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DECENTRALISED MINI-COMPUTER NETWORK FOR STEEL DISTRIBUTION

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SUMMARY

1. Introduction

In 1976 the Electronics Commission funded a study, at the Systems Research Institute, in cooperation with the **Commercial Directorate of the Steel Authority of India**, of the Information Support needs for Steel distribution, with particular reference to the feasibility of using a decentralised minicomputer network for this purpose. This study of which the present report is the result consisted of a field study of steel users, of the steel distribution organisation and of the interface with steel production plants, as well as a state-of-the-art survey of **Distributed Data Processing Systems** and a theoretical study of decentralised organisations, followed by the design of configurations for different echelons and. an analysis of the costs and benefits of the system.

2. Background

The steel industry in India has achieved a considerable degree of maturity in its seventieth year. We have four large integrated steel plants in the public sector and one in the private sector. We also have several dozen functioning mini-steel plants and steel re-rollers. In this design study we have focussed essentially upon the integrated steel plants in the public sector.

All the Indian steel plants are found in the eastern region of the country. On the other hand the users of steel are distributed all over the country. Last year the integrated steel plants of India produced 7 million tonnes of steel in more than 2000 varieties of sections and qualities. There were estimated to be a total of about 6000 domestic customers of steel (2000 of them quite large). The Western region consumed about 2 million tonnes, the Southern region about 1 million tonnes, the Northern about 2.5 million tonnes, The balance of about 1,5 million tormes were consumed in the

Eastern region. This degree of dispersal, and situation of variety pose formidable logistical problems for the distribution agency.

Before 1974-75 steel distribution from the public and private sector plants was controlled by the **Joint Plant Committee (JPC)**. Customers would place their indents with the JPC. Based upon certain priority norms, they would be "allocated" material. An enormous number of indents (some genuine, many speculative, some spurious) were sent to the JPC: even genuine users had to keep increasing the quantity ordered just to cover the lengthening lead-time for delivery. As a natural consequence, JPC could allocate only a fraction of the amounts in each indent, causing the indents to be further escalated. By the time the system was shelved in 1975, the backlog of indents on paper was equal to several years of production of steel. Most genuine users had great difficulty in obtaining steel. Ad hoc customers had to depend entirely on the "open" market; exporters and fabricators were worst affected; government projects and others piled up steel requirements for years in advance.

With certain changes in the situation, e.g. improved production of steel and a slackening in demand after 1974 consequent on the recommendations of Tandon Committee report on Bank Credit, the JPC system was judged ineffective and the distribution of steel was reoriented. In the new system people could go to the nearest HSL Branch Office, place their orders and collect the material from a stockyard. Steel plants shipped their production, in rake loads, to stockyards instead of direct to customers. This system has now grown to 7 zones, 28 branches, and 60 stockyards in the public sector and a parallel but smaller (25 stockyards) system for Tata Steel.

Now the Steel Distribution System has to arrange for advance placement of steel at the stockyards and the corresponding physical, inventory and accounting transactions have multiplied in number. Further, the emphasis on meeting the evolving needs of the market placed a premium on effective design of the information flows in the system. It was at this point that the Electronics Commission funded a study to be conducted by the Systems Research Institute, to identify the information support required, to assess the feasibility of a minicomputer-based network system to provide the information support to steel distribution.

5. Study Methodology

SRI took up this study in October 1976. Some field work had however been done as early as November 1974 while the proposal was under consideration. For purposes of the study, the three immediate environments of the steel distribution system have been identified as (a) **Customers**, (b) **Plants**, and (c) **Railways**. The steel distribution system itself has at its core, the Sales Head Office at Calcutta consisting of the **Central Sales Organisation (CSO)** and the **Central Shipping and Transport Organisation (CSTO)**.*

In the first stage of our study different kinds of customers large and small, located in urban and remote areas, manufacturers and traders, near the plants and away from the plants were contacted and. interviewed to find out the difficulties faced by customers in getting steel.

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*The selling function of steel (for exports, domestic sales and imports) is proposed to be managed by a new organisation called SAIL International Ltd. (or SIL). For the sake of simplicity we shall use SIL to denote the countrywide Sales organisation for Steel distribution, and SHO (Sales Head Office) to refer to the Calcutta operations in Steel distribution.

In the next round, discussions were held with different officers involved in the steel distribution including Customer Contact Officers (CCOs), Branch Managers, Zonal Managers, general Sales Managers, General Shipping and Transport Manager, Chief (M.R. & S), Director (Commercial), etc.

We also attended the Production Plan Meeting, which is held every month at each plant, to get an idea of the planning information required.

Discussions with senior South-Eastern and Eastern Railway officials informed us about their difficulties and expectations.

4. Design Criteria

From our understanding of the perceived needs of the people at different levels in the Steel distribution system and the associated organisations in the supra-system, three important and necessary characteristics of the information system emerged. They are:

(1) The ability to capture transaction data at branches, and. to update the branch files so as to enable fast and correct actions in the field.

(2) The need for analytic capability at all levels to enable effective decision making.

(5) The need to enable resilient forward planning through use-of an information-image of operations, & through models at SHO, and to incorporate an organisationcl control system.

With these criteria we have aimed at choosing an appropriate technology of information processing to match the organisational structure and needs.

5. Main Design Concepts

Two concepts - one **organisational** and one **technological** – have provided the basic foundation to our thinking in the information system design work. They are Decentralisation and Distributed data-processing (DDP).

a. Decentralisation

Decentralisation as an organisational philosophy and management strategy has emerged to the fore with the growth in size and complexity of organisations. As an organisation grows and becomes more complex it is increasingly difficult for the apex in a centralised hierarchy to collect and analyse uptodate and complete information about operations and to take the correct decision, or even to formulate detailed plans. The solution lies in decentralising decision making and distributing the responsibility in a way that each level in the hierarchy collects that information most easily available to them and takes the decisions which are timely and relevant to their functioning.

To complement the decentralisation process, all the echelons in the hierarchy have to be provided appropriate analytic or information processing capability – and this is where the second concept is to be applied:

b. Distributed Data Processing

With advances in electronics, computers for data processing have become progressively smaller and cheaper, and at the same time have grown in power. So-called "minicomputers" today pack more power than the largest second-generation machines of 1962-63. This is more than enough to handle the data processing needs of any department, office or division in any organisation. Convenient new portable data storage devices like tape cassettes and cartridges, and "floppy discs", have been designed which can facilitate quick, reliable and economic movement of data, especially in a country like India where digital telecommunications cannot be freely availed of.

At the lower end of the spectrum there are microprocessors and 'intelligent terminals' which also process a surprising amount of data through on-line man-machine interaction. This makes completely obsolete the traditional punched card and all the expensive associated machinery for punching, verifying, sorting, collating and printing.

These innovations in technology make it possible to design data processing systems which have information processing or analysis capability distributed exactly in line with the needs of the different levels (echelons) in any organisation.

6. Advantages of Minicomputer Technology

Minicomputer technology has several advantages from the implementation point of view also. The network can be built up in a phased manner: Starting with the installation of equipment where it is most needed, the network can be gradually expanded to cover other locations. **Modular growth** allows for the necessary learning to take place, which means that there are fewer mistakes and therefore implementation can be smoother and faster. The initial investment is comparatively low and further investment can be stopped – or speeded up at any point. In a minicomputer network environment there is a great deal of flexibility; hardware and software changes can be made with very little effort at any time. One can also take fullest advantage of the falling cost curve for minicomputers. ***In short, the organisation remains in control of the technology.*** The recommended system is built up from the following self-sufficient modules – Microcomputer system (with terminal, floppy disk and printer) at upcountry branches (cost ~ $20,000), minicomputer (with many terminals, cartridge disk and printers) at metropolitan branches, shared with the zonal office (cost ~ $ 100,000), Dual mini at SHO (cost ~ $ 180,000). The Bombay and Calcutta zone-branch-stockyard complexes are of course given special treatment, Intercity data transfer is by cassettes or floppies.

7. Pitfalls in Centralised system

We would like to mention that we also evaluated the alternative of having a centralised computer system (costing about Rs 1.8 crores or $ 2,000,000), and rejected it, because of its monolithic nature ***requiring a large investment which immediately becomes a fixed cost***. This makes the rigidity of the system itself the determining factor in design, rather than the wishes of management.

A centralised system also provides analytical support only to the headquarters group in the organisation, Other substantial problems are - delays in processing field data due to waiting for all branches to report; bottlenecks in card punching; lack of uptodate decision data and, files in the field offices, etc. A teleprocessing centralised system is not yet feasible in India because of the cost, error rate, and unreliability of the telecommunication systems. Even if teleprocessing were feasible, a centralized system cannot cater to 'local' decision-making needs, as is witnessed by the growth of DDP in the USA where teleprocessing is both cheap and ultra-reliable.

8. Resilience of Proposed System

One of the key characteristics of the proposed decentralised information is its resilience

(a) to changes in policy related to distribution, pricing, etc. Such changes might include permitting or restricting direct despatches from plants, or centralising allocations, even total decontrol of prices;

(b) to changes in organisational structure. Thus adding branches or stockyards or reallocating them to other zones, or changing the authority vested in each echelon could be easily taken care of;

(c) to changes in major environmental factors, like a transition from surplus to a shortage situation due to increased demand.

The resilience of the system lies in the very nature of the design – its modularity; its flexibility and, its adaptability. Basically it provides the means for decision-making and for control under all the foreseeable circumstances.

9. Organisational Processes and the New Technology

Implicit in the changes since 1974 in the steel distribution system has been a move towards decentralised decision-making and professional management at all levels. The minicomputer network system is capable of supporting the development of truly modern management especially in relation to three key factors: Uptodateness of data, correctness of data, and information analysis through simple models. Thus, computerised short term operating plans make it possible for operating management to be future-oriented rather than day-to-day crisis-management oriented. They solve calmly arid in advance next week's bottleneck or next month's shortage visualised by the on-line real-time computer rather than merely cope frantically with yesterday's difficulties over the telephone or in meetings. Similarly, the uptodate information files of an on-line information system gives branch managers more and better control. Their thinking can be customer-oriented rather than organisational-constrainta-oriented.

With the availability of decentralised minicomputer technology, the concern of the higher echelon, viz. Zonal office, would shift from the present, to what will happen in the next few months. The Zonal Manager can concentrate on strategic medium and long term decisions using forecasts and end use analysis to understand the trends and. behaviour of his customer classes, well in advance. The Zonal office will no longer merely be doing sorting and collating of requisitions from branches. Instead the Zonal Manager can give SHO a closer feel of the customer world, e.g. by evaluating customer responses to price changes.

At the Sales Head Office, the coordination function would be performed by maintaining uptodate the rolling six month "shadow plan" for production and despatch with the help of the information image of the plants and of the branch requests. This "shadow plan" in the computer becomes the focus of the SHO activity, with coarse adjustment possible for future months and only very fine adjustments in the current period. The 'shadow plan' acts as a buffer between the steel production and steel consumption systems, absorbing sudden fluctuations in either one and eliminating the sense of perennial crisis characteristic of the present situation. The SHO thus has responsibility for the key task of sales vs. production planning and despatch, and also has the information processing tools to do the job – and the uptodate information for this task. The potential of the zonal office as an echelon in the Steel System hierarchy gets much more fully exploited.

The three-volume report presents, in addition to the Computer configuration and Benefit-Cost analysis for a distributed information network, a full discussion of the organisational and managerial implications underlying the proposed technology and. a plan for the phased implementation of the network.

Given the catalytic capability of the proposed system, briefly covered in this summary and expanded in greater detail in the three volumes, we are confident that implementation of it will help SAIL to harness the Steel sector effectively for the rapid economic growth of the country.

10. Guide to the Report

This Report is divided into three volumes for ease of reading: **Volume I** contains most of the details of the analysis specific to the Steel system. **Volume II** emphasises the human and organisational factors in decentralised working and evaluates the system beneficiary-wise. **Volume III** covers the technological aspects, the configurations, and the costs and benefits of DDP vs. a Centralised Computer system. It also deals with implementation factors and provides cost estimates for the phased implementation proposed by us.

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