

**"INDONET: A PUBLIC SERVICE
DATA NETWORK IN INDIA"**

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Two problems affecting the growth of the computer industry in the country were that one, there were not enough customers in India who could afford the use of mainframes and two, targeting the export market for potential customers was also not possible because the infrastructure in the country was bad. Networking technology was felt to be important because it would help alleviate both these problems - with networks, computing costs would be spread over a wider base with customers paying for only those services they utilized and the experience gained by setting up such networks, developing associated software etc. would help penetrating markets abroad.

Initially however, this was not the approach followed. Instead, the government set up Regional Computing Centers in several places such as Jadavpur in West Bengal, etc. CMC concentrated its activities towards setting up the infrastructure necessary to fulfil its target objectives. Mainframes and minicomputers were manufactured in India by companies such as Burroughs. However, the main users were very large organizations such as the Durgapur steel plant, Dunlop India, TISCO and so on. There were some links between academic institutions and business houses - the Indian Institute of Technology, Madras, for example, gave remote login facilities to a number of private sector business houses, but these were not many.

Around the end of the 70s, the Computer Society of India set up a demonstration of networking but till the early 80s, the only major users of networking technology were very large public-sector organizations (such as the Oil and Natural Gas Commission of India (ONGC) which used networks to link its computing center in Dehradun to its offshore plants) and government departments such as defence.

THE INDONET NETWORK

DEVELOPMENT

Between 1982-86, C.M.C. Ltd. organized a series of seminars on networks debating the merits of networks - whether they should be publicly or privately owned, what services they should provide and so on. The feasibility study for a computer network which resulted from this, formed the basis for a Government of India approval for installing the network.

The INDONET network was made operational in March 1986. The thrust areas of the company were to:

- A. Create the infrastructure for a network and promote a "network culture" within the country.
- B. Create a "software library" so that specialized users could afford to use software
- C. Provide a platform for developing software
- D. Develop in-house expertise in networking and disseminate information to the computing professional arena through training programs, seminars etc.

Government laws placed restrictions on the ownership of the actual lines carrying the data. The Department of Telecommunications (DOT) was the only organization, apart from the railways,

allowed to own telephone lines. The first three years, 1986-89 were spent in educating the personnel of the DOT to get higher quality/reliability for data networks as opposed to voice networks, which had been the only kind of networks serviced by DOT.

The network was still neither very reliable nor available however. Users of the network took it mainly as a batch and remote computing facility rather than exploring its possibilities as a network. Users with in-house computing facilities ignored the computing capabilities of the network. There was no possibility of connecting these in-house systems to INDONET because in most cases, the data protocols were different. Meaningful applications were also not available as the uptime was very low.

In 1988-89, CMC made two changes in its emphasis - one, it started offering value-added services such as electronic mail and file transfer services between clients' computers and second, it started emphasizing availability of the network to consumers at all times - to require an uptime of 95-99% or better.

In 1988, the organization implemented its first major on-line transactions processing application - an inventory control system on the network. This was initially a package used almost entirely by CMC's internal spare parts management system and the organization discovered an immense increase in efficiency of the system after implementation of this package.

In 1990, CMC decided to switch from handling batch-processing activities to on-line activities. There was a difference in the pattern of computer usage for the two types of activities and CMC developed prototype computer applications to demonstrate this. However, though availability of the system for outside users improved, the network was still not reliable enough for consistent on-line applications. Small duration failures, while not significant for batch-processing activities, could cause havoc with on-line applications. Also, the gestation period for releasing a data circuit was quite high in some cities. For on-line activities, users wanted access links to INDONET simultaneously from different cities and this was not possible to provide.

The organization increased its emphasis on reliability to take care of the on-line usage problems. Another problem was that the DOT placed a limitation on the number of asynchronous ports it provided: If it provided, say 60 ports in each of the four major cities, Delhi, Calcutta, Bombay and Madras, it would mean that if each port were dedicated to one user, CMC could have a maximum of only 240 users. However, this would be a waste, as not every user needed a dedicated port - a solution to this was the introduction of dial-up modems being used to share a port among customers - each customer being allotted a specific time-slot he could use exclusively. Also, radio-frequency modems were issued to customers whenever the distance and line of sight were not issues.

These measures did lead to a drop in batch-processing which was compensated for by an increase in on-line processing and for CMC, the revenue remained constant at around Rs. 30 million (@ US \$ 1 million) annually.

In addition, the network was also expanded physically around this time with access points being set up in other cities such as Ahmedabad, Bangalore, Delhi, Hyderabad, Pune and Vishakapatnam through multiplexers. Other transactions processing applications were developed for specific client organizations such as a reservation system for the Welcomgroup chain of hotels, a tourism database for the government of India and so on.

During the last two years, demand on INDONET has grown substantially. At this stage, two major factors have become important:

- A. At peak times, restrictions are imposed on the users due to a lack of computing power; CMC spends more time maintaining its computers rather than doing productive work - more computing power was perceived to be necessary.
- B. Many customers have heterogeneous computer systems eg. UNIX boxes which are not supported by the System Network Architecture (SNA) protocols on INDONET.

In 1990, therefore, CMC brought out an INDONET plan document which aims at substantially upgrading and strengthening the network. This is now felt as all the more necessary as during the last few years, competitors to INDONET have emerged. The two most important are

1. I-NET:

This is a packet switching network belonging to the DOT. It has an X-25 backbone and is merely a transport media - there are as yet, no installed software packages. It is the main competitor to INDONET.

2. RABMN:

The Remote Areas Business Methods Network is also a DOT network. It has been in existence for more than two years now. It is now felt to be congested - with more users in cities than in remote areas. This network is offered through satellites - users with own earth-stations qualify.

In addition, several private companies, especially large multi-national banks such as Citibank and Hongkong and Shanghai Bank, with its Hexagon network, have been setting up their own in-house data networks.

SYSTEM DESCRIPTION

The INDONET system consists of a network of three computer systems located at Bombay, Calcutta and Madras. A brief description of the system is given in Table I below:

	MADRAS	BOMBAY	CALCUTTA
CPU	IBM 4361 Group 5	IBM 4361 Group 5	IBM 4361 Group 5
Memory	12 MB	12 MB	12 MB
Disks	4 GB	4 GB	4 GB
Tapes	2 × 1600/6250 BPI 1 × 800/1600 BPI	2 × 1600/6250 BPI	2 × 1600/6250 BPI
Printer	1200 LPM	1200 LPM	1200 LPM
Protocol Converter	1	1	1
Communication Controller (3705)	1	1	1

Table I: Hardware Configuration of INDONET

In addition, dedicated access to the network is provided from eight other cities in India. There are currently 230 terminals spread over the eleven INDONET locations from which users can access any one of the above three systems. The terminals are connected through radio modems, dial-up modems and leased voice-grade lines of DOT operating at 2400/4800 bps. The communication system is based on IBM's System Network Architecture (SNA) protocol. User terminals are connected to the nearest CMC nodes using circuits leased from DOT operating at 1200/2400 bps. There are several different classes of software and services supplied on the system:

1. Routine services to help the customer interact between offices in different cities:

These include electronic mail and file transfer services on a PC/UNIX based Mini/IBM system.

2. Software packages/ libraries installed on the system:

This is mainly intended for customers whose usage of such packages is not enough to justify the investment. These packages are selected after surveys which are carried out by the marketing department. If there is a good possibility that the package will be used, it is developed in-house or bought from external sources. Examples of such packages include: FEAST (a structural analysis package for civil/mechanical engineering); MPSX (a package for solving complex linear programming problems); PROJACS (a package for planning and monitoring very large projects); OLIMPICS (an on-line spare parts inventory control system originally designed for CMC's internal use) and so on.

In addition, INDONET also supports access to several databases, both within and outside the country - within the country, the CMIE (Centre for Monitoring of Indian Economy) contains financial information on about 2000 large Indian companies for the last five years; the National Information Centre for Crystallography (NICRYS) database provides Cambridge crystallographic data on organic and organometallic compounds; - for access to international databases and to facilitate software export, a connection has been set up between the Bombay node of INDONET and the packet switch at the Bombay telephone authority - the Videsh Sanchar Nigam Ltd., providing connectivity to over 12 countries - this allows access to international networks such as TYMNET and TELENET (USA); TELEPAC (Singapore) or DATEX-P (Germany) and to databases such as COMPUSERVE, DIALOG etc.

3. Specialized turnkey packages tailored to the requirements of particular customers:

Examples of such systems include an on-line reservation system designed for a chain of hotels; a tourism database management system for the government of India; an on-line tracking system for courier service and so on.

4. Platforms for software development:

These are platforms where the user can develop his own customized applications in areas of transactions processing and data base management and include CICS (software to develop on-line transaction processing applications); SQL/DS (a relational database with a query language); FOCUS (a 4GL development tool) and so on.

As has been mentioned above, in the last two years, the demand on INDONET has grown substantially. The transition of the network to Phase II of its development (now in progress) is thought to be able to address all the problems which have arisen so far. The two major aspects of this transition phase involve the purchase of another large computer - now decided as a Tandem Cyclone/R with six processors and 30 gigabytes of online storage, thus upgrading the computing capacity of the network and a shift from SNA to OSI protocols with an X.25 backbone - this will have two advantages: It allows the connectivity of heterogeneous computer systems and it places no limitation on the number of ports. Other activities in this phase include:

interfacing INDONET with the I-NET network offered by the DOT; and introducing data encryption/decryption facilities for security reasons.

INDONET CUSTOMERS

A. MARKETING INDONET:

There are three major approaches used by CMC to market the INDONET network. These include:

1. Direct marketing:

One of the factors that seems to be important to the adaption of a new system is the existence of champions at high levels of authority and responsibility (Arthur Young, 1989; Runge, 1985). This has especially been found true in India (Rau and Rao, 1993; Rau, Shekhar and Rao, 1992). This realization plays a fundamental part of the company's marketing strategy - the company has set up a marketing group for INDONET in each office of CMC. This targets potential customer organizations and attempts to sell INDONET to the organization by singling out the senior managers in the target and selling the network to them. CMC has found that the implementation/sale is usually successful due to champions in target organizations. A demonstration facility has been set up at all units to demonstrate INDONET to the senior personnel in the target organization. This group also handles direct requests by potential customers to demonstrate INDONET.

However, this emphasis of direct marketing to potential champions in a way also helps create conditions for the eventual rejection of the system. Generally, there are two classes of users in most Indian organizations - the general class of users with very little knowledge of computers and IT practices, and the in-house computer systems department. Since IT is a relatively new and glamorous field in India, there is a resentment of users towards the in-house computer department - the feeling is usually that the computer department has direct access to top management. Consequently, sales of INDONET fail when CMC contact only the top management (the computer department resents this and uses delaying tactics) or only the computer department (the line-users resent having to learn a new system; without being educated as to the advantages of the system, they feel that this is another new management practice being thrust down their throats.) The eventual result is that once every 6 months, a customer generally leaves INDONET.

2. Network seminars:

The organization organizes or participates in network seminars where it presents a paper focussing on any one aspect of INDONET. Question and answer sessions are organized as per requests to discuss specific details of INDONET.

3. General promotion through press releases, printed brochures etc.

B. INDONET CUSTOMER CHARACTERISTICS

The main customer of INDONET is the parent organization CMC itself. The two most important activities carried out by CMC on the network are the maintenance of a Management Information System (MIS) available for each of the departments - marketing, finance and personnel and OLIMPICS - the spare part inventory management system developed in-house for maintaining an accurate inventory of all spare parts necessary for any maintenance or repair job anywhere in India.

The MIS system provides information to various levels of management, caters to ad hoc queries and greatly reduces data redundancy by ensuring that data is captured only once. For example, a Claims Approval and Payment system (CAPS) does away with approvals on paper for day-to-day expenses: claim details are entered by staff and approved by managers on terminals and the relevant details are automatically fed into the MIS database after payments are made. The expenses of the MIS application is allocated to each department on a resources-used basis. However, there is no actual attempt to charge an accurate estimate of resources used to each department - the analysis is more on an investigative basis - to see which department is misusing resources and so on.

The OLIMPICS application has been one of the biggest benefits from the network. The annual closing of the accounts invariably used to take up to the second week of April, two weeks beyond the closing of the financial year, because of the problems encountered with keeping an accurate track of the inventory - this was a major problem since the organization stores over 67000 spare parts spread over 120 locations and valued at over Rs. 150 million (US \$ 5 million). OLIMPICS is an on-line transactions processing application with a centralized database and distributed access and processing, supporting over 25 standard queries on the database. The implementation of this system has allowed CMC to close its annual accounts on time, for the last two years - allowing substantial savings.

As far as external customers are concerned, there are three major categories:

1. Customers with their own applications:

These customers generally wish to use INDONET as a facilitator to carry out their transactions or batch processing activities. An example is the Indian Oil Corporation (IOC). Some of them such as ICI and TinPlate also use INDONET to interact with their international operations.

2. Customers with turnkey applications purchased from CMC:

Examples of such organizations include the UPS-Elbee parcel courier service; the Welcomgroup chain of hotels etc.

3. Customers who use the general services available on the network eg. file transfer; e-mail etc.

These are usually organizations that have transactions processing operations separated from decision making. They may not be able to afford specialized software or do not feel the frequency of usage justifies the purchase of such software.

A few examples of some of these customers and descriptions of the way they use INDONET is given below:

C. INDONET CUSTOMERS: SOME EXAMPLES

1. BATA:

Bata is a large private-sector company in India which markets footwear, sportswear etc. The company locates its warehouses called RDCs in many cities in India. These RDCs handle orders for stocks etc from the individual retail shops of the company. In turn, the stocks at the RDCs are replenished periodically from a regional or central warehouse. The problem faced by the company was that sales analysis is done on computers at the regional level, based on detailed data supplied by the retail shops to the RDCs. This sales analysis forms the basis for deciding on stock levels, promotions of specific brands of footwear at the shop level. However, the data is generally too bulky to be compiled manually at the RDC level and takes too long to transfer to the regional level to be processed on the regional-level computers.

As a beginning, the company has decided to establish a link between its regional office for the south established at Bangalore and its RDC at Madras. The data is compressed and sent via INDONET to Bangalore, for processing and is analyzed and sent back to Madras, where it is used as a basis for stock-level decisions. The second phase of the project involves making a terminal at the Madras office a remote terminal to the system at Bangalore.

2. THE WELCOMGROUP CHAIN OF HOTELS:

This project envisages the creation of an on-line hotel reservation system for the WelcomGroup chain of hotels throughout the country. The system involves the linking of 23 hotels of the chain over INDONET, with terminals at each hotel providing access to the system over dedicated P&T lines. This enables the company to offer better service to its customers by carrying out reservations for example, for any hotel from any other hotel anywhere else in the country; and also provides better information to management on occupancy analysis, forecasting etc.

3. BANKNET:

This is a Reserve Bank of India (RBI) sponsored general purpose data communication network based on the X.25 packet switching network. This has been set up to allow nationalized banks to exchange geographically distributed data and provide a gateway to the international banking system. Currently, there are 5 computers at the RBI offices: Bombay, Calcutta, Nagpur, Madras and Delhi. All intercity cheques are sent to RBI offices where they are magnetically read and stored. Cheque clearance previously took 2 months - now it takes less than 7 days. The ultimate objective is to link up bank branches to RBI offices - then there will be no physical movement of cheques.

D. CUSTOMER TRAINING ON INDONET

To acquaint personnel within CMC with the system, once a year a three week indepth training session on technical maintenance is organized for people taking care of the system next year.

When the system has been sold to the customers, customer training consists of several parts: a users' manual and help cards are provided on application to be used and/ or the network system itself. A training program is organized for all the actual line users of the system and finally, a 2-3 day training programme is organized for senior personnel.

Earlier, two to three times a year, CMC used to organize courses on applications such as CICS, SQL etc and also organize specific courses tailored to the needs of the customers on the customer's request. However, it was found that these courses lost more in expenses than they gained as revenues and hence are not organized any more.

MAINTENANCE OF INDONET

CMC uses a hierarchical approach towards the maintenance of INDONET. First, INDONET managers are located at six major locations over the country. These coordinate the maintenance activities on a regional basis. Their major functions are to ensure that the network remains operational; customer queries and problems are sorted out, preferably on the phone; software training is provided - both to CMC internal staff and to customers; and to sort out problems in resource allocation - allocation of ports etc.

If there are still problems, an overall INDONET manager at Delhi is assigned to coordinate activities on an all-India basis - he attends to resource constraints of regions eg. lack of skilled engineers; looks into cases where it has taken over two days to resolve problems and so on.

IMPACT OF INDONET

With a total investment in the whole project of Rs 80 million (\$ 250,000), INDONET was envisaged as a paying proposition with a payback period of three years. However, the project has made consistent losses till today - it has been profitable for the first time in 1992 after 6 years.

However, the organization feels that the intangible benefits outweigh the physical costs. In addition to the physical benefits detailed above, there have been three major intangible benefits the network has brought:

1. Improved customer service
2. The development of in-house expertise

Using the experience it has gained by setting up and maintaining this network, the organization has managed to secure several contracts to set up networks for different organizations: it is installing a campus network for the Indian Institute of Science, Bangalore and has undertaken a networking project linking Iris, Sun, Apollo and Macintosh workstations, MicroVax and PC/ATs for the Centre for Artificial Intelligence and Robotics, Bangalore.

3. The change in the organizational working culture

Perhaps the biggest change reported both in CMC and in the client organizations is a change in the organizational working culture towards increasing centralization. This is in contrast to the results reported from outside organizations which were setting up their own networks - these reported increasing decentralization after the network was installed.

In CMC and several of its client organizations, however, an increasing formalization of interaction was reported. For example, all internal memos etc. were to be sent through INDONET. This meant that excuses could not be made about non-receipt of the memo - in fact, it was practically a crime if there was no response to a memo in 48 hours. A lowering in the previous informal modes of communication has also been concurrently observed, along with a drop in secretarial assistance required. Other effects reported from the introduction of the network include a decreased outgo on faxes, telephone calls etc. and a smaller generation of actual paper documents. Lastly, all senior managers are given a terminal to work with at home - this has led to social changes in the home environment as well.

As far as customers are concerned, most felt that the major advantage of the network was the increasing access to timely information, especially for on-line applications. These organizations felt that reports were now generated on a timely basis. Thumb rules were less used ie. reports are based on actual data - previously, for example, they were based

on consolidation of data carried by infrequent couriers carrying floppy disks; now, the same data is available on-line.

However, INDONET has not had a significant impact on industry throughout the country. It does not have a very positive image among many of the companies who are not customers of INDONET. The major problem seems to be that the most common application used on the network, e-mail is generally an application which is not very frequently used, but when it is necessary, it is critical for the network to be up. In spite of all CMC's efforts, it is still not adequately geared to meet this. One common perception is that CMC still does not give very much commitment to up-time.

The network is also viewed as a low volume network and there is a general worry about security of data on the network - as yet, INDONET has no encryption/decryption facilities. This last especially seems to be one of the major reasons why many organizations do not wish to entrust their data to INDONET. Lastly, the marketing of INDONET is perceived on being focussed on the fast transfer of data between major cities - however, there are lots of competing services - courier etc on these routes; there are fewer ways to send data between smaller cities, hence there would be a greater demand for INDONET on these routes.

CMC has not adequately addressed all these issues, and even the cases where it has taken care of the issues, the lack of an aggressive marketing campaign has not helped to bring this to the notice of industry.

In fact, many private-sector organizations, especially multinational banks such as Citibank, American Express and so on have set up their own in-house networks. A mini case study of one such bank is detailed below:

A BANK WHICH DOES NOT USE INDONET

Like CMC, the private sector is not allowed to own its own transmission media - all lines are leased from the DOT. The most important class of potential network users are the private-sector banks.

The private-sector banks, though more restricted in their operations by the government than their public-sector rivals, the nationalized banks, - for example, they are allowed to open offices only in the four major cities - Delhi, Bombay, Calcutta and Madras - face intense competition from each other. The major competitive force in their environment therefore is their foreign rivals. Because of India's high growth rate in the latter half of the 80s, the customer base of these organizations - generally the middle class - has expanded tremendously. The requirements of these customers for different varieties of financing and savings instruments has also mushroomed. Therefore, the foreign banks generally vie with each other in either trying to be the first or a close second in introducing more and more varieties of schemes to attract business.

To many of these banks, therefore, a network with its attendant advantages of on-line transactions processing, is now perceived to be of crucial significance. Three banks, Citibank, Hongkong and Shanghai Bank and American Express are the farthest ahead in their plans for actually implementing a network. One of the significant advantages these banks have is that their parent organization generally has a network infrastructure already built in. For example, Citibank links its Bombay office to Singapore in a Global Telecommunication Network. Thus, the initial hurdle - acquiring network expertise and so on, is lower for these banks. The following case study describes the efforts of the consumer banking division of one of these banks¹ to develop its own in-house network.

The bank has several independent divisions in India. In 1982, the merchant banking division started its own network. The consumer banking division was formed three years later and started piggybacking on the merchant banking network in 1989-90. The tremendous increase in the volume of business over the past three years forced the division to start its own network. Over the next few years, the parent company plans to integrate the networks of each subsidiary into a Global Information Network centralizing all network services under one body.

Currently, the system in the division involves the offices in the four major cities linked by a network. Activities are concentrated in one office or another - for example, Madras handles all matters connected with credit card deals/loans while Bombay handles matters related to non-resident Indians, e-mail etc. and forms the point of connection between India and the global telecommunication network of the parent company. The actual network consisted of rent-and-guarantee lines laid between the bank office and the local office of the telephone authorities, from where it was sent by microwave to another city. Only recently, has the X.25 protocol been introduced.

The bank's parent organization is dedicated to technology. The overriding motivation is a drive to be a first leader in technology. As part of the organizational culture, the employees of the bank, usually MBA's or graduates at the middle management level, are oriented towards technology. Everyone is trained on systems as the only way to work and if the system went down, in many cases, they would not know how to react. All installation of systems is done in-house by a Technology Group - no turnkey systems are commissioned; the technology is felt to be middle-level - not much expertise is required. The only involvement of outside companies is in the supply of hardware. These are either bought locally or imported - depending on whether parts are available in India.

There are two sources for the introduction of systems into the organization - the parent organization and the bank in India. As far as the former is concerned, global recommendations are handed down with limited discretion as to local implementation. The essential idea is that certain basic services should be offered globally - these services may have originated in one office and caught on in different regions before being standardized by the parent organization -

¹The bank wishes its identity to be kept confidential.

telebanking, for example, started in Hong Kong. These global guidelines and basic approaches to dealing with customers are usually implemented without discussion.

However, other products have been developed uniquely in India. This development process starts either with recommendations from the marketing department attached to each group eg. the Consumer Services Group etc. or from changes demanded by individual users. For the former, first business surveys are carried out to see whether the product will have a good market. Next, the potential cost of the system is worked out - based on lines of code etc. It is then decided whether the improvement in service is major enough to justify investing in writing the application. Note that only the incremental cost is considered on top of the hardware commitment - it is not analyzed for example, whether a manual system would be better - the organization is committed to automation. The bank does not always get its figures right - a service enabling consumers to pay their telephone bill through the bank has less than a hundred subscribers in Delhi so far. User-demanded changes on the other hand, are implemented as per priority. The process involves the user asking for changes and the users and the technology group go through an iterative improvement process until both are satisfied. There is rarely a conflict of interest between competing projects. Issues of the priority given to implementing various projects on the network is decided by top management - the technology group has no discretion in the matter.

Attempts are made to make changes global - on an all-India basis. These should be as transparent as possible to the end-user - with new products, the bank tries to retain the same command structure as previously and so on. If this is not possible, orientation training, manuals etc. are supplied.

As has been mentioned before, the nature of the industry is highly competitive. The bank therefore believes in going all out to seize a first-mover advantage. This it feels, will give it three advantages:

1. Higher initial margins while the other banks try to introduce the same product:

This advantage is becoming more and more fleeting - while initially the time frame before innovations were copied by rivals was around four years, this has since shrunk to around 1 to 1½ years and is still dropping.

2. Product differentiation by branding

3. Creation of entry barriers:

The bank uses a number of vendors who sell its products eg. car dealers sell its car-financing schemes and so on. These vendors are tied to the bank using the network technology - in fact, the vendor is not allowed to sell the bank's products unless he uses the technology. The investment in learning the system ties the dealers closely to the bank.

In fact, in a variant of the Ives-Learmonth customer resource lifecycle framework (Ives and Learmonth, 1984), the bank involves its dealers/vendors as much as possible in the development of its systems for example it creates specialized reports for the collectors it engages to handle credit-card defaults/bad loans. Systems are supplied to vendors who procure a great deal of business for the bank, with more elaborate systems going to more profitable vendors.

The bank feels that many of its products would have been impossible to introduce without the network. Examples of such products include on-line Automated Teller Machines (ATMS); intercity banking; credit card operations; non-resident Indian services eg. funds transfer between other countries and India and so on. Given the intense competition in the field, being the first to have an operating network has in many cases, given the bank crucial advantages in gaining market share.

Curiously, all these banks report an increase in decentralization, especially at the middle management level, after the introduction of the network. This is probably because of the extremely competitive environment. The network helps middle management to make decisions in real-time. This level of management supplies monthly reports to top management, as before on the various indicators on which their performance will be judged. However, the network enables middle management to monitor the indicators much more closely for any changes. The level of competition being so high, there is usually not enough time to wait for responses to reports to top management on sudden adverse changes in indicators - the volume of data supplied to top management is too large to permit quick decisions. Hence middle management usually tries to correct these problems itself before it sends its monthly report to top management.

In contrast, the increasing level of centralization reported in CMC and many of its client organizations probably stem from the relative lack of competition in these businesses - in spite of the large volume of data supplied to top management by on-line networks, top management usually has enough time to analyze this sufficiently and send back detailed instructions.

CONCLUSIONS:

INDONET was set up by CMC, a public-sector organization to fulfil the following objectives: To create the infrastructure for a network and promote a "network culture" within the country; to create a "software library" so that specialized users could afford to use software; to provide a platform for developing software and to develop in-house expertise in networking and disseminate information to the computing professional arena through training programs, seminars etc. By any standards, the organization has been extremely successful in fulfilling its last three objectives. The fulfilment of its first objective - developing a network culture within the country - has however had rather mixed success. The network has not made a great impact on the general business community in India, especially in the private sector. In some ways, this is not the fault of the organization but rather of the uncertain economic environment in India.

The situation in India today is rather chaotic - there are three government networks - INDONET, I-NET and RABMN. Several private sector organizations have set up their own in-house networks. Most of these are not compatible with each other.

According to a CMC survey, there is a potential market of over 150,000 organizations in India who could be users of network services such as those supplied on INDONET. These would need basic services such as e-mail and so on to their suppliers, auditors etc to coordinate their business activities. However, neither CMC nor any other organization has any concrete plans to satisfy this demand, mainly due to a lack of funds. The initial investment is estimated to be well over Rs 1 billion (US \$ 30 million). With additional marketing and running costs, the payback period for such a project will be well over five years.

The overwhelming problem as perceived by most of the organizations surveyed is that there seems to be no vision on the part of the government or any one else as to how a network and/or a networking culture could be developed in the country. There is also no single organization responsible for setting standards, deciding on the mix of private-sector and public-sector investment for networks and so on. Currently, there is no coordination among even the various government departments - different networks are being set up for public-sector firms such as the Steel Authority of India Ltd (SAIL), the Ministry of Commerce and so on. INDONET personnel report rivalry from the competing (also government-owned) I-NET network - they believe for example, that it may be due to lobbying from the DOT that CMC has repeatedly been turned down for satellite transponder space for its network; they complain about the high prices the DOT charges for data networks - double the normal charges for voice networks and so on.

An example which many organizations cited approvingly is that of the Singapore TradeNet network. Here, the Singapore government has spent around \$50 million to develop this system for linking trade agents with relevant government agencies, thus speeding up port clearance procedures for ships immensely (Cash, McFarlan and McKenney, 1992). However, it was also realized that India is much larger than Singapore and consequently, especially with the prevailing shortage of cash with the government, it would be difficult to carry out the same kind of investment in India.

It is therefore expected that with the current turbulent political situation in India and the lack of champions at the governmental level for any specific kind of system, the present *ad hoc* situation with each organization trying its own solution to the problem, will endure for some time to come.

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