

STRUCTURATIONAL ANALYSIS OF IT-ENABLED ORGANIZATIONAL CHANGE: A CASE OF PUBLIC ORGANIZATION IN SINGAPORE

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Abstract

The implementation of Information Technology (IT) is always associated with a series of complex organizational change issues. For this reason, the literature on IT-enabled organizational change is growing large and spans across management science, organizational development, and Information Systems (IS) research. Despite the handful of research in IT-enabled organizational change, the change initiative projects continue to fail. There are two particular issues arise from such problems, which are conflicting results due to the differential of theoretical model's structure and the difficulty of contemporary IT-enabled organizational change literature in informing the dynamic environment and customizable technology issues. For this purpose, this research aims to understand the reciprocal relationships between technology and organization by adopting structuration theory. This research proposes the extension of Orlikowski's (1992) structuration model of technology by separating the institutional properties into environmental structural properties and organizational structural properties. An interpretive case study was conducted on one IT project at public organization in Singapore. The application of structuration theory facilitated understanding the structuration factors and process in IT-enabled organizational change. In addition, the distinct separation of institutional properties enables us to understand reciprocal relationship amongst influencing types of institutional properties, technology, and human. As well, it shows the importance of environmental influence in IT-enabled organizational change. The findings and the implications of this research are discussed.

Keywords: IT-enabled organizational change, structuration theory, interpretive case study

1 INTRODUCTION

Information Technology (IT) has been regarded as the enabler and essential force in achieving business efficiency and effectiveness. Over the years, the emergence of information systems, such as Internet and Enterprise Systems, have changed the way organizations conduct their businesses, transcending their boundaries by connecting to customers, suppliers, and partners instantaneously (Davenport 2000). Despite the rapid growth of IT investment and benefits promised by IT, the failure rate of Information System (IS) implementation is surprisingly high (Ptak and Schragenheim 1999). The reason is the series of organizational change issues that arise along with IS implementation (Doherty et al 2003). Since 1950s, the study of IT-enabled organizational change has grown rapidly and received a lot of attention (Robey and Boudreau 1999). A number of theoretical frameworks and practical approaches are articulated in addressing IT-enabled organizational change, such as Strategic Information Systems (Brynjolfsson 1996) or the economic value of IT (Hitt and Brynjolfsson 1996) in management, behavioural science approach in organizational development (Argyris 1970), and socio-technical model (Bostrom and Heinen 1977) in IS field of study.

Despite the handful research on the IT-enabled organizational change, many organizations still have difficulty in taking advantage of IT (Kling and Lamb 2000). Beer and Nohria (2000) reported the fact that 70% of all change initiatives fail. The reason is conflicting results of relationships between technology and organizational change due to differences in structure of theoretical model (Markus and Robey 1988). Such as, the preoccupation with the economic value of IT drives out the serious consideration for the human and organizational aspects of IT-enabled organizational change (Coghlan and McDonagh 2001). In another approach, the role of technology and business strategy in IT-enabled organizational change have received little attention in the area of organizational development, which mainly focuses on the social and psychological aspects of change in individual (Worren et al 1999). In addition, the unanticipated organizational outcome, due to the dynamic and complex change process, as well as the customizable technology has produced the difficulty of contemporary theoretical model to explain and offer an effective IT-enabled organizational change (Orlikowski and Hofman 1997). With these limitations, several studies have called the need for a well addressed mixed level of analysis in the social dynamic process of interaction amongst technology, organization, and environment in IT-enabled organizational change (Markus and Robey 1988, Orlikowski and Barley 2001, Pettigrew et al 2001)

This research aims to understand IT-enabled organizational change from the structuration theory perspective by answering how and why the structuration - the structuring of social relations (Giddens 1984, p. 370) - can facilitate and constrain organizational change with IS implementation. Thus, we will analyze the recursively mutual-interacting relationship between institutional properties, technology, and human throughout the process of IS design, development, implementation, and use. Structuration theory has been acknowledged as a useful theory in explaining the IT-enabled organizational change (Orlikowski 2000). In this research, we propose the modification of Orlikowski's (1992) structural model of technology, separating the institutional properties into organizational structural properties and environmental structural properties. In this research, our understanding of structuration theory is also drawn upon the interpretations and emphases offered by Jones (1999), Orlikowski and Robey (1991), Orlikowski (1992), and Walsham and Han (1991) in their discussion of structuration theory in information systems research. An interpretive case study approach was conducted at Alpha (a pseudonym), a public organization in Singapore, on how and why Alpha developed and implemented Permit Application System (PAS) (a pseudonym) through the analysis of structural lens. The overview context of PAS implementation is characterized by involvement of several parties, the dynamic of organizational dimension and environmental factors, and the long period of the system development and implementation.

2 STRUCTURATION THEORY

Structuration theory (Giddens 1984) aims to bridge the gap between functionalist view, which predominantly emphasizes on structure of social systems, and interpretivist view, which predominantly emphasizes on the importance of human actions. Structuration theory posits that the structure of social systems and human actions are mutually dependent and recursively related in which structure is constituted by human actors, and yet at the same time structure serves as the medium of human interaction.

Giddens (1984) distinguishes three structural dimensions of structure: significant, domination, and legitimation. At human interaction, it is broken down into three dimensions as well, which are communication, power, and sanction. Both dimensions of social structure and human interaction are linked by dimensions of modality: interpretive scheme, facility and norm. Giddens (1984) asserts the separation of these dimensions is solely for analytic purposes since they are inextricably interlinked in practice. In addition, Giddens (1984) regards structure as rules and resources that are recursively implicated in social reproduction and exist only as memory traces.

Structuration theory has been adopted in several fields of IS namely, e-government (Devadoss et al 2002), ERP implementation (Volkoff 1999), and executive information systems (Jones and Nandhakumar 1993). Notwithstanding the absence of technology concept in structuration theory, the idea of "duality of structure" concept – reciprocal relationship between structure and human action - appeals to IS researchers to employ the tenet of structuration theory in providing useful insights to IS community (Orlikowski and Robey 1991, Orlikowski 1992, Walsham and Han 1991). Structuration theory offers significant insights in interpreting IS phenomenon, either the development or organizational impact of information technology (Jones 1999, Orlikowski and Robey 1991). In addition, it also offer the potential to identify patterns of relationships between human activities and contextual factors that are observed throughout the case study setting (Jones and Nandhakumar 1993). In an attempt to adapt structuration theory to IS field, Orlikowski (1992) presents the structural model of technology as a theoretical model to reconstruct the concept of technology and study the relationship between technology and organization. Two premises of this model are offered by Orlikowski (1992) in reconceptualizing technology, which are duality of technology and interpretive flexibility. In the first premise, technology is seen as "created and changed by human action, yet it is also used by humans to accomplish some action" (Orlikowski 1992, p. 405). In the second premise, technology is seen as interpretively flexible, refers to the degree of technology flexibility that may be appropriated by human actors in their development or use of technology across time and space.

This research proposes the modification of structural model of technology (Orlikowski 1992), separating the institutional properties into two dimensions namely, the organizational structural properties – structured features of social systems in organizational context- and the environmental structural properties - structured features of social systems in environmental context. The environmental structural properties (outer context in which the organization is located) consists of technological and socio-economic conditions. The organizational structural properties (inner context in which the technology is used) consists of organizational culture, mission, resources, and business strategy. An equal attention to environmental setting illuminates the impact of environmental conditions on IT-enabled organizational change and avoids the "insufficient account of the broader social context that constrains and enables action at the focal level" (Walsham and Han 1993). It is exemplified by the difficulty of management of information systems in organizational change due to the dynamic environment, such as changes in government regulation, customer, and technology (Lederer and Mendelow 1990). In summary, an inference of appropriation of IT processes into work practice must take into an account the differential of environmental context, such as cultural issues (Walsham 2001).

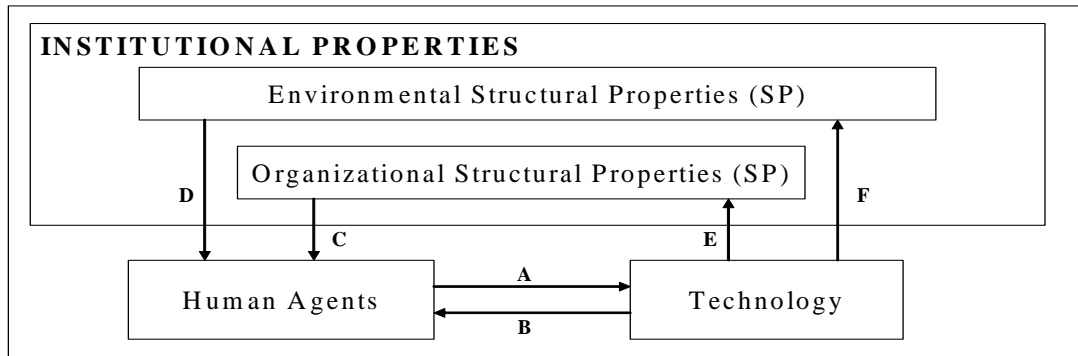


Figure 1 An Extension model of Structural Model of Technology (Orlikowski 1992)

The modified structurational model of technology (Orlikowski 1992) (depicted in Figure 1), comprises human agents, technology, and institutional properties. Institutional properties are divided further into organizational and environmental structural properties. Technology, medium or outcome of human action (arrow A), developed by human agents and institutionalized over time through its ongoing use. As the technology is appropriated by human agents on their ongoing work practices, it has the influential ability to mediate human actions (arrow B), either by facilitating or constraining the human social practices. Throughout human actions in designing or using the technology, human agents draw upon the organizational structural properties (such as existing stocks of knowledge or understanding, the allocation of resources, and rules or norms) (arrow C) and the environmental structural properties (such as economic conditions, government policies, and public expectations) (arrow D) throughout their continuous monitoring of activities and surroundings. In ongoing usage of technology inside the organization, the technology may influence the institutional properties, in reinforcing the existing structures or enacting the emergent structures. With the influential ability of technology in institutional properties, ongoing relationships between technology and human actors reinforce, enact, or transform social systems of environment and organization (arrow E and F, respectively).

3 RESEARCH METHODOLOGY

This research adopts an interpretive approach which assumes that meanings are shaped by actors through the social construction of IS and that understandings are assigned on the basis of a person's subjective interpretation (Klein and Myers 1999, Walsham 1995). In this study, an in-depth case study was conducted at Alpha to explore the process of PAS project. The selection of this case is based on two reasons. First, our accessibility to all phases in PAS project suits the needs for a complete structurational analysis and understanding of time-space discontinuity between the design and use of technology (Orlikowski 1992). Secondly, the complex process of the development and implementation that spanned over several years, through the involvement from several departments and an outsourcing consultant, is deemed as suitable for our case study analysis in IT-enabled organizational change. Thus, the case provides a rich source of data that is suitable to understand IT-enabled organizational change in real life.

The data collection was conducted from May 2003 to October 2003. Initially, several semi-structured interviews were conducted with IS project leader, as a key respondent, in providing us the useful insights about the system development and implementation processes. Subsequently, a total of 38 interviews with semi-structured questionnaire were conducted with 20 participants from three departments –Customer Service Department (CSD), Engineering Department (ED), and Quality Department (QD) (All department names have been disguised to preserve anonymity) - who involved in the PAS project. Each interview session lasted from 30 minutes to two hours. In each interview session, notes were taken and transcribed immediately. During the transcription, the collected data

were checked for their consistency and accuracy with other sources of evidence in order to increase the validity and reliability of the study. As the history of the project covered over seven years, the memories of several participants would be inconsistent. As a result, the interpretation of the interviews would not suffice data reliability. Therefore, the usage of multi sources approach allowed us to get objective view of events and the subjective interpretation of participants (Benbasat et al 1987). Next, the sequence of events was constructed based on several extensive interviews with IS project leader and key participants having different perspective on development and implementation processes as well as the related sources of evidence. After an initial analysis had been done, an iterative process was conducted between analysis and further data collection, until specific findings had shown a strong relationship to the specific phenomena being studied. The role of structuration theory, structurational model of technology particularly, in our research is used as an initial to case design, data collection, and subsequently data analysis (Eisenhardt 1989).

4 CASE OVERVIEW

Alpha was established under a statutory board of the Ministry of National Development to develop Singapore building. Due to large customer base and the complexity of its mission-critical organization, Alpha has found the necessity to keep itself in the pace of technology innovation to ensure the achievement of customer satisfaction. With the continuous realization of technology innovation, the seamless interlinking of computer systems at different divisions, departments, and among staff members as well as the work computerization have facilitated easy communication, faster information access and retrieval, and improved service delivery. Some of the applications have won recognition, such as Permit Application System (PAS).

Prior to the PAS implementation, the handling of permit application at all branch offices was manual. The manual process of getting approval for the permit was inefficient due to high turnaround time. The turnaround time was largely due to manual dispatch of forms from branch offices to headquarter for certain approval. In addition to that, the physical storage as well as duplications of large volume of hardcopy forms resulted into islands of information thus creating difficulty in generating reports of customer trend due to longer time spent in data searching and compilation.

Initiated in 1994, PAS project was led by Information Technology Department (ITD) with three departments – CSD, ED, and BQD, as well as the partnership with one outsourcing vendor. The period of PAS project spanned over five-year period from 1996 to 2001. PAS is an enterprise wide workflow system which facilitates and tracks permit applications submitted by customers. The major objective of the system is improvement in customer service delivery at branch office and the turnaround time of approval that requires approval from several departments. In addition, it improves staff productivity and benefits top management, e.g. the generation of monthly report; trend analysis and historical data report that are helpful in decision-making process. Currently, PAS is used by 1,500 staffs in Alpha.

5 STRUCTURATIONAL ANALYSIS

Series of various events are compiled into the schematic of phases. The structurational analysis of ongoing recursive relationships between technology, human agents, and institutional properties will provides an insight into the process of IT-enabled organizational change, depicting number of changes that occur during the development and implementation phase.

5.1 Initiation Phase (June 1994- July 1996)

In addition to problems faced by departments due to manual work process, the high involvement of government in national IT plan and encouragement to public organizations to actively adopt and use IT (show in arrow 1 at Figure 3) motivated Alpha to implement a computerized system to handle the permit applications. Drawing upon knowledge of software development methodologies and

organizational requirement (arrow 2), ITD undertook the task to develop PAS (arrow 3). However, limited time and manpower constrained ITD in completing the project (arrow 2). One developer recalled "...We had difficulties to develop PAS due to limited time and resource..." With the limited resources available for PAS development had forced ITD to find an alternative way to develop the system. As PAS was unable to interface with mainframe-based applications to retrieve data, it had resulted into an additional work for data entry (arrow 4). This extra work was viewed as cumbersome and lamented by management executive. One project representative noted: "... This system may improve the business efficiency but not effectiveness. In longer time, it is not a good idea to have such effort spent on data entry. There are over 120 applications inside Alpha and integration of systems is the answer to achieve unified view about our business..." Therefore, the system development was stopped by senior management as it was viewed as ineffective in improving customer satisfaction and staff productivity.

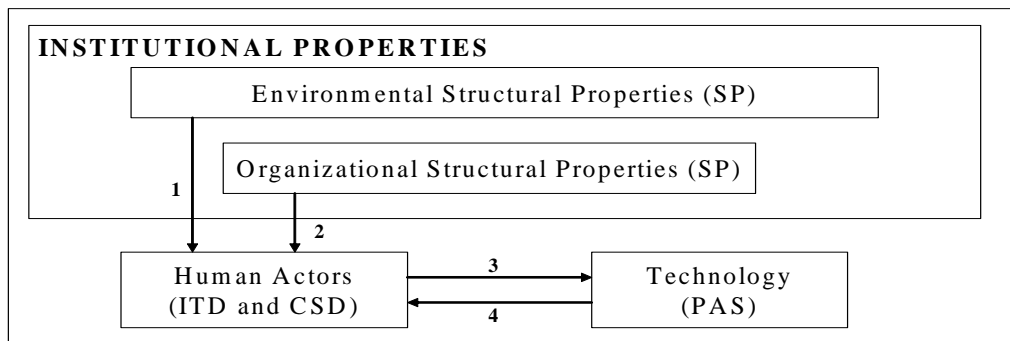


Figure 3 Structural Analysis at Initiation Phase

5.2 Development Phase (July 1996- August 1997)

The management decided to outsource the project due to the unavailability of off-the-shelf-package which could address the needs of system's scope and dynamic changes of requirement. In the development of PAS, outsourcing consultants were influenced by two institutional properties, which were Alpha's and outsourcing organization's institutional properties. The outsourcing consultants exhibited their institutionalized knowledge and norms of their own system development methodologies (shown in arrow 5 at Figure 4) and utilized the resources provided by Alpha with the understanding of user ongoing works (arrow 6) to develop the PAS (arrow 7). In addition to that, the outsourcing consultants were constrained or mediated by Integrated Communication System (ICS), an office automation system, in their PAS development (arrow 8). Previously, ICS was implemented by ITD and institutionalized across the functional departments in the organization. As PAS leveraged ICS infrastructure in the achievement of business efficiency and effectiveness, ITD provided previous experiences on IOS implementation with the purpose of facilitating the outsourcing consultants in developing PAS. In the cooperation with outsourcing consultants, IS project leader applauded "...Their technical skill is excellent. The system could be delivered according to our requirements"

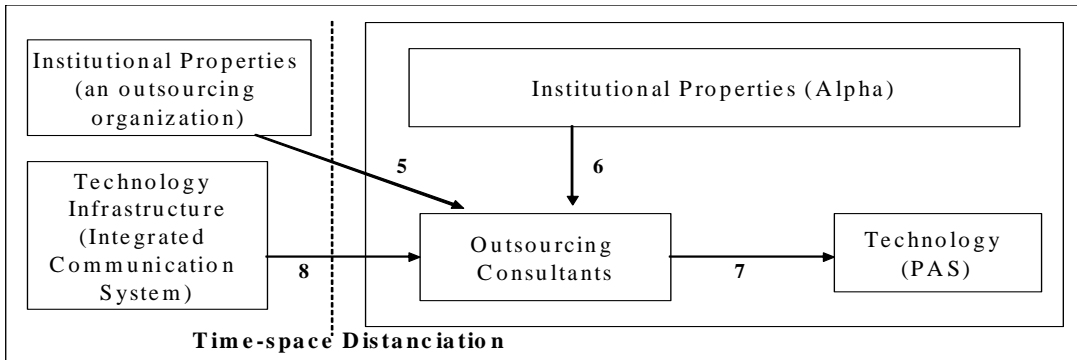


Figure 4 *Structurational Analysis at Development Phase (Continuity through the engagement with outsourcing consultants)*

5.3 Pilot Implementation and Implementation Phase (August 1997- January 2001)

Through the ongoing usage of PAS, the technology was institutionalized in institutional properties (arrow 9 in Figure 5), transforming the old organization structural properties. As the medium of human action, PAS could facilitate or constraint end-users in their ongoing work practices (arrow 10). On one hand, technology was perceived by customer service officers from CSD as ineffective. The slow response time of PAS constrained customer service officers to improve their customer service delivery. One customer service officer said: "...We need to do an additional work, which is data entry into the system. Although the system will automatically generate the result of applications: approved or pending, it takes a longer time than manual work processes..." On the other hand, engineers from ED and QD found the system enable them to work faster in approving permits. One engineer noted "... With PAS implementation, this system has shortened the turnaround times of our department in approving the permits..." In a similar way, one of the top management executive said: "...The system enables us to generate a report about current customer trends. This report allows Alpha to deliver services that are suitable with current customer needs..." Resolving customer service problems, ITD developers and the outsourcing consultants modified the system (arrow 11), informed by their knowledge of user's intention and motivation (arrow 12). As a result, the modified PAS could reduce response time, by which eventually the project received the support from customer service officers.

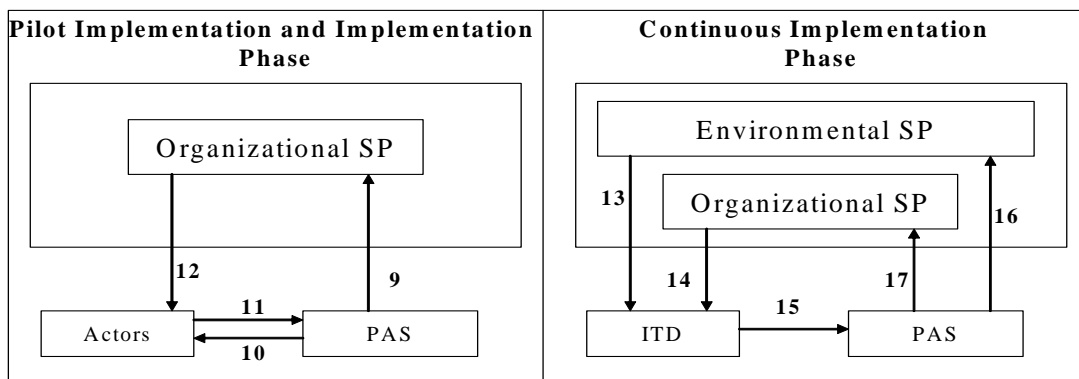


Figure 5 *Structurational Analysis at Pilot Implementation, Implementation, and Continuous Implementation Phases*

5.4 Continuous Implementation Phase (January 2001 – Present)

Largely influenced by the launching of E-Government Action Plan II (arrow 13 in Figure 5) and shared understanding of senior management (arrow 14), ITD enhanced the system (arrow 15), extending its availability to the public through the Internet. In turn, PAS has enacted the emergent structure in environmental context – the encouragement to apply permits through the Internet – (arrow 16) as well as organizational context – the priority will be given to the electronic application through the Internet (arrow 17). One project representative from CSD said “...Therefore, public can apply the permits through the Internet at their convenience time. To encourage, we prioritize their applications. Currently, the rate of electronic submission through the Internet is encouraging...”

6 DISCUSSION

From the structural perspective, the preceding case study shows how IT-enabled change unfolds over time by analyzing the interactions among elements of structuration theory. Next, numbers of key concepts in each element of structuration theory are highlighted in the discussion.

6.1 Institutional Properties (Organizational and environmental structural properties)

As one of major findings, we found the different contextual influences of external environmental context and internal organizational context in IT-enabled organizational change. The analyses showed how the development and implementation of IS was mediated by organizational structural properties (such as organizational strategy) and environmental structural properties (such as government regulations). As recursively implicated, the technology may transform and reinforce the institutional properties. An overview findings of organizational and environmental structures, which are divided into structures of signification, domination, and legitimation in our case study is presented in table 1

Realm of social structure	Signification	Domination	Legitimation
Environment structures	Shared understanding of government IT policy The faster application and approval for Internet access	Public accountability The availability of resources to support the development and implementation of information systems	National culture (Strong respect for the authority) Government laws and conventions
Organization structures	Shared understanding of organization mission Emphasis on coordination between related departments Efficiency through centralized and integrated work processes Development methodologies	The strong support from top management Allocated budget and time Balanced of allocative resources between user departments	Organizational values and conventions (Top-down approach, respect for the authority)

Table 1. An overview of realm of social structures

The separation of institutional properties into environment and organizational structural properties provides clarity of the influential factors from environmental setting in mediating the human agents to draw upon their existing shared assumptions to act on their daily work as well as the ability of human to enact the environment (Weick 1979). The initiation of PAS and its extension to the availability of electronic access through the Internet were largely driven by government’s influence, such as the need

for more efficient public service offered by public sectors and the high level of involvement in the computerization of Singapore. In a recursive way, the continuous PAS development has enacted social structures in environmental dimension. With the launching of electronic access, the public citizens drew their knowledge of internet usage in using electronic permits application. As recursively interacting between customers service officers with their existing institutional properties, their daily routine work in processing the permits application manually indeed had reinforced the existing structures. Therefore, this routinization - continually reproduced of established social structures as a result of people's sense of security reinforcement (Walsham and Han 1991) - has resulted into difficulty for ITD to introduce PAS in changing their old work practices. The IS project leader noted "...In the beginning of PAS implementation, it was a difficult period. As users were used to manual approval of this permits application, they felt uncomfortable with the work computerization. Even that, we had to teach them on how to use mouse..."

6.2 Human Agents

The characteristics of human intention or motivation for human action in relation with IS implementation are regarded as important factors in analyzing the role of human in IT-enabled organizational change process. As knowledgeable actors, the users continuously observe their ongoing work practices. Thus, they may choose not to follow the introduction of technology, by resisting or using them in different way. The reason to do so can be equated with their intentional behaviour, which means act that human agents perform in order to produce their own expected quality or outcome (Giddens 1984). In the beginning, customer services officers resisted the usage of technology as they needed to put an extra effort in data entry, which they did not have to attend to in their manual work practice. In resolving such issues, the management provided briefings to them, citing the achievement of long-term benefits. In addition to that, the issue of cross-cultural context in technology development and use (Walsham 2002) should be taken into account in the area of outsourcing of IS development and implementation. With the understanding of cultural differences between outsourcing consultant and organization, the ongoing change process of IS implementation may offer the possibility of negotiating "culture of cooperation" (Walsham 2002). In the case of PAS implementation, cross-cultural issues are not visible in our case study as the outsourcing consultants had little influence over culture issues in PAS implementation. The planning and system requirements had been conducted by ITD developers before outsourced the system development to outsourcing consultants.

6.3 Technology

On the ongoing recursive practices, human agents will draw on social structure, which in turns reproduce or reinforce particular social structure in their mind. Likewise, technology, in its equal level with other resources such as land and building, will only become resource when it is only instantiated in human minds on their action and drawn by human agents in their interactions (Giddens 1984). This notion is useful to explain that technology by itself will have no value unless being used by human agents through their daily social interactions (Markus and Keil 1994). In this research, we carefully posit our idea of technology as socially constructed, drawn from the designers' intention, motivation, and knowledge using the facilities within their institutional context, and seen as one of the resources when being appropriated by users during the technology use. However, the reproduction of technology is bound by its material characteristics, or known as material constraint - "constraint deriving from the character of the material world and from the physical qualities of the body" (Giddens 1984, p. 176)

The juxtaposition of concepts of technology, the availability of material properties and the instantiation of such resource in human minds of technology, overcomes the issue of conceptualization of technology definition in Orlikowski's (1992) structural model of technology (Jones 1999). Further, we offer two issues from our case study. First, not all material properties of technology are instantiated in certain user's mind as resources in their recursive practices. The reason is differences in conditions of institutional properties drawn by each user. By focusing our attention on the

technology's material properties and its instantiation in institutional properties, we learn how each role of groups may appropriate certain characteristics of technology. For example, the resistance of customer service officers to appropriate PAS during the early pilot implementation phase was caused by the slower response time of application processing. The institutional properties – improvement in staff productivity (organization structural properties) and rising in customer expectation (environment structural properties) – drawn by customer services officers caused their resistance to PAS. On other hand, engineer staffs viewed PAS useful in enabling them to make a faster approval through the electronic access.

Secondly, the analysis of technology should extend to socio-historical context (time-space distanciation). The greater time-space distanciation of institutional properties, the “more resistance they are to manipulations or change by any individual agent” (Giddens 1984, p. 171). As institutionalized inside Alpha, Integrated Communication System (ICM) is viewed as rigid. Thus, the development of PAS is limited to any changes in ICM infrastructure. As a result, the outsourcing consultants were required to draw upon the underlying assumptions and motivations in the IOS implementation prior to the PAS development.

7 IMPLICATIONS AND CONCLUSION

This study examined the IT-enabled organizational change by adopting the modified structurational model of technology. From the case study, we could understand how and why an organization changes with the implementation of IT. In addition, we could perceive the usefulness of the modified structurational model of technology.

This research has several implications for academicians and practitioners. From the academic perspective, the use of structuration theory in this research supported our aim to study the IT-enabled organizational change, through the understanding of context, content, process, and reciprocal linkages between them (Pettigrew et al 2001). Our modified structurational model of technology (Orlikowski 1992) provides an insight on the importance of environmental context, informing the mediating environmental structural properties in the development and implementation of technology which may shape the organizational change. For example, it was found that there is a striking difference in Singaporean IS executives in terms of cultural, political and economic environments, as compared with their USA and Australian counterparts in the study on key issues in information systems management from an international perspective (Watson and Brancheau 1992).

The modified structurational model is also effective in analyzing IT-enabled organizational change in terms of its components and the interactions among the components over time. Although it has been argued that the different factors in the social, technical, and environmental dimensions affect each other and that the correlations between them have potential effects on the results of IS implementation (Bostrom and Heinen 1977), there has been little research to understand how they are related, and how and why they can lead to the organization consequences of information technology. The present research makes a contribution to the filling of this gap in the extant research by modifying the structuration model of technology and explaining what factors are associated with the IT-enabled organizational change, how and why the factors influence each other in the IS project.

From the practical perspective, this research offers several important insight for practitioners in IS implementation. First, IT practitioners should understand the reciprocal relationships between technology, organization, environment, and people. Throughout the process of IS implementation, it is necessary to identify the casual patterns of change and the focus should aim at facilitating and constraining conditions characterized by each element of structuration theory in order to inform the occurrence of unintended consequence in IS implementation. Secondly, the technology is flexible and customizable. As socially constructed of the technology (Orlikowski 1992), IS implementation will be disrupted by certain social and organizational aspects which require IT practitioner to re-visit the phases and re-design the technology itself. At last, the understanding of environment influences in IS

implementation is equally important with the understanding of the business reasons for IT practitioners. The understanding of the unpredictable environment, such as changes in technology, changes in government policy, may inform and aid IT practitioners to react fast in order to avoid the disruptive events during IS implementation.

There are several limitations to this research. First, the extensive study of PAS usage by public citizens is limited in this research. Future research may address on how the ongoing usage of electronic access of PAS by public may reproduce the environment structural properties, in which the organization structural properties and technology are recursively implicated, across the time and space. Secondly, the analysis of our study is conducted within the context of Singapore public organization only. Therefore, this research represents the starting point for future research to adopt this modified structural model of technology in understanding the process of IT-enabled organizational change from another environmental setting.

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