CHAPTER 8

CONCLUSION & POLICY

IMPLICATIONS
CHAPTER 8

CONCLUSION & POLICY IMPLICATIONS

8.1 INTRODUCTION

India has reached the end of its second computer decade. While the developing countries reached the era of large scale computer expansion, within the first decade of entry of computer in the industrial arena, the likely computer explosion expected in this country during the 70's is not yet in site. During the first decade of computerisation according to the U N document No.1/3 3/11 entitled 'Application of computer Technology' this country had only 185 computer installed by 1971. The rate of growth of computerisation in the country during seventies has been even slower than the previous decade. This in spite of the fact that after the deliberations in the Committee of Automation headed by Prof. Dandekar in 1971, the labour and management in the industrial world of the country had reached an understanding, which brought in a considerable change in the view of labour unions. The view shifted from position of total ban on computers to one where they considered that computers could be instrument of national economic growth. Creation of a favourable atmosphere like that obviously raised the expectations of a higher rate of growth of computerisation during the later years, but these expectations have unfortunately not been fulfilled.

8.12 This deviation of results from actual expectations raised some basic macro-level questions. Resource gaps, need for
manpower like system analysts and programmers, opportunities for training manpower for future computer users. The benefits that could accrue to the unions through the improvement of performance were some of the basic questions raised. Even narrowing of gap between desire to use computer to greater and more effective use, from the plans for introducing and extending their use was considered. These questions could be answered only through a proper analytical tool engulfing the technological, economic and organisational goals in the field. Unfortunately due to a fast changing technology in this field, and high investment cost coupled with heavy dependence on foreign exchange and foreign know how, an answer to these questions was not easily forthcoming. The interest of multinational corporations like IBM, ICL etc who were exercising major control of computer industry in the country, could also be considered to be a contributory factor for the slower rate of growth of computerisation in this country.

3.13 There could also be other factors like scarcity of resources, lack of clearcut guidelines and policies, both at the corporate as well as the Governmental level. Sharing of benefits accrued from introduction of computers between the management and the workers was made difficult due to the existing legislation. The methods available for assessing such benefits were also inadequate for applying to the problems raised by computers. Under such situations management appeared to be the main beneficiary of this powerful new tool. They obviously could not isolate themselves from the technical, economic and social problems that are a part of any new
development which could be brought about through computerisation.

3.14 If the country has not been able to achieve the fruits of economic growth catalysed by the computers at the rate desired it could be due to the failure on the part of management to identify the social purpose of computerisation. Understanding of expertise and beneficial deployment of the use of computers was most crucial for deriving the maximum benefit in employment of this scarce economic and technical resource.

3.15 As it was purely the management decision which could affect the growth and success of computerisation in any industry, there was a necessity to study the problem at the micro level, the firm level. The management had to be offered a tool for this decision making process and also a tool to analyse the effect of this decision. This background consideration helped in deciding the mode of this study.

3.16 Applying the technique of cost-benefit analysis, a tool of welfare economics generally used in macro level studies - to a micro level study might appear to be a little unconventional at the outset. However, when one considered the broad issues involved, the difference would appear to be only of scale and not of concepts. The lessons learnt through an analysis of scaled down model could beneficially be employed even on a larger scale problem provided the limitations imposed by the scales were taken due care of.

3.17 Unlike other technological innovations, computer offers a new way of doing business or any complicated form of organised
activity. It involves heavy investment, both to install and manage. A well managed computer system can help the organisation to multiply its size; provided due care was taken to formulate the plans and assimilate the necessary resources.

6.18 Besides these, the computers produce certain problem areas for the management and labour resistant to change. Retooling for the new machinery and other related production problems have to be considered. The psychological preparation of the workers to accept the change and training of man power for operating the new system are the areas affected by management decision to automate, where, how and when to automate are the difficult decisions management is called up to take during the initial stages of automation. What tool the management has, to gauge the impact of his decision on these problem areas?

6.19 Management was also concerned with the assessment of the rate of recovery on its investment decision for computerisation. For achieving the fastest rate of return it was essential that the facility was put to optimum use. What measures could the management take to get an answer to all these problems. Obviously no single tool was available for offering all the answers to the problem of a rational decision making in these areas. An economic and financial analysis could, however, provide the necessary framework from which all aspects of project on computerisation could be evaluated. The benefit cost ratio computed from such an analysis could, therefore offer a fairly useful measure of the wealth creating capacity of the project. This study therefore, explores the areas of
of project development for automation in data processing and aims at finding the requisite tool for the evaluation of the project through analytical tool of cost-benefit approach.

8.2 THE BROAD PERSPECTIVES

8.2.1 Beginning of the computer era.

8.2.1.1 A search into the development process of computer and automatic data processing reveals that the electronic computers entered the field of data processing in developed countries during the early fifties. Within a decade in the field of automatic data processing, countries like USA and England, who were responsible for bringing in the computer era reached the stage of computer explosion in the field of data processing.

In India, however, the entry of computers was rather belated and its growth has been even slower.

8.2.1.2 Having first made its appearance in the country in 1961, for the next five years or so the country saw a negligible growth rate for computerisation. This was possibly a period of assessment and education for the public and the computerisation was expanding at a very slow pace only in educational and R & D installations. Its use in industry picked up only from 1966 onwards but the rate of growth has been rather slow.

8.2.1.3 Due to heavy cost of investment in foreign exchange and total dependence on foreign knowhow and expertise, the country had to soon formulate a policy for indigenousisation of the computer industry. Licenses were granted to IBM, HCL and ECL for indigenous developmental and manufacturing activities. Simultaneously the workers resistance was building up against
computation as the unions felt that computerisation would bring in large scale labour displacement and cause reduction in employment opportunities. These fears of workers were alleviated through the examples of public sector undertakings like Railways, where computerisation was introduced without any marked labour displacement or retrenchment. A tripartite conference succeeded by the formation of Committee on Automation also helped in proper education and alleviating the labour resistance against computerisation.

8.214 For deriving the full benefit from the limited computerisation programme, however, an understanding of the economics of computerisation was essential. It was not possible to realise the full benefits of computerisation in the initial stages unless the technological and marketing operations worked hand and glove. The management had to plan from the beginning to increase the effective demand of computer time to reach the theoretical demand within the shortest possible time. But care had to be taken not to load the idle capacity of computer time with jobs which could be done more economically through other means.

8.215 A private motive of profitability and economic growth of organisation was not the only outcome of computerisation. Computerisation produced its impact on general public as well as the employees, and all this could not be measured only in monetary terms. The impact of the computer produced on different economic and social systems was quite at variance from each other. Control of computer power in hands of well
intentioned socialistic societies could produce public good in the form lowering prices, shortening of working hours and thus increased leisure. On the other hand same control in the hands of capitalistic power could go only to increase the private profit and concentration of economic power resulting into increased exploitation of workers and consumers. The impact of computerisation in mixed economy like that of India was not that easy to gauge. Possibly a proper economic analysis taking the help of cost-benefit approach could help in evaluating the decision making process under such situations. Thus this study.

S.318 It was, therefore, essential to develop a concept of cost-benefit approach and analyse the project of datamation in light of that concept. For developing this concept, one had to study the literature and examine other previous applications of the technique, also compare it with other tools of economic analysis like that of profitability analysis and examine their relevance to the issue. This tool of analysis could not be affectively employed for the project in datamation unless one was clear of the characteristic nature of technological and economic problems of the project formulation and its development. Evaluation of the benefits and costs of datamation also posed their own characteristic problems. All these had to be examined in detail, before deciding upon a suitable model through which the data generated could be applied to for assessing the effectiveness of the decision making process through the development and execution of the project.
8.217 All these has been achieved in part I of the study described from Chapter I through 6. To assess the validity of this study, the concepts discussed in part I have been applied to a real life problem through a case study as described in Chapter VII. While the concepts discussed in part I are from a global point of view and it may not be possible to apply all these concepts to a single case in real life, the case study does bring out a lesson into the real application of the technique and certain lessons highlighted have global applications.

8.3 PROBLEMS OF APPLYING COST-BENEFIT APPROACH TO DETERMINATION

8.31 The foundation of cost-benefit analysis is based on a single criterion of Pareto improvement. In other words, it should bring about an economic change in which the gains are so distributed as to make everyone concerned better off.

Applying this concept in the field of data transmission produces its characteristic problem. The components that will enter into the calculations of cost-benefit analysis are the fragments of gains and losses of the system. In case the economy was free to regulate the price structure, possibly there was no requirement for cost-benefit analysis. But in the field of computerisation in the country, it was a highly controlled economy. Investment in computer would produce significant spill over effects that escape the normal price mechanism. The varying degree of monopoly created by the cornering of the scarce technological and economic resources in the field of computerisation produce the familiar market imperfection in this field.
These limitations could possibly be overcome through the "accounting" or "shadow" pricing in cost-benefit analysis.

2.32 The real problem was felt when one wanted to engulf additional objectives like achieving a faster rate of growth in computerization or achieving improved service from existing installations. The variations in preference of distributional structure or the will to sacrifice more today in the hope of increased future benefit are factors which cannot be easily engulfed in the shadow price structures. Attaching weights to different objectives in order of their importance, also does not help in a society controlled by political pressure groups, because the economists view of reasonableness in the circumstances might be always challenged on results. In this country particularly due to dominance of foreign market in the field of computerization the political thinking has always dominated the economic thinking.

2.33 It is also not easy to engulf the social objectives of datamation into the accounting or shadow prices. Even if it is somehow achieved, the resulting rules obtained on the basis of such cost-benefit analysis are likely to conflict with the Pareto basis of cost-benefit analysis. Resulting calculations will therefore not be consistent with social objectives obtained on consensus, and it will be difficult to defend such calculations.

2.34 Nevertheless, the application of the cost-benefit analysis technique to a situation like this had its advantage when the standard allocative rule could be modified through
explicit clarifications. While applying this technique for project analysis in datamation, it was explicitly clear that standard all-occative procedure based on Pareto's improvement was not fully adequate. Obviously the proposal obtained through this analysis could not establish their superiority to the other tools of economic analysis in achieving these objectives.

3.35 These inadequacies of the cost-benefit analysis in its application to datamation limited the scope of objectives of the study. The objective was accordingly limited to the formulation and analysis of a project to assess the advisability or otherwise of an investment decision.

3.4 WIDER IMPLICATIONS OF THE STUDY

3.41 The main body of the study brings out the considerations affecting the application of cost-benefit technique in various decision making processes. How the uncertainties of the outcome of a project can be handled through estimates of probabilities, analysis and qualifying of the benefits in relation to the uncertainties? How the alternative offered out of a range can be allocated various rankings for the choice of the best alternative? These are some of the questions answered.

3.42 The importance of cost-benefit analysis over other techniques of economic analysis like profitability analysis has also been stressed on the ground that such other techniques do not take into consideration the market externalities affecting the consumer surplus or the social rate of discount, which determines the rate at which the societies' weight in increments to consumption declines over time. The measure of true
worth of a project is the net-benefits derived through it. In case of a project on computer where a large number of benefits evade a direct quantification, measurement of the net benefit poses some structural problems. It has been suggested that even in such cases, assignment of suitable weights in keeping with set objectives can offer a solution.

8.43 A detailed micro analytic approach of the study into all the aspects of project development for computerisation, has dissected the system approach and the engineering aspects of information processing through electronic computers. Discussing the engineering aspects, the complete mechanism of data processing, giving the importance of instructions, codes and coding media and the computer language has been explained, with a view to build up a real insight into the complex process of dataatation.

8.44 Selection of proper technique and equipment were important aspects of project development. These were affected by the preferences of decision makers. It was possible to arrive at an optimal cost-benefit combination of these preference through an advance planning and plotting of a large number of indifference curves regarding the choice of techniques of decision makers.

8.441 Changing the manual operations to computerisation produced certain structural changes in organisations. Such changes produced both desirable and undesirable impacts on management particular at the lower and middle management levels. Through proper motivation and participation of management of
at all levels in the development of new project, the adverse changes in internal relationship could be warded off. Any changes or adjustments in the organisational set up carried out during the development process should be aimed at achieving full benefits from the control measures available in the new structure.

8.45 Even selection of equipment and peripherals for a new project was a complex activity, particularly when a large range was offered by the market. Under Indian conditions where the range of availability of equipment was limited, this was not a major consideration in project formulation, but one had to be aware of the problems envisaged. A number of techniques for selection of equipment have been discussed but for getting a correct measure of overall beneficial effect of the computer hardware, the choice of ranking method, with due caution has been suggested.

8.46 Measurement of costs and benefits of the computer project offers the most formidable area of project formulation. It is also the most important aspect of the evaluation through cost-benefit technique. The problems faced in these evaluation have been discussed at length bringing out the importance of systematic evaluation choices, constraints, alternatives and objective functions. Techniques of estimation based on empirical results and their backs have also been pointed out.

8.47 For accurate and true assessment of costs and benefits, these were required to be properly classified in the tangibles and intangibles, quantifiable and non quantifiables. Depending on the objective functions, they had to be graded, ranked and
weighted appropriately. Help of management, operators and concerned authorities could be taken in this regard and suitable averages arrived at.

8.48 Evaluating the project involved a proper choice of the cardinal measures, assessment of profitability of datamation accurate estimation of benefits and costs, including the effect produced by the management on these structures and then applying the actual technique of cost-benefit analysis after assigning appropriate weights. Each one of these activities had their characteristic requirements when applied to a project on computerisation.

8.49 Computerisation proceeded through stages. Each stage of computerisation had to be assessed appropriately to get an overall picture for evaluation. Formulation of the project started with the conduct of preliminary studies and ended with the installation and usage of the system through its life.

8.491 Computer being an expensive piece of equipment, required high cost of investment both to purchase and maintain. It was not always possible to achieve real savings through computerisation. It was, however, possible to achieve increased income and offset the increased cost of operations. The evaluation procedure, therefore, had to be so designed as to assess the income generating capacity of the system through its life.

8.492 The investment on computer did not stop with the installation of the equipment. The operational and maintenance costs were continuous. At a certain stage the yield from computer
could reach a saturation point but the costs kept on increasing through the life of the project. An empirical model based on this concept has been suggested to assess the income generating capacity of the computer and the optimum level of its operation. The point of inflexion of the model gives an indication where the management should become conscious of undue increases in the cost of operation and maintenance.

8.6 ISSUES LEFT OUT DUE TO LIMITATION OF APPROACH IN THE CASE STUDY

8.51 Micro level approach of selecting a single firm project for the case study produced its inherent limitations in application of all the concepts developed during the study. Under the situations of Indian market conditions for computers, it was not possible to test validity of all the concepts of selection of techniques and equipment. One had to go in for the equipment available according to his pocket. Even the range of equipment available in the market was quite limited.

8.52 The case taken for study was one where computerisation of data processing was contemplated right in the beginning of the computer era of the country. By then the technology and knowledge base of the country in these areas was quite limited. It was, therefore, not practicable to develop the project in that systematic manner as could be, with the present day knowledge. However, as the project was developed through the help of a contracting firm who had built up sufficient know how and experience in the field, major pit falls of project development could be taken care of.

8.53 The major issues which had to be left out due to limitations of approach in the case study were the examination of
the impact of attitude of management on costs and benefits, the social costs of the project, ranking of alternatives and selection of an optimal mix of operations. It was not practicable to test the validity of the concepts developed in these areas, from the limited approach of the case study. In spite of these limitations, however, it was possible to test a number of issues raised during the study. From the data generated during this study, it was possible to test the validity of the model and certain results which could have wider policy implication at a global level, are described subsequently.

3.6 POLICY IMPLICATIONS

3.61 Our study had focussed its attention towards the project formulation of computerisation and its evaluation through the cost-benefit approach. In these efforts, we located the cardinal points of project formulation and could assess to a limited extent the reasons for the slow rate of growth of computerisation in the country. As the evaluation process adopted was of a micro level assessment of investment of a single firm, the policy implications of this assessment were limited. However, the results of the case study highlighted certain lessons which had broad policy implications in project formulation and assessment of investment decision. These are discussed below.

3.62 A detailed feasibility study and intimate planning of the future course of events was of paramount importance before launching the project. Involvement of the management
Worker affected by the new system had to be attempted from the very beginning. This would create a sense of participation from the affected parties and remove the psychological fear of unknown that such situations often create in the minds of old workers.

8.63 The operations that were to be delegated to computerisation had to be decided well in advance. It was not a desirable thing to switch over operations for computerisation merely to fill up the idle computer time. Its long range implications had to be assessed. It was not possible easily to switch back to manual system later when computer time was at a premium. A very considered thought, therefore, had to be given before deciding the operations which were to be computerised.

8.64 The staff displacement and training was another area requiring detailed planning before launching a project on datamation. Availability of trained and experienced managerial and supervisory staff was of great importance. These were scarce and not easily available at call. Before launching the project, their availability had to be assessed and confirmed. Also a detailed training plan had to be drawn out to absorb the displaced work force drawn from the personnel who were going to be affected by switching over of manual operation to computerisation.

8.65 For the assessment of the investment decision, the 'S' shaped model discussed, offered a reasonable tool for application, through the life of the project. For deriving the maximum yield from the computer project at reasonable investment
one had to assess the level of operation. It was not a wise decision to keep on increasing the costs or investments merely to increase the effective demand of computer time nearer the theoretical demand.

8.66 The increasing programming and stationary costs placed a premium on maximum utilisation of the computer hardware.

But the hardware was not the only high cost item of the system. In fact a very high level of utilisation of the computer time could result in higher costs of maintenance also. The costs of system analysts, programmers and operators were equally important. In the long run, their cost was likely to increase even the cost of hardware. The 'S' shaped model, therefore, helped in assessing the level of utilisation for any computer system.

8.7 SCOPE FOR FUTURE STUDY

8.71 In this study, an effort has been made to develop the concept of Benefit-Cost analysis for applying it to assess the project of computerisation. The concepts have been utilised to a limited extent at micro level to an actual case work. There are still a large number of areas in the related field where this technique could be judiciously employed to assess the economics of computerisation.

9 There is a scope to study the impact of computers on employment at macro level industry wise or nation wise. The computers are known to have escalated the wage rate in developed countries and still provide a more attractive and economic alternative to manual operations. Creation of such
a situation in developing countries is not very desirable. Yet if use of computers results in achievement of efficient operations, coupled with high level of employment and continuing employee development, it is definitely a desirable thing for even a country like India.

One could, therefore, study the operation where use of computers could result in achieving higher efficiency, fuller employment and how it helped in continuous development of employees.