

Adoption & Implementation of IT in Developing Nations: Experiences from Two Public Sector Enterprises in India

Monideepa Tarafdar, University of Toledo, USA
Sanjiv D. Vaidya, Indian Institute of Management Calcutta, India

EXECUTIVE SUMMARY

This case describes challenges in the adoption and implementation of IT in two public sector enterprises in the postal and distribution businesses respectively, in India. In spite of similarities in the scale of operations and the general cultural contexts, the IT adoption processes and outcomes of the two organizations were significantly different. While one failed to implement IT in its crucial processes, the other responded effectively to changes in external conditions by developing and using IT applications for critical functions. The case illustrates how differences in organizational factors such as top management commitment, unions, middle management participation, capabilities of IS professionals and specific aspects of organization culture resulted in such differences. The case is interesting and significant because it is representative of experiences of many government-aided organizations in India, which have undertaken IT modernization as a response to external changes and government mandates. The findings can also be generalized across similar organizations in other developing countries.

Keywords: end users; information technology adoption; IS evolution; IS/IT planning; MIS implementation; senior management support

ORGANIZATIONAL BACKGROUND

Introduction

The adoption of IT in large public sector organizations poses some interesting challenges and issues. These are related to specific characteristics of these organizations with regard to their entrenched processes, culture, the role of bureaucracy, performance measurement criteria and decision-making processes (see for example, Caudle et al., 1991). This case describes challenges in the adoption and implementation of IT in

two public sector enterprises in India. The enterprises were in the postal and distribution businesses respectively.

Public sector enterprises (PSEs), in the context of the Indian economy, are companies that are largely administered and supported by the government. They exist in different areas such as transportation, goods distribution, postal services, telecommunications, and other manufacturing and service sectors of the economy. There are different types of PSEs (Mathur et al., 1979). Some of them are statutory corporations established through legislative resolutions of the Parliament. The Parliament is the executive branch of the Government of India, similar to the House and the Senate in the United States. Many other PSEs are departmental agencies, functioning directly under a particular department of the government. Others are established as companies with limited liability under the Companies Act of India. A few PSEs, like those in the Railways sector, function exclusively under one ministry of the government.

The government plays an important role at the strategic level, in activities such as policy making and financial outlay. At the operational level, PSEs run directly by government departments are staffed through a cadre of bureaucrats and administrators. In PSEs that are established through legislative acts, professional managers and technical specialists manage the operations. These bureaucrats, administrators, professional managers and technical specialists are responsible for achieving annual objectives in terms of activities accomplished and budgetary goals. Policy implementation with respect to modernization and IT adoption is the responsibility of organizational employees, who have autonomy over operational details of the implementation process, within a broad framework specified by the government.

National Couriers Limited (NCL) was in the business of providing postal, courier and information transfer services to different parts of India. It functioned directly under a government department. The company also provided limited banking services such as money transfer, insurance and certificate of deposit services. It had about 90,000 employees working in offices in various states in the country. Eighty-five percent of the personnel of the company were unionized and were either unskilled or clerical level workers. The remaining were professionally trained administrators.

National Traders Limited (NTL) was a distributor of agricultural products, particularly food grains, to different parts of the country. It was created by a Parliament resolution. It provided services such as procurement of these products from producers, their storage and management in warehouses, and distribution to non-producing consumers through retail outlets. During the 1970s and 1980s, the organization had played a key role in encouraging farmers to increase their production, by providing them with an assured market and stable purchase prices. Subsequently, the major function of the company had been to collect part of the surplus agricultural produce, and suitably store and distribute it, so that it could be used during lean production seasons and in places where emergencies and natural calamities happened. The organization procured, distributed and transported about 22 million metric tons of produce, annually. Most of the purchasing centers were located in the northern part of the country. Consumers were located all across India and also in the islands off the southern part of the country. NTL had about 63,000 employees, 95% of whom were unionized.

Table 1: Background Information for National Courier's Limited

| | 1992-93 million | 1993-94 million | 1994-95 million | 1995-96 million | 1996-97 million | 1997-98 million | 1998-99 million | 1999-2000 million |
|---|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|----------------------|
| Total Mail (no. of articles) | 13,400 | 13,051 | 13,607 | 13,957 | 15,096 | 15,750 | 16,790 | 17,430 |
| Money Transfer (no. of transactions) | 105 | 99 | 102 | 106 | 111 | 111 | 120 | 122 |
| Money Transfer (Rs. mn) ¹ | 29,124 | 31,825 | 33,555 | 37,872 | 41,018 | 44,654 | 47,450 | 48,790 |

¹45 INR (Indian Rupee) = 1 US dollar

Services & Processes: Brief Description

Both NCL and NTL were service organizations. The major processes of NCL were collection, sorting and delivery of articles. Articles were collected from more than half a million collection centers, sorted in 550 sorting offices and delivered through more than 100,000 delivery offices. Other processes included activities related to banking, money transfer and information transfer functions.

Some financial details about the operations of the company are provided in Table 1.

All these functions involved managing and processing significant amounts of information. In this context, the head of the operations of the Eastern Region observed:

"The sheer volume of information and articles that is required to be handled is tremendous."

Table 2: Procurement of Food Grains from Different Parts of the Country

| Year | PROCUREMENT OF FOOD GRAINS (in * 100,000 tons) | |
|---------------------|---|-------------------------------|
| | WHEAT (April – March) | RICE (October – September) |
| 1999-2000 | 120 | 185 |
| 2000-2001 | 150 | 220 |
| 2001-2002 | 200 | 215 |
| 2002-2003 | 185 | 160 |
| 2003-2004 | 150 | 170 |
| *(As on 27.02.2004) | | |

Table 3: Movement of Food Grains Moved in Different Parts of the Country

| Year | Movement of Food Grains (in Million Tons) |
|--------------------------|--|
| 1996-97 | 25 |
| 1997-98 | 20 |
| 1998-99 | 22 |
| 1999-2000 | 20 |
| 2000-2001 | 15 |
| 2001-2002 | 19.5 |
| 2002-2003 | 26.8 |
| 2003-2004 (up to Nov'03) | 15.3 |

The major activities of NTL related to the distribution of agricultural produce. Relevant figures in this context are provided in Tables 2 and 3.

There were four critical activities for NTL, as described next.

1. *Purchase of agricultural produce from producers:* This was done through a network of purchase centers all over the country.
2. *Storage of the purchased produce in appropriate places and under appropriate environmental conditions:* NTL had a network of storage depots for this purpose.
3. *Interfacing and maintaining liaison with administrative authorities in different states:* This was required in order to plan for state-wise requirements of produce.
4. *Distribution planning and transportation of produce:* This function involved the transfer of produce from purchase centers to storage warehouses and then to the numerous distribution centers. It required access to good transport infrastructure, and liaising with professional transport agencies.

The overall processes of both organizations were therefore similar, in that they involved the transfer of physical goods and the accompanying information to and from different parts of the country. They also involved interfacing with government authorities at the state and national levels.

Organization Structure & Characteristics

The bureaucracy in India is typically the administrative arm of the central government and is largely responsible for turning legislation into policies and policies into practice. Bureaucrats therefore have a wide range of functions in many sectors of the economy, including the government departments. Their responsibilities can be broadly visualized in terms of two types of functions.

One, they are responsible for assisting in policy formulation in the different ministries and departments. They are also charged with the direct running of the day-to-day government functions like general administration, law enforcement, resources disbursement and tax collection. Two, they are also required to head government controlled PSEs in different industries such as utilities, postal services, nationalized banks, railways and public distribution systems for food grains. Both NCL and NTL, being public sector enterprises, were headed by a senior member of the administrative arm of the bureaucracy. They also had bureaucrats in different top management functions.

The operations of NCL were divided into four regions. Each region was headed by a Regional Office, with the Regional Manager as the executive head of the region. The Regional Manager was a member of senior management who supervised a team of middle management. Each region was further divided into districts, with a District Office supervising the operations of each district. The head of each District Office was a member of middle management. Members of junior management worked in the Regional and District Offices. There were about 200 districts and each district supervised the operations of a given number of collection centers, sorting offices and delivery centers, which were staffed by unionized employees and clerks. At the apex, there was one head office, from where the top management and company policymakers operated.

In a similar manner, NTL also carried out its operations through a network of administrative offices across the country. There was one central administrative office from where the top management functioned. The operations were divided into five zones and 17 regions. Each zone had a Zonal Administrative Office and each region had a Regional Administrative Office, supervised by a Zonal Manager and Regional Manager respectively. The regions were divided into a number of districts and each district was administered through a District Office, which managed the functions of a number of purchase centers and storage warehouses. There were 123 districts. There were 12,000 purchase centers and 1,700 depots and storage warehouses. Zonal Managers belonged to senior management cadre. Regional Managers and District Managers were middle managers. Junior managers also worked in all these offices. All employees in the management cadre were professional administrators. The company also had a number of clerical employees to carry out low-skilled functions in the different offices, purchase centers and warehouses.

The scale and scope of the operations of the company were very large. One of the senior managers in the company observed:

"The scale of operations is among the largest for any organization in the country. The amount of information required to be processed is tremendous."

Although the particulars of the organizational hierarchy such as specific office names and designations of managers were different, the broad organization structures of the two organizations were similar, as shown in Figure 1. There were five levels of hierarchy and the decision-making processes were largely centralized. The top management in the apex (central) office and senior management in the zonal and regional offices was responsible for overall policy setting and strategic planning. All new initiatives and programs were designed at the higher levels, and were subsequently communicated

through orders and directives to the middle and lower levels. Implementation strategies were planned by the senior management in consultation with middle management and implemented by middle management. This kind of planning and implementation structure is often a feature of public sector enterprises. This is because public sector enterprises usually operate on a large scale and scope, and hence it is more efficient to decide on policy at the top and leave the implementation to the middle managers in the various regional offices. The role of middle managers in policy implementation is therefore crucial (Caudle et al., 1991). In India, the accountability of the public sector to the people of India only further enhances the justification for rigid bureaucratic procedures. Such procedures lead to this rather strict division of labor between the senior management and the middle management.

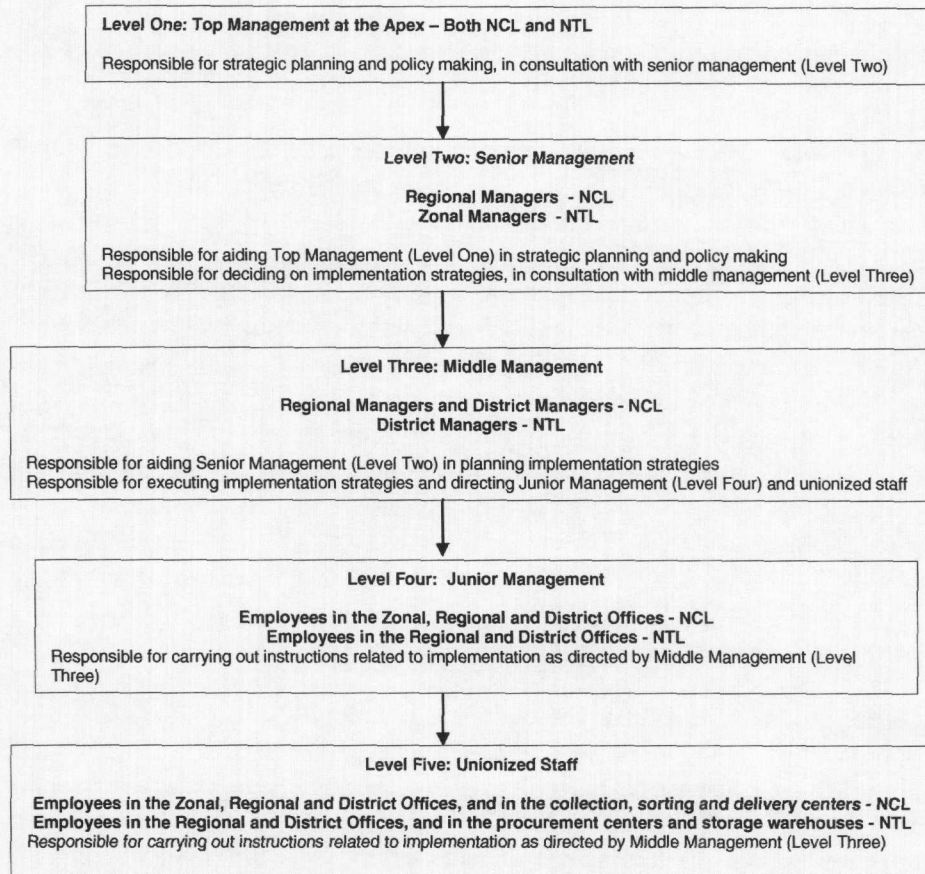
Traditionally, both organizations were similar in that they were large and centralized, and had historically functioned in stable economic and business environments. They had been largely supported by the government and had not seen any major changes in their business strategies or processes for the past 20 years. Between 1980 and 1987, the top management of both companies was indifferent towards the use of IT and there was no commitment on the part of the organizational leaders to deploy IT in any of the functions. Further, most employees did not have any knowledge or awareness about IT, and tended to associate technology with loss of jobs. This observation has also been recorded in other organizations in India during the 1970s and 1980s. During this time, the Indian economy was a closed one and most organizations did not have any exposure to the use of IT (Nidumolu et al., 1993; Tarafdar & Vaidya, 2002b; Wolcott & Goodman, 2003).

SETTING THE STAGE (1987-1991)

External Conditions

The government financially aided NCL and, to a large extent, decided the rates for its services. NCL catered to both urban and rural segments of the population. During this time, the rural and semi urban segments accounted for over 70% of the customer base, and the company was a monopoly in this segment. Entry barriers were high because a vast distribution network was required to handle the volumes and reach in order to operate on a national scale. In the urban retail and corporate segments, the first major changes in the environment came in the late '80s and early '90s when a number of private companies were set up which provided faster deliveries, although at much higher prices. Hence there was some competition in this category. However, these new competitors were too small to pose any threat to NCL on a nationwide basis. Even then, NCL did have an internal drive towards business innovation. It introduced special premium "Speed" services in 1987, which were faster and more expensive than their regular services. Corporate customers were interested in efficient and reliable service and accounted for a majority of the high value transactions through the premium services. According to a senior manager in the eastern region:

Figure 1: Decision Hierarchy & Organization Structure at National Couriers Limited & National Traders Limited



"The products and services prior to 1987 were standard. There were no innovations. However, after 1987, we could sense some of the then happening and some impending changes in the competitive environment. Hence, even though we were a monopoly in the rural retail segment, we introduced new services directed towards the urban corporate and retail segments."

NTL was financially aided by the government and many of the policies regarding purchase price, selling price, and distribution requirements were decided in consultation with the government and representatives of the producers. The company was required to interact with a number of external agencies such as distribution and transport service providers in order to carry out its functions. All interactions with these external organizations were through established procedures. For example, producers were given a fixed price for their produce, and customers also paid a fixed price. Similarly, transporters were selected on the basis of tenders. There had been no significant change in most of these processes over the years. Therefore, the external environment had remained stable.

In case of calamities such as floods and drought however, the company faced tremendous pressures because produce had to be rushed to specific places at all costs. The regional manager of one of the regions observed that:

"Normally there are no pressures on us. We function in a regulated and financially supported environment. However in times of emergencies, we have to deliver at all costs."

Such instances however, were few and had occurred once in two or three years on an average. Moreover, in such times, NTL and other similar companies were given financial support from the government and also used their own slack resources. On the whole, NTL did not have any innate drive for business innovation. For example, it did not initiate efforts for introducing changes in its processes in a proactive manner. Its managers functioned within the parameters laid down by the government. The performance of the company was measured by the amount of produce purchased, the manner of quality control of stored produce and effectiveness of distribution. There was scope for performance slack because the company was financially supported by the government. In this context, one senior manager who had been with the company for 30 years observed:

"Everyone follows standard procedures. There is no inherent drive to change and improve."

Process Descriptions & Information Processing Requirements

The primary processes for NCL included the logistical activities of sorting and transferring articles. The company also carried out limited operations related to banking functions such as money transfers and money orders.

Information processing had to be carried out quickly because article delivery times depended largely on the speed with which articles could be sorted and transported. Organizational processes were standardized through the use of standard operating procedures. Procedures were laid down for collection, sorting, delivery, after-sales activity like enquiry handling, refund, lost articles or other specific customer complaints. Tasks were structured and routine and, the context in which information had to be processed was clear. The presence of bureaucratic procedures, along with inherently simple tasks, did not leave much room for decision support requirements in the day-to-day operations. Decision making followed predictable patterns. There were well-defined rules for communicating information. All official communication was in written format. Information required for decision making was mostly available.

A senior executive explained the situation in this manner:

"There are fixed procedures that we are trained to follow. All possible requirements can be anticipated because there is a limited set of options that customers can choose from."

Organizational processes for NTL included functions like packing, storing and handling of the produce. These were routine, standardized and well documented. There were written instructions and well-defined procedures for different activities. For instance, there were norms for storing bags in the warehouses, for deciding how many

bags would be placed in a stack, how they would be stacked, how they would be issued for distribution and so on. There were specifications for the way in which warehouses were to be constructed. There were standards for preserving the produce in the warehouses according to the desired purity and quality levels. Information regarding relevant parameters such as humidity, temperature and cleanliness were clearly specified. All official communication was in standardized formats, formal and always recorded on paper.

One of the middle managers in a regional office in the eastern region said:

"All tasks are standardized and we have to follow standard operating procedures. There is no ambiguity."

As far as information processing was concerned, some aspects of the company's operations required information to be processed within a given period of time. For instance, all the purchasing activities had to be completed within two to four months from the time that the produce was plucked and harvested. Transport and logistics operations involved coordination of activities across many geographical regions, and the produce had to be distributed to specific areas within a very short time, in case of disasters. The manager of one of the districts in the eastern region said:

"There is a short span of two to three months within which we have to finish off all the purchase and storage activities. This is a time of great pressure for all of us."

Both organizations functioned in a stable environment and were financially supported by the government. This led to the possibility of having extensive bureaucratic procedures and well-defined processes. Thus, there was not much room for ambiguity and decision support. This is a common feature in public sector organizations, and has been found to influence the adoption of decision support aids in these organizations (Mohan et al., 1990). All policy decisions regarding the adoption of new innovations were taken by the top management team in consultation with representatives of the government and communicated clearly within the organization. However, there were some differences. NCL was widely regarded as one of the best public sector organizations in India, and within the broad framework of government-mandated policies, there was considerable scope for small-scale, local-level initiatives and innovations by its middle and junior managers. NTL, on the other hand, was more prone to functioning within the confines of government mandates, and there were not many opportunities for local innovation.

IT Adoption During This Period

Basic computerization was first introduced in both these organizations in the mid-to late-1980s. This period was also marked by commencement of similar initiatives in other public sector enterprises in India (such as nationalized banks). These initiatives were largely driven by policies of the central government. To begin with, both NCL and NTL went in for applications like payroll and financial accounting at their respective

central administration offices. These were later extended to their different regional offices. Overall, the IT infrastructure during this time was quite elementary and did not have any significant impact on their critical operations.

Soon after, NCL took steps to introduce some additional IT applications as well. In 1989, money transfer pairing machines were first introduced in each zone. Hitherto, all the money transfer order slips originating in a particular region and bound for all other regions were collated separately and sent to each region. This was done by all the regions, so that a number of slips changed hands everyday between all the regions. With the introduction of the computerized pairing machines, instead of counting off individual slips for each region, each region's outgoing sum was simply netted off against the incoming sum. This was a spreadsheet application in which the total amount of money ordered for each zone was collated on a spreadsheet and paired and matched for each zone. Also in 1989, counter operations for article booking were computerized in the largest office in the two largest cities. Stand-alone PCs were given to the counter clerks at these offices. This significantly reduced the waiting time for the customer and rationalized queues at the counters. Although these applications were introduced in a limited manner, it was an important step for NCL in that it had proactively implemented some IT beyond the overall parameters suggested by the government. Although the monetary investment in IT during this period was small, it nevertheless set the stage for the implementation of IT in more critical processes, in subsequent years. Further, it also served as a pilot project for demonstration and learning purposes.

Impending Changes in the External Environment

Government policies form an important aspect of the external environment for public sector organizations. Changes in these policies have often been the cause of IT deployment in organizations in developing nations in general (Albadvi, 2002; Li et al., 2002; Molla & Licker, 2002) and in India in particular (Tarafdar & Vaidya, 2002a).

In 1991, the Government of India took a policy decision to liberalize the Indian economy. This decision resulted in an increase in external pressures for public sector undertakings in many industries including telecommunications, steel, banking and transportation, among others. The resulting changes in the business and economic environment had implications for adoption of IT in both NCL and NTL. There were also overall pressures for process re-engineering, modernization and human resource development.

CASE DESCRIPTION (1992-2000)

Changes in the External Environment

Economic liberalization in the early 1990s resulted in changes in the external and competitive environment for both organizations. Liberalization provided enormous opportunities for firms from developed economies to set up manufacturing, service or distributing units in India. This resulted in the entry of many of these companies in a number of Indian industries including banking, financial institutions and the manufactur-

ing sector (see for example, Cavusgil et al., 2002; Joshi & Joshi, 1998; Tarafdar & Vaidya, 2002, 2003). Many of these companies had advanced IT-enabled processes. This created pressures for improved performance of processes among Indian organizations. There were also pressures from different customer segments for more flexibility and better service.

As far as NCL was concerned, private companies — from both India and outside — that provided courier and fax services entered the urban markets, and targeted the retail and corporate segments. There was also an increase in the volume of business related mail. Some customer segments like businesses, government organizations and institutional bodies required faster delivery, even if it was at a higher cost. Thus, increasing competition gave rise to a need to segment customers on the basis of specific needs and provide customized service options. Therefore, a Business Development Cell was set up in 1996 to design and develop a market for value-added premium products for specific customer segments. New services were introduced for corporate customers, and the accent was on speed and reliability rather than on cost. Utility payment and e-mail services were also introduced.

That the organization perceived the pressures to be somewhat high can be gauged by the following statement, which appeared in the Annual Report of 1997-1998:

“... will spend 65% of its plan budget on the induction of technology with a view to improving and upgrading the quality of service...developing and providing new value added services and products. NCL will continue to look at the technology options so that the postal products and services can be re-oriented to the needs of the customers.”

The second change as a result of economic liberalization was related to the role of the government. As mentioned before, the government can, through its policies and regulations, influence the adoption of IT (Nidumolu & Goodman, 1996; Rainey et al., 1976). Toward the later part of the eighties, the government laid down certain policies and mandates for adoption of IT in all major public sector enterprises in India, across different industries. Public sector banks, manufacturing units and service organizations embarked upon IT modernization programs. These organizations typically generated and processed huge volumes of transaction data due to their large scope of operations. Consequently, the most pressing requirements were for transaction processing systems.

Initiating & Implementing IT Adoption: Two Contrasting Approaches

Both NCL and NTL initiated a program for organization-wide computerization in response to the government's mandates.

According to Caudle et al. (1991), there are four major concerns that are required to be addressed for adoption and implementation of IT in public sector organizations. The two organizations addressed these four factors in different ways.

1. *Goals of IT Adoption & Identification of Information Requirements:* Market signals and profits guide companies in the private sector. In contrast, the public sector faces different goals, many of which are not necessarily related to financial

performance. These could be related to efficiency and quality of customer service, scale of operations, the different kinds of customers served, social objectives and addressing political influences (Caudle et al., 1991). Thus, it is not always possible to directly link the adoption of IT with financial parameters, particularly for public sector enterprises. Hence, one of the ways to approach IT planning is to identify improvements that are required in concerned critical processes, and implement IT in the individual activities entailed in those processes. Identification of information requirements thus forms an important part of the planning for IT adoption and implementation in public sector organizations.

National Couriers Limited

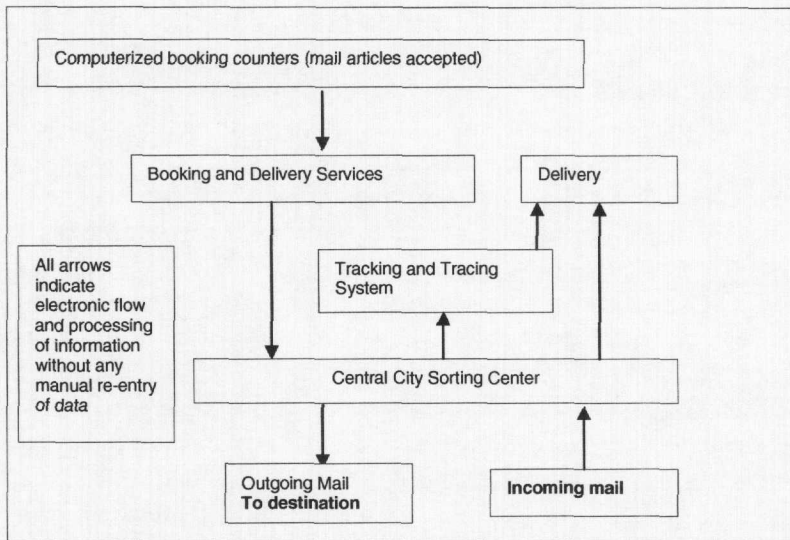
Interviews with the head of the Eastern Region illustrated the process of identification of important information processing activities and requirements at NCL:

"We had already implemented computerized transaction processing systems in the payroll and financial accounting functions, starting in 1988. After the government mandates in 1991, we identified three critical areas in order to focus our computerization efforts. The first was the handling of and sorting registered mail articles. This process was the key to speed, efficiency and customer satisfaction in our operations. The second was the transfer of information related to the status of mailed articles, money transfer and banking services. Information transfer processes formed our second largest area of operations after mail handling. The third focus for computerization was information exchange activities within our offices. These included sharing of files, data and other resources such as printers. Our computerization efforts during the period 1992-1999 were concentrated largely in these three areas."

Between 1992 and 1999, a number of new information technologies were introduced at NCL. In 1992, computerized mail handling and sorting was introduced in the two busiest centers in the country. This reduced the time required for sorting and directing articles by half. Computerized systems for article booking, tracking and delivery systems for select cities were introduced in 1997-98 in select cities (refer to Figure 2). This sped up the booking and delivery procedure, and enabled customers to keep track of their articles. A VSAT network consisting of 75 terminals was installed for this purpose. The articles would be booked with the help of a computerized system at the booking office, and the information would be transferred via a modem connection to the Central City sorting center, where the tracking system was installed. This center was connected through the VSAT network to other sorting centers. Customers could call up at the sorting center and find out the status of the booked articles. Computerized money transfer services were introduced in 1998. This was also done through the VSAT network. Individual offices were connected to the network through a leased line modem connection. This reduced the transit time of money orders from nearly a week to a few seconds. In 1997-1998, office operations were computerized and put on a WNT-based local area network. This enabled the sharing of files, data and other resources, and significantly enhanced the efficiency of office operations.

The approach used by NCL has been referred to as the "functional approach" to IT planning (Nidumolu & Goodman, 1996). Organizations that follow this approach believe adoption of IT is desirable because it can improve the timeliness of information

Figure 2: Computerized Booking, Tracking & Delivery System at National Couriers Limited



flow and reduce process cycle times. NCL was able to respond effectively to the external conditions and government mandates through deployment of IT applications and infrastructure in many critical functions. The financial expenditure on IT between 1990 and 1999 was INR 1000 million¹, which was 75% of the total expenditure on modernization during this period and about 2.75% of the organization's revenues. This was relatively much higher than that during the previous 10 years.

According to the head of operations of the eastern region:

"For the first time, substantial budgets were being allocated annually, for the computerization process."

A senior manager in the eastern region further described the possible financial implications in the following way:

"The areas that we targeted for IT adoption covered 65% to 70% of our operations. So we expected to see significant cost savings in around 70% of our functions."

National Traders Limited

A member of the top management, who had been with the organization for more than 30 years, described the overall phenomenon of IT planning and adoption at NTL in the following manner:

"We tried to follow the general instructions from the government, in identifying potential areas of IT adoption. The first step in this regard was the computerization of all high volume transaction processes. We decided to begin by computerizing the payroll and financial accounting processes."

In the mid-1990s a UNIX mainframe system was installed at the central office. This was used in batch processing applications for calculation of accounts, reporting of produce inventory and stock positions, and payroll accounting. In the late 1990s, the mainframe system was converted to a PC-based LAN. An ORACLE-based client server system was installed and the mainframe data were transferred to this. The administrative offices in the different regions carried out the same functions at the regional level using PC-based dBase applications.

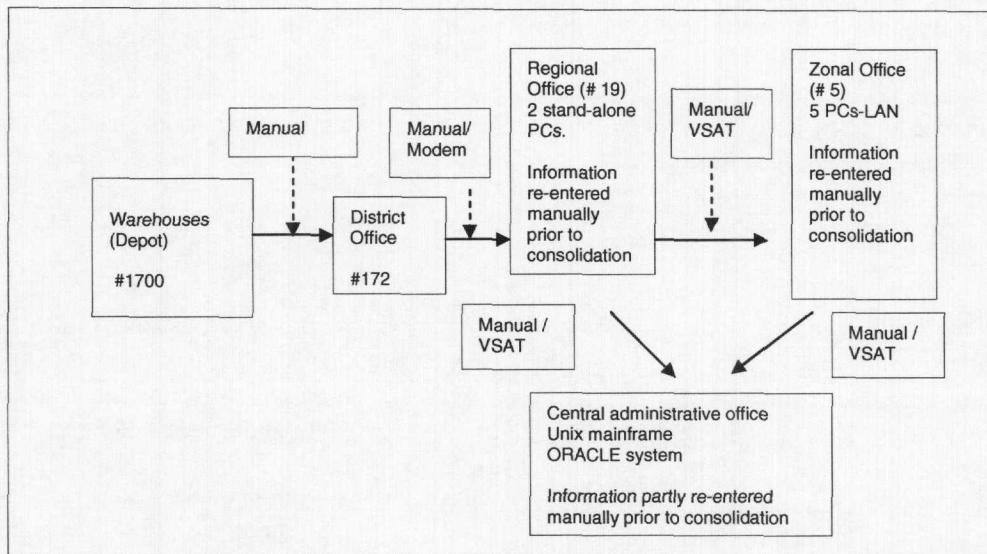
In 1998, NTL connected its central administrative office, five zonal offices and 17 regional offices through VSAT links. The district offices were connected to the respective regional offices through dial-up modem connections. At the time of the study, there were about 50 PCs at the central headquarters, four to five PCs in each zonal office, two in each regional office and one in each district office. The depots communicated with the district offices through postal mail and the districts communicated with the regional offices through modems. Forty percent of the data transferred between depots and district, regional and zonal offices related to the inventory and stock position. Forty percent related to financial information and 20% to payroll data. Stock and inventory data were sent in by the depots and district offices to the regional and zonal offices manually, or through leased line modem connections. The regional and zonal offices consolidated the data and then transferred them to the central administrative office through VSAT as well as on paper. Data from all the regional and zonal offices were again consolidated at the central office. Reports about stock positions and requirements were generated for senior managers at both the head office and the regions. The transfer of stock-related information took place on a weekly basis from the depots to the zones and subsequently to the headquarters. A central server housed the consolidated data from all the regions. All the communication links were backed up by traditional mail and fax systems. The IT infrastructure is shown in Figure 3.

The investment in IT acquisition, maintenance and training during the period between 1992 and 1999 was INR 35 million, which was less than 5% of the total capital expenditure during this period.

2. *Management of Bureaucracy and Paperwork:* The public sector produces a lot of paperwork that results in a proliferation of forms and paper (Caudle et al., 1991). All these records need to be computerized in an integrated manner during the process of computerization, in order to make electronic transfer of information possible between offices and minimize manual re-entry of data. Hence it has been suggested (Mohan et al., 1990) that a central governing structure be set up. This structure should oversee the integration of IT management with records management and other information resource management areas.

For NCL, the different systems were designed such that seamless integration and flow of information between different functions was possible, in a limited manner, as shown in Figure 2. For instance, in the computerized booking and tracking system, article information generated at the time of booking was transferred using electronic means through intermediate stages, all the way to the central sorting centers. Similarly, office information related to administrative activities was shared electronically within each

Figure 3: Information Technology Infrastructure National Traders Limited



office. These capabilities were also planned to be extended to cover electronic transfer among different offices.

For NTL, information transferred from the depots and district offices was manually reentered at the regional offices prior to consolidation and transferred to the Head Office, as shown in Figure 3. At the Head Office also, information was partly reentered manually before the generation of management reports.

3. *Role of Top Management:* The top management plays a key role in deciding the thrust and direction of IT adoption in public sector organizations (Nidumolu & Goodman, 1996). This is because the planning and decision structure with respect to implementation of changes is usually centralized.

National Couriers Limited

At NCL, there was a change in the top management in 1991 as a new CEO joined the organization. The new top management team was favorably disposed towards IT adoption and took many proactive initiatives in this regard. NCL was a member of the Universal Postal Union, and hence information about the latest IT applications in similar organizations around the world was available to the top executives. It was the thinking, planning and drive of top management that led to the introduction of the early IT initiatives. A middle manager in the eastern region office described the new priorities of the top management in this manner:

"After 1991, a number of new thrusts towards IT adoption have been generated at the central office. Our new CEO is enthusiastic about the introduction of IT, and is aware of the possible areas of application. Seminars are often organized to educate and inform us about the use of IT in postal services worldwide."

All decisions regarding IT planning and deployment were centralized. However, the implementation of IT initiatives was decentralized. According to a member of the top management at the central office:

"We tell the regions what the overall plans are, regarding the purchasing of hardware, installation of software and the applications required to be used. Broad decisions regarding all IT applications, hardware and software are taken at the headquarters in consultation with the regions and communicated to the zones and regions. The zones and regions have the power to make their own implementation decisions and purchases within given financial limits."

National Traders Limited

At NTL, the top management was not, in principle, unfavorably oriented towards IT. They did realize the benefits that could accrue from the use of IT, in view of the size of the company and its scale of operations. However, they were not proactive about identifying areas where the company could benefit from IT. The senior managers and policy makers were typically professional administrators and bureaucrats, and the average age was more than 50 years. They did not have any knowledge of emerging IT applications and their use by similar companies around the world. Nor were they comfortable with the use of computers. They were content to depend on the government for direction and instructions on IT adoption.

One of the middle managers who had worked in the organization for the last 15 years said:

"...If the government had not made certain suggestions, computerization might have come to NTL even later than the late 1980s."

Interviews with some of the senior managers revealed attitudes that varied from measured tolerance for IT, *"It seems to be useful, but it is not indispensable,"* to downright rejection, *"Computers are just expensive typewriters."*

4. *Role of Middle Management in Driving IT Implementation:* There is evidence that middle managers play a very critical role in driving IT implementation and use in public sector organizations (Caudle et al., 1991). This is because these organizations are usually large, with multiple levels of decision hierarchy (Figure 1), and it is not possible for top management to oversee the details of the implementation processes. Further, middle managers have considerable bureaucratic power in the individual departments and units. Hence, while the top management is responsible for policy setting and strategic planning with respect to IT adoption, it is the middle managers who play the most crucial role in driving the implementation processes within different organizational units.

National Couriers Limited

The middle management influenced IT adoption at NCL in two ways.

First, they were actively involved in framing the specifics of IT adoption policies and driving implementation initiatives within their units. They used their collective orga-

nizational power to frame implementation schedules and timelines. They also developed programs for end-user training and education. This was a crucial aspect of the implementation process, given the large number of unskilled and unionized employees in the organization, who viewed IT as a potential threat to their jobs. In this context, one of the middle managers observed:

"We encouraged the clerical and low skilled employees to get familiar with the PC, and start out by just playing games. We hoped that once they became comfortable with the use of PCs, they would be able to appreciate the benefits of computerization. We also conducted education programs regarding the use of IT in organizations. Further we took steps to assure them that their jobs were safe. Throughout the entire computerization process, there was not a single day in which there was a loss of working hours because of union problems."

In this connection, studies in the domain of IT adoption suggest that IT acceptance and innovation at the grassroots levels in different end-user units are crucial to the adoption of IT by an organization (Agarwal & Prasad, 1998; Nambisan, 1999; Rockart, 1988; Vaidya, 1991). In many developing countries, IT is seen to be the cause of reduction in opportunities for employment, and there is a hostile attitude to IT adoption and acceptance, not only at the level of semi-skilled and unskilled employees, but also by middle management. This has been a crucial factor in the introduction and management of IT in developing countries (Jantavongso & Li, 2002; Tarafdar & Vaidya, 2003).

The middle management also played an effective role as IS professionals. While the overall head of the IS function was a member of the senior management, IS activities in each regional and district office were supervised by middle management. These managers were also responsible for IT implementation in the delivery and sorting centers. In other words, middle managers were the IS heads in their respective functional departments. They supervised teams of junior managers who were responsible for installing and maintaining the hardware and software. These junior and middle management members had received technical training and were hence capable of managing the technical aspects of project implementation and systems maintenance. This kind of an "indigenous" implementation strategy is often followed in public sectors. This is because in such organizations there are constraints on hiring and firing employees. Hence existing employees are retrained and reallocated to the newer functions (Nidumolu & Goodman, 1996). Thus there was no separate IS department in NCL. Members of middle and junior management were responsible for IT implementation.

The middle management IS professionals also played an important part as IT champions. The role of IT champions in driving IT adoption has been well documented (Beath, 1991). The middle managers in NCL were credible and commanded authority by virtue of their positions. They had a good working relationship with the top management as well as the unskilled and clerical workers in the company. They were powerful enough to influence decisions at the higher levels, and saw to it that the resources required were made available. Initially there was considerable resistance — especially from the unionized staff — but this was neutralized through the efforts of middle and junior managers. In fact, in many instances, some of the unionized staff subsequently became advocates of the IT-related changes, after having gone through the training processes. They be-

came IT champions themselves and saw to it that strong resistance groups were convinced and neutralized.

Various studies have explored the role of IS professionals in influencing the adoption of IT. IS professionals have a positive impact on IT adoption in the organization when they are technically aware of the possibilities from IT, are competent at developing new IS and maintaining existing IS, and are capable of promptly solving end-user needs (Al-Khaldi et al., 1999; Dvorak et al., 1994; Swanson, 1994). At NCL, the IS professionals influenced IT implementation through their traditional organizational power as middle managers. They were able to effectively carry out project management and end-user training; they were also able to ensure that resources were available. This case therefore illustrates a new dimension of the role of IS professionals in driving IT adoption and considerably enhances similar preliminary findings by Caudle et al. (1991).

National Traders Limited

The Central IS department at NTL was headed by a senior manager who reported to the head of the finance function. He was somewhat aware of the possibilities of IT and had some limited ideas of its usefulness for the company. He supervised a team of 60 Central IS employees. Out of these 60 people, 10 had a diploma or some other professional training in different aspects of software development, and could develop applications on dBase, MS Access and ORACLE. About 30 people were data entry operators, whose tasks were to key in and consolidate the data from the zonal, regional and district offices. All these employees had received the requisite training and looked after various functions in the IS department. They worked in the central administrative headquarters, and were responsible for centralized consolidation and collation of data from the regions. They also designed and implemented training programs for data entry staff in the different regions. They looked after incremental modifications to the existing applications. Further, they managed third-party vendors who carried out maintenance of existing hardware and the development of new applications.

The IS departments in the zones and regions comprised junior-level employees who had been transferred from other departments after training. They had no formal education in computer hardware or software. They were responsible for entering and consolidating the data received from the districts and depots, and generating relevant reports for senior managers at the zonal offices. At the time of the study, about 200 such employees, mostly staff and junior managers, had been trained in various applications, and had later been shifted to dedicated IS functions. They themselves were reluctant to use computers. Third-party vendors carried out the maintenance work.

The IS manager was not powerful and senior enough to convince top management to make resources available for any IT initiative other than the most basic applications. He had no significant power to independently make important decisions relating to IT deployment. Moreover the IS professionals at the central office did not have any control over whether or not the regional heads would actually implement specific IT applications. The IS department had not met with much success in this regard and there had been stiff resistance in many cases. This greatly hindered the penetration of IT because regional heads had independent authority over IT implementation initiatives in their areas.

The chief of the central IS function said:

"The implementation and use of computers in the offices is completely decentralized. We cannot force anyone to start using computers. Ultimately the extent of IT use depends on the policies of the respective regions and zones."

There were more than 60,000 employees in the company, 85% of whom performed low skilled and clerical jobs. Similar to the situation at NCL initially, employees were not favorably biased towards IT, because they feared that they would lose their jobs. Hence they tried various ways to express their opinions in this regard. For example, very often, when reports were not made available on time to senior managers, subordinate junior employees would excuse themselves by saying that the computers were not working or the relevant officer in charge of taking the print-outs was not available. They would even suggest that such problems did not exist before computers were introduced. The reluctance of employees to use computers is exemplified by the fact that those who used them had to be given monetary incentives. Further, most of the middle managers and even some of the senior managers in the regions were against the deployment of IT. There was limited penetration of IT into the user departments. Senior managers did not directly use computers. They would ask data entry operators to enter data and furnish printouts.

The similarities and differences between the two organizations have been described in Table 4.

CURRENT CHALLENGES & PROBLEMS (2000 & BEYOND)

In spite of similarities in their overall nature and scale of operations and historical and cultural contexts, the IT adoption processes and outcomes in the two companies were considerably different. While NTL failed to implement IT in its crucial processes, NCL was able to respond effectively to the external conditions and government mandates through organization-wide deployment of IT applications and infrastructure in many critical functions.

National Couriers Limited

The computerization process at NCL took place in two distinct phases. In the first phase, from 1987 to 1991, computerization was limited and driven by the requirements of high-volume transaction processing. During this period, the company used IT for very basic and rudimentary transaction processing operations. It was in the Support Mode (McFarlan et al., 1983) or Delayed Sector (Earl, 1989). These two modes are the first stages of IT adoption in organizations where IT is not fundamentally essential for the smooth running of operations of the company. It is used to accomplish nonessential and noncritical tasks, and the IS department functions as a back-room support department, with no participation in functions like strategic planning and implementation.

Table 4: Similarities & Differences Between NTL & NCL

| | National Couriers Limited | National Traders Limited |
|--|--|--|
| Similarities | | |
| Size | 90,000 | 63,000 |
| Overall Organization Structure | Multiple levels of hierarchy, centralized planning | Multiple levels of hierarchy, centralized planning |
| Public Sector Enterprises and the accompanying characteristics | <p>Having functioned in stable business and economic environments.</p> <p>Historically supported by the government.</p> <p>Working under overall policy directives of the government.</p> <p>Subject to the IT adoption and modernization plans of the government.</p> <p>Staffed by bureaucrats. Professional managers and technical specialists who were responsible for tactical and operational tasks.</p> | <p>Having functioned in stable business and economic environments.</p> <p>Historically supported by the government.</p> <p>Working under overall policy directives of the government.</p> <p>Subject to the IT adoption and modernization plans of the government.</p> <p>Staffed by bureaucrats. Professional managers and technical specialists who were responsible for tactical and operational tasks.</p> |
| Service Organizations | Postal Sector | Distribution Sector |

The second phase of computerization between 1992 and 2000 saw an acceleration of the computerization process. The acceleration was partly in response to government mandates and partly as a result of the enthusiasm of the new leadership about IT. During this period, NCL went through the Turnaround Stage (McFarlan et al., 1983). IT became increasingly crucial to the future development of the organization. There was a change in focus, as far as IT planning and implementation were concerned. New applications were developed and there was an increase in IT investment. At the time this study was conducted, different applications had been introduced in a limited number of offices, and covered about 40% of the operations of the company. The Annual Report of 1994-95 described the induction of computerization in this manner:

"... NCL has made a gradual and phased attempt to introduce information technology into the postal system, so as to provide better services to its customers ..."

The most important impact of IT had been to increase operational efficiencies, and IT was accorded a high priority by the top management. Hence the organization was well positioned to move to the next level of IT use, that is, the Factory Mode (McFarlan et al., 1983) or the Dependent Sector (Earl, 1989). This would include the extension of current applications to more offices and the development of more sophisticated applications. The challenge before NCL was therefore to transform from a Turnaround organization into a Factory organization. One of the most important aspects of the Factory Mode is to ensure that IT is delivered efficiently and reliably. This implies that resource requirements and budgets be correctly estimated (Earl, 1989). In this context, Mohan et al. (1990) suggest that since public sector organizations operate under fixed and often tight budgets, an inability to logically derive and clearly communicate IS budget require-

Table 4: Similarities & Differences Between NTL & NCL (cont.)

| | National Couriers Limited | National Traders Limited |
|--|---|---|
| Differences | | |
| Goals of IT adoption | Based on systematic identification of critical processes (Article handling and sorting, Information management of mailed articles, Information exchange within offices) and their computerization. IT investment between 1990 and 1999 was INR 900 million, which was 70% of the total expenditure on modernization. | Followed general instructions from the government and did not attempt to identify critical processes. Computerization aimed at basic transaction processing, and not at critical processes. IT investment between 1992 and 1999 was INR 35 million, which was less 5% of the total expenditure on modernization |
| Management of paperwork | Different systems were designed so as to try to enable seamless integration and information transfer through electronic means. This was a consequence of an integrated approach to records management | In absence of an integrated approach to records management, information transferred from the depots to the district offices was re-entered manually before the generation of management reports. |
| Role of Top management | Favorably disposed towards IT adoption. Kept abreast of the latest IT developments in similar organizations in other countries. Resources were allocated to new IT thrusts. | Not, in principle, favorably oriented towards IT. Not proactive about identifying areas that could potentially benefit from IT, beyond the obvious high transaction areas. Not comfortable with the use of computers and depended on the government for instruction and directions on IT adoption. |
| Role of middle management and the IS department | Actively involved in framing IT adoption policies and driving IT implementation efforts, schedules and timelines. Supervised IS activities in the regions and districts, and took on the role of IS professionals. Acted as IT champions, generated grassroots awareness and interest, and developed management and union buy-in for IT adoption efforts. | IS department was headed by a senior manager who reported to the head of the finance function. Junior level employees were responsible for data entry, data consolidation and report generation. The IS head did not have any control over the implementation issues and schedules in the regional offices. Middle management was reluctant to use computers and depended on junior management to provide reports. They did not participate in or influence the IT adoption process in any way. |
| Extent of IT adoption | Basic computerization in conjunction with computerization in other public sector enterprises in India Use of IT in transaction processing for payroll and accounting. Proactive IT adoption beyond the overall parameters suggested by the government such as pairing machines and computerization of counter operations. Introduction of IT in key processes: Computerized mail handling and sorting, article tracking, money transfer. LAN's within offices and a VSAT network connecting different offices. | Basic computerization in conjunction with computerization in other public sector enterprises in India. Use of IT in batch processing transactions and for reporting- for payroll, accounting and stock calculations. Information transfer between offices manually or through modems. In many cases information from one MIS report was re-entered manually at the next organizational level, because of incompatibility of technology and/or formats. |

ments is a primary reason for these organizations not allocating adequate resources for IT adoption. A similar problem existed at NCL also, in that there were no budget-driven planning processes that could broaden the scope of the existing IT applications.

National Traders Limited

NTL was an interesting organization to study because it was large and there was significant potential for the use of IT. However, the organization did not use IT for any

but the most basic functions. This was because there was a strong overall negative inclination towards IT adoption and use among the middle and junior management. For instance, none of the departmental heads at the head office or in the regional and zonal offices used computers for the latest available inventory positions. They would ask their secretaries for the relevant paper files or would simply ask their immediate subordinates over the phone.

One senior manager observed:

"Anyway, I have to ask for most of the information over the phone or through fax. So what is the use of the computer in tracking the movement of the stock?"

Lack of enthusiasm among managers in public sector enterprises for using IS has been documented by Mohan et al. (1990). The primary reasons for this are a low comfort level with the use of computers and a lack of awareness of applications relevant to the organization. Nidumolu and Goodman (1996) suggest that perceptions towards IT can change from unfavorable to favorable, as more projects are undertaken and more functions are computerized.

At the time this study was conducted, IT was used for routine administrative tasks, and not for any critical activities like logistics and distribution planning. Hence IT was not crucial to the achievement of the strategic objectives of the firm. Moreover, all electronic information was also stored in paper format. Transfer of information was both electronic and paper based. The challenge for NTL therefore was to move from the Support Mode to the Turnaround Mode (McFarlan et al., 1983), and increase the scope of existing IT applications. At the time of writing, they were pilot testing the use of a software for managing distribution and storage of food grains.

Change Management Issues

Change management has been suggested as an especially important issue in government organizations because of their entrenched processes (Caudle et al., 1991). In fact, the adoption of IT in the nationalized banks in India, which commenced in the mid-1980s, had been fraught with issues regarding acceptance of process changes and the fear of job losses due to automation. Employee unions, perceiving that their concerns had not been adequately addressed, had offered considerable resistance and had significantly slowed the process of IT adoption in the banks (Joshi & Joshi, 2002). Hence it is anticipated that change management issues would be crucial to the continued infusion and diffusion of IT at NTL and NCL.

The first aspect of change management had to do with overcoming resistance at different levels of the two organizations, especially at NTL. In a study of e-government initiatives in the Indian state of Kerala, Kumar (2003) reports that top management drive has been an important issue in driving IT adoption in various government departments and has facilitated the acceptance of IT at lower organizational levels. In this regard NCL had so far been able to manage differences between the various units and had been able to convince unions and clerical staff about the benefits of IT adoption, largely through the efforts of its middle and top management.

This process had been more difficult at NTL, given that the top and middle management themselves were not quite convinced about the usefulness of IT and that they had not proactively driven its adoption. As Joshi and Joshi (2002) have pointed out, it is relatively easier to work towards middle and lower management commitment after top management commitment has been secured.

It has been observed that supervisors may often be reluctant to adopt IT in their departments because of possible reductions in head count, which might lead to a decrease in their span of control. This may partially explain the reluctance of middle and junior management cadres to adopt IT, especially in NTL. The middle managers were afraid of losing headcount in their departments as a result of the junior management receiving training and getting relocated to IT-based functions. Similarly, junior management was apprehensive about the reduction in the number of unionized employees, the resultant loss in their own power and possible backlash from the labor unions.

The second aspect of change management was that of managing the work environment during the change process. Studies by Amabile (1996) have suggested that the work environment often becomes negative in times of new technology implementation and significant business process changes. This is because the difficulties associated with adjusting to the changes often result in collective cynicism and confusion. Such conditions stifle creativity and motivation. This was observed in NTL, where the new IT was met with collective skepticism from all levels of the organization.

Public sector organizations are characterized by complex performance measurement criteria. The lack of a clearly defined bottomline in most cases leads to a focus on inputs and budgets, rather than on outputs and productivity measures. Economic liberalization in India has resulted in an emphasis on service quality, process efficiency and overall modernization in both the public and private sectors (Wolcott & Goodman, 2003). The challenges before NCL and NTL would be to use IT for enhancing their service quality, for increasing the efficiency of their operations and to appropriately manage their IT adoption processes. In absence of such an effort, both organizations would be burdened with high-cost operations and increasingly dissatisfied customers.

REFERENCES

- Agarwal, R., & Prasad, J. (1998). The antecedents and consequents of user perceptions in information technology adoption. *Decision Support Systems*, 22(1), 15-29.
- Al-Khaldi, M.A., & Wallace, R.S.O. (1999). The influence of attitudes on personal computer utilisation among knowledge workers: The case of Saudi Arabia. *Information and Management*, 36(4), 185-204.
- Amabile, T., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the work environment for creativity. *Academy of Management Journal*, 13(5), 1154-1184.
- Beath, C.M. (1991, Sept). Supporting the information technology champion. *MIS Quarterly*, 15(3), 155-371.
- Caulde, S.R., Gorr, W.L., & Newcomer, K.E. (1991). Key information systems management issues for the public sector. *MIS Quarterly*, 15(2), 171-188.

- Cavusgil, S.T., Ghauri, P.N., & Agarwal, M.R. (2002). *Doing Business in Emerging Markets: Entry and Negotiation Strategies*. CA: Sage Publications.
- Dvorak, R., Dean, D., & Singer, M. (1994). Accelerating IT innovation. *The McKinsey Quarterly*, 123-135.
- Earl, M.J. (1989). *Management Strategies for Information Technology*. London: Prentice Hall.
- Jantavongso, S., & Li, K.Y.R. (2002, May). E-business in Thailand: Social and cultural issues. In M. Khosrow-Pour (Ed.), *Issues and Trends of IT Management in Contemporary Organizations. Proceedings of Information Resources Management Association Conference* (pp. 443-446).
- Joshi, V.C., & Joshi, V.C. (2002). *Managing Indian Banks* (2nd ed.). CA: Sage Publications.
- Khera, S.S. (1979). Public sector management. In B.C. Mathur, K. Diesh & C.C. Sekharan (Eds.), *Management in Government*. Publications Division, Ministry of Information and Broadcasting, Government of India.
- Kumar, A. (2003). E-government and efficiency, accountability and transparency: ASEAN Executive Seminar on e-Government. *International Journal of Information Systems in Developing Countries*, 12(2), 1-15.
- Lachman, R. (1985, Sept). Public and private sector differences: CEOs' perceptions of their role environments. *Academy of Management Journal*, 28(3), 671-679.
- Li, Q., Zhang, X., Sun, C., & Wang, S. (2002, May). Strategies of securities electronic commerce in China: Implications of comparative analyses between China and other countries. In M. Khosrow-Pour (Ed.), *Issues and Trends of IT Management in Contemporary Organizations. Proceedings of the Information Resources Management Association Conference*, (pp. 1080-1083).
- McFarlan, F.W., McKenney, J.L., & Pyburn, P. (1983). The information archipelago: Plotting a course. *Harvard Business Review*, 61(1), 145-156.
- Mohan, L., Holstein, W.K., & Adams, R.B. (1990). EIS: It can work in the public sector. *MIS Quarterly*, 14(4), 435-448.
- Molla, A., & Licker, P.S. (2002, May). PERM: A model of e-commerce adoption in developing countries. In M. Khosrow-Pour (Ed.), *Issues and trends in IT Management in Contemporary Organizations. Proceedings of the Information Resources Management Association Conference*, Seattle, WA (pp. 527-530).
- Moynihan, T. (1990). What chief executives and senior managers want from their IT departments. *MIS Quarterly*, 14(1), 15-25.
- Nambisan, S. (1999). Organisational mechanisms for enhancing user innovation in information technology. *MIS Quarterly*, 23(3), 365-395.
- Nidumolu, S.R., & Goodman, S.E. (1993). Computing in India: An Asian elephant learning to dance. *Communications of the ACM*, 36(4).
- Nidumolu., S.R., Goodman, S.E., Vogel, D.R., & Danowitz, A.K. (1996). Information technology for local administration support: The Governorates project in Egypt. *MIS Quarterly*, 20(2), 197-224.
- Rainey, H.G., Backoff, R., & Levine, C. (1976). Comparing public and private organizations. *Public Administration Review*, 36(2), 233-244.

- Rockart, J.F. (1988, Summer). The line takes the leadership: IS management in a wired society. *Sloan Management Review*, 29(4), 57-64.
- Swanson, E.B. (1994). Information systems innovation in organizations. *Management Science*, 40(9), 1069-1091.
- Tarafdar, M., & Vaidya, S.D. (2002). Evolution of the use of IT for e-business at century financial services: An analysis of internal and external facilitators and inhibitors. *Journal of IT Cases and Applications*, 4(4), 49-76.
- Tarafdar, M., & Vaidya, S.D. (2003). Challenges in the adoption of information technology at Sunrise Industries: The case of an Indian firm. *Annals of Cases in Information Technology*, 6, 457-479.
- Vaidya, S.D. (1991, Dec 26-29). End user computing: An Indian perspective. *Proceedings of the Indian Computing Congress* (pp. 533-541).
- Wolcott, P., & Goodman, S. (2003). Global diffusion of the Internet in India: Is the elephant learning to dance? *Communications of the Association for Information Systems*, 11, 560-646.

ENDNOTES

- ¹ 45 INR (Indian Rupee) = 1 U.S. Dollar

Monideepa Tarafdar is assistant professor at the University of Toledo in Ohio. She has an undergraduate degree in physics and a graduate degree in telecommunications & electronics engineering from the University of Calcutta, India. Her doctoral degree is from the Indian Institute of Management Calcutta. Her current research and teaching interests are in the areas of strategic information systems management, management of IT, enterprise systems and organizational aspects of IS. Her teaching has been in the areas of management information systems, data management, data communications and e-commerce. Her research has appeared in the Journal of Information Technology Cases and Applications, Journal of Global Information Technology Management and System Dynamics: An International Journal of Policy Modeling.

Sanjiv D. Vaidya is currently associate professor with the Management Information Systems Group at the Indian Institute of Management Calcutta, India. He holds a BTech in electrical engineering from the Indian Institute of Technology Bombay, and an MBA and doctorate from the Indian Institute of Management Calcutta. He has spent several years in Indian industry and has held positions in the operations and IT functions. He has also worked in the capacity of a principal advisor on strategy matters for a leading IT organization in India. His research interests are approaches and processes for information systems strategy formulation, impact of IT on organizations, end-user computing, DSS and knowledge management and e-Business. His research work has been primarily of the theory building type. He has publications in Indian and international conferences and a book of strategic use of IT. His teaching interests are IS/IT strategy and management, and e-Business strategies. He also participates extensively in training corporate executives.