.63***
	T2_MCO6 <- T2_MCO	8.86***
T2 Organizational Commitment	T2_OCM1 <- T2_OCM	11.59***
	T2_OCM2 <- T2_OCM	25.07***
	T2_OCM3 <- T2_OCM	26.34***
	T2_OCM4 <- T2_OCM	47.62***
	T2_OCM5 <- T2_OCM	7.76***
T2 Process Satisfaction	T2_PSA1 <- T2_PSA	56.64***
	T2_PSA2R <- T2_PSA	6.05***
	T2_PSA3 <- T2_PSA	21.77***
T2 Role Overload	T2_ROV1 <- T2_ROV	12.70***
	T2_ROV2 <- T2_ROV	42.44***
	T2_ROV3 <- T2_ROV	22.22***
	T2_ROV4 <- T2_ROV	20.17***
	T2_ROV5 <- T2_ROV	71.53***
T2 Task Significance	T2_TSI1 <- T2_TSI	**0.46**

	T2_TSI2 <- T2_TSI	2.25*
	T2_TSI3 <- T2_TSI	2.17*

* p < .05; ** p < .01; *** p < .001

Table 11 – AVE and reliability scores (Essay 3)

Construct	AVE	Composite Reliability	Cronbach's Alpha
T1 Method Control	0.60	0.90	0.86
T1 Organizational Commitment	0.69	0.92	0.89
T1 Process Satisfaction	0.74	0.90	0.83
T1 Role Overload	0.79	0.95	0.93
T1 Task Significance	0.90	0.95	0.90
T2 Method Control	0.58	0.89	0.86
T2 Organizational Commitment	0.74	0.93	0.91
T2 Process Satisfaction	0.73	0.89	0.81
T2 Role Overload	0.82	0.96	0.94
T2 Task Significance	0.78	0.88	0.73

Table 12 – Cross loadings of measurement items to latent constructs (Essay 3)

Construct	Item	1	2	3	4	5	6	7	8	9	10
1) T1 MCO	T1_MCO1	**0.79**	0.24	0.35	-0.45	0.01	0.30	0.00	0.16	-0.13	-0.17
	T1_MCO2	**0.83**	0.24	0.40	-0.39	0.04	0.32	0.09	0.05	0.00	-0.10
	T1_MCO3	**0.69**	0.34	0.31	-0.24	0.13	0.27	0.14	0.05	0.15	0.01
	T1_MCO4	**0.62**	0.46	0.39	-0.33	0.40	0.35	0.36	0.08	-0.15	0.23
	T1_MCO5	**0.83**	0.34	0.48	-0.49	0.23	0.34	0.18	0.15	-0.19	0.12
	T1_MCO6	**0.86**	0.34	0.51	-0.45	0.10	0.38	0.13	0.17	-0.10	-0.03
2) T1 OCM	T1_OCM1	0.38	**0.73**	0.51	-0.30	0.61	0.31	0.50	0.37	-0.34	0.17
	T1_OCM2	0.34	**0.88**	0.40	-0.51	0.27	0.37	0.56	0.33	-0.36	0.09
	T1_OCM3	0.30	**0.87**	0.39	-0.40	0.40	0.40	0.67	0.31	-0.30	0.08
	T1_OCM4	0.44	**0.86**	0.37	-0.45	0.29	0.38	0.59	0.22	-0.25	0.09
	T1_OCM5	0.24	**0.80**	0.27	-0.28	0.44	0.22	0.61	0.16	-0.11	0.23
3) T1 PSA	T1_PSA1	0.53	0.46	**0.91**	-0.45	0.31	0.39	0.29	0.57	-0.38	0.17
	T1_PSA2R	0.40	0.32	**0.84**	-0.47	0.23	0.42	0.21	0.47	-0.32	0.19
	T1_PSA3	0.45	0.47	**0.83**	-0.25	0.54	0.51	0.42	0.47	-0.21	0.27
4) T1 ROV	T1_ROV1	-0.38	-0.37	-0.41	**0.72**	-0.27	-0.27	-0.29	-0.41	0.41	0.14
	T1_ROV2	-0.48	-0.49	-0.43	**0.92**	-0.12	-0.35	-0.33	-0.38	0.56	0.13
	T1_ROV3	-0.48	-0.43	-0.33	**0.92**	-0.20	-0.36	-0.28	-0.28	0.54	0.10
	T1_ROV4	-0.52	-0.45	-0.40	**0.96**	-0.10	-0.36	-0.27	-0.34	0.49	0.16
	T1_ROV5	-0.43	-0.37	-0.42	**0.92**	-0.05	-0.24	-0.14	-0.27	0.47	0.20
5) T1 TSI	T1_TSI2	0.18	0.44	0.39	-0.05	**0.95**	0.18	0.41	0.30	-0.18	0.39
	T1_TSI3	0.21	0.51	0.40	-0.25	**0.95**	0.23	0.48	0.32	-0.16	0.38
6) T2 MCO	T2_MCO1	0.36	0.33	0.27	-0.22	0.30	**0.74**	0.34	0.19	-0.18	0.12
	T2_MCO2	0.42	0.23	0.34	-0.27	0.07	**0.69**	0.25	0.17	-0.15	0.09
	T2_MCO3	0.11	0.25	0.25	-0.21	0.16	**0.70**	0.36	0.18	-0.29	0.02
	T2_MCO4	0.21	0.40	0.39	-0.26	0.37	**0.68**	**0.60**	0.36	-0.28	0.38
	T2_MCO5	0.49	0.36	0.52	-0.35	0.05	**0.89**	0.45	0.37	-0.21	0.12
	T2_MCO6	0.33	0.24	0.43	-0.27	0.04	**0.82**	0.37	0.29	-0.26	-0.04
7) T2 OCM	T2_OCM1	0.11	0.44	0.29	-0.12	0.49	0.38	**0.80**	0.35	-0.17	0.42
	T2_OCM2	0.12	0.64	0.31	-0.21	0.37	0.44	**0.89**	0.42	-0.23	0.33

	T2_OCM3	0.24	0.75	0.36	-0.32	0.46	0.57	**0.91**	0.35	-0.20	0.32
	T2_OCM4	0.25	0.68	0.37	-0.36	0.38	0.54	**0.92**	0.45	-0.26	0.20
	T2_OCM5	0.09	0.46	0.14	-0.29	0.32	0.46	**0.77**	0.21	-0.10	0.19
8) T2 PSA	T2_PSA1	0.18	0.32	0.55	-0.37	0.26	0.39	0.43	**0.94**	-0.58	0.21
	T2_PSA2R	0.15	0.26	0.46	-0.35	0.19	0.30	0.17	**0.71**	-0.47	0.03
	T2_PSA3	0.04	0.33	0.50	-0.28	0.38	0.27	0.47	**0.90**	-0.46	0.17
9) T2 ROV	T2_ROV1	-0.01	-0.23	-0.24	0.42	-0.10	-0.20	-0.16	-0.48	**0.79**	0.07
	T2_ROV2	-0.22	-0.30	-0.43	0.66	-0.11	-0.33	-0.19	-0.57	**0.93**	0.07
	T2_ROV3	-0.12	-0.36	-0.25	0.52	-0.20	-0.28	-0.22	-0.50	**0.93**	-0.03
	T2_ROV4	-0.04	-0.31	-0.32	0.40	-0.24	-0.24	-0.23	-0.53	**0.90**	-0.17
	T2_ROV5	-0.09	-0.36	-0.33	0.49	-0.17	-0.30	-0.27	-0.57	**0.95**	0.02
10) T2 TSI	T2_TSI2	-0.11	0.10	0.17	0.29	0.49	0.10	0.32	0.12	0.20	**0.83**
	T2_TSI3	0.10	0.16	0.25	0.06	0.28	0.20	0.30	0.18	-0.14	**0.93**

Table 13 – Correlation of the latent variable scores with the square root of AVE (Essay 3)

Construct	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1) Age	4.05	0.99	NA												
2) ExpCo	123.9	90.2	0.47	NA											
3) Gender	0.44	0.50	0.02	-0.14	NA										
4) T1 Method Control	4.94	1.06	-0.04	-0.11	-0.07	**0.82**									
5) T1 Org. Commitment	5.84	0.91	0.23	0.07	0.08	0.37	**0.83**								
6) T1 Process Satisfaction	4.25	1.03	0.12	0.05	-0.01	0.51	0.49	**0.86**							
7) T1 Role Overload	3.09	1.36	-0.01	0.02	0.06	-0.51	-0.47	-0.45	**0.89**						
8) T1 Task Significance	5.01	1.33	0.04	-0.18	0.12	0.13	0.50	0.42	-0.16	**0.95**					
9) T2 Method Control	4.65	1.14	-0.25	-0.09	0.13	0.44	0.35	0.48	-0.34	0.13	**0.81**				
10) T2 Org. Commitment	5.72	0.98	0.01	0.02	0.07	0.14	0.70	0.36	-0.30	0.47	0.45	**0.86**			
11) T2 Process Satisfaction	4.29	0.98	0.06	0.03	-0.02	0.15	0.36	0.59	-0.39	0.33	0.32	0.43	**0.86**		
12) T2 Role Overload	3.55	1.48	0.02	0.02	0.11	-0.09	-0.35	-0.35	0.56	-0.18	-0.26	-0.24	-0.59	**0.90**	
13) T2 Task Significance	5.15	1.07	0.00	-0.05	0.06	-0.03	0.15	0.25	0.17	0.41	0.08	0.34	0.17	-0.01	**0.88**

Notes - Diagonals represent square root of AVE

Table 14 – Mean difference and correlation analysis (Essay 3)

Construct	T1		T2		T1 - T2	
	Mean	SD	Mean	SD	Mean Diff	Correlation
Role Overload	3.09	1.36	3.55	1.48	p < .05	0.56***
Task Significance	5.01	1.33	5.15	1.07	NS	0.54***
Method Control	4.94	1.06	4.65	1.14	NS	0.42***
Process Satisfaction	4.25	1.03	4.29	0.98	NS	0.59***
Organizational Commitment	5.84	0.91	5.72	0.98	NS	0.70***
Perceived Process Transformation	5.00	1.17	5.25	1.22	NS	0.39**

** p < .01; *** p < .001

Table 15 – Difference of means, BPM vs. no BPM (Essay 3)

	T1					T2				
	BPM N=34		No BPM N=23		Diff of Means	BPM N=34		No BPM N=23		Diff of Means
Construct	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
ROV	3.14	1.34	3.01	1.42	NS	3.43	1.34	3.73	1.67	NS
TSI	5.53	1.10	5.20	1.54	NS	5.54	1.13	5.41	1.01	NS
MCO	4.95	.96	4.93	1.22	NS	4.51	1.07	4.85	1.24	NS
PSA	4.48	.86	3.91	1.18	$p < .05$	4.53	.72	3.94	1.20	$p < .05$
OCM	5.75	.83	5.97	1.02	NS	5.67	1.02	5.78	.96	NS
PPT	5.08	1.11	4.87	1.28	NS	5.14	1.19	5.42	1.26	NS

Notes:
ROV = Role overload
TSI = Task Significance
MCO = Method Control
PSA = Process Satisfaction
OCM = Organizational Commitment
PPT = Perceived Process Transformation
NS = Non-significant
All sample variances found to be equal

APPENDIX B – LIST OF ITEMS FOR ESSAYS 2 AND 3

Perceived Process Transformation

Adapted from (Morris and Venkatesh 2010) "Perceived Job Transformation"
Seven-point anchors (1=Strongly Disagree to 7=Strongly Agree)

Item	R	Item Description
PPT1		The new process will change my job significantly.
PPT2		The new process will alter my job substantially.
PPT3		The new process will make my job very different.
PPT4		The new process will transform my job greatly.

Perceived Process Knowledge

Adapted from (Sawyer 1992) Clarity constructs
Seven-point anchors (1=Very Uncertain to 7=Very Certain)

Item	R	Item Description
CL01		How to divide my time among the tasks required of my job.
CL02		How to schedule my work day.
CL03		My duties and responsibilities.
CL04		The goals and objective for my job.
CL06		How my work relates to the overall objectives of my work unit.
CL07		The expected results of my work.

Perceived Procedural Knowledge

Adapted from (Sawyer 1992) "Goal Clarity"
Seven-point anchors (1=Very Uncertain to 7=Very Certain)

Item	R	Item Description
CL08		How to determine the appropriate procedures for each work task
CL09		The procedures I use to do my Job are correct and proper.
CL10		Considering all your work tasks, how certain are you that you know the best ways to do these tasks?

Role Overload

Adapted from (Bacharach, Bamberger et al. 1990) “Role Overload”
Seven-point anchors (1=Strongly Disagree to 7=Strongly Agree)

Item	R	Item Description
ROV1		There is a need to reduce some parts of my new role
ROV2		I feel overburdened by my new role.
ROV3		I have been given too much responsibility in this new role.
ROV4		My workload is too heavy in this new role.
ROV5		The amount of work I have to do in this new role will interfere with the quality I want to maintain.

Task Significance

Adapted from (Idasazak and Drasgow 1987) “Task Significance”. As in (Morris and Venkatesh 2010), all items use the same seven-point anchors.
Seven-point anchors (1=Strongly Disagree to 7=Strongly Agree)

Item	R	Item Description
TSI1		In general, how significant or important is your role in the new process? That is, are the results of your work likely to significantly affect the lives and well-being of other people?
TSI2		This new process is one where a lot of other people can be affected by how well the work gets done.
TSI3		The new process itself is very significant and important in the broader scheme of things.

Method Control

Adapted from (Jackson, Wall et al. 1993) “Timing Control”
Seven-point anchors (1=Strongly Disagree to 7=Strongly Agree)

Item	R	Item Description
MCO1		Will you be able to control how much you produce?
MCO2		Will you be able to vary how you do your work?
MCO3		Will you plan your own work?
MCO4		Will you be able to control the quality of what you produce?
MCO5		Will you be able to decide how to go about getting your work in the new process done?
MCO6		Will you be able to choose the methods to use in carrying out your work?

Process Satisfaction

Adapted from (Morris and Venkatesh 2010) “Job Satisfaction”
Seven-point anchors (1=Strongly Disagree to 7=Strongly Agree)

Item	R	Item Description
PSA1		Overall, I am satisfied with the new process.
PSA2	R	I would prefer another, more ideal process.
PSA3		I am satisfied with the important aspects of the new process.

Organizational Commitment

Adapted from (Ahuja, Chudoba et al. 2007) “Organizational Commitment”
Seven-point anchors (1=Strongly Disagree to 7=Strongly Agree)

Item	R	Item Description
OCM1		I am willing to put in effort beyond the norm for the success of the organization.
OCM2		For me, this is the best of all possible organizations for which to work.
OCM3		I am extremely glad to have chosen this organization to work for over other organizations.
OCM4		This organization inspires me the best in the way of job performance.
OCM5		I show by my actions that I really care about the fate of this organization.

APPENDIX C – INSTRUMENT FOR ESSAYS 2 AND 3

Section 1 – General Information

1) Which of the following roles most closely represents your own role within the Purchasing and Receiving process? If you perform more than one of these roles, choose the one you believe is most important in your job. Please select only one.
   - ☐ Purchaser of Goods
   - ☐ Approver of Purchase Orders
   - ☐ Receiving
   - ☐ Accounts Payable
   - ☐ None of these apply to me

2) Please enter the amount of time you have been with your company.
   - ☐ Years: Months:

3) Please enter the amount of experience you have with purchasing and receiving of goods from vendors.
   - ☐ Years: Months:

4) Please specify your age bracket
   - ☐ Under 15 years
   - ☐ 15 to 24 years
   - ☐ 25 to 34 years
   - ☐ 35 to 44 years
   - ☐ 45 to 54 years
   - ☐ 55 to 64 years
   - ☐ 65 years and over

5) Please specify your gender
   - ☐ Male
   - ☐ Female

Section 2 – Statements/questions concerning the new purchasing & receiving process

Please respond to the following statements concerning the new purchasing and receiving process you have just reviewed. Circle the number directly below the answer that best matches your response. Please circle only one number for each statement.	Strongly Disagree	Moderately Disagree	Slightly Disagree	Undecided	Slightly Agree	Moderately Agree	Strongly Agree
The new process will change my work significantly.	1	2	3	4	5	6	7
The new process will alter my work substantially.	1	2	3	4	5	6	7
The new process will make my work very different.	1	2	3	4	5	6	7
The new process will transform my work greatly.	1	2	3	4	5	6	7
There is a need to reduce some parts of my role	1	2	3	4	5	6	7
I feel overburdened by my role.	1	2	3	4	5	6	7
I have been given too much responsibility in this role.	1	2	3	4	5	6	7
My workload is too heavy in this role.	1	2	3	4	5	6	7
The amount of work I have to do in this new role will interfere with the quality I want to maintain.	1	2	3	4	5	6	7
In general, how significant or important is your role in the new process? That is, are the results of your work likely to significantly affect the lives and well-being of other people?	1	2	3	4	5	6	7
This role is one where a lot of other people can be affected by how well the work gets done.	1	2	3	4	5	6	7
The role itself is very significant and important in the broader scheme of things.	1	2	3	4	5	6	7
Will you be able to control how much you produce?	1	2	3	4	5	6	7
Will you be able to vary how you do your work?	1	2	3	4	5	6	7
Will you plan your own work?	1	2	3	4	5	6	7
Will you be able to control the quality of what you produce?	1	2	3	4	5	6	7
Will you be able to decide how to go about getting your work in the new process done?	1	2	3	4	5	6	7
Will you be able to choose the methods to use in carrying out your work?	1	2	3	4	5	6	7
Overall, I am satisfied with the new process.	1	2	3	4	5	6	7
I would prefer another, more ideal process.	1	2	3	4	5	6	7
I am satisfied with the important aspects of the new process.	1	2	3	4	5	6	7
I am willing to put in effort beyond the norm for the success of the organization.	1	2	3	4	5	6	7
For me, this is the best of all possible organizations for which to work.	1	2	3	4	5	6	7
I am extremely glad to have chosen this organization to work for over other organizations.	1	2	3	4	5	6	7
This organization inspires me the best in the way of job performance.	1	2	3	4	5	6	7
I show by my actions that I really care about the fate of this organization.	1	2	3	4	5	6	7

Section 3 – Statements/questions concerning the new purchasing & receiving process

Please respond to the following statements concerning the new purchasing and receiving process you have just reviewed. Circle the number directly below the answer that best matches your response. Please circle only one number for each statement.	Very Uncertain	Moderately Uncertain	Slightly Uncertain	Undecided	Slightly Certain	Moderately Certain	Very Certain
How to divide my time among the tasks required of my job.	1	2	3	4	5	6	7
How to schedule my work day.	1	2	3	4	5	6	7
How to determine the appropriate procedures for each work task	1	2	3	4	5	6	7
The procedures I use to do my Job are correct and proper.	1	2	3	4	5	6	7
Considering all your work tasks, how certain are you that you know the best ways to do these tasks?	1	2	3	4	5	6	7
My duties and responsibilities.	1	2	3	4	5	6	7
The goals and objective for my job.	1	2	3	4	5	6	7
How my work relates to the overall objectives of my work unit.	1	2	3	4	5	6	7
The expected results of my work.	1	2	3	4	5	6	7

Section 4 – Statements concerning the new purchasing & receiving process

Please respond to the following statements concerning the new purchasing and receiving process you have just reviewed. Below you will find pairs of work tasks. Please indicate the degree to which each pair is related. Circle the number directly below the answer that best matches your response. Please circle only one number for each statement.

Task A	Task B	Strongly Unrelated	Moderately Unrelated	Slightly Unrelated	Neutral	Slightly Related	Moderately Related	Strongly Related
Approver approves PO's in timely manner	Accounts Payable systematically enters invoice receipts in a timely manner	1	2	3	4	5	6	7
Vendor works with Purchaser to resolve PO issues in a timely manner	Vendor receives timely payment for goods	1	2	3	4	5	6	7
Vendor ships an accurate number of goods in timely manner	Vendor receives timely payment for goods	1	2	3	4	5	6	7
Vendor quickly submits an accurate invoice for goods shipped	Vendor receives timely payment for goods	1	2	3	4	5	6	7
Approver quickly approves PO changes when necessary	Receiver systematically creates an accurate goods receipt	1	2	3	4	5	6	7
Receiver systematically creates an accurate goods receipt	Accounts Payable pays invoices within payment terms	1	2	3	4	5	6	7
Approver approves PO's in timely manner	Vendor ships an accurate number of goods in timely manner	1	2	3	4	5	6	7
Approver quickly approves PO changes when necessary	Vendor receives timely payment for goods	1	2	3	4	5	6	7
Vendor works with Purchaser to resolve PO issues in a timely manner	Vendor quickly submits an accurate invoice for goods shipped	1	2	3	4	5	6	7
Vendor works with Purchaser to resolve PO issues in a timely manner	Receiver systematically creates an accurate goods receipt	1	2	3	4	5	6	7
Vendor works with Purchaser to resolve PO issues in a timely manner	Approver quickly approves PO changes when necessary	1	2	3	4	5	6	7
Approver quickly approves PO changes when necessary	Accounts Payable pays invoices within payment terms	1	2	3	4	5	6	7
Vendor ships an accurate number of goods in timely manner	Accounts Payable systematically enters invoice receipts in a timely manner	1	2	3	4	5	6	7
Vendor receives timely payment for goods	Accounts Payable systematically enters invoice receipts in a timely	1	2	3	4	5	6	7

	manner							
Approver approves PO's in timely manner	Vendor receives timely payment for goods	1	2	3	4	5	6	7
Vendor works with Purchaser to resolve PO issues in a timely manner	Accounts Payable pays invoices within payment terms	1	2	3	4	5	6	7
Vendor quickly submits an accurate invoice for goods shipped	Accounts Payable systematically enters invoice receipts in a timely manner	1	2	3	4	5	6	7
Approver quickly approves PO changes when necessary	Vendor quickly submits an accurate invoice for goods shipped	1	2	3	4	5	6	7
Receiver systematically creates an accurate goods receipt	Vendor receives timely payment for goods	1	2	3	4	5	6	7
Receiver systematically creates an accurate goods receipt	Accounts Payable systematically enters invoice receipts in a timely manner	1	2	3	4	5	6	7
Approver approves PO's in timely manner	Accounts Payable pays invoices within payment terms	1	2	3	4	5	6	7
Vendor ships an accurate number of goods in timely manner	Receiver systematically creates an accurate goods receipt	1	2	3	4	5	6	7
Approver quickly approves PO changes when necessary	Vendor ships an accurate number of goods in timely manner	1	2	3	4	5	6	7
Vendor ships an accurate number of goods in timely manner	Vendor quickly submits an accurate invoice for goods shipped	1	2	3	4	5	6	7
Vendor quickly submits an accurate invoice for goods shipped	Accounts Payable pays invoices within payment terms	1	2	3	4	5	6	7
Approver approves PO's in timely manner	Vendor works with Purchaser to resolve PO issues in a timely manner	1	2	3	4	5	6	7
Vendor receives timely payment for goods	Accounts Payable pays invoices within payment terms	1	2	3	4	5	6	7
Approver approves PO's in timely manner	Receiver systematically creates an accurate goods receipt	1	2	3	4	5	6	7
Accounts Payable systematically enters invoice receipts in a timely manner	Accounts Payable pays invoices within payment terms	1	2	3	4	5	6	7
Vendor ships an accurate number of goods in timely manner	Accounts Payable pays invoices within payment terms	1	2	3	4	5	6	7
Vendor works with Purchaser to resolve PO issues in a timely manner	Accounts Payable systematically enters invoice receipts in a timely manner	1	2	3	4	5	6	7
Approver approves PO's in timely manner	Vendor quickly submits an accurate invoice for goods shipped	1	2	3	4	5	6	7
Approver quickly approves PO changes when necessary	Accounts Payable systematically enters invoice receipts in a timely manner	1	2	3	4	5	6	7

Vendor quickly submits an accurate invoice for goods shipped	Receiver systematically creates an accurate goods receipt	1	2	3	4	5	6	7
Approver approves PO's in timely manner	Approver quickly approves PO changes when necessary	1	2	3	4	5	6	7
Vendor works with Purchaser to resolve PO issues in a timely manner	Vendor ships an accurate number of goods in timely manner	1	2	3	4	5	6	7