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IT IMPLEMENTATION THROUGH THE LENS OF ORGANIZATIONAL LEARNING: A CASE STUDY OF INSUROR

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Abstract

Recent research suggests that it may be useful to explore IT implementation issues from the perspective of organizational learning. Based on the work of Robey et al. (1995), a model is proposed that conceptualizes IT implementation within the context of organizational learning. The proposed model is tested through a case study of a major insurance company where two previous IT systems for claims processing have failed and a third system is being implemented. A major issue that surfaced from the experiences with these systems is the central role of technical knowledge and know-how learning in IT implementation. Based on the findings from this revelatory case study, the proposed model is extended to incorporate a technological perspective of organizational learning.

Keywords: Organizational learning, IT implementation, double-loop learning, case study research.

1. INTRODUCTION

Today's business environment requires organizations to respond to environmental changes as quickly as possible. Organizational learning is an increasingly important area of research that examines how organizations learn and thus increase their competitive advantage, innovativeness, and effectiveness (Dodgson 1993; Fiol and Lyles 1985; Miner and Mezias 1996; Weick 1991). It has even been said that organizational learning may be the only sustainable competitive advantage that will enable businesses to compete in the long run (Geus 1988). At the same time, the concept of information technology (IT) as an enabler of business competitiveness has been expounded with the rising popularity of business process reengineering (BPR) (Davenport and Beers 1995; Hammer and Champy 1993; Venkatraman 1991). This development is accompanied by a trend of increased IT investments (*The Economist* 1996).

Traditionally, information systems (IS) play an important role in organizations because they allow organizations to process, store, retrieve, and present information more efficiently and effectively (Huber 1991; Zuboff 1985). More recently, it is suggested that IT implementation can be viewed as a form of organizational learning (Attewell 1992; Gill 1995; Pentland 1995). Appropriate and effective use of IT can lead to strategic advantage for organizations, but the converse is also true: in some cases, existing IT investments have inhibited the ability of organizations to learn and adapt to a fast-changing environment (Gill 1995). With the increase in IT investments, a better understanding

of how IT and organizational learning can affect eventual effectiveness or prevent organizations from maximizing IT benefits will have far-reaching implications.

The objective of this paper is to examine how organizational learning may be used to explain the IT implementation process. The theoretical background to the research is presented in the next section. Following this, an organizational learning model that conceptualizes IT implementation within the broader context of organizational learning is developed. The model is then tested through a case study. Analysis of the results provided insights which are used to extend the proposed organizational learning model.

2. ORGANIZATIONAL LEARNING AND IT IMPLEMENTATION

Two perspectives of the relationship between organizational learning and IT implementation are articulated in the literature. In the first perspective, IT implementation is viewed as an episode of organizational learning. Pentland (1995) argued that there is an intuitive connection between organizational learning and IT. At each stage of IT implementation, there are processes that evoke the metaphor of learning. Attewell (1992) also described IT adoption as a learning process. Robey et al. (1995) noted that IT can capture many organizational routines stored in memory by embedding those routines within its programs and procedures. Memory stored in electronic storage may be more accessible to members of the organization. However, IT can also become a disabler of learning. Embedded routines may become difficult to disembed for purposes of re-evaluation and change.

Evidence of IT implementation as a form of organizational learning has been elaborated upon by a number of researchers. Pentland noted that the development of a new IS entails an intensive effort at identifying requirements and codifying organizational procedures and practices. One could infer from the model of organization memory (Robey et al. 1995) that such an effort does require the organization to access its current repository of knowledge (routines, procedures, causal maps, and underlying assumptions), followed by a revision of the old knowledge that will form the new knowledge within the memory. Single-loop learning occurs when IT implementation encodes existing manual routines, procedures, rules, and assumptions into computer systems without questioning or changing the governing variables. Hence, the identity, causal maps, and organizational routines are unchanged, except only in the physical form or medium. Examples of such systems include transaction processing systems that increase the efficiency of processing daily routine transactions. Double-loop learning occurs during the process of IT implementation when the underlying assumptions are surfaced, questioned, and tested; eventually, these altered assumptions, routines, procedures, and rules are encoded. Robey et al. provided an example of such systems:

> Cognitive mapping systems, for example, may expose implicit assumptions made by groups and bring poorly understood issues to the surface. By facilitating groups to reflect on and articulate their underlying assumptions and reasoning, these technologies [IT] contribute to organizational learning.

In the second perspective, IT implementation is viewed as an occasion for double-loop organizational learning to occur. This view is suggested by Stein and Vandenbosch (1996), who asserted that the implementation of IS (such as expert systems and executive IS) allows the user and designer to interact, i.e., surfacing the underlying assumptions and questioning those assumptions that are obsolete. When such assumptions are surfaced, validated, and made relevant to the current environment, they are embedded within the IS as a form of organizational memory, thereby completing the double-loop learning process. In this manner, IT implementation can be viewed as a trigger to, as well as providing a context for, double-loop learning within the organization.

Compared to the first perspective, the second perspective presents IT implementation as a pro-active process. Stein and Vandenbosch have argued that designers/implementers should capitalize on the potential for higher-order organizational learning inherent in the development and implementation of IT. The position of this paper is that there are four reasons why this could be achieved. First, designers/implementers have a legitimate reason to go about studying the current business processes when an IT implementation is underway. Often, it is the responsibility of the IT personnel to delve into the intricacies of the business processes. Second, through the process of gathering user requirements, the designers and the users engage in "symbolic interaction" through artifacts or technology (e.g., user requirements specification, user-interface design screens, data flow diagrams, and entity-relationship charts) thus allowing deeply-seated assumptions to be surfaced. Through questioning the validity of these assumptions, the relevance of these assumptions can be verified. Third, working with the users to design the final system could have the positive effect of committing users to the design and preparing them for the eventual changes that will occur. By reflecting on their work practices, users have the opportunity to modify their understanding of how their work processes can be improved (Stein and Vandenbosch 1996). Finally, when these assumptions are coded into the final system in the form of computer software, new rules, and operating procedures, the change will be "frozen" in place. While IT provides a good medium to embed and codify the assumptions, once embedded they are often rigid and difficult to change (Argyris 1992). Hence, organizational learning should be a continuous and ongoing process. Otherwise, IT will inhibit the ability of the organization to learn when the assumptions of the business environment embedded within eventually become obsolete (Gill 1995).

In this paper, both perspectives of the relationship between organizational learning and IT implementation are adopted. At a higher level, it is noted that there are limitations in interpreting IT implementation from a single theoretical approach, in this case, the organizational learning approach. For example, the organizational learning perspective does not directly address politics and power issues. Notwithstanding these limitations, the belief here is that the organizational learning approach can contribute new insights into the study of IT implementation. In the next section, a model that conceptualizes IT implementation within the broader context of organizational learning is proposed.

3. PROPOSED ORGANIZATIONAL LEARNING MODEL

The model is adapted from the research by Robey et al. in the context of BPR. They asserted that a BPR endeavor, with IT as an enabling technology, would work more effectively if housed under a broader perspective of organizational learning. This is because the reengineering process can be accompanied by efforts to reconfigure the organizational memory in accommodating organizational changes. Figure 1 presents the model.

In *assessment of current memory*, pre-existing organizational memory—composed of the shared identity, causal maps, and organizational routines—must first be understood as a baseline for change. Identity reflects the shared understandings of the organization's boundaries, mission, and character. Causal maps represent shared assumptions about the links between an organization's actions and their outcomes. Organizational routines refer to procedures that are followed and understood by members of the organization. Robey et al. asserted that such an assessment provides a useful framework for the *learning objectives* stage where three types of learning objectives are set: (1) changes in identity, (2) revision of causal maps, and (3) alteration of routines. In *changing an identity*, the existing identity is examined and a desired future identity is articulated to produce a compelling, shared vision to guide and motivate organizational members through the reengineering effort. In *revising the causal maps*, the main purpose is to remove causal maps that are obsolete and counterproductive due to a changing competitive environment. Finally, with a revision in causal maps, *organizational routines* must be explicitly redesigned to fit the new causal maps. It is necessary that consensus exists among organizational members that these changes are legitimate and effective means

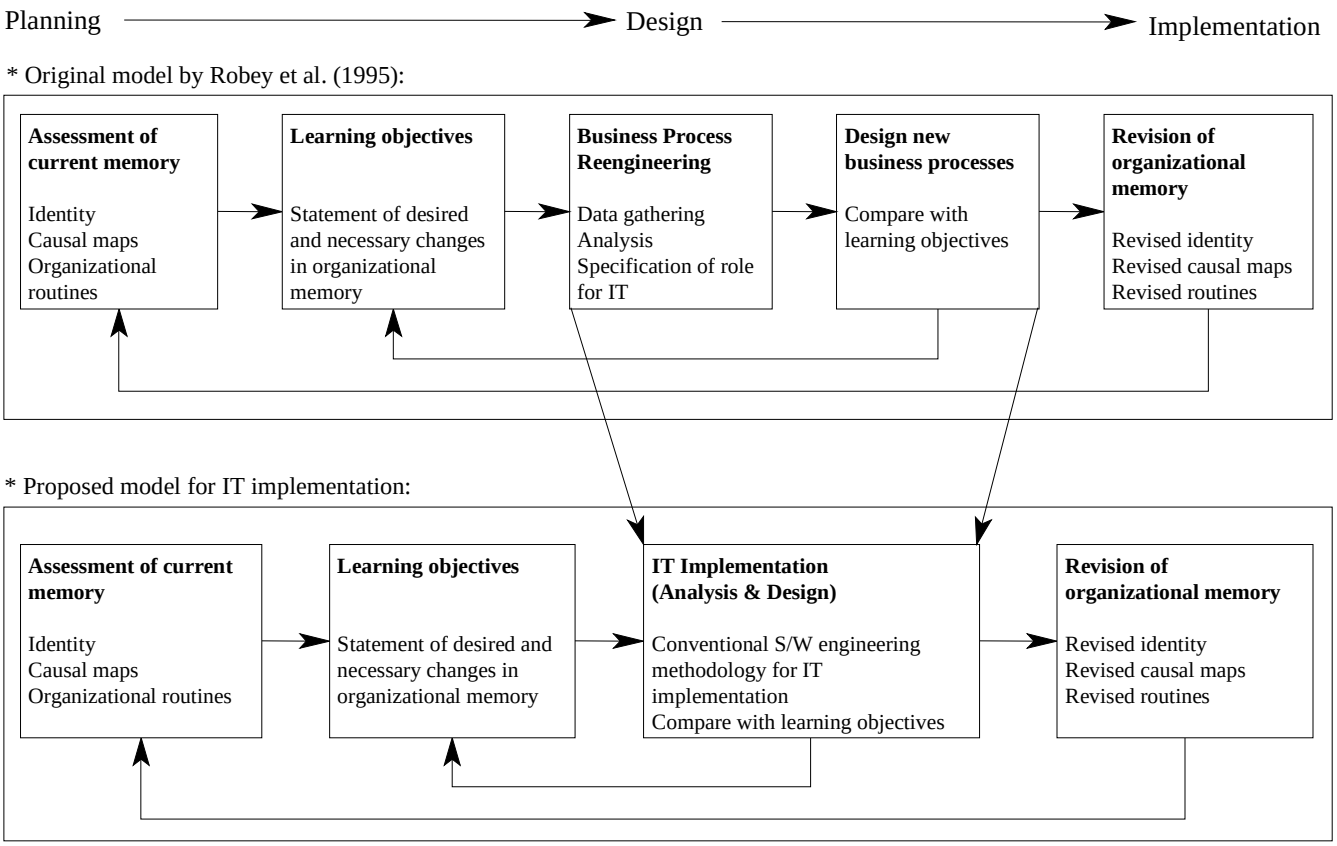

Figure 1. Proposed Organizational Learning Model for IT Implementation

to achieving the shared goals. Once the assessment of current memory and objectives for change have been established and accepted by organizational members, the specific methods of *business process reengineering* may be applied. The end result is a collection of reengineered business processes placed in the context of a revised organizational memory compatible with the changes.

In the proposed model, the stages of *business process reengineering* and *design new business process* are coalesced and replaced with *IT implementation*. It could be argued that BPR and the typical IT implementation are entirely different phenomena—one advocates drastic changes and totally redesigned processes to achieve dramatic results (Hammer 1990), while the other is usually incremental in nature and a step-by-step process (Ghezzi et al. 1991), and less ambitious in achieving dramatic gains.

Some justification for the shift in context from BPR to IT implementation is provided by Robey et al. They found that, although reengineering the business processes needs to be radical and discontinuous to be effective, the actual implementation is "a long, drawn-out process wherein only incremental progress was achieved." The implementation process should be incremental because "an organization is an intelligent cognitive entity that can improve through self-awareness." A small portion of the reengineered business processes was implemented first, very much like a pilot project, "to reduce the growing anxiety that business process reengineering was taking too long and was not producing tangible results." Through this pilot project, management demonstrated that the perceived benefits from the redesigned business processes could be realized.

There are other parallels between BPR and IT implementation. Typical IT implementation efforts are achieved through conventional software engineering techniques in an incremental manner. In fact, incrementality is a principle of software engineering paradigms like the classical waterfall model, prototyping model, and spiral model (Ghezzi et al. 1991; Pressman 1992). In the case study by Robey et al., the strategy of showing users the initial benefits from the pilot project and assessing if the organization is ready for change is synonymous in principle with the prototyping approach and risk analysis of the spiral model. Hence, BPR is not all that different from IT implementation. In fact, they are similar in some important dimensions.

In summary, Robey et al. conceived of BPR as a component of the more general process of organizational learning. Organizational learning provides the rationale for change, as well as insights into how such changes may be implemented. Reengineering focuses on the tools for converting planned objectives into realized form. The rationale for replacing the BPR components with IT implementation is similar: view IT implementation as an episode of learning within the organization, be it drastic or incremental. Thus, change must be accompanied by reconfiguration to achieve the full measure of success anticipated.

4. RESEARCH APPROACH

In order to test the model, a case study was conducted on a major insurance company, designated as INSUROR. In conducting the case study, the steps recommended by Yin (1989) were followed. A case study protocol containing an overview of the objectives of the project, field procedures, and self-directed questions was developed. Use of a standard protocol provides greater insights and is less susceptible to biases. Data collection was conducted over a period of eight months, which overlapped with the implementation and subsequent abandonment of the second IT system. Multiple interviews were conducted with the chief executive officer (CEO), the two IT department managers, five user department managers, and end-users of the systems. On average, each interview lasted one and a half hours. Permission was obtained to tape the interviews. Further clarification of the interviewees' comments was obtained via follow-up interviews, e-mail, and telephone calls.

Other sources of evidence were the project files, which included interim management reports, purchase contracts, printed copies of e-mail, and faxes. Physical artifacts, like computer product brochures, and actual computer applications being used provided yet another source of data. A final source of evidence was field observation of the work practices in the organization. The richness and variety of the data allowed triangulation of the facts, and the convenience of e-mail and onsite attachment of one of the researchers provided ample opportunities to verify facts. An evidence database, which separated the data or evidence from the final report, was maintained. This database consisted of audio tapes, transcribed copies of the audio tapes, case notes, manuscripts, and files. The purpose of the database was to allow other researchers to review the evidence independently. In this manner, the database would increase the reliability of the case study analysis.

The unit of analysis is each implemented system, where the common objective is to computerize claims processing. At INSUROR, the IT implementation has failed twice and is currently being attempted again. Each attempt is treated as a separate IT implementation endeavor because (1) each implementation has distinct starting and ending points, (2) the implementation approaches are significantly different, and (3) the implementation is handled by different IT departments. Each IT implementation endeavor provides an opportunity to trace the events, problems, and difficulties, as well as lessons learned.

5. CASE DESCRIPTION

There are 58 direct insurance and 35 reinsurance companies operating in Singapore. In 1994, the total insurance premiums of these companies were US$3.7 billion and their total assets reached US$11.3 billion. INSUROR is one

of the leaders in the insurance industry. It is among the top five insurance companies dealing in life and general insurance. In 1996, it had over 800,000 policies in force with premiums of over US$375 million.

Claims processing is a main business activity with direct impact on INSUROR's performance and profitability. It involves resolving the monetary claims filed by policyholders or other insurers acting on behalf of their insured. A typical case of claim potentially involves a lot of paperwork. Besides the standard documents used within INSUROR, it involves legal documents and correspondence with external parties (i.e., other insurers, the police department, and the courts of law). With an expanding business, INSUROR was faced with the inevitable inefficiencies associated with managing the voluminous paperwork. In the claims processing department, this problem was particularly acute. In 1994, a study conducted on the volume of paperwork in the claims department yielded the following: 1,600 claims per month, with about 30,000 documents being processed.

The procedure under the manual system is depicted in Figure 2a. Under the manual system, there were three main problems associated with handling the voluminous paperwork. First, there were difficulties in locating the paper files when requested. Second, paper files were commonly misplaced. Third, only one staff member could refer to a file at any one time. Besides solving these problems, the anticipated benefits of a computerized system included: (1) faster response to inquiries on the status of a claim, (2) increased productivity by computerizing parts of the claims processing, (3) office space savings, and (4) archiving the documents cost-effectively. Some functions were supported by an application developed in-house on a Hewlett Packard (HP) minicomputer system. The functions included (1) generating standard letters to policyholders, (2) capturing claims information for report generation, and (3) retrieving policyholders' details.

INSUROR has a strong culture of using IT and the CEO believes that IT will provide strategic advantage in a highly competitive industry. In the early 1990s, imaging workflow was touted as the solution to handling voluminous paperwork in information-intensive industries such as insurance. This development in IT and the concept of the paper-less office aroused the interest of top management at INSUROR. Hence, an IT solution was sought to improve the efficiency and quality of service. Table 1 compares the characteristics of the systems implemented (System 1 and System 2). Despite the failure of the two systems, management commitment to improve claims processing was unabated. At the time of this study, System 3 was under development.

5.1 System 1 (Imaging Workflow)

The first system is a Windows-based imaging workflow application developed by an American firm specializing in workflow systems. The concept behind the imaging workflow application is to replace the flow of physical paper documents with electronic images. Document scanners were used to scan the images of documents which were then stored in electronic files. The required hardware was sourced from various vendors, while the proprietary software

Table 1. Characteristics of Systems Implemented

	System 1	System 2
1.	Imaged-based	Text-based
2.	Separate and stand-alone	Integrated with HP3000 system
3.	Windows GUI user interface	Text, menu-driven user interface
4.	Implemented by consultants	Implemented entirely in-house
5.	PC platform on LAN (Client-Server)	HP platform (Host-Terminal)
6.	Documents stored as electronic images	Documents summarized in text form

was available as a general-purpose imaging workflow that could be customized by incorporating rules to route imaged documents to various users on the system. At the time of implementation, INSUROR was also involved in a separate project to migrate applications from Microsoft DOS to the Microsoft Windows platform.

5.1.1 Scanning the Environment

Potential vendors dealing in imaging workflow systems were identified and invited to submit proposals. After evaluating the proposals and system demonstrations, a consulting firm was selected. The consultants in this firm had prior experience with other local organizations. An experienced claims officer acted as a facilitator to assist the consultants in studying the current paper flow and translating it to the workflow system. System 1 operated in parallel with the manual system as a contingency. There was also a need to continue handling old cases on paper files and relieving the backlog while the users familiarized themselves with the new system. The final system consisted of three file servers, 19 computer terminals, and one scanner. The revised claims procedure under System 1 is depicted in Figure 2b.

5.1.2 Initial Results

The initial implementation was smooth and on schedule. The consultants provided two weeks of training for the end-users. Initial results based on a small sample of claims were encouraging. The average time taken to handle a simple case dropped from the previous 40 to 50 minutes to 25 to 30 minutes. For complicated cases, the average time taken dropped from one to two hours to 40 to 80 minutes. Other benefits included significant time savings in searching for files, as scanned documents could be retrieved electronically. In an internal report, it was mentioned that the users were still familiarizing themselves with the system, and another two to three months would be required for users to fully exploit the potential of the system. It was further suggested that a productivity increase of up to 20% could be expected in that time period, and an additional 10% to 20% might be achievable in the long run.

5.1.3 Problems

When the claims department began to use System 1 with the full load, problems began to appear. These problems included (1) lack of integration with the HP system resulting in need to maintain data integrity on both the HP system and System 1, (2) system instability, which resulted in System 1 "crashing," (3) important documents and photographs were not scanned in or were of poorer quality than the originals, (4) proprietary software prevented technical staff from fine-tuning the system or solving problems without relying on the consultants, (5) a backlog of documents to be scanned and indexed, and (6) slow response time and frustration experienced due to inadequate hardware resources. Most of the technical problems might be due to the infant state of technology at that time. These problems are elaborated on in Appendix A.

5.1.4 Assessment

Analysis of the evidence database led to the observation that the claims department had to reorganize to integrate their manual procedures with System 1. For example, a user manager noted that manipulating images on the system was difficult and suggested standardizing the important information to be scanned into the system. Another example was the deployment of additional temporary staff to assist at the scanning and indexing stations to relieve the backlog of documents. However, it was difficult to retain staff as they resigned out of boredom. Eventually, after one year of trying to solve the technical problems and improve the operating procedures, the system was abandoned as the problems proved insurmountable. However, the system was not shut down completely but was used occasionally to access documents previously processed on the system. In the meantime, documents scanned into System 1 were slowly reconstructed back into manual files for future use.

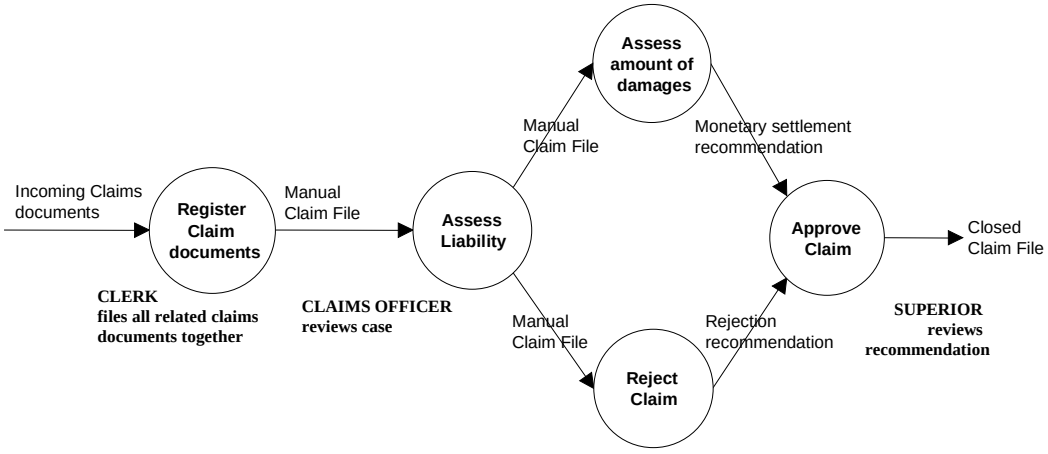

Figure 2a. Procedures under the manual system

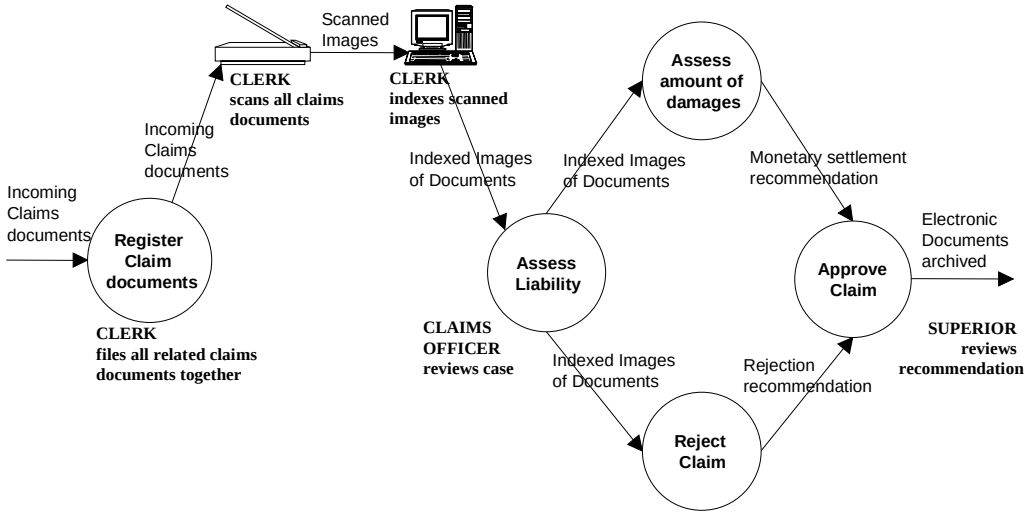

Figure 2b. Procedures under System 1

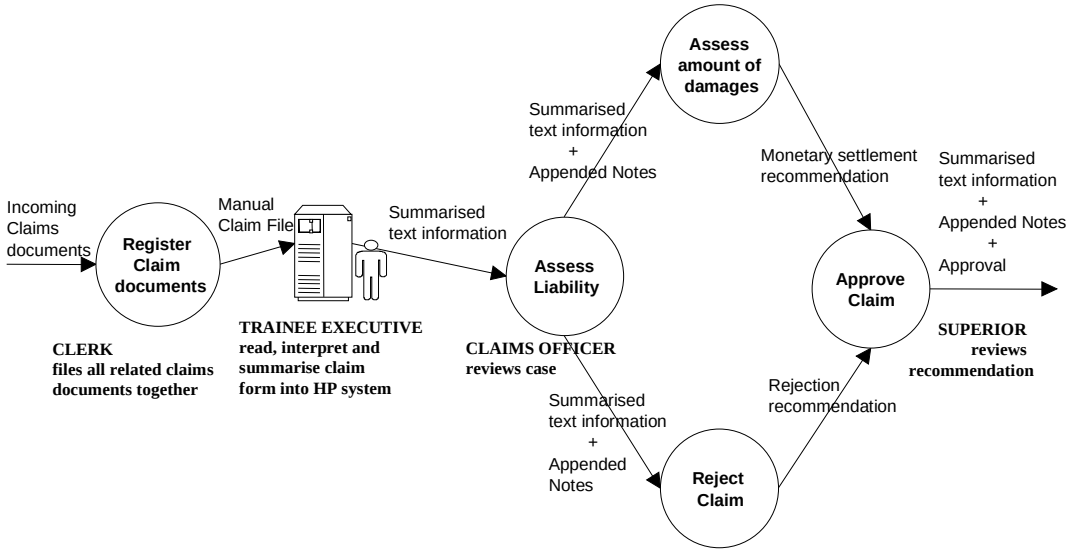

Figure 2c. Procedures under System 2

5.2 System 2 (Text-Based)

5.2.1 Scanning the Environment

On a visit to an insurance company in the United States, the CEO of INSUROR chanced upon a successful claims processing system that did not require the use of images, but instead utilized mainly textual information. When System 1 was abandoned, the CEO commissioned a new manager to lead a special project team to look into this approach.

5.2.2 Learning from System 1 Experiences

Based on their previous experience, the management and users realized that with the state of technology then, an imaging solution might not be technically stable. It was also expensive to maintain and expand. Further, the need to integrate with the HP system was a critical factor of implementation success. Also, it was inevitable that fine-tuning of the system would be required and hence it would not be desirable to be too dependent on the vendors. Despite the failure of System 1, it was clear that a computerized solution would have important benefits such as a faster response to queries on the status of claims and better tracking of files. Misplaced files were a thing of the past and the ability to provide superior customer service through speedy response was very much appreciated.

Management decided to concentrate efforts on expanding the existing HP system and building a text-based system with workflow capabilities. It was envisaged that this would solve the issue of maintaining the databases residing on the HP system and facilitate control of data and maintenance. Further, the HP system had an almost flawless track record of stability and reliability compared to the Windows platform on the LAN. However, this was the first time that the MIS department was developing an application involving routing and queuing functions, with a high degree of interaction with the users. Typical applications developed prior to System 2 were generally transaction processing systems that ran in batch mode, online database query-and-update applications, and report-generation applications. Existing in-house expertise could be tapped to develop and test the applications and still allow for ongoing modifications to fine-tune the system. Various parts of the existing system were expanded, and new functions were designed and developed incrementally, including (1) routing to queues similar to System 1, (2) generation of standard letters, (3) data entry and inquiry of claims processing details, and (4) an automated payment system.

Based on the text-based claims processing system that was observed in the US company, a different approach was taken in the design of System 2. The main difference from System 1 was the use of textual information, instead of images, to process a claim. It was believed that not all information was critical to processing a claim, but there was certain standard information that needed to be captured. The new procedure under System 2 is depicted in Figure 2c.

5.2.3 Initial Results

One of the main benefits of System 2 was allowing telephone operators to answer claim-status queries quickly without having to search for the paper documents. This query facility was welcomed by the operators. Another advantage was the “Notes” facility, which allowed users to write down what has been done on the case. This facility enabled users to track the history concerning a claim and was especially useful when they needed to review a case.

5.2.4 Problems

System 2 met with a new set of problems. These included (1) difficulties in processing claims using only the summarized information, (2) time-consuming new procedures, and (3) difficulties in using a menu-driven system. These problems are elaborated on in Appendix B.

5.2.5 Assessment

In System 2, a special team of ten executives was introduced into the claims department. Their duties were to summarize claim forms so that the users could act on the information. No bottleneck was associated with the summarizing of claim forms. However, these executives experienced boredom from summarizing claims forms all day. They requested to be transferred to other departments and finding replacements proved difficult. Subsequently, the users reverted back to manual files, but continued to use the "Notes" facility to keep track of claims status. This had the added benefit of allowing telephone operators to answer claim-status queries from policyholders and other parties. Eventually, while the system was still undergoing refinements, it was abandoned and management decided in favor of the latest reincarnation (System 3).

5.3 Epilogue: System 3 (Best of Both Worlds?)

The latest attempt is another in-house effort led by another department. Having gained experience in developing Windows-based applications, the PC LAN department ventured to produce a prototype of a general archival system, System A, that could store and retrieve imaged documents as well. After System 1 was terminated, the claims department used System A to view some of the important documents already scanned into the workflow. When users had to resort to using the summarized information in System 2, they realized that they could use System A to scan and retrieve the claim documents as well. In this way, they could refer to the original details if they felt that the summarized information was inadequate.

With the apparent lack of success in encouraging users to use System 2, top management decided to abandon it and go ahead with System 3. There was, however, one major development: the CEO was actively involved in the latest project. System 3 will have hybrid features resembling the imaging workflow technology of System 1 and the "Notes" facility of System 2. In some ways, the imaging capabilities in System 3 will be technically more cost-effective and advanced than those found in System 1. A "gray-to-scale" feature as well as image enhancing features were added to improve the quality of the scanned documents. A working prototype of System 3 was targeted to be ready by the middle of 1997. Positive feedback was given by the users who had a preview of System 3.

6. DISCUSSION

6.1 Support for Proposed Model

Even with top management support and user involvement, two success factors that have been identified in the traditional IS literature, the two systems ended up as failures. From an organizational learning perspective, the proposed model suggests that for an IT implementation to succeed, it should be preceded by an assessment of the elements of organizational memory and a deliberate effort should be made to change and reconfigure these elements so that they will be congruent with the new combination of technology, people, and processes after the implementation. Another way of looking at the model is that if the preceding step of "assess-reconfigure" was not performed properly, it is likely that implementation will fail. This evaluation method is necessarily limited due to the absence of a successful system to compare with the failed systems at the time of the study.

In INSUROR, one element of organizational memory, organizational routines, played an important part in the failure of System 1. Albeit technical problems, some user managers suggested that System 1 might have succeeded if the operational procedures specified that only the most important documents were to be scanned into the system, instead of every document. This would have avoided the bottleneck at the scanning/indexing stations. Also, the optical disk

would not have been cluttered with unnecessary information, and the response time would have improved. Further, management could have been persuaded to invest in a "jukebox" because System 1 would probably have been stable under the lighter load. When the users were more familiar with the system, it could have been fine-tuned.

In System 2, the claims staff were uncomfortable working without color photographs and using textual information summarized by others. Experienced users, who were used to working with manual files, could not be persuaded to use the system. If the MIS department had attempted to examine the causal maps of the users prior to or just after implementation, two important findings could have been identified. First, in order for the users to get used to the new paradigm of claims processing, they had to change their causal maps of how to interpret the summarized information provided by the system. Second, surfacing the causal maps could have indicated that the system could not support the information needs of the users.

In general, the evidence supports the proposed model. However, the proposed model does not explain how learning that occurred due to the implementation of Systems 1 and 2 contributed to the pool of required technical expertise and know-how that is crucial to the development of System 3. Through learning from the experiences of Systems 1 and 2, there was a significant change in the perception of the MIS, PC LAN, and user departments toward IT. Through learning-by-doing and research and development, the IT departments acquired technologies that were critical components of System 3. Learning also occurred among the users of the systems and, through the experience gained, they became more receptive toward IT. Further, solutions to the main problems that affected the success of the two earlier systems would now be implemented in System 3, because these problems were now better understood. The objectives of the projects and the benefits of switching from the manual system to a computerized system could now be clearly articulated. It was also observed that through interacting with technology and reflecting on the earlier failures, the users underwent a marked change in their expectations of IT. They realize that they should have realistic expectations if the project is to succeed. In summary, there are two facets to the organizational learning experience. One is the accumulation of technical expertise (learning by the IT departments). The other is the tacit knowledge and change in perception as a result of using technology (learning by the user departments).

6.2 Technological Perspective of Organizational Learning

Attewell proposed that organizational learning is partly a consequence of the immobility of technical knowledge: the burden of developing technical know-how becomes a hurdle to technology adoption. He distinguished between two types of communication in the diffusion process: signaling versus know-how. Signaling refers to communication about the existence and potential gains of a new innovation. In classical diffusion theories, it is assumed that when an organization learns of an innovation, and is persuaded about the benefits of using it, the innovation will be adopted. Technical knowledge and know-how, however, require both individual and organizational learning because it is usually the case that technology is transferred to the organization but not the know-how, which is required for effective use of the technology. There are two ways to gain technical knowledge: learning-by-using and learning-by-doing (Levitt and March 1988). For complex technologies, users develop an awareness for the strengths and weaknesses of the technology by using the system, while organizations learn about how best to put technology to effective use by gradually modifying (doing) the technology to suit their needs.

In the development of System 1, when management decided that a computerized solution was necessary, they scanned the environment for a solution and were made aware of the existence and potential of imaging workflow technology. However, they had neither the expertise to implement a customized in-house system based on this new technology, nor the expertise required to use the complex innovation successfully. Consultants were engaged to lower the technical knowledge barrier and transfer imaging workflow technology into INSUROR. In the development of

System 2, management chanced upon a claims processing system based on textual information in another company and decided to develop a text-based workflow system. This is a form of signaling.

When System 1 failed, an interim system (System A) was developed to retrieve information stored within the proprietary System 1. Through learning-by-doing, the PC LAN department gained technical knowledge and expertise in developing image-based applications, a key technology in imaging workflow. Further, the need to integrate the client-server technology and the HP system led to development of socket technology by the PC LAN and MIS departments. The expertise gained in the area of socket technology ensured that another major knowledge barrier was surmounted.

Similarly, the users of System 1 went through a learning experience and gained knowledge of using Windows-based applications. Through learning-by-using, the technical knowledge mastered included learning a new paradigm of using icons, the mouse, and viewing documents in Windows, and the use of computer jargon. The familiarity with the technology from using it daily helped the users to overcome the phobia associated with any new system. Further,

Maturity of Technical Knowledge →

	Before System 1	**After System 1**	**After System 2**	**System 3 (Under Development)**
USER DEPT	Users largely computer-illiterate in GUI Windows applications Users familiar with text-based systems only Initial phobia of new system	Users accustomed to using GUI Windows applications Users familiar with both text and Windows systems		Users accustomed to using GUI Windows applications Users familiar with both text and Windows systems Users confident of using new applications
IT DEPTS (MIS and PC LAN)	Software development on HP System and DOS PCs Adopting Windows Operating System in LAN No prior experience in developing workflow application	Visual Basic adopted in PC LAN Dept Collaborative research on Socket technology between IT departments GUI Windows applications are developed and used enterprise-wide	Windows-based PowerBuilder adopted in MIS Department Socket technology available to integrate with HP system Acquired imaging know-how through R&D, learning by doing	Visual programming languages widely adopted Socket technology available to integrate with HP system Acquired latest imaging know-how through R&D, learning by doing Proliferation of GUI Windows application Development of workflow system targeted for enterprise-wide implementation

Figure 3. Progression of Technical Knowledge Learned

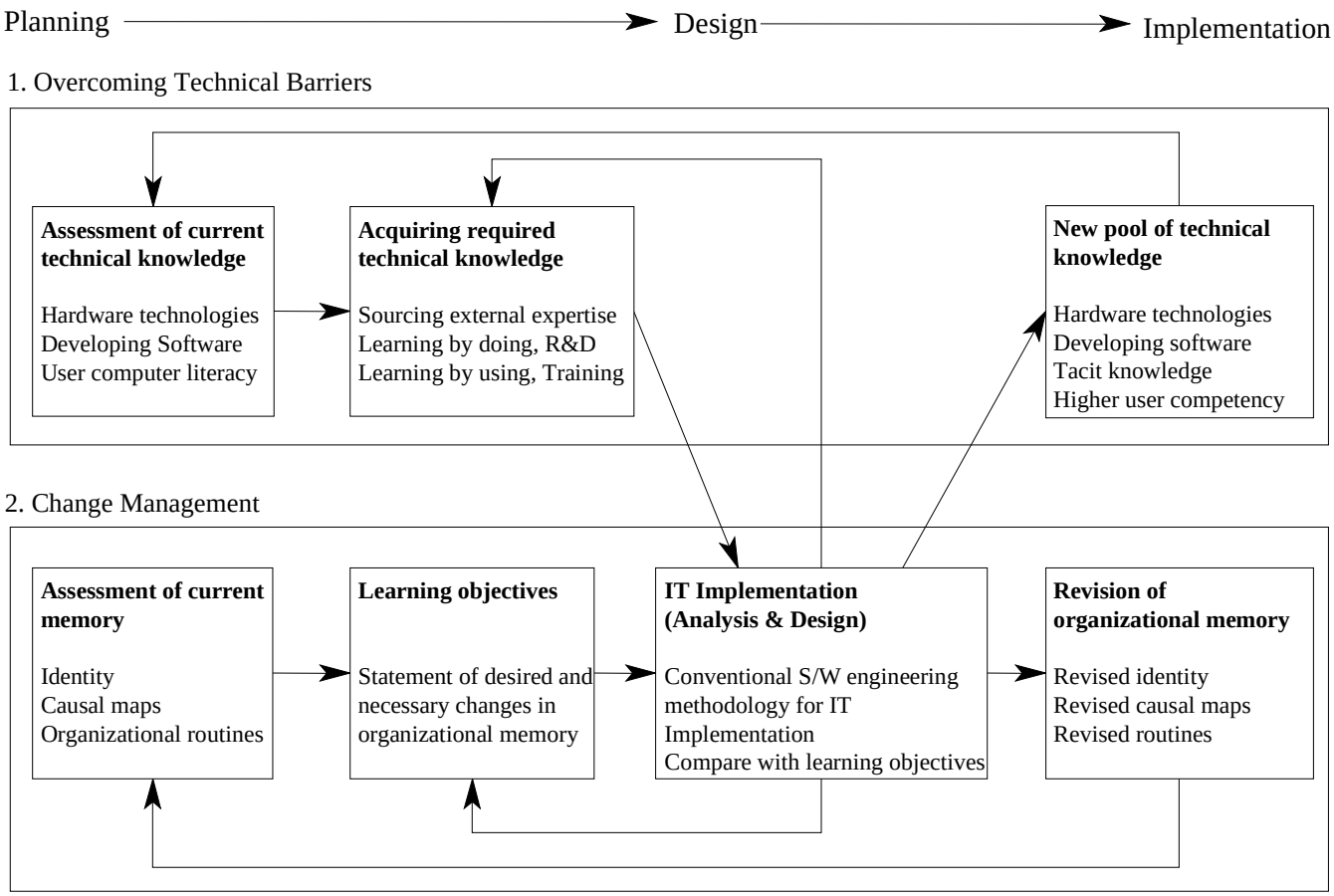

Figure 4. Revised Organizational Learning Model for IT Implementation

the users could appreciate the impact of an image-based solution on the work processes. They expressed awareness of the strengths and weaknesses of the technology and articulated the changes that must be made to the existing processes. For example, in preparation for the implementation of System 3, one user manager saw the need to acquire more scanners and manpower to support the "back-room operation." This awareness goes beyond a superficial level of balancing the quantity of documents with the scanning capacity. The same user manager also articulated the human resource problems and outlined strategies to procure the human resources needed for the monotonous task by adopting job rotation and sourcing for alternative temporary staff. The implications of the above management policies and the tradeoffs on the new system were understood as well. Knowing the implications of scanning and indexing too many documents is notable because it reflects cognition (understanding the reasons and consequences of delay in the scanning/indexing stations), as well as behavioral change (adopting a more pragmatic approach) in agreeing to compromise some convenience and functionality in order to achieve a successful new system. Figure 3 summarizes the maturity of the technical knowledge of the IT departments and user department from System 1 leading up to System 3.

6.3 Extended Organizational Learning Model

The proposed model is extended to reflect the technological perspective of organizational learning. An organization cannot prepare for change if it does not have the technical knowledge and expertise required for IT implementation and does not understand how IT will impact business processes. A new learning process to conceptualize the notion of overcoming technical barriers is incorporated into the model (see Figure 4). *In assessment of current technical knowledge*, an analysis of the current level of technical knowledge is necessary to gauge the level of technical competence in the IT and user departments. If the requisite technical knowledge for IT implementation is deemed to be insufficient, the next stage, *acquiring required technical knowledge*, serves to upgrade the level of technical competency through external expertise, learning-by-doing and learning-by-using. A feedback loop from *IT implementation* to *acquiring required technical knowledge* reflects that overcoming the knowledge barrier is a continuous and evolutionary process. Feedback occurs through the IT implementation process as knowledge is gained when the particular technology or software development is perfected and better understood. In the user departments, users may become accustomed to using the particular hardware or user interface and hence become more confident and less fearful of new technology. It is implicit that the users' mental models and causal maps may change as a result of learning-by-using. While expertise may be brought in from external sources, the model highlights the fact that it may be some time before users and technical staff develop the skills to master it effectively through exploration (learning-by-using or training) and experimentation (learning-by-doing or research and development).

7. CONCLUSION

This case study shows that it is useful to view IT implementation as an episode of organizational learning. By assessing current organizational memory and technical knowledge, potential problems with business processes and technical know-how could be surfaced. It is important that both users and IT personnel understand how technology can impact the business processes. Users can accumulate tacit knowledge about the technology and how it can impact their work. Then, they can foresee potential bottlenecks within the system and anticipate the tradeoffs that will be required for the new system to succeed. IT personnel need to develop expertise in the technology to be implemented either through training or research and development. In the face of rapid technological change, there is utility in incorporating a technological perspective into the organizational learning model. According to the CEO, "If not for going through Systems 1 and 2, we would not have learned the skills to build System 3."

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Appendix A. Problems with System 1

1. Lack of integration with the HP system resulting in need to maintain data integrity on both the HP system and System 1

   As the number of claims processed on the system increased, the need to update the same information twice was a burden on the users and slowed down the processing speed on System 1. This also meant that the information in the HP system sometimes would not be up-to-date. This had serious repercussions as other departments were dependent on the HP databases. For example, after the approval of a claim, payment was initiated by using a separate payment system residing on the HP system. Hence, the users either had to process the payment on a stand-alone HP terminal or switch to another application that could emulate the HP terminal in a Windows environment. In addition, the users frequently needed to retrieve information (e.g., details of policyholders) from the HP system. Information from the HP system could not be directly transferred into System 1 because the systems were not compatible. The net effect was that users felt that their flow of thought and work were interrupted frequently by having to switch between applications.

2. System instability which resulted in System 1 "crashing"

   This led to serious and embarrassing stoppages because the users could not retrieve any files from the system. The users described how, when System 1 "crashes," an error message would appear on the computer screen or the system would suddenly "freeze" and not respond to commands. No work could be done until the vendor arrived at the scene to remedy the situation. Depending on the fault, the consultants sometimes took days to revive the system—the longest breakdown experienced was one week. When the system was revived, document images were lost or were not in the correct sequence.

3. Important documents and photographs were not scanned in or were of poorer quality than the originals

   In a management report about two weeks after the implementation, the issue was raised that only two out of possibly up to ten color photographs were scanned into the system. The users felt that it could affect their ability to make an informed decision because an important photograph was not scanned. In addition, the scanned images were perceived as not identical to the original and were displayed in gray-scale. An unforeseen problem also emerged:

   > You could not compare between documents. With paper files, we could just place different documents from two or more files side by side … but on the system, we had to click on the screen here and there, but could only see one image at a time.

   In complicated cases, this was a serious drawback.

4. Proprietary software prevented technical staff from fine-tuning the system or solving problems without relying on the consultants

   When the system became unstable, the users had to appeal to the consultants to rectify the situation. In-house computing staff from the PC LAN department could not provide "patches" because the system was proprietary and the consultants could not reveal the technical details of the system. Among the errors that surfaced was a cryptic message, *"Cannot load picture file,"* that appeared every time a user logged on to System 1. The problem was solved by the consultants three months after installation.

5. Backlog of documents to be scanned and indexed

   As an increasing number of cases were processed by the system, bottlenecks in the scanning/indexing process became evident. The scanning station with one high-speed scanner manned by one permanent staff was overwhelmed by the volume of incoming

documents. This meant that when dealing with a claim, a user might find that the latest documents were not captured in the system. As one user put it, "Sometimes when the other party calls up to say that they had already replied, we realized that it was somewhere waiting to be scanned into System 1. It can be quite embarrassing."
In the minutes of a meeting, it was revealed that:

> We [users] should perhaps look into the organization of our human resources… they [consultants] pointed out that much of our scanning staff's time was wasted in removing staples, attaching and detaching the documents. To improve the rate of scanning, we [users] did try to deploy one staff to do these tasks before passing on to scan. This method we discovered does not save us much time either. The other area of concern is indexing. We could either expand the staff strength or deploy one staff from each section to handle the voluminous task.

It was discovered that the indexing procedure of System 1 required the users to index almost every document pertaining to a claim and this took too much time. As one of the users aptly described, "It was like a see-saw. If the bottleneck was at the scanning station, the indexing station would be idle. If scanning caught up, the indexing station would have a lot of backlog."

When the staff assigned to perform indexing was transferred away, it exacerbated the problem because it was not easy to train a new staff. It would take about two to three days to educate them on the types of documents. A longer time was required for the new staff to be familiarized with the software. Although the staff worked overtime on most days and on weekends to meet the influx of documents, the backlog continued. Three months after installation, some 6,700 documents were not indexed; six months after, the backlog increased to 14,600 documents.

6. Slow response from the system and frustration experienced due to inadequate hardware resources

Documents were scanned into the system and stored on optical disks, and retrieved from a file server. An optical disk could store images on both surfaces. When the disk ran out of storage space, a user manually flipped it to the other surface or inserted a new disk. As more images were stored on the system, the response time increased. It took ten minutes before an image could be viewed. The situation was exacerbated when different users had to retrieve images stored on different surfaces of the same, or on different, disks. As only one server was available, other users had to wait. Should a user unknowingly flip or change an optical disk while another was using it, the other user would be interrupted in the process. To further complicate the issue, the scanning and indexing stations also had to access the optical disks during their operations. However, only 19 users could access the system simultaneously. The consultants subsequently recommended that an additional piece of expensive hardware, the "jukebox," could solve the problem. The "jukebox" could hold many disks and automatically find the correct one without manual intervention. However, management did not want to invest in it, as system stability was still an overriding issue that could not be resolved.

Appendix B. Problems with System 2

1. Users found it very difficult to process the claims using only the summarized information

The experienced users were already accustomed to examining photographs to spot inconsistencies and reading claim forms and police reports with sketches of the accidents to visualize how an accident happened. Without the actual documents, they felt that they could not arrive at an informed decision. This was because the summary often did not contain enough information. They felt a strong need to look up the actual documents for confirmation. Sometimes, the executives writing the summaries might miss some subtle information that an experienced user could pick out, or unintentionally leave out vital information. Such information could affect the eventual outcome of a claim. The users also felt that different individuals had different conceptual models of how accidents happened. Although an effort was made to standardize the summary so that all necessary information was captured, the users felt that they could not rely on second-hand information for such an important task as assessing liability, much less information interpreted by a "third party." As one user put it:

> Each case is different, although some of the information is the same… Even if I had summarized the information myself, after a while, I may need to refer back to the original document after new documents are received.

Their lack of confidence with the system eventually led them to fall back on manual files and only use a portion of the functions available.

2. Users found the new procedures time-consuming

Users' duties were expanded to include summarizing other documents received (executives summarized only the claim form). They were supposed to perform this additional task in order to allow other users to keep abreast of the development of the claim. However, after initial attempts, the users began to feel the strain of having to perform the extra duties, especially when they felt that the same information was available on paper. Furthermore, photographs were very difficult to summarize.

3. Users found it difficult to use the menu-driven system

In text mode, the computer screen could accommodate limited information. Hence, different functions were divided into sub-menus and users could get to different functions by choosing a desired option from a main menu. Sub-menus likewise could contain further lower-level sub-menus. Without a graphical user interface, users could not directly access functions by using the mouse. Also, the user interface was perceived to be unfriendly: to access a document in the middle of a queue, a user had to scroll through all the previous ones. Due to the design of the queue, a claim was only removed when its payment was approved. However, very often a claim could not be approved until required documents arrived or letters from external parties were received. One of the users recounted the surprise: "I logged into the system and was shocked to see some 300 to 400 files in the queue."