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The cultural and political influences on IT diffusion in the People's Republic of China

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ABSTRACT

This paper investigates how political and cultural influences impact the diffusion and use of information technology (IT) in the People's Republic of China. Five separate interviews were conducted with individuals in five state-owned businesses. Based upon our interviews, it appears that the role and use of information technology in these organizations depends largely upon societal spectrums such as politics, culture, economic status, and the educational levels of the employees.

INTRODUCTION

With over 3.6 million square miles and a population of 1,190,430,000 (1992 estimate), sheer size alone makes the People's Republic of China (PRC) an important member of the world community (Concise Columbia Encyclopedia). Since 1949 the PR's international trade policy and trading partners have been in a state of change. The PRC's initial trading partners included the former Soviet Union and other communist-block countries. As relations with these countries became less friendly, the PRC began to increase its trade with Japan, West Germany, the United States, and Canada. Furthermore, the PRC's total trade with non-communist countries increased from \$1.3 billion to approximately \$32 billion between 1959 and 1982. The economy has grown dramatically and is now the third largest in the world (Concise Columbia Encyclopedia).

The PRC's economic system was formerly centrally planned, where an authoritarian economy required strict government control and an economic model based on pure public ownership. A planned economy, whereby the government controlled the supply, production, and sale of all goods, did not support any competition in the marketplace. Private ownership was not allowed and any wealth was to be divided equally among the people.

Within the past decade, however, the PRC has begun to show the sometimes painful change from pure government or public ownership to a "socialist market economy" that allows for greater private ownership and joint ownership with foreign companies. This move toward a new economy will require access to new trade and technologies that can come from closer relationships with countries such as Japan, West Germany, the United States, and the United Kingdom.

The focus of this paper is to investigate and describe the role and use of information technology (IT) in the PRC. The findings of this study should be of value to both IS practitioners and IS researchers. For practitioners, this study may provide some insight for organizations contemplating a new business venture in the PRC. Understanding how these factors influence the role and use of IT may define or limit the types of systems developed and how those systems may or may not support the organization. In addition, few studies have looked at the role and application of information technology in China (Dologite, Fang, Chen, & Mockler, 1995). This study provides a unique opportunity to view the diffusion of IT in country just at the beginning of the information revolution.

PREVIOUS STUDIES

Franz, Wynne, and Fu (1991) provide one of the earliest studies in this important area. Their study included five state-owned businesses and reported that IT supported primarily the operational areas of these organizations. Moreover, the IS manager's job focused more on the technology, and IT did not support strategic decision-making.

A similar study in 1995 by Dologite, Fang, Chen, and Mockler looked at four state-owned companies located in Beijing. The authors postulated that the role of IT would be more prevalent after four more years of economic reform. They reported that Chinese management is now beginning to view information technology as a vehicle for strategic competitiveness as China evolves from a planned to a free-market-based economy. However, the Chinese IS manager's role has remained relatively unchanged, while these companies continue to implement more advanced information systems and technologies.

METHODOLOGY

Semi-structured interviews were conducted with a knowledgeable individual in five state-owned businesses in the People's Republic of China. The organizations included a bank, a stock exchange, an aircraft manufacturer, a trading company, and a textile machine manufacturer. Interviews were conducted from May, 1995 through June, 1995.

Four of the interviews were conducted at the organization and were tape-recorded so that information could be translated and subsequently analyzed. One interview was conducted over the phone since time and distance made travel to the company unfeasible.

Each interview focused on two parts. In the first part, the individual being interviewed was asked to provide background information about the company and to describe how IT is being

implemented in the organization. In the second part, the participant was asked to describe some of the important IT-related problems or challenges faced by the organization. At the request of the interviewees, company names and names of individuals will remain anonymous.

INTERVIEWS

A Bank in Wuhan

Background: Although the concept of a credit card is relatively new in China, the credit card is beginning to catch on quickly and is viewed as having great potential due to China's large population. Financial institutions are now starting to compete for customers and encouraging those customers to use credit cards.

In order to take advantage of this opportunity, a bank located in Wuhan entered the credit card business three years ago. In early 1994, the bank's management decided to develop an information system for credit card management and hired a consulting company to develop the system. The head of the system development team provided background information about the system and described some of the challenges involving the credit card system.

The implementation of the entire credit card system was divided into three subprojects or components. At the time of the interview, the first component of the system had been in use for less than a month. This component supports various business activities such as accounting, authorization, card management, direct deposit, and telephone credit information.

The other two components of the credit card project are expected to be completed and implemented concurrently by June 1996. The second and third components will provide point of sale (POS) and automated teller machine (ATM) capabilities, as well as provide additional telephone service features and payment services. Moreover, a decision support feature will be added to the system for supporting the information needs of the top management. Eventually, management will be able to analyze business performance by department, region, or salesperson, as well as identify potential problems or opportunities. The systems will also have a risk analysis function and an important customer follow-up feature.

The system uses a STRATUS RS/25 as the host computer. This machine was chosen for its fault tolerance and for the associated software's protection capabilities. The bank uses a X.25 packet switching network using IBM's SNA tree topology with 1700 terminals. Informix is used as their platform for database applications.

Challenges: The head of the credit card system development project described the development team's frustration during the analysis and design phases. Since the credit card is a recent phenomenon in China, no one in the bank had any extensive knowledge about the credit card business. Many employees recently joined the bank as a result of the rapid growth of the business and the subsequent demand for more employees. These newly hired employees are still learning the business and therefore are unable to offer accurate or complete user requirements. As a result, both the users and the developers attempted to learn the credit card business while developing the system.

Another challenge involves top management's ability to plan for the long run. A planned market economy may have focused management's attention on short-term goals. However, as China moves towards a market economy, it appears that the bank's managers lack the tools and experience to forecast future business trends or respond appropriately to changing environments.

The head of the project development team also expressed concern about the employees' lack of basic computer knowledge. As she explained, the bank is experiencing many problems with data entry. It appears that the data entry clerks lack a basic understanding of how the system works and thus tend to enter inaccurate or incomplete data. The bank has begun to address this problem by offering intensive training that focuses not only on the system but on basic knowledge of computers.

Security has also become an important issue after some unauthorized modification of information was discovered. The bank is now making progress on providing better security controls.

Stock Exchange in Wuhan

Background: The stock exchange is another new phenomenon in China. The nature of the business requires that the stock exchange use the latest technology to obtain internationally standardized information and to provide shorter settlement and delivery time. The head of the computer department was interviewed, and he described how IT is being used as well as some of the challenges encountered.

The stock exchange in Wuhan was the third stock exchange established in China. With about 150 employees, the stock exchange maintains 271 memberships, where the majority of these memberships are non-local. The stock exchange supports a volume of approximately 50.8 billion Yuan (approximately 6.2 billion U.S. dollars) in treasury government bond transactions. This accounts for about two-thirds of the total transaction volume in China. Moreover, the stock exchange has two trading floors with 500 seats on each floor.

The stock exchange uses a Fiber Distributed Data Interface (FDDI) token ring network with 8000 terminals attached to it. The system uses STRATUS XA/R300 computer as the host computer which was chosen for its reliability. The FDDI LAN has six smaller LANs connected to it: a stock quotation LAN, an over-the-counter transaction LAN, a quotation broadcasting LAN, a settlement and delivery LAN, a transaction math LAN, and a central registration LAN.

Challenges: One important challenge concerns the accuracy of the data when converted from English to Chinese. Conversion software developed in China was said to be error prone and many times could not distinguish between text and graphic characters. Conversion software developed in Taiwan does not have this problem; however, Taiwan and China use different language characters.

The demand for computer-related training throughout the organization was cited as another problem. Due to the nature of the business, the stock exchange depends heavily on information technology. Subsequently, employees must have a good, basic understanding of

information technology in order to use the information systems. To support this need, the computer department finds itself having to offer basic computer training to all levels of employees in the organization.

Aircraft Manufacturing Company in Sichuan Province

Background. The aircraft manufacturing company located in Sichuan Province is a prominent manufacturer and exporter of aircraft. The company is owned by the Ministry of Space Industry and currently has 20,000 employees. A telephone interview was conducted with a project leader of the systems design team. Due to the length of travel, an on-site interview was not feasible.

The company's core information system is a Manufacturing Resources Planning (MRP-II) system that supports personnel, accounting, material, suppliers, sales, and production functions. The company started with a CAD/CAM system in the 1970s and eventually expanded its information technology base in 1989 with the addition of 4 minicomputers, 10 workstations, and over 300 PCs. At that time, the company employed 726 people as part of their computer application team (i.e., IS function). Currently, the company has 22 system administrators, 138 computer operators, 75 hardware maintenance employees, and 491 software developers.

The development of the MRP-II system began in early 1990 as a result of organization's need to develop new products, improve efficiency, lower costs, support shorter production cycles, reduce inventory, improve quality, and respond more quickly to market demands.

The company uses an HP3000/950 as their host computer. TCP/IP is used as the network protocol, and IMAGE, ORACLE, and dBase are used to support database applications.

A materials management module and a production management module were purchased from Hewlett-Packard. A labor management component and a financial management component were developed by the company. A business management component is currently under development.

Challenges: According to the project leader, the notion of using information systems to support management decision-making was not widely accepted by top management in the beginning. Moreover, the IS function had limited responsibility and lacked the support of top management. To compound the problem, systems development was left largely in the hands of technical people who lacked in general business background.

Furthermore, a pyramid structure of the organization created many levels of management. As a result, information flowed up and down the organization with relative ease, but not laterally among departments and functions. Business procedures and responsibilities overlapped frequently among individuals and departments. Subsequently, this caused problems with data accuracy since there was little standardization of operations, rules, or procedures. A lack of basic computer skills and understanding was also cited as another important challenge since proper training is essential to ensure that the system is used correctly.

A Manufacturing and Trading Company: Shanghai Branch

Background: The manufacturing and trading company that participated in this study has 10 branches in China with one branch located in Shanghai. The Shanghai branch has 11 divisions and 370 employees. The major business function of the Shanghai branch is exporting the trading company's products and importing raw material and parts. Only a small portion of its business is domestic. The system administrator from the Shanghai branch participated in this study and described how IT is being used by the company as well as some of the important challenges he faces.

The company's information system supports various foreign trade operations. A foreign trade management component provides information about divisions, salespeople, contracts, invoices, customers, suppliers, and products. An ad hoc query capability supplies top management with information on the company's day-to-day operations or on the performance of a specific area of the business. A foreign trade goods storage and shipment component facilitates the tracking of storage and shipment information.

A client-server architecture uses a Compaq ProLiant 2000 M5/66M2000 PC as the database server and a Compaq Prosignia as a file server. The network is a star Ethernet 10-base-2 with backbone multiport repeaters that connects the network to five smaller LANs. The company uses Novell's Netware 3.12 as the LAN operating system. The smaller LANs are IEEE 10-base-T networks connected to a HUB via bridges that allow access to remote stations.

Challenges: The Shanghai branch has led all the other branches in terms of using information technology. For example, the Shanghai branch was the first branch to use stand-alone PCs for word processing, even though all contracts and invoices were created manually. According to the system administrator, the company's profit has grown by 10 percent since the system was completed in January 1995. The implementation of the system has allowed the company to streamline and simplify many of its business processes.

Interestingly, the system administrator indicated that user training is not a major concern. He commented that over 90 percent of the employees in this organization have a college degree. (The percentage of college graduates is low in China. An average primary school student has a chance of about one in 145 of enrolling in a college or university and only about 2 to 3 percent of the high school graduates go on to higher education [Concise Columbia Encyclopedia]). In addition, most of the company's employees have had some computer experience and therefore tend to learn the system with relatively few problems.

However, frequent financial and foreign trade policy changes create important challenges. For example, the system administrator described a situation where the Chinese government used to provide bonuses to authorized trading companies, which made up a significant portion of their export trading revenue. The government has stopped providing these bonuses, and this change requires extensive modifications to the system.

Textile Machinery Manufacturer in Shanghai

Background: The textile machinery manufacturing company that participated in this study has been in business for over 30 years. The company has 4500 employees of which 200 are computer-related technical staff. The company has 5 departments and 7 factories. A senior software engineer participated in this interview. He described the current use of information technology and some of the important IT-related challenges.

The network utilized by this organization has two LANs. One LAN is used for MRP-II and the other to support CAD/CAM. The CAD/CAM LAN uses Apollo and Hewlett Packard workstations. The operating system for the CAD/CAM LAN is UNIX and the protocol is TCP/IP. The network to support MRP-II uses a mainframe computer as the host computer and has about 100 terminals connected to it. These terminals are located near the production line as well as in the administrative departments.

Customer orders are handled by the production planning department. A product scheduling list is then generated from the customer orders. A technical support department maintains all of the equipment as well as ordering raw material and parts for production.

The Chinese government sponsored the implementation of the CAD/CAM and MRP-II systems by providing a design team for development. The design of these systems began in 1994, and subsequent development and implementation of these systems have been slow.

The product scheduling and payroll components of the MRP-II system are currently implemented; however, about half of the product scheduling function is still performed manually. For example, production schedules are generated by the computer and then sent to a copying office. An employee then photocopies this document, and the document is then hand-delivered to the appropriate production plant.

At each production plant, a scheduling control staff person enters the part name, production start time and required time to complete the order into the computer. A printout of the production schedule is then given to the production workers. When these workers complete the production, they return the schedule sheet to the scheduling control person so that the actual time to complete the job can be entered into the computer. Implementation of a fully automated system is expected to be a long and slow process.

Challenges: The senior software engineer gave four reasons for the slow implementation of the system. The first reason was attributed to the make-up of the top management and their poor management skills. The company is owned by the state, and the assignment of top managers generally has to be approved by a higher-level of government administration. Therefore, management skill is only one of the many attributes considered for the assignment. It is rare for a young person or a non-communist party member to be assigned to a high-level manager position of a large state-owned organization.

Another reason is the education system in China. As a result of the 10-year-long cultural revolution, universities were closed down for political reasons. Students were encouraged to go to the countryside to join the peasants in farm work for "re-education." Consequently, China

is missing a generation of well-educated people between the age of 35 to 45. Managers therefore tend to be from the older generation and lack any type of technical background. On the other hand, younger individuals tend to lack general business experience and the political power needed to gain these positions. This situation has created a so-called "generation gap" that makes it difficult for individuals to generate and implement new ideas.

Third, it is common for state-owned organizations to be over-staffed in order to provide employment for such a large population. With lifetime employment for its employees, organizations do not want information systems to displace the workforce. For example, the product scheduling system could send the scheduling information to the terminals in the production line through the network. However, the organization was not enhancing the communication functions of the network because it was thought to take away jobs.

The fourth reason for slow implementation is the low cost of labor. In China, hardware and software are more expensive than the cost of labor. Even though the monthly salary of a computer engineer is about 150 U. S. dollars, the cost of employing several manual workers is significantly less. Moreover, computer hardware and software are very expensive in China since it is imported from the United States or other countries. Subsequently, it becomes more cost efficient to maintain a labor-intensive business. Unless an organization depends heavily on information technology, such as the stock exchange, an investment in information systems is not viewed as important since it may not provide a quick payback.

Organizations Not Using Information Technology

It appears that relatively few organizations in China use or have successfully implemented information technology. A number of additional contacts were made to other organizations to ask for their participation in this study; however, none of these organizations use any type of information technology. The following discussion is purely anecdotal and comes from casual conversations and observation while visiting China.

We were unsuccessful in finding information systems in retail stores. No large retail chain stores exist presently in China, and most large department stores are rented to many manufacturers. Since each manufacturer operates independently, no central management system is in place. As a result, there is no need for an information system.

It appears that most hospitals also do not use information systems. This may be partly due to the demand for medical services being greater than the available resources. Although doctors earn a fixed salary, which is slightly above the average level of income in the society, most of the cost for treatment is for medical supplies used. Hospitals do not have the funds available to invest in information technology since any available funds are used to cover the basic costs of providing medical services.

CONCLUSIONS

For a developing superpower like China, the diffusion of information technology is at an early stage. Viewed within the context of the stage concept described by Gibson and Nolan (1974) and Nolan (1979), it appears that the companies who participated in this study are on the early stages of the EDP growth curve.

The diffusion of IT is affected by many aspects of the society. As reported in this study, diffusion of technology in an organization is not simply a technical issue, but also involves other societal spectrums such as politics, culture, economic status, and the educational levels of the employees.

However, other barriers to slow this diffusion exist. Organizations in China tend to look for a quick payback when it comes to investing in information technology. For example, some state-owned organizations are managed by a contractor. In this situation, an individual signs a contract with the government to manage a financially-troubled state-owned organization. Generally, these contracts are written to cover a period of only a few years so pressure exists to focus on short-term goals. If this individual succeeds in turning the troubled company around, the government receives a fixed sum of money from the organization. The contracted manager can reinvest the rest into the organization. Due to the focus on short-term goals, however, most contractors may not invest in information technology since it may not provide any real benefits in the short term.

Another factor influencing the use and diffusion of information technology is the different economic development levels within the provinces in China. The government has created ten special economic zones along the east coast of China. These economic zones receive many favorable policies in terms of tax and foreign trade authorization. In addition, some provinces and cities are economically advantaged because of their access to important natural resources. Organizations in cities, such as Beijing, Shanghai, Canton (Guangzhou), Wuhan, and Chengdu, which all have a population of more than 100 million, have greater access to technology, financial resources, and human resources needed to develop and implement information systems.

At the time of this study, there is no wide area network in China. The telephone system and communication capabilities are behind those of more developed countries. However, the demand for telecommunications is growing. Organizations and individuals have to wait for a long time to get phone service, and the installation cost is about that of a regular worker's two or three month salary. Leased trunk lines are not readily available. Satellite communication may be a feasible approach for providing telecommunications throughout the country. Interestingly, for those organizations using information technology, it appears that they use state-of-the-art technology.

In China, the transition from traditional human management toward information management still involves many challenges; however, the opportunity for implementing information technology successfully in China is bright. With the continuing development of a market economy, many bright, young people with both technical and management skills will eventually enter the management ranks. This should bring forth new ideas and new opportunities for business. As a result, we may see a greater diffusion of information technology.

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