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2000

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Keywords: *IS development, knowledge, organizational learning, outsourcing, interactions*

Abstract

Research on Information Systems development has been central to the Information Systems field and the focus had been to improve the interactions between the users and developers during the process. Further examination of the change process reveals the necessity for research on user and developer knowledge domains and on approaches to change them resulting in better systems. IS development outsourcing intensifies the necessity to understand the user developer relations from a knowledge perspective. A framework is developed to explain the user-developer knowledge domains and a case research is performed, spanning insourcing and outsourcing environments, to further explore and explain the learning processes that could occur.

Introduction

Information Systems development (ISD) has been central to the Information Systems (IS) field and many different methods and approaches are adopted by researchers and practitioners to improve the ISD process (Hirschheim, Klein, and Lyytinen, 1996). Despite the availability of different methods and approaches, IS failure is yet a critical issue faced by researchers as well as practitioners, which results in business losses. One factor found to be important in ISD was user participation (Barki, and Hartwick 1994a, Guinan et. al. 1998,Hirschheim and Klein, 1994; Markus, 1983). Traditional life cycle approaches and previous research on user participation stresses the importance of user interactions. Although user participation is found useful, it could raise problems (Ives and Olson, 1984; Robey and Markus, 1984), implying that there is a likelihood of failure of systems even with user participation. Therefore, the imperative was to search for determinants of effective and quality user participation (Guinan, Cooprider, and Faraj, 1998; Salaway, 1987). The previous studies and methods emphasized the communication of user needs and the dialogue between the users and developers. Nevertheless, ISD is a change process consisting of knowledge, and learning in addition to the effective communications and interactions. By investigating the effective knowledge domains and the learning process of the ISD, it will be possible to explain the effect of communications and the changes that occur.

Such an organizational learning approach will become more important with the growing use of different sourcing options such as off-the-shelf packages and outsourcing,. Outsourcing of IS development adds more dimensions to the IS developer-user relations. Vendor opportunism, trust (Nelson and Cooperider 1996), risks due to lack of vendor skills and business knowledge, and lack of IT knowledge in the clients can become important factors that determine success of IS development. Research prescribes selective outsourcing where only activities that would be less risky to outsource are transferred to external vendors. Furthermore, earlier research has found that outsourcing applications development do not lead to increased satisfaction (Grover, Cheon and Teng, 1996), and IS development is an activity that needs to be outsourced with careful assessment. Such discretion is required because the difficulty for vendors to gain the necessary knowledge of relevant business processes (Beath and Walker, 1998) and the risk faced by them due to the project not being completed as anticipated resulting in losses. IS research could contribute to improve the knowledge transfers between the vendor and client by applying an organizational learning perspective to understand the interactions between the users and developers.

The following specific questions can be raised. Are participation and agreement sufficient for better development? What is the role of organizational learning in ISD? How to improve ISD process using organizational learning? The present research attempts to explore answers to these questions.

Determining the occurrence of learning empirically would require investigation of interactions between users and developers and a critical analysis of the differences and conflicts they have. Through a case study method, it is possible to collect rich data on the objectives, interactions and learning that occurs between users and developers. Therefore, qualitative data was collected from an IT service vendor and a large chemical company, where different types of applications are deployed and IT sourcing has changed from an internal department to outsourcing. This data was analyzed using a critical social theoretic approach (Habermas 1984; Ngwenyama, and Lee, 1997), exploring and explaining the user developer learning processes.

In the following section of the paper, role of organizational learning in ISD is discussed. It is followed by the discussion of data collected, analysis and explanations with development of concepts. Finally, implications for future research and practice are

presented. Moreover, note that in the paper user and developer will be used to refer to client and vendor in an outsourcing context.

Systems development and organizational learning

Knowing user needs and context is important irrespective of the motives for ISD and different approaches for user-developer relations have been explored and discussed in research literature (Barki et. al., 1994a, Davis 1992). Facilitating good communications, resolution of conflicts (Barki, and Hartwick, 1994b) and proper user attitude are necessary for eliciting requirements effectively. Although effective user-developer interactions occur, ISD can become a process with conflicts due to dominance of either the users or the developer (Hirschheim, et. al., 1996). On the other hand, user-developer interactions could be conflict free and at the same time may not elicit all the requirements. Using an organizational learning approach, (Salaway, 1987) had shown that error-prone communications occurs and it is necessary to use methods that facilitate error correction. Salaway (1987) presented a framework formed by causal thinking, strategic thinking and verbal interaction patterns that could improve communications. Although this framework is useful for improving user-developer interactions, learning factors relevant for changing user and developer domains were not present in it. The focus on learning from knowledge perspectives was lacking in this previous study due to focus on the user-developer communications only. A knowledge perspective could provide further explanations of the learning process required during systems development.

From a developer perspective, the ISD process must actualize gaining knowledge of user requirements, and designing and implementation of a system accordingly. During this process, the developer needs to gain knowledge about the business and the users should possess some knowledge of the systems to be developed. Early research has viewed this knowledge as a common knowledge base and the emphasis has been in understanding the user requirements (Ewen and Vessen, 1981). A view that considers the knowledge domains of users and developers can be helpful in improving the user-developer interactions and facilitate the change process.

Knowledge Domains

Users' knowledge domain primarily consists of the present business knowledge, learning from past experiences and future plans. Developer's knowledge domain primarily consists of IT knowledge, learning acquired through past experience, and future plans. Although the knowledge domains mentioned are assumed to be consisting primarily of their respective expertise, having some knowledge related to the other's activities would help the ISD. Previous IS research had shown that managerial IT knowledge could cause high levels of IT use (Boynton, Zmud, and Jacobs, 1994). It is necessary to investigate beyond mere IT use. Lack of relevant vendor expertise and lack of knowledge about a company's business and environment can cause failure of IS development efforts by the vendors. Managers or users might possess IT knowledge and developers might possess some business knowledge. ISD process will require creation of common or shared knowledge between developer and users (Nonaka, 1994). Creation of this shared knowledge must be facilitated by each others domains of knowledge. In addition, users possessing IT knowledge and developers possessing business knowledge can enable creation of the shared knowledge between the users and developers. During ISD, learning changes the knowledge domains as well as helps creation of shared knowledge. Prior to explaining the learning process, it is necessary to understand how the knowledge used in the ISD process is stored.

Past research have shown that knowledge could reside in individuals (Walsh and Ungson 1992; Starbuck 1988), in organizational structures and routines (Levitt and March 1988; Wegner 1986), in cultures (Cook and Yanow , 1993), or in technologies (Galbraith, 1990). For example, a developer organization will use certain methodologies or approaches when developing systems or will use already developed software packages when providing solutions to the users. Then the developer has its knowledge embedded in the methodologies and technology (e.g. software packages). On the other hand, some of the users' knowledge will be stored in the business processes and procedures. These user and developer knowledge are organizational knowledge in addition to the knowledge possessed by them as individuals. Therefore, user and developer knowledge domains could consist of these types of embedded knowledge irrespective of whether they are complete or partial. During the ISD process, both the users and developer need to learn from these knowledge domains.

Knowledge domains and learning

According to the organizational learning perspectives, shared cognitive maps among organizational members are created (Argyris and Schön, 1977). These shared maps are followed, as theory-in-action, by the members in organizations during their activities, and they may be different from the formally stated image maps, espoused theory, or procedures and policies etc. (Argyris et. al., 1977). As an organization learns, these actual shared maps are changed and learning occurs through feedback loops modifying the underlying norms and assumptions. In addition, the shared maps may be created through inter-subjective meaningful symbols, artifacts, and rituals that contribute to organizational learning

(Cook et, al., 1993). Furthermore, organizational learning could be routine-based and goal oriented. Such learning could be more based on the history of an organization than on the anticipation of future (Levitt et. al., 1993). Based on all three perspectives shared cognitive maps occur – Argyris et al, (1977) refers to as maps, Cook et al, (1993) refers to symbols etc. and Levitt et al, (Levitt, and March, 1993) routines.

Shared maps occur during the ISD process due to user developer interactions, and feedback during the process would further modify the shared maps as well as the individual knowledge domains. Also during the ISD process, symbols and artifacts are used as shared knowledge, e.g. when developer communicates with the users by means of diagrams. Learning through routines will occur when the user and developer create or modify routines and procedures during the ISD process.

Creation of shared maps during the ISD process is influenced by user's (or developer's) knowledge about IT (business) since this process requires making sense of others knowledge. People search for meanings based on what they already know (Augostinos and Walker, 1995). Moreover, having one-sided knowledge could cause shifts in preferences ("persuasive arguments" theory, - Burnstein and Vinokur, 1977). Therefore, ISD being a social process is effected by the knowledge of participants about the others.

Overall, developers knowledge can consists of IT knowledge, some knowledge of user's business, shared knowledge, shared norms, routines, and other tacit knowledge, past experience, and future plans (users knowledge would be similar). Each party's knowledge will be complete when it has all the constituents, while it may be partial when some constituents are missing. For example, a user not having any IT knowledge possesses only partial knowledge. Nevertheless, these knowledge domains could change through the interactions.

When organizations interact with each other in activities such as applications development, shared cognitive maps should occur for them to have successful relationships. As the users' processes and needs change, systems developers will have to learn through changing the shared maps. While well-defined shared maps may not pose problems to the IT user-developer relationships, changes or creation of new maps could cause differences and problems. Legal contracts, policies, formal routines and procedures are the stated formal shared maps and actual cognitive maps may differ. Furthermore, changes to the actual cognitive maps may occur during the period of contract. Especially, for applications development to be successful such alterations are the imperative as the user requirements change.

This learning approach goes beyond mere conflict resolution and good communications. To fully accommodate user needs, developer may have to learn new skills, and change their norms. On the other hand, users may have to change their processes to fully accommodate the developer solutions as well.

Method and analysis

Research on creation and changes of shared maps could be performed by collecting data on the mutual activities as well as on individual perceptions about the relation. A qualitative study could provide rich data and valuable understanding of a hitherto less known phenomena. A researcher with a functionalist perspective could argue that this be possibly done using quantitative methods or qualitative case study methods. Nevertheless, due to the lack of knowledge relevant to instrumentation of concepts it is more suitable to perform an exploratory study (Yin, 1994). From an interpretive perspective, such an exploratory study would help understand the knowledge and learning relevant for ISD.

In this study, a critical social theoretic approach is taken to critically analyze the user-developer interactions and attitudes to reveal the important underlying behaviors. Critical Social Theory is adopted as the method of analysis because it assumes that people are not mere passive participants but intelligent actors (Habermas, 1984; Ngwenyama and Lee 1997). Major assumptions in critical approach are that the differences or conflicts could occur in an organization, and epistemologically knowledge is subjective. It is assumed that through the interactions and communications the types of actions taking place could be understood. Moreover, instead of attempting to find causal relationships as in a positivist approach attempts are made to understand the phenomena and synthesize a framework.

Field research was conducted at a large chemical company referred to as Nano and at the major IT supplier to the company. This company was selected because of their wide use of IT and changes it had undergone in sourcing which would give a wide spectrum of activities to be researched. Nano is an international company with billions of dollars in sales. The IT department at its US headquarters consists only of eight people since all its IT services are obtained through outsourcing. A CIO manages the division and eight other managers report to him. Three of these eight are CIO's who manage the IT for the three functional divisions. The other five managers, i.e., a knowledge manager, two infrastructure managers, a maintenance manager and a Y2K manager, are responsible for the management of tasks that span across the divisions. Nano obtains its IT services from several vendors and data was collected from the major supplier of IT, which is called Techservices in this paper.

Data for the research was collected from several user managers and a CIO at Nano as well as from the account manager and a manger of the systems integration at Techservices. Interviews were semi-structured where the subjects were free to provide responses and some specific

questions were asked to obtain the research goal oriented data. The responses were tape recorded during the interviews except one, which was conducted over the telephone. Notes were taken on the relevant comments and some documents were observed.

The major IT supplier to Nano, Techservices, was formed from the former IT department of Nano and it is still the source of IT services of most of the companies under Nano. Although Techservices is one of the group of companies Nano belongs to, it supplies IT to companies outside of Nano and has become an IT service vendor.

Macro Level Organizational Learning

Since Techservices is a separate company now, Nano is not under any obligation to obtain IT services exclusively from Techservices and it obtains IT services from several other major vendors as well. Techservices is also aware of its competitive position and aims at keeping a good relationship with Nano. The manager in charge of Nano account stated "They in turn will look to us or others like Anderson Consulting, IBM, E &Y, HP. Obviously what we are trying to do is retain our position as primary service provider."

A variety of services, including payroll, financial and supply management, is provided to Nano by Techservices. Data warehouses and an ERP system are implemented at Nano by Techservices, and it is currently working on a global network and knowledge management services at Nano. Techservices' knowledge domain has changed from its prior internal IT department days.

An internal IT department may not be concerned about earning profits and maintenance of its equipment since the company will be treating them as assets. The prerogative of the internal IT department would be to provide the service regardless of the profits or the costs incurred. Techservices' account manager confirmed this recollecting the objectives of the internal IT department prior to outsourcing. "I processed data, developed applications, deployed applications, provided some business services, provided computer network but all the costs incurred I just cleared that to the customer." This shows the concerns for costs were not part of the knowledge domain of the IT when developing systems earlier. The developer had learned by changing the organizational norms of not considering the costs and this learning amounts to a double loop learning (Argyris et. al. 1977). This learning has changed the shared knowledge domains within the developer organization (Nonaka 1994).

After changing the IT sourcing arrangements, Nano has revised its IT strategy and instituted new plans and budgets. As a CIO at Nano stated, "I think something that is helping is that two years ago we did an IT strategy project in the company. We looked at all out entire IT portfolio. We instituted a five-year plan and at the same time on annual basis, we're doing our IT planning process and budgeting process. So we're still learning how to do it." Nano's organizational learning has also occurred as a result of the strategy project. Nano also is changing its norms from financial as well as IT needs aspects. This learning is similar to what had occurred in the previous IT department when it became a vendor as Techservices. The user also had learned and knowledge domains changed (Nonaka 1994, Argyris et. al. 1977). Nevertheless, it is necessary to consider the learning and knowledge domains pertaining to both users and developers. In addition to the 'individual' knowledge domains of the IT and the users, it is necessary to examine the type of knowledge shared in the ISD process.

Sharing of knowledge through shared maps was not prominent in the previous organization. This was evident from the IT account manager's description of prior behavior "I was in control in stating what is needed at the users' desk if there were any differences our decision was the final one." IT was providing the solutions judged to be suitable from the IT department's perspective rather than from the users' perspective. Problems may arise when implementing some applications where IT lacks a clear understanding of the users' business resulting in failure or misalignment of IT and the business activities. Although the stated shared map was to provide services to the users, the actual map provided the service suitable to the IT.

Occurrence of learning without actually changing the shared norms was evident in Nano and Techservices. Because of outsourcing, Techservices has to maintain its own organization and earn profits. It is more concerned about earning profits and maintaining good relations with its customer. In order to achieve these objectives, sometimes Techservices would attempt to provide services below the cost. Vendors cannot be flexible invariably due to the need to earn profits. When an ambiguous situation arises and the vendor will decide on profit against the flexibility or lower cost. As Techservices manager stated, "We offer them and then they expect us to offer them multiple options…We keep our products and services at market and sometimes they are even offered below the market. They think they should get a break because of the relationship. I'd love to honor that expectation but I can't do that every time. I need to return to my stockholders." The norm of providing solutions as deemed fit from IT perspectives has not changed in Techservices as the result of becoming an outsourcing vendor. When providing the services to its customer, it is still taking a proactive approach placing its perspectives over that of the customer. Account manager's and the systems integration manager's views on supplying solutions and services to Nano showed evidence of this proactive approach. Although Techservices is eager to receive feedback from the customers almost daily, changing of norms in ISD relationships may have not occurred at the outset.

Nevertheless, through interactions that facilitate such double-loop learning, the IS developer may change.

In the case of some systems development activities, the previous norms at Nano are followed although new procedures warrant differently. Actual activities may deviate from the formal procedures and strategies instated to control applications development. Occasionally, norms agreeing with the vendor resulting in satisfactory relationships are followed. In Nano, new IT plans and strategies were formulated and implemented however some users may still follow the former norms. The CIO's comments about differences in objectives underscore this "We start getting tensions in the path where the role of control was not clearly defined or just didn't exist. The folks are used to going finding and buying packages or hiring to build software so my role is sometimes perceived as someone getting in the way."

The conflicts in building shared knowledge between the users and developer are evident. Although both developers and users had learned and changed their respective knowledge domains, inter-organizational learning has not occurred. The shared knowledge component in the knowledge domains has not changed. Lack of IT knowledge in the Nano users and the lack of knowledge about the business processes contributed to this deficiency in learning. Self-reference and self-description leads to seeking knowledge based on what is relevant to the seeker (Luhmann, 1990). Prior knowledge makes the distinction between others and self (Von Krogh, Roos and Slocum, 1994). Furthermore, for organizational knowledge to connect it is necessary to have proper relationships and self-descriptions (von Krogh et. al. 1994). As evident from Nano and Techservices, the states of knowledge domains of the users and developers could impact the ISD process and the outcome as well. Data were collected from finance, sales, marketing, and knowledge management divisions at Nano in order to investigate the knowledge states and learning that occur at the user levels as well.

Knowledge related to three user systems

The users of the financial analysis applications were satisfied and no apparent conflicts were present between the users and the developer. Nevertheless, further critical analysis indicates that the satisfaction is due to lack of knowledge. According to a senior financial analyst, the users were satisfied with the existing system and it provides enough flexibility. "The users are happy most of the time, there is flexibility for their requests, and there are standards we agreed to and the standards are agreed from time to time. They are ok". From the developer perspective also, the financial applications were highly satisfactory and they were major users of IS at Nano. Nevertheless, after the IT strategy study Nano is in the process of implementing a SAP R3 system. The SAP implementation would change the system at the finance division as well. Upon further inquiry, the senior financial analyst agreed that SAP could result in major changes. As he stated, "Once SAP is implemented I don't have a good feel for what it's going to look like…This position may or may not remain once SAP is in place". Therefore, the satisfaction expressed on the current systems by both the financial analyst and Techservices was due to the lack of knowledge. Hence, from the possible prospects as identified by CIO, both users and developer are having partial knowledge. Learning occurred had been incomplete due to the partial knowledge of the users and developers (Nonaka 1994, von Krogh 1994, Argyris et.al. 1977).

At the sales and marketing division, the expertise of the developer could be seen by its ability to develop a system that was being sold to outside customers as well after the successful deployment at Nano. During ISD not only the present needs but also future modifications of the business processes were also taken into consideration. Nevertheless, the marketing group uses another support system based on Lotus Notes. The marketing manager admitted his lack of IT knowledge despite his enthusiasm and exuberant satisfaction with the software. On the contrary, the CIO was not very happy with the learning occurred at these departments. As the statement with reference to the attempts to use Lotus of Notes in other planned systems indicates, "some managers think the same package can be used for all the applications… like using the hammer for everything". Without some prior knowledge the users will not seek further knowledge (von Krogh et. al. 1994). Despite the knowledge of the developer, lack of IT knowledge of the users were restricting the learning due to the inability to create shared knowledge (Nonaka 1994, Wegner 1986).

When developing new applications, where both user and developer have no prior knowledge, they may have to change their practices and norms. Since the requirements for such applications may not be found properly at the outset, the developer tends to provide services more familiar to them and conflicts could occur. Disagreements between some users at Nano and Techservices accounts manager were observed. Upon inquiry about the users to obtain research data from Techservices' account manager was very helpful and arranged meetings with some of the managers at Nano, who did not have any disagreements with the vendor. However, the knowledge manger referred to by Nano's CIO (and not referred to by Techservices) had disagreements with Techservices. Techservices manager also revealed the disagreements later. The knowledge manager was a person who was eager to learn about the IT and use it for his applications. Upon further discussions with the knowledge manager, after explaining the system he wanted to develop, he was eager to point out the differences with Techservices manager. Since the developer wanted to use traditional systems rather than the Intranet to distribute necessary information or knowledge

to the strategic levels, the disagreements have risen. Gaining IT knowledge by the users had facilitated the user developer learning in this situation, since possessing some knowledge they could seek further knowledge (von Korgh et. al. 1994) as well as create shared knowledge.

In summary, at Nano, shared maps created were based on different knowledge states of users and developers. At the finance division, both parties had partial knowledge, and at sales and marketing division, users possessed partial knowledge. In the knowledge management application, when the users attempt to gain more knowledge attempting to complete their knowledge domain, the transitions had occurred to a more optimal state. Finally, the following propositions could be stated.

- Participation and agreement in interactions is not sufficient in the ISD process
- Both users and developer must possess adequate knowledge
- Organizational learning resulting in change in knowledge domains must occur for optimal solutions
- A framework representing relative knowledge states can be conceptualized as given below.

Conceptually four possible knowledge states – users having complete or partial knowledge and developers having complete or partial knowledge can be represented in a two dimensional framework as shown in figure 1. Four quadrants I, II, III, and IV represent the possible states of knowledge between users and developers. Learning during the development process must move the users and developers to the state represented in quadrant III. ISD processes where the knowledge states are in quadrant I will result in conflict free environment and participation, and user involvement will be non-problematic from a communications perspective. In quadrants II and IV, conflicts could occur and other factors such as politics and power could have a deciding influence. In quadrant III, both users and developers will have the knowledge necessary for success of the ISD and learning processes. Transition towards the quadrant III would require organizational learning from both user and developer since it may be necessary for them to change the underlying norms and assumptions of their ISD activities.

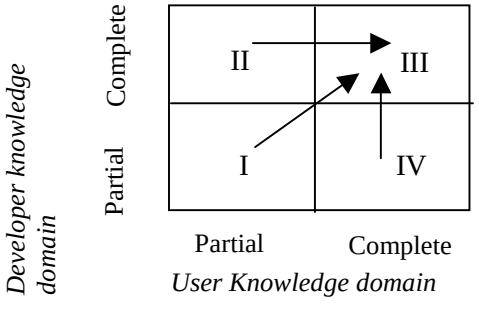

Figure 1 – User –developer Knowledge states

Limitations

The following are the limitations of the research presented.

- The research is exploratory in nature.
- Need further confirmatory studies applications of different methodologies would be useful
- Need to do a more long-term study to determine the success of applications that were developed amidst disagreements.

Implications and Conclusions

This confirms the necessity for the flexibility of IS professionals (Markus and Benjamin, 1996). From practitioner point of view, the findings imply that it is important for the users to possess some IT knowledge, and outsourcing does not necessarily mean freeing users and managers from IT knowledge. Best ISD process would occur when the users and developers both have shared knowledge that is the result of complete knowledge on their parts. Further research is needed to improve the understanding and determine the processes that would allow users and developers to move towards more effective knowledge states. Research on IT management that could reveal the factors facilitating the knowledge creation and organizational learning during the ISD process will be useful. Furthermore, research on ISD using outsourcing should focus on the knowledge and organizational learning perspectives, e.g. extending work of (Beath and Walker, 1998).

Overall, the research provided a new perspective for explaining the ISD process and showed the necessity of an organizational learning perspective and inadequacy of the past research focus on user-developer agreement. The perspective used in this research will be helpful in IS innovation studies also since innovation could be greatly facilitated by shared knowledge (Swanson and Ramiller, 1997, Nambisan, Agarwal, and Tanniru, 1999).

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