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The Role of Systems Support & Maintenance in Business Process Innovation

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Abstract

There are an abundance of studies on examining the pre-adoption use and impact of information technology on organizations. In recent years, post adoption studies that relate to technology usage after it has been adopted, have started to appear in various research outlets but its scope remains limited. A great majority of these studies examined the post adoption related issues from technical perspective. This paper is an attempt to draw more attention to post adoption stage from a management perspective, and to define and present an initial set of factors that are likely to be involved in achieving business process innovation at the post adoption stage. In this paper, we present and explain antecedents of business process innovation having its basis in innovation dynamics literature. In sum, academics and practitioner contributions and implications by this research is also highlighted.

Keywords

Post Adoption, Systems Support & Maintenance, Process Innovation

1. Introduction

Every year organizations spend billions of dollars in the design, development and maintenance of Enterprise Information Systems (EIS). The major goals for this investment are to automate, reengineer, improve or support their business processes. This investment is made mainly in different parts of an organization so that each department in the organization can work in a more effective and efficient way. Despite huge investments made to date, majority of the organizations hardly exploit the true potential of EIS. The inability of these organizations for not realizing value and not unleashing the true potential of these investments has significant implications in terms of cost (Davenport and Short 1990). Furthermore, senior management teams are continuously put under pressure to improve process innovation capabilities of their organization to fully exploit the investment made in different parts of the organization.

In a recent survey of senior management, improving business processes remains the top priority of many Chief Information Officers (Gartner, 2009). In practice, an improvement in a business process is achieved through continuously refining the enterprise system. For example, at the pre adoption phase, this refers to bringing refinement in the IS design and development processes. At the post adoption phase, a refinement in an enterprise system is achieved through maintenance process. Empirical evidence shows us that maintenance has long been recognized as the most expensive phase in the Information Systems (IS) Development lifecycle (Polo et al. 2003). In general, two areas of studies are considered when examining the need to perform maintenance. First area consists of technical related issues that may trigger the maintenance of a computer

based system. For example, a problem in software may cause disruption in smooth flow of information in the organization. In order to solve this issue, a technical (i.e. software maintenance) solution is required to fix the problem. Terms like corrective maintenance (Chapin et al. 2001) are used to capture scope of this work. Second area consists of managerial related issues that likely to start the maintenance operations. Few management issues include an alignment with current or prospective customer or staffing.

Erlikh (2000) argues that managing the maintenance process is highly expensive and time consuming. Furthermore, Polo et al. (2003) predict that this cost will almost equal the total cost of the system in the near future. Table 1 shows the evolution of maintenance cost based on existing studies. Chapin et al. (2001) suggests that overall management of the maintenance process involves complex activities, both of the “doing” and the “managing” character. Furthermore, Khan & Zheng (2005) suggest to conduct rigorous studies to clearly understand the IS evolution and maintenance activities.

A great deal of academic and practical attention has been devoted to studying the maintenance area from technical perspective (i.e. software maintenance) in the literature; considerably less attention has been devoted to studying the maintenance area from non technical perspective. This paper addresses an important management issue of building process innovation capability in the organization through maintenance. In order to achieve this, this paper assimilates knowledge from management and IS literature to define and explain antecedents of process innovation at the post adoption stage. The process innovation factors presented in this paper are built its theoretical foundation on the innovation dynamics literature. The research is guided with main research question of exploring what are the factors involved in achieving process innovation at the post adoption stage.

Reference	Date	Maintenance (%)
Pressman	1970s	35-40
Leinz and Swanson	1976	60
Pigoski	1980-1984	55
Pressman	1980s	60
Schach	1987	67
Pigoski	1985-1989	75
Frazer	1990	80
Pigoski	1990s	90

Table 1: Evolution of maintenance cost

Source: (Polo et al. 2003, p. 203)

This paper is organized as follows. First section defines and explains the post adoption phase and operations in detail. This section also explain the nature of a maintenance object followed by discussion on associated issues related to the management of maintenance object. Second section presents theoretical foundation having it basis on innovation dynamics literature. Third section presents initial set of factors of process innovation followed by discussion on academic and practitioner contributions, and, implications for future research.

2. Understanding Post adoption Phase & Operations

There are different terms used in the IS literature to explain the post adoption stage. Terms like post adoption / acceptance / implementation are used interchangeably in the literature. In this paper, we adopt the explanation provided by Markus and Tanis (2000) to understand the post adoption stage. They used the term “onward and upward phase” to explain the post adoption

stage. The onward and upward phase continues from normal operation until the system is replaced with an improved, upgraded or a completely different and new system. This is the stage when organization discovers the true benefit of a system investment. Key players include end users, IT support personnel, operational managers, and, internal, external consultants and vendors may be also involved if upgrades are considered. Key activities include the post implementation audits, benefit assessment, upgrading to new software releases, and additional user skill building. The onward and upward phase identified by Markus and Tanis's (2000) is aligned with the stages of the traditional systems development lifecycle. For the purpose of this study, we consider the post adoption stage to be the same as the onward and upward phase.

At the onward and upward phase, a continuous refinement to the enterprise system is carried out through post adoption operations. In IS literature, these operations are referred to as systems support and maintenance. A maintenance object hierarchy can be used to fully understand the scope of these operations. Under maintenance object hierarchy, operations and activities are targeted towards maintaining the objects rather the system. This establishes a micro-organization for each object where the systems as well as the processes are portrayed. Three layers are considered while understanding a maintenance object (Nordström & Welander 2005). First layer includes the channel by which company provides support to their product or service. Second layer includes the office functions that are used to develop the product or service. Third layer includes the Information Technology (IT) systems used by the organization to support its business operations. Within the context of this study, IT systems include all the enterprise systems currently in use by an organization. Enterprise systems are software applications that are implemented in an organization to automate complex transactions and improve overall organizational effectiveness (Markus & Tanis 2000). All the three layers are shown in Figure 1:

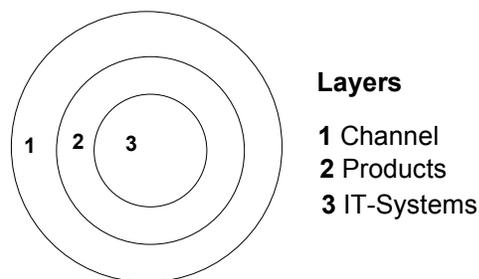


Figure 1: Maintenance Object

Source: (Nordström & Welander 2005, p. 332)

Let's take an example of an auto insurance company to further understand the maintenance object shown in Figure 1. This figure shows one of the maintenance objects in an insurance company. In the case of auto insurance, first layer consists of different channels used by the company to provide support to their product. This includes customer service support via phone, internet or through online web support. The second layer consists of company functions to develop and maintain auto insurance product. The third layer consists of IT-systems that are required to create auto insurance product for their customers. This includes local intranet, company web sites, or other supporting IT systems.

Even though post adoptive operations like systems support and maintenance (SSM) are reported as the most expensive activities yet very limited research has been focused to examine this area. Normally intern students or entry level workers are hired to carry out maintenance and support work. The people who carry out this work do not enjoy the same level of organizational status as compared to other employees. The reason for this is because normally very few incentives are attached with their work. Their work is not well regarded and high staff turnover rate could be common in organizations. To date, there have been few studies that explore the relationship between post adoption operations and process innovation.

3. Theoretical Foundation

Extant research in the area of innovation shows us that the organizations that innovate outperform their competitors in short and long term. Edward (1987) explains that innovation occurs when invention and exploitation happens together. He further explains that the invention includes the operations directed towards new idea generation and putting it to action, and, exploitation includes commercialization of that invention. Empirical evidence shows us that innovation is not a random event but involve knowledge and effort of many people in the organization. In other words, innovation can be viewed as a team effort.

Broadly speaking, there are three types of innovation as identified by the previous studies. Gaynor (2001) suggests that first type of innovation can be viewed as service or product innovation. This type of innovation focuses on improving business services and products. He further adds that second type of innovation is about business model innovation. This type of innovation deals with developing and implementing new ways of running a business. Two prominent examples include new way of selling music on the internet by Apple, and inventing novel approach to generate revenue through online ads by Google. Third type of innovation, which is the focus of this paper, is called process or operational innovation. In this type of innovation, the focus is on making internal business processes as a source of competitive advantage. Toyota automotive process and Dell's direct retail model are typical example of process innovation.

This paper adopts the definition of process innovation by Srivardhana & Pawlowski (2007). They define process innovation as "improving the sequencing of work routines and information flow to achieve business improvement" (Srivardhana & Pawlowski 2007, p. 53). For the purpose of this paper, the research scope is limited to incremental process innovation at an organization level. Incremental process innovation deals with the minor enhancement or refinement made to the existing tasks, routines, products or services. This is usually being done based on the knowledge learned over the time. The reason for considering this type of innovation is because it heightens the relationship with different stakeholders of the product or a service. These stakeholders may be internal or external to the organization.

In IS research, the leading work in defining what constitutes IS process innovation is done by Swanson. He argues that the "overall domain of IS innovation may be mapped on two basic dimensions: 1) business impact and 2) technological and organizational feature composition" (Swanson 1994, p. 1070). He identifies two types of IS process innovation namely administratively and technical IS process innovation based on the dual-core model of organization.

Furthermore, he argues that both (administrative & technical) types can be defined as process innovation that would increase the effectiveness and efficiency of information systems used in the organization. The nature of work related tasks would determine what type of process

innovation may be used. For example, technical IS process innovation can be used if organization is interested in bringing changes in the technical IS tasks. In the same manner, administrative IS process innovation can be used if goal is to bring administrative improvements. It is important to note here that maintenance of information systems falls under this category of IS process innovation, however Swanson argues that influence of maintenance work go beyond the boundary of IS department.

Swanson's innovation classification was further extended by Mustonen-Ollila and Lyytinen. They suggest that Information Systems Process Innovation (ISPI) can be further divided to two categories namely administrative innovation and technological innovation. They suggest subdividing administrative innovation into Management and Description Innovation, and, technological innovations into Tool Innovation and Core technology innovations.

Management innovations can be viewed when changes are required in the administrative processes that deal with the overall IS development activities. The consequence of this change can bring improved new organizational structure or project management guidelines. A description innovation deals when changes are required in the notational systems. These systems can be used for effective communication between different stakeholders of the project. Typical example include the usage of standardize notational techniques like Unified Modeling Language (UML) in IS development projects. A tool innovations deals with embracing the usage of technology tools to support information systems processes. A core Technology innovations is about bringing enhancements in the overall technical infrastructure that is required to deliver IS products. Some example includes the practice of using different database management system and programming languages in the organization.

This paper builds its theoretical foundation on innovation dynamics literature. As the technology evolves, innovation activities have advanced from linear to more dynamic and interactive process (Amesse & Cohendet 2001; Tidd et al. 2001). Early studies suggest to view innovation process as an inter and intra unit interactions and knowledge combination processes (Cohen & Levinthal 1990). This view limits the ability of incorporating the knowledge from external sources like network partners. To address this, new concept like interactive innovation (Myers & Rosenbloom 1996) emerge to fully understand the scope of innovation process. The role of IT becomes more important as a result of changes in innovation process. Schilling (2005) suggests that the companies may combine internal and external IT, and, non IT resources, capabilities, and knowledge to generate product or process innovation in their organizations.

Furthermore, Davenport (2000) argues that complex set of factors are involved in turning the data into knowledge and business results. He further explains that this is achieved through first establishing the context; transforming the data into knowledge through analysis of data and, then realizing the outcome. In the same manner, post adoption stage involves set of factors that are required in achieving process innovation and hence achieving business result.

4. Methodology

We used three steps process to identify and explain the factors involved in achieving process innovation. Table 2 shows initial set of studies considered in this study. A complete list is excluded due to size limit of this paper. First step involves identification and selection of factors involved in achieving process innovation from IS & strategic management literature. For example, the term "collaboration" is expected to have an influence on the process innovation. Several studies including (Attaran, 2003; Tarafdar & Gordon 2007) identified collaboration as one of the factor for achieving process innovation. Based on the extent literature, it is proposed

that “collaboration” can be used as one factor that likely to bring process innovation. Second step involves critical review of the available competencies, activities, & roles and identify only those factors that positively affect business process innovation at the post adoption phase. This step further reduces the number of process innovation factors to only those which contribute in successful innovation outcome. Third step involves further reducing down the number of process innovation factors to those that are affected by post adoptive operations like systems support and maintenance. For example, empirical evidence shows us that organizational learning is improved based on the knowledge gained at the post adoption stage.

Source	Innovation-enabling Activities, Roles & Competencies
Tarafdar & Gordon (2007)	Knowledge Management Collaboration Project Management Ambidexterity IT/innovation governance Business IS Linkage Process Modeling
Marjanovic (2005)	Knowledge Management Coordination
Ravichandran and Lertwongsatien (2005)	IS planning sophistication System Development Capability IS support maturity IS operations capability
Bhatt and Grover (2005)	IT Infrastructure IT business experience Relationship infrastructure
Attaran (2003)	Infrastructure flexibility Communication Coordination Collaboration Project Management Process Analysis

Table2: Factors affecting Process Innovation

4.1 Initial List of Factors

Based on the above discussion, we identify four factors namely Systems Support & Maintenance Readiness, Organization learning, technology planning, and collaboration for the purpose of this paper. Following section explains each factor in detail:

Systems Support & Maintenance Readiness

The term *readiness* is defined as the availability of needed organizational resources (Barua et al. 2004). In this study, we are concerned with the organizational readiness toward providing an effective and efficient systems support. Several IS/IT adoption studies including (Grover & Ramanlal 1999) argues that lack of internal organizational readiness limit the IT adoption rate. Similarly we presume that lack of organizational readiness towards providing post-adoption service limit its ability to innovate and gain competitive advantage. Furthermore, Weiner (2009) suggests that organizational readiness is multilevel construct. He further argues that organizational dimension and digital option dimension needs to be considered in explaining organizational readiness.

Organizational dimension describes level of preparedness of an organization to provide the system support and maintenance to an organization. In other words, it refers to the level of financial, technical and human resources to support the systems support work.

Digital Options dimensions refer to the reach and richness of firm knowledge available to an individual. This dimension can be viewed from two perspectives. First perspective can be referred to as the comprehensiveness and accessibility of codified knowledge that is available to an individual and second dimension refers to the quality of the information available to individual in support their work. The term option is used here because the available knowledge can be used or remain unused in the firm. An individual will have an option to access the available knowledge or ignore to use it for systems support and maintenance operations.

Organizational Learning

Organization learning (OL) is an area of study that studies models and theories about the way an organization learns and adapts. Takeuchi and Nonaka (1995) argues that OL development is based on the well structured knowledge. Garratt (1990) suggests that organization learning capabilities are required to support and satisfy customer demands. He further adds that good knowledge management (KM) processes should be in place to develop organization learning capabilities. For the purpose of this study, we propose that the knowledge gained at the post adoption stage directly influence the OL capability of an organization that in return will have direct impact on process innovation.

Technology Planning

Cusumon and Elenkov (1994) suggest that company's ability to develop incremental innovation depends on their technical capabilities. These technical capabilities are developed when serious attention is given to the technological planning phase. Furthermore, technological development and quality literature suggest that technology planning plays an important role towards building technological innovation (Panizzolo, 1998).

Collaboration

Collaboration is defined as "working together to create value while sharing virtual or physical space"(Rosen, 2007, p. 104). The Oxford English dictionary defines collaboration as "the process of working jointly on an activity or project". These two definitions indicate that collaboration happens when two or more than two people work together to create something of value. It is important to note here that a competency in collaboration does not point to competency in knowledge management (KM). Madanmohan (2005) suggests that the output of collaborative effort does not guarantee the effective retention of knowledge and nor does it guarantee two parties involved in the collaborative effort have access to information generated during the process of collaboration. In the same manner, competency in KM does not lead to competency in collaboration. For example, two researchers working on similar research projects can have access to the research published by other researcher but does not imply that they are collaborating.

Tarafdar and Gordon (2007) suggest that competency in collaboration is required to develop and innovative idea in the organization. Collaboration is also required at every stage of innovation to successfully convert an idea into innovative product or service. This is typically referred to as that whole is greater than sum of its parts. Furthermore, McKnight and Bontis (2002) suggest that competency in collaboration is an important factor in the development and implementation

of innovation culture. It allows team members with same or different set of knowledge and skills to assemble, irrespective of their job functions, roles or office location

5. Research Contributions

This paper lays out foundation work in identifying initial factors involved in achieving process innovation at the post adoption stage. This work can be extended by adding additional factors and testing the influence of each factor on process innovation. This paper adds theoretical value to an existing innovation literature by explaining and linking the firm's capability of systems support and maintenance with innovation outcome. This study would also provide new insights in explaining and improving process innovation at an organization level.

This study allows timely response for information systems practitioners to find innovative ways to improve their existing business processes (Gartner, 2009). This study would increase their understanding of process innovation through post adoption operations. This study would enable practitioner to revise their current policies of dealing with post adoption activities and motivate and reward employees who take part in the maintenance work.

6. Conclusion

This paper presents and explains a list of four factors of achieving process innovation based on innovation dynamics literature. These factors can be used to better understand the relationship between post adoption operations and process innovation. This paper is an attempt to shift focus towards exploring research issues that are related to post adoption in IS research.

References

- Amesse, F., & Cohendet, P. (2001). Technology Transfer Revisited from the Perspective of the Knowledge-Based Economy. *Research Policy*, 30(9), 1459-1478.
- Attaran, M. (2003). Information technology and business-process redesign. *Business Process Management Journal*, 9(4), 440-458.
- Barua, A., Konana, P., Whinston, A. B., & Yin, F. (2004). AN EMPIRICAL INVESTIGATION OF NET-ENABLED BUSINESS VALUE. *MIS Quarterly*, 28(4), 585-620.
- Bhatt, G. D., & Grover, V. (2005). Types of information technology capabilities and their role in competitive advantage: an empirical study. *Journal of Management Information Systems*, 22(2), 253-277.
- Chapin, N., Hale, J. E., Khan, K. M., Ramil, J. F., & Tan, W. G. (2001). Types of software evolution and maintenance. *Journal of Software Maintenance and Evolution*, 13(1), 3-30.
- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35(1), 128-152.
- Davenport, T. (2000). Transforming the Practice of Management with Enterprise Systems *Mission Critical*. Boston: Harvard Business Press.
- Davenport, T., & Short, J. (1990). The new industrial engineering: information technology and business process redesign. *Sloan Management Review*, Summer, 11-27.
- Erlikh, L. (2000). Leveraging legacy system dollars for E-business. *IEEE IT Pro*, 2(3), 3.
- Garratt, B. (1990). *Creating a learning organization: A guide to leadership, learning and development*. New York: Simon & Schuster Press.
- Gartner (2009). Meeting the Challenge: The 2009 CIO Agenda, from http://www.gartner.com/resources/165000/165048/executive_summary_meeting_th_165048.pdf

- Gaynor, G. H. (2001). Innovator: what does it take to be one? *IEEE Antennas and Propagation Magazine*, 43, 126 - 130.
- Grover, V., & Ramanlal, P. (1999). Six Myths of Information and Markets: Information Technology Networks, Electronic Commerce, and the Battle for Consumer Surplus. *MIS Quarterly*, 23(4), 465-495.
- Khan, K., & Zheng, Y. (2005). *Managing Corporate Information Systems Evolution and Maintenance*: Idea Group Publishing.
- Madanmohan, T. (2005). Incremental Technical Innovations and their Determinants. *International Journal of Innovation Management*, 9(4), 481–510.
- Marjanovic, O. (2005). Towards IS supported coordination in emergent business processes. *Business Process Management Journal*, 11(5), 476-487.
- Markus, M., & Tanis, C. (2000). The Enterprise Systems Experience - From Adoption to Success. In R. W. Zmud (Ed.), *Framing the Domains of IT Research Glimpsing the Future Through the Past* (pp. 173-207). Cincinnati: Pinnaflex Educational Resources.
- McKnight, B., & Bontis, N. (2002). E-improvisation: collaborative groupware technology expands the reach and effectiveness of organizational improvisation. *Knowledge and Process Management* 9(4), 219-227.
- Mustonen-Ollila, E., & Lyytinen, K. (2004). How organizations adopt information system process innovations: a longitudinal analysis. *European Journal of Information Systems*, 13(1), 35-51.
- Myers, M. B., & Rosenbloom, R. (1996). Rethinking the Role of Industrial Research. In W. J. Spencer (Ed.), *Engines of Innovation: U.S. Industrial Research at the End of an Era*, R. Rosenbloom (pp. 209-228). Cambridge, MA: Harvard Business School Press.
- Nordström, M., & Welander, T. (2005). Business oriented maintenance management - A reference model for (system) maintenance. In K. M. Khan & Y. Zhang (Eds.), *Managing Corporate Information Systems Evolution and Maintenance* (Vol. 1). Stockholm, Swedish: Idea Group Publishing.
- Panizzolo, R. (1998). Managing innovations in SMEs: A multiple case analysis of the adoption and implementation of product and process design technologies. *Small Business Economics*, 11, 25-42.
- Penrose, E. (1959). *The Theory of the Growth of the Firm*. London: Basil Blackwell.
- Polo, M., Piattini, M., & Ruiz, F. (2003). *Advances in Software Maintenance Management: Technologies and Solutions*. Hershey PA: Idea Group Publishing.
- Ravichandran, T., & Lertwongsatien, C. (2005). Effect of information system resources and capabilities on firm performance: a resource-based perspective. *Journal of Management Information Systems*, 21(4), 237-276.
- Ray, G., Barney, J. B., & Muhanna, W. A. (2005). Information technology and the performance of the customer service process: a resource-based analysis. *MIS Quarterly*, 29(4), 625-652.
- Roberts, E. B. (1987). *Generating technological innovation*. New York: Oxford University Press.
- Rosen, E. (2007). *The Culture of Collaboration* (Vol. 9). San Francisco, CA: Red Ape Publishing.
- Schilling, M. A. (2005). *Strategic Management of Technological Innovation*. New York, NY: McGraw-Hill.
- Srivardhana, T., & Pawlowski, S. D. (2007). ERP systems as an enabler of sustained business process innovation: A knowledge-based view. *The Journal of Strategic Information Systems*, 16(1), 53.
- Swanson, E. B. (1994). Information Systems Innovation among Organizations. *Management Science*, 40(9), 1069-1092.
- Takeuchi, H., & Nonaka, I. (1995). *The knowledge-creating company*. New York Oxford University Press.

- Tarafdar, M., & Gordon, S. R. (2007). Understanding the influence of information systems competencies on process innovation: A resource-based view. *The Journal of Strategic Information Systems*, 16(4), 353-392.
- Teece, D. J. (2007). Explicating Dynamic Capabilities: The Nature and Microfoundations of (Sustainable) Enterprise Performance. *Strategic Management Journal*, 28(13), 1319-1350.
- Tidd, J., Bessant J., & Pavitt, K. (2001). *Managing Innovation-Integrating Technological, Market and Organizational Change*, Chichester: John Wiley and Sons.
- Weiner, B., J. (2009). A Theory of organizational readiness for change. *Implementation Science*, 4(67).
- Wernerfelt, B. (1984). A Resource-Based View of the Firm. *Strategic Management Journal*, 5(2), 171-180.