Using Multiple-case Studies to Investigate Relationships among Knowledge Management Systems, Business Process and Business Performance: A Task Technology Fit Perspective

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ABSTRACT

In the face of heighted competition, organizations need to continuously improve their competitive advantage. Both knowledge management (KM) and knowledge management systems (KMS) play a pivotal role in helping organizations to stay competitive. There is much research in KMS, however very little is known about how they affect individual and organizational performance. Drawing on task-technology fit theory (Goodhue and Thompson, 1995), this study explores the fit or alignment between business process (task) and KMS (technology) and its impact on KMS utilization based on multiple case studies. Subsequently, the impacts of both the task-technology fit and KMS utilization on individual and business performance are investigated. This paper contributes to the KM literature in several ways. First, it applies task-technology fit theory to an important context, that of KM. Second, it characterizes task as business processes which have the potential to help explain KMS success on business performance. Third, the paper explores the positive impact of task-technology fit on KMS utilization and business performance. Fourth, the study provides insight into the future development of KMS which are better aligned with managerial purposes.

Keywords

Knowledge management; task-technology fit; knowledge management systems; business process; business performance

INTRODUCTION

Knowledge is a powerful resource in helping organizations, groups and individuals preserve key learnings, identity, culture, best practices, and core competencies. Managing this knowledge has become an important topic to both industry and academics. The topic of KM has been around for two decades and the practice of KM is still evolving and changing for both practitioners and researchers alike. The importance and influence of KM is evident by the amount of research articles dedicated to the topic (see Alavi and Leidner, 2001; Schultze and Leidner, 2002; Tanriverdi, 2005; Gunasekaran and Ngai, 2007; Nachiappan, Gunasekaran, Jawahar, 2007; Wang, Klein, Jiang, 2007). KMS is an information technology used by an organization to capture, represent and apply knowledge to itself and its collaborative network (Dhaliwal and Benbasat, 1996) and in other words, it is a viable tool for achieving effective knowledge management.

Substantial investments have been made to KMS technologies and in 2007 KM software was a $73 billion market (Research, 2007). Despite the high expenditures in KM, some researchers note the failure rate of KM projects around 50% (Akhavan, Jafari, Fathian, 2005). Despite the spending, KM approaches fail when they do not integrate humans, processes and technology. Very little is known about how to enhance business processes or how to measure KMS' impacts on business

performance (Kulkarni, Ravindran, Freeze, 2007). We endeavor to fill the void from both managerial and academic perspectives in the KMS arena.

Drawing on task-technology fit theory (Goodhue and Thompson, 1995), this study explores the fit or alignment between business process (task) and KMS (technology) and its impact on KMS utilization based on multiple case studies. Subsequently, the impacts of both the task-technology fit and KMS utilization on individual and business performance are investigated.

This paper contributes to the KM literature in several ways. First, it applies task-technology fit theory to an important context, that of KM. Second, it characterizes task with business process which has the potential to help explain KMS success on business performance. Third, the paper explores the positive impact of task-technology fit on KMS utilization and business performance. The paper presents a viable framework for practitioners to effectively implement the KMS. Fourth, the study provides insight into the future development of KMS which are better aligned with managerial purposes. The development of more appropriate and useful KM tools has the potential to be a critical enabler of improved business performance.

The paper proceeds as follows. In the next section, literature on KM and KMS is reviewed. Next, in the theoretical background section, a theoretical approach is proposed that is appropriate for the study of KMS, namely, the TTF framework. Third, the research model based on TTF framework is explained and propositions of the study are developed. Fourth, the case studies and the analytical procedures are described. Finally, next steps, possible limitations to the study, and possible avenues for future research are discussed.

LITERATURE REVIEW

There are a number of different definitions of KM and KMS (Earl, 2001). According to Schultze and Leidner (2002, p. 218) KM is defined as the 'generation, representation, storage, transfer, transformation, application, embedding, and protecting of organizational knowledge'. A more concise definition of KM is that it refers to identifying and leveraging the collective knowledge in an organization to help the organization compete (Alavi and Leidner, 2001).

The practice of KM is broad and covers many topics from business processes, business practices, concepts, tools, and architecture. According to a recent survey of 342 managers knowledgeable about their company's usage of knowledge management and collaboration technologies, 47 percent of companies have formal knowledge management initiatives or are planning them (Currier, 2010). KM is also used across different industries ranging from the oil and gas (Preece, Flett, Sleeman, Curry, Meany, Perry, 2001), manufacturing (Paiva, Roth, Fensterseifer, 2002), government (Liebowitz, 1999), agriculture (Kristjanson, Reid, Dickson, Clark, Romney, Puskur, MacMillan, Grace, 2009), high-tech firms (Collins and Smith, 2006), and healthcare (Bose, 2003).

KM topics also cover a range of different methodologies and frameworks. These methodologies and frameworks range from knowledge creation (Nonaka and von Krogh, 2009), knowledge assets (Wiig, 1997; Wilkins, van Wegen, de Hoog, 1997), intellectual capital (Liebowitz and Wright, 1999), strategy management (Drew, 1999; Hendriks and Vriens, 1999), systems thinking (Rubenstein-Montano, Liebowitz, Buchwalter, McCaw, Newman, Rebeck, 2001), artificial intelligence (Liebowitz, 2001) and knowledge inertia (Liao, 2002). Given the breadth of different methodologies, frameworks and industries that utilize KM, research topics are vast and numerous.

Like KM, KMS has also been subject to a number of different definitions. In this research, KMS is defined as a class of information systems that captures, represents and applies expert knowledge to an organization (adopted from Dhaliwal and Benbasat, 1996; Alavi and Leidner, 2001). As mentioned before, KMS is employed across multiple industries, in multiple ways, by a large number of companies in today's ever competitive marketplace.

Alavi and Leidner (2001) proposed a framework to analyze and discuss the role of information technologies in knowledge management. Their framework is rooted in the sociology of knowledge (see Berger and Luckmann, 1967; Gurvitch, 1971; Holzner and Marx, 1979). According to this grounded theory of knowledge in sociology, this framework consists of four processes 1) knowledge creation, 2) storage/retrieval, 3) transfer and 4) application/use. Each of these processes has their own research streams and is examined by both academics and practitioners. Knowledge creation is the process of creating new or replacing existing tacit or explicit knowledge. Storage/retrieval is the storage, organization and retrieval of organizational knowledge for an organization. Transfer is referred to the complex interactions of knowledge transfer between individuals, between groups, across groups, from explicit and tacit and from tacit and explicit. Lastly, application/use refers to how the organization uses the knowledge it stores.

In both practice and research these processes are not meant to stand alone, but rather interact and interconnect with one another. In this research, the application and the use (i.e., post-adoption) of knowledge management are examined. Creating, storing and transferring knowledge is important, but if the organization does not utilize that knowledge then the entire effort of a knowledge management system is lost.

THEORETICAL BACKGROUND

Task Technology Fit

A model created by Goodhue and Thompson (1995) proposes that task (which is defined as actions carried out by individuals in turning inputs into outputs) and technology (which is defined as tools used by individuals in carrying out his or her tasks) predict a construct called task-technology fit. The task-technology fit is defined as the degree to which technology assists an individual in performing his or her tasks. This construct combined with whether an individual utilizes the technology determines the impact on an individual's performance. Utilization of the technology may be voluntary or mandatory for the individual.

The task technology fit theory is a contingency theory that explains that the use of technology may result in different outcomes depending on the task that it is used for (Goodhue and Thompson, 1995). This theory proposes if a technology is utilized and it is a good fit with the task it supports then the technology will have a positive impact on individual performance. This model has been extended by Zigurs and Buckland (1998) to test the effect of different types of tasks and technology on group performance.

The task technology fit theory has been used in information systems research over the last fifteen years. The theory has been used to study how virtual teams can match communication technologies to different types of interpersonal interactions (Maruping and Agarwal, 2004). The theory has also been used to study the effects, adoption and impacts of mobile commerce (Gebauer and Shaw, 2004; Lee, Cheng, Cheng, 2007). Other ways the theory has been studied is in the use of simulation training for the military (Cane, McCarthy, Halawi, 2010), the use of the web as an information source for international travel (D'Ambra and Wilson, 2004), the ease and use of user interfaces (Mathieson and Keil, 1998) and the study of information technology in managerial decision making (Ferratt and Vlahos, 1998).

Proposition Development

We apply the TTF framework by Goodhue and Thompson (1995). In this application, business processes (BP) represent tasks and KMS represent technology. Fit is defined as the degree to which a KMS assists individuals or organizations in performing their business process. The BP-KMS fit construct combined with whether an individual utilizes a KMS determines the impact on an individual or organization's performance. The research model is below:

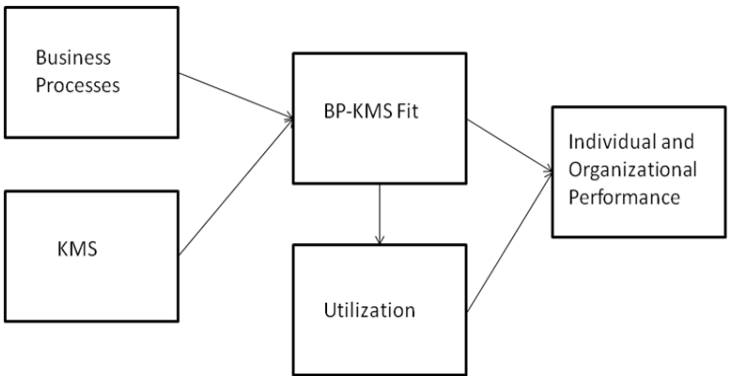

Figure 1: Research Framework (Derived from TTF model from Goodhue and Thompson, 1995)

In this research, KMS represents the technology aspect for the model. As defined by Goodhue and Thompson (1995), technology comprises tools used by individuals in carrying out their tasks. We posit that a KMS is a tool that manages organizational knowledge and is used by individuals and organizations to perform and facilitate tasks.

A business process is an activity or set of activities that will accomplish a specific organizational goal. Business processes are defined as any activity or group of activities that takes one or more inputs, transforms them, and provides one or more outputs for its customers (Krajewski, Ritzman, Malhortra, 2010). In the TTF model, Goodhue and Thompson (1995) define

tasks as actions carried out by individuals in turning inputs into outputs. We posit that a business process contains one or more task as defined by Goodhue and Thompson (1995). As such, we substitute business process for task in the research model.

In Figure 1, business processes have three characteristics: non-routineness, interdependence and job title. A business process is non-routine if the number of exceptions is large and its search is not logical or analytical (Perrow, 1967; Thompson, 1967; Goodhue, 1995; Goodhue and Thompson, 1995). A non-routine business process is one where individuals deal with ill-defined business problems or ad-hoc business problems. In organizations the knowledge exists, either explicitly or tacitly, on how to deal with non-routine business processes. However, for the knowledge to be beneficial, individuals will need a way to access the knowledge. Interdependence of business processes is defined as dependence with other organizational units (Perrow, 1967; Thompson, 1967; Goodhue, 1995; Goodhue and Thompson, 1995). Some business processes involve multiple organizational units and knowledge is shared across the different units. A KMS can aid an individual to find the cross-organizational knowledge. The last characteristic of the business process construct is job title which is a pragmatic proxy to capture the differences of employee levels ranging from clerical users to high-level managers (Goodhue and Thompson, 1995). Different levels of an organization use a KMS to find content for different business processes. For example, a clerical employee may use a KMS to find content for ordering supplies from a specific supplier and a high-level manager may use a KMS to find content on how to conduct vendor selections.

Another construct in Figure 1 is KMS, which has two characteristics, systems used and department (Goodhue and Thompson, 1995). Systems used refer to the number of systems individuals use to perform their job. In order to measure the effect of a KMS, it is important to understand how many other systems an individual uses. For the department characteristic, we use it as a proxy measure to capture the potentially different levels of attention paid by IS departments (Goodhue and Thompson, 1995).

In the research model the business process construct and the KMS construct correspond to describe a new construct called BP-KMS fit. The BP-KMS fit is defined as the degree to which KMS assists an individual or organization in performing business processes. The BP-KMS fit construct consists of eight different factors which are adopted from Goodhue and Thompson (1995) with modifications to fit the context: data quality, locatability of data, authorization, compatibility between systems, training and ease of use, production timeliness, system reliability and relationship with user. The first five focus on using content in facilitating business processes. The next two focus on meeting day-to-day operations and the last one focuses on responding to changing business needs (Goodhue and Thompson, 1995). The first factor, data quality is measured by the detail and currency of the content (Goodhue and Thompson, 1995). The content in a KMS must be kept up to date and old content must be systemically purged. The content must also be at the right level of detail, too much detail can complicate an issue and not enough detail can obscure an issue. The second factor, locatability of content, refers to the ease of determining what content is available and the ease of determining what the content means (Goodhue and Thompson, 1995). From a KMS perspective, locatability is a measure of how easy it is to find content in a KMS even on issues that rarely occur. The third factor, authorization, is defined as access to content that is necessary for a participant to do his or her job (Goodhue and Thompson, 1995). Depending on the employee level, content may be restricted in a KMS. External customers may have access to only a small percentage of an organization's content, clerical employees may have access to a little more content and so forth. This measurement verifies whether restricted content in a KMS is given to individuals or groups who need it in order for them to carry out their job responsibilities. The fourth factor, compatibility, is defined as the degree to which content from different IT systems can be consolidated or compared without inconsistencies (Goodhue and Thompson, 1995). Although organizations strive to consolidate content into one KMS, as seen from the case study, content exists in multiple systems across an organization. Compatibility verifies if the content in the different systems are consistent. The fifth factor, timeliness, is defined as the degree to which the IT department meets its pre-defined production turnaround schedules (Goodhue and Thompson, 1995). A KMS is supported by either an internal IT department or by specialized vendors and these groups set a maintenance schedule for upgrades and/or updates to the KMS. Timeliness measures how well these groups meet their maintenance schedule. The sixth factor, reliability, is defined as dependability and consistency of access and uptime of a KMS (Goodhue and Thompson, 1995). As true with any IT system, in order to use a KMS, the system must be up with little downtime, dependable, and free of major errors and defects. The seventh factor, ease of use and proper training, is defined as the ease of using the KMS and access to the proper amount of training to use the system (Goodhue and Thompson, 1995). Like any IT system, a KMS must be easy to use and if not, adequate training should be provided to use the KMS. The last factor relationship, is defined as how well the IT department understands the business customer's day to day operations, supports the business customer and provides adequate turn-around to the business customer's needs (Goodhue and Thompson, 1995). This definition also applies to a specialized vendor if they host the KMS. These are the eight components of the fit construct and are used to measure its effectiveness.

The BP-KM fit construct combined with whether an individual utilizes the KMS determines the impact on an individual or an organization's performance. Utilization of the technology may be voluntary or mandatory for the individual or group. Utilization is measured by a user's perceived dependence on the KMS and finally the dependent variable, individual and organizational performance impact is measured by perceived impact.

Individual and organizational performance impact relates to the accomplishment of a portfolio of tasks by an individual or group (Goodhue and Thompson, 1995). As demonstrated in Goodhue and Thompson's (1995) research, performance impacts are a function of both task-technology fit and utilization, not utilization alone. In the spirit of this research, we posit the fit of BP and KMS will influence individual and organization performance. Therefore, adopting the task technology fit model proposed by Goodhue and Thompson (1995), the first and second propositions are as follows:

Proposition 1: *User evaluations of BP-KMS fit will positively influence the utilization of KMS by individuals*

Proposition 2: *User evaluations of BP-KMS fit and utilization will positively influence perceived individual and organization performance impacts respectively.*

Figure 2 shows the propositions within the model.

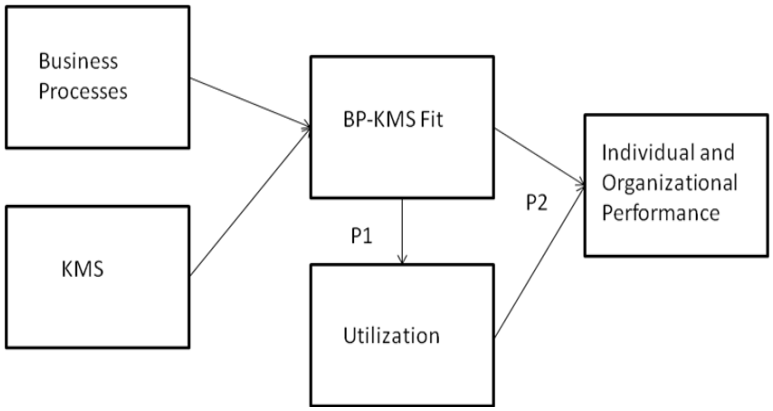

Figure 2: Research Framework with Propositions (Derived from TTF model from Goodhue and Thompson, 1995)

In the next section, the case study methodology that was employed along with a discussion of the data collection and validity of the methodology are discussed.

METHODOLOGY

A multiple-site case study was conducted with the organization as the primary unit of analysis. Since multiple sites were selected, the findings may be more robust than if just a single case study was chosen (Yin, 2009). As such, data from a major business communications provider, a networking infrastructure solutions provider, and a GPS technology provider were collected (referred to hereafter as BizCom, NetInfra and GPSTech, respectively).

BizCom is a global organization that has received numerous leadership, customer service and communications awards. It provides products, services, solutions and supports a global market either directly or through partner channels. Its client base is vast and ranges across multiple markets. Two employees were interviewed at BizCom, an IT manager/solution architect and a global business owner of web and knowledge management. The two interviewees are from different departments, have different job responsibilities, and are located in different parts of the country but both use the KMS.

NetInfra is global organization that has received numerous awards including product of the year, best practices, hottest growth, fastest growing company, and many more. It provides products through resellers, distributors, and OEM channels. At NetInfra, a senior manager of technical support in the global services division was interviewed. The interviewee uses a KMS to perform some of his duties.

The third company, GPSTech, is a global leader in GPS technology, products and services. GPSTech has also won many awards including best products and innovation awards. Its clients range from multinational companies to individual consumers. At GPSTech, two employees, the director of IT and the director of marketing were interviewed. Both employees are head of their respective departments, located in the same building and use the KMS to support their roles.

These specific organizations were selected for several reasons. First, these three companies use a KMS to support their business strategy. The KMS is an integral part of business operations and this allows us to study the KMS in routine and

non-routine business processes. Second, these three companies are competing in different markets, with different products, services and customers. This allows us to draw comparisons between different companies and their KMS post-adoption and performance. Lastly, these three organizations were chosen because of the access to different levels of employees in the companies. At GPSTech, the interview was at the director level. At NetInfra and BizCom the interviews were at the manager level. The different employee levels allowed us to study KMS post-adoption at different levels of business processes. In particular, one employee from NetInfra and two employees each from GPSTech and BizCom, were asked general questions about job titles, job responsibilities, and length of employment at their respective organization. These questions were followed up with more specific questions about KMS use, finding KM solutions, relationship with the IT department and handling customer problems. Interviews were conducted on a confidential basis but were recorded with the employees' permission.

NEXT STEPS

In the previous section, the methodology employed to examine the propositions about BP-KMS fit were discussed. The next step is to identify direct quotations from the interviews that align with the propositions. We will go through each transcript and seek to identify the theoretical concepts from the propositions.

During this process, we will use the definitions of the dimensions of BP-KMS fit from prior literature on task-technology fit (Goodhue and Thompson, 1995). Using similar definitions from prior literature will help ensure that I am able to accurately identify the relevant information from the case studies. One question that often arises in case studies is whether one's findings are applicable outside of the study context. Another question with respect to case studies has to deal with reliability. Reliability refers to the stability, accuracy, and precision of measurement. As such, we will document the procedures and develop a case study protocol so that this work can be repeated with similar results. To further increase the study reliability, we will develop a case study database which includes interview recordings, transcripts, and previous literature.

CONTRIBUTIONS

This study will aim to identify the fit between BP and KMS. In addition, this research aims to explore if BP-KMS fit and KMS utilization positively influences the business performance. The ultimate goal of any organization is to improve its performance as well as its employee's performance. To my knowledge, this study is the first to apply TTF theory exploring the BP-KMS fit and its impact on business performance in KM research domain.

From the theoretical perspective, this study underscores the importance of the fit between business process and knowledge management systems in achieving a successful collaborative network. From a managerial perspective, CIOs and other business administrators can use this case study as a framework to understand elements of the fit between business processes and KMS which will lead to higher perceived individual and organizational performance.

There are some limitations of this study that warrant further discussion and need to be kept in mind when interpreting the results. First, this study employs the multiple case study approach on three companies of high tech industry in the United States. Multiple-case study allows for cross-case analysis and yield more general research results (Benbasat, Goldstein, Mead, 1987), which help to validate and apply the theory generated in this study. Still cautions need to be taken when generalizing the results of this research to other industrial settings or applying the model generated from this study to companies in other cultural contexts. We suggest that further empirical survey research exploring both individual categories of industries and a broader collection of industries should be considered as a viable avenue of future study. Second, the KMS application in the organization under study was limited in scope (e.g. specific functional areas not enterprise-wide). As the participants highlighted during the interviews, the limited scope of the KMS project prevented them from seeing the whole values/benefits of KMS applications. A follow-up study can be conducted to examine the difference in terms of the end-users' reactions to the holistic applications of KMS.

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