December 2003

The Impact of Process-Technology Fit on Usage Behavior and Process Performance

Michele Gribbins
University of Illinois, Urbana-Champaign

The Impact of Process-Technology Fit on Usage Behavior and Process Performance

Michele Gribbins
University Illinois, Urbana-Champaign
mgribbin@uiuc.edu

Abstract

Assessing the interplay between information technologies, employees' acceptance, organizational processes and operational tasks can be important in predicting the potential impact that a technology can have on the organization's processes. The fit among these factors is crucial as organizations must have its employees' acceptance of the technology and the technology must fit well with the underlying business tasks and processes before it will achieve intended benefits. This research will address the interplay between technologies, users, processes and tasks by proposing a process-technology fit model that will assess the fit among these factors. This research will further identify the impact that this fit has on the supported business processes.

Keywords: Task-technology fit, technology acceptance, organizational processes, technology usage

Introduction

Emerging technologies designed to automate and streamline business processes potentially could provide several organizational benefits, including improving productivity, lowering operational cost, increasing customer satisfaction, improving decision making and enhancing business efficiency (Leung & Antypas, 2001; Varshney et al., 2002). However, as we have seen over the last several years, the deployment of information technologies in organizations does not always provide organizations with the outcomes that were projected. By understanding the factors that promote desirable performance outcomes for the business process, we can strengthen the potential impact of information technologies.

With this proposed research, we will investigate the interplay and the fit among (a) the technology and its characteristics (e.g., usability), (b) the technology and its intended users' technological capabilities, attitudes, and behaviors (e.g., their willingness to learn new technology), and (c) the technology and the organizational processes and tasks that it supports, as this interplay influences the impact of technology on the business process. Assessing this interplay can be especially important when new technologies come along, such as mobile commerce technologies, as organizations must have its employees' acceptance of the technology and the technology must fit well with the underlying business tasks and processes before it will achieve intended benefits. This research will propose a process-technology fit model that assesses the fit among these factors and then will evaluate the impact that process-technology fit has on business processes as organizations support the business processes with information technologies.

Research Questions

As businesses consider new technologies, several questions arise: (a) What organizational processes and what functional tasks would most benefit from an information technology?, (b) Will employees be willing to use the technology given their existing habits and experiences with technology?, (c) If so, what will be their usage behavior (e.g., what applications will they most utilize, what functional tasks would they be willing to conduct)?, (d) Will usage behavior differ if the usage of the technology is mandatory compared with voluntary? (e) What impact will the technology have on the organization and its processes?, (f) How will we assess the value of the technology to the organization? The answers to these questions can ultimately guide the development and implementation of emerging technologies at vendor and user organizations, while increasing the potential impact of the technology on the organization.

In order to better understand the factors that strengthen a technology's impact on business processes, the following research questions will be investigated:

(1) How do process-related factors and situational-related factors influence individuals' usage behavior?
(2) What factors contribute to a stronger process-technology fit (the fit between technology, tasks, and the users)?
(3) How does process-technology fit influence the impact that technology has on business processes?

Literature Review

Although emerging technologies could potentially benefit organizational processes, businesses will not get the most value out of any technology if it is not accepted and efficiently used by users. Even despite strategic decisions made by management to implement a technology, the lack of user acceptance has led to the failure of many information technology projects (Van de Ven, 1986). Adoption research, based on models extended from the Theory of Reasoned Action (Fishbein & Ajzen, 1975), including the Technology Acceptance Model (Davis et al., 1989) and the Theory of Planned Behavior (Ajzen, 1985), confirms the importance of understanding the user and the impact that usage requirements has on individuals' attitudes and acceptance of IT applications (Davis, 1989). In these models, the beliefs and attitude of the individual towards a certain behavior are important determinants of the individual's intention towards the adoption of that behavior (Khalifa & Cheng, 2002).

Other research suggests that the successful adoption of a technology will only result after both the diffusion of the technology (i.e., the breath of adoption) and the infusion of the technology (i.e., the depth of adoption) has occurred (Kishore & McLean, 1998). Technology innovation and diffusion literature has indicated the importance of matching information systems with the organizational tasks to be supported or automated (Tornatzki and Klein 1982, Kimberly 1981), as a precursor to system use and subsequent benefits. Task-technology fit, defined as the degree to which technology features match the requirements of the task and the abilities of the individuals involved with the task, has shown that the fit between the technology and the task to be completed by the user impacts the users' evaluation of the system (Goodhue, 1995). Task-technology fit has also been shown to impact technology performance outcomes, as technology has a positive impact on performance only when functionality is appropriately matched to user requirements (Goodhue and Thompson, 1995).

Thus, research suggests that we must consider the user's technological capabilities and attitudes, as well as the fit between the user's task and the technology as an indicator of usage behavior. This understanding may be even more critical in the context of emerging technologies, such as mobile devices, as various technological design factors (e.g., small display screens, awkward methods for inputting data, limited processing power, and low bandwidth capabilities (Zhang et al., 2002)) can impact the potential usability of the technology (Gebauer and Shaw, 2002). These disadvantages may impact an employee's usage behavior, despite any process benefits attributed to using the technology.

Research Model

The primary objective of this dissertation research is the development and testing of model that assesses the impact that process-technology fit has on usage behavior and business process performance. Process-technology fit can be conceptualized as the degree of match between the transaction needs of the individual as determined by the process-task environment (e.g., the access to information and the processing needed to successfully achieve the goals of the business) and the transaction support as provided by the infrastructure-application tools combination (Shaw & Subramaniam, 2003). In other words, the information and processing needs of the user will depend on the nature of the process and the user's role in the process, and the information technology provided to the user should match those needs (Shaw & Subramaniam, 2003). Figure 1 illustrates the interplay among the components of the IT-supported process environment. The process management component includes characteristics of the process (e.g., the procurement process), as well as characteristics of the tasks within the process (e.g., requisition approvals, order notifications). The information technology component consists of the application software (e.g., the procurement software) and the infrastructure used to access the software (e.g., laptop with wireless connectivity). Through a series of transactions, participants in the business process interact with the technology, thus becoming users. The model proposed in this research considers the interplay of these components as we study the fit of the technology with business processes and its influence on usage behavior and its impact of the process.

On an individual level, several factors could potentially impact an employee's usage of a technology, including the employee's ability to use and operate the technology and the employee's perception of the usefulness of the technology as derived from her task requirements. Thus, the research model applies technology-related and user-related constructs, which are commonly considered in studies derived from the Technology Acceptance Model (Davis et al., 1989), as well as task-related constructs, which are commonly considered in studies derived from the Theory of Task/Technology Fit (Goodhue & Thompson, 1995). However, as companies incorporate technologies into business processes, the individual's usage decision incorporates organizational factors such as the employee's level of process involvement, and the employee's level of mobility (for mobile technologies), the effect one's usage has on process performance (e.g., faster requisition approval) and the negative ramifications associated with non-usage (e.g., delays in ordering needed supplies). Thus, the model is expanded to consider process-related factors and situational-related factors that could influence usage behavior and the impact of the technology on the organization. Figure 2 illustrates the research model.

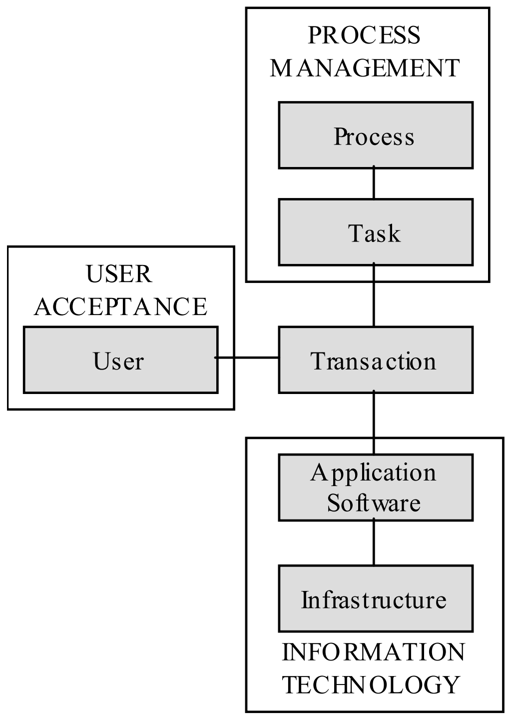

Figure 1. Environment of IT Supporting Business Procurement Process

Dependent Variables

Two dependent variables will be measured in this study. The first is Actual Usage Behavior, which is defined as the actual level of usage of the system by the user. Intention to Use, defined as the individual's intention to use the system to facilitate process activities (Davis et al., 1989), will also be measured in pre-implementation situations. The other dependent variable is Impact on Business Process, which is defined as improvements in the process's performance measures attributed to the use of the system. Factors that will be measured to assess the Impact on Business Process will vary based on the process under consideration, but may include changes in process efficiency and employee productivity.

Independent Variables

The following factors are under consideration for influencing the usage behaviors and the impact of the technology on the business process. They are categorized based on whether they result from the information technology component, the process management component or the user component of Figure 1. A fourth category, situation-level factors, is also included as a category to represent factors that may influence usage behavior under certain circumstances, while a fifth category, dynamic factors, is included to represent factors that contribute to longitudinal changes in usage behavior.

Technology-Level Factors. This category incorporates the factors that are attributed to the characteristics of the information technology. These factors can further be defined as those derived from the infrastructure of the information technology or the application software associated with the technology. Infrastructure-based factors include the following:

(1) Scope of the System, which is defined as the extent to which the system supports business functions (e.g., production, marketing, administration) (Shaw & Subramaniam, 2003).
(2) Intensity of the System, which is defined as the extent to which the system fully supports all aspects of the business process.
(3) Connectivity, which is defined as the quality of the connection to the network that the user experiences. The distinguishing factors for network connectivity include bandwidth and the level of network traffic. For users that utilize remote connections to the information systems, other factors may include geographic network coverage and the interoperability between networks (Gebauer & Shaw, 2003).
(4) System Performance, which is defined as the quality of the system, as perceived by the user. Quality can be assessed through the use of various performance measures, including the reliability of the system and the response time of the system.

Application-based factors consist of the following:

(1) Functionality, which is defined as the capabilities and tools of the technology. Functionality varies based on the system. Available functionalities may include (a) notification capabilities, (b) information access capabilities, (c) data processing capabilities, and (d) two-way communication capabilities.
(2) Interface Layout, which is defined as the user's perceptions of the display screen's interface and layout.

Process-Level Factors. This category includes the factors that represent the characteristics of the business process supported by the technology. These factors are further sub-classified into process-level factors and task-level factors. Process-level factors include the following:

(1) Process Type, which is defined as the degree to which the process is routine and involves little human intervention or judgment for each transaction (Shaw & Subramaniam, 2003).
(2) Level of Process Involvement, which is defined as the user's role in the process (e.g., approver).
(3) Interdependency, which is defined as the extent to which the user's participation in the process is dependent on others, as well as the extent to which others are dependent on the user's participation in the process.
(4) Goals, which is defined as the level of importance for the process to be completed successfully for the user and for other processes.

The following are classified as task-level factors:

(1) Structure, which is defined as the type of task that a user typically performs (Gebauer & Shaw, 2003). Structure ranges from highly structured, simple operational tasks, such as routine procurement tasks, to highly unstructured complex tasks, such as strategic planning and other management tasks (Simon, 1997; Gebauer & Shaw, 2003). Simple tasks can be defined as repetitive and structured, while complex tasks are not repetitive and are difficult to structure (March & Simon, 1958). Complex tasks typically require more complex information systems support (Zigurs & Buckland, 1998).
(2) Frequency, which is defined as the repetitiveness in which certain tasks occur (Gebauer & Shaw, 2003).

User-Level Factors. This classification includes the constructs that represent the individual's relation with the technology. Included are the following:

(1) Ease of Use, which is defined as the user's positive or negative feelings about using the system (adapted from Fishbein and Ajzen, 1975).
(2) Usefulness, which is defined as the degree to which the user attributes the use of the system in enhancing job performance (Davis, 1989).
(3) User Attitude, which is defined as the degree to which the user attributes the use of the system to be free of effort (Davis, 1989).

Situation-Level Factors. This classification includes the factors that impact a particular instance of a user's transaction with the technology. Under consideration for this study are the following:

(1) Urgency, which is defined as the pressing importance of action (e.g., the processing of a task).
(2) Mobility, which is defined as the time spent away from the office and out of immediate physical access to the information systems that the employee typically uses when on location (Gebauer & Shaw, 2003). This will be considered for mobile technology.

Dynamic Factors. This category represents those factors that impact continued usage behavior as user factors are dynamic. Thus, it is important to address the factors that influence long-term usage of the technology. Under consideration for this study are the following:

(1) Learning Curve Effect, which is defined as the change in usage behavior (e.g., efficiency) attributed to an increase in the user's familiarity with the technology.
(2) Network Effect, which is defined as the number of people using the technology, and the influence that this mass has on the user's continued usage of the technology.

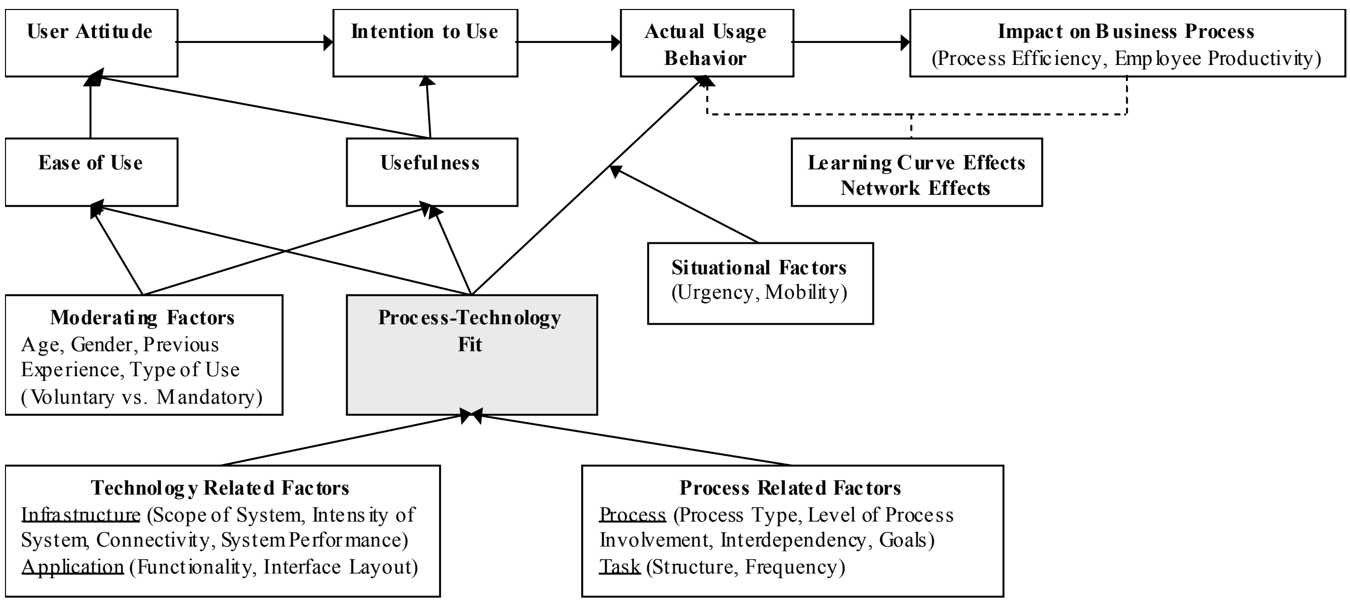

Figure 2. Impact of Process-Technology Fit on Business Process

Hypotheses

Presently, the following hypotheses are being considered:

H1: Higher levels of Process-Technology Fit will positively affect Ease of Use.
H2: Higher levels of Process-Technology Fit will positively affect Usefulness.
H3: Situational factors moderate the relationship between Process-Technology Fit and Actual Usage.
H4: Higher levels of Process-Technology Fit will result in (a) higher Actual Usage, and subsequently, (b) a greater Impact on the Business Process.
H5: Continued Usage will be influence by (a) Learning Curve Effects and (b) Network Effects.

Research Methodology

The current plan for this study involves a field survey of employees, as well as interviews with managers, to gain empirical support for the research model. The plan for conducting this research is as follows: after completing an extensive search of prior research, the questionnaire instrument will be designed and validated, a pilot test will be conducted, and data will be gathered from the participants. Employees using information technology that supports organizational processes will serve as participants. The model will be tested for validity and the reliability of the measures. The findings of a mobile technology acceptance case study (Gribbins et al., 2003), conducted at a Fortune 100 company, provide exploratory support for the framework.

Expected Contributions

Contributions from this research will be highly relevant to the field of information systems as it incorporates user behaviors, business processes and tasks, and information technology characteristics into a single model. We hope that the understanding of this interplay, and the resulting process-technology fit framework, can help organizations improve process performance and strengthen the potential effectiveness of information technology before the technology is developed and deployed in organizations.

References

Davis, F. (1989) "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, (3), pp. 319-341.

Davis, F., Bagozzi, R., and Warshaw, P. (1989) "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models", *Management Science*, (35:8), pp. 982-1003.

Fishbein, M., and Ajzen, I. (1975) *Belief, Attitude, Intention & Behavior: An Introduction to Theory and Research*, Addison-Welsey, Reading, MA.

Gebauer, J., and Shaw. M. (2002) "A Theory of Task/Technology Fit for Mobile Applications to Support Organizational Processes", University of Illinois, College of Commerce and Business Administration, Office of Research Working Paper 02-0124.

Gebauer, J., and Shaw, M. (2003) "Success Factors and Benefits of Mobile Business Applications: Results From A Mobile E-Procurement Study", University of Illinois, College of Commerce and Business Administration, Office of Research Working Paper 02-0128.

Gribbins, M., Shaw, M. & Gebauer, J. (2003) "An Investigation Into Employees' Acceptance of Integrating Mobile Commerce Into Organizational Processes," *Proceedings of the Ninth Americas Conference on Information Systems*, Tampa, FL.

Goodhue, D. (1995) "Understanding User Evaluations of Information Systems", *Management Science*, (41:12), 1827-1844.

Goodhue, D., and Thompson, R. (1995) "Task-Technology Fit and Individual Performance," *MIS Quarterly,* (19:2), pp. 213-236.

Khalifa & Cheng. (2002) "Adoption of Mobile Commerce: Role of Exposure," *Proceedings of the 35th Hawaii International Conference on System Sciences*, Waikoloa, HI.

Kimberly, J. R. (1981) "Managerial Innovation," *Handbook of Organizational Design*, P. C. Nystrom, and W. H. Starbuck (eds.), Oxford University Press, London, U.K.

Kishore, R., & McLean, E. (1998) "Diffusion and Infusion: Two Dimensions of 'Success of Adoption' of IS Innovations." *Proceedings of the Fourth Americas Conference on Information Systems*, Baltimore, MD, pp. 731-733.

Leung, K., and Antypas, J. (2001) "Improving Returns on M-Commerce Investments." *Journal of Business Strategy*, (22:5), pp. 12-13.

March, J., and Simon, H. (1958) *Organizations*, Wiley, New York, NY.

Shaw, M., and Subramaniam, C. (2003) "A Theory on the Role of Information Technology for Supporting
Enterprise Business Processes: The Process-Technology Fit Model." University of Illinois, College of Commerce and Business Administration, Working Paper.

Simon, H. (1997) *The New Science of Management Decision*, Englewood Cliffs, Prentice Hall.

Tornatzki, L. G. and Klein, K. (1982) "Innovation Characteristics and Innovation Implementation: A Meta-analysis of Findings", *IEEE Transactions Engineering Management*, (29:1), 28-45.

Van de Ven, A. (1986) "Central Problems in Management of Innovation", *Management Science*, (32:5), pp. 590-607.

Varshney, U., Mallow, A., Jain, R., and Ahluwalia, P. (2002) "Wireless in the Enterprise: Requirements and Possible Solutions." *Proceedings of the Workshop on Wireless Strategy in the Enterprise: An International Research Perspective,* University of CA, Berkeley. October 15-16.

Zhang, J., Yuan, Y., Archer, N. (2002) "Driving Forces for M-Commerce Success E-Business Management: Integration of Web Technologies with Business Models." *Business Management: Integration of Web Technologies with Business Models,* Michael J. Shaw [ed.], Kluwer's Academic Publishers, Boston/Dordrecht/London, pp. 51-76.

Zigurs, I., and Buckland, B. K. (1998) "A Theory of Task/Technology Fit and Group Support Systems Effectiveness." *MIS Quarterly*, (22:3), pp. 313-334.