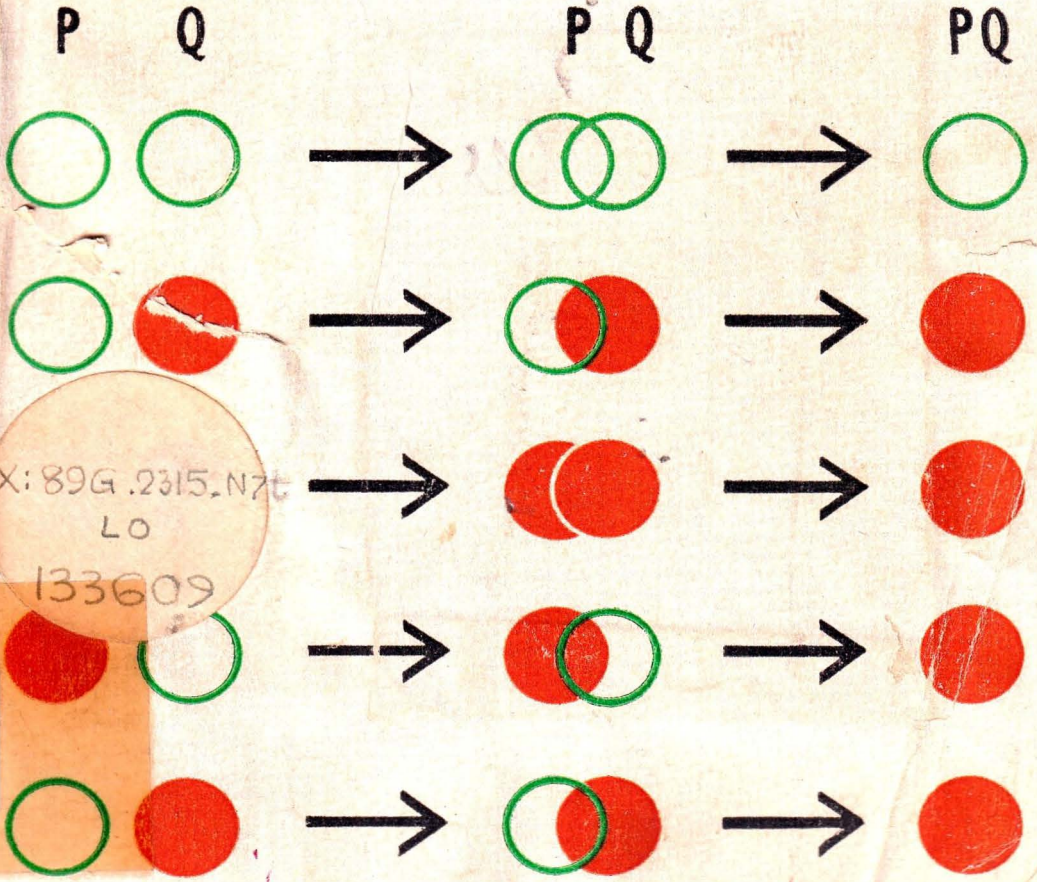




REPORT OF THE WORKS STUDY TEAM ON AUTOMATION (OFFICE AUTOMATION) IN MAHARASHTRA STATE



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GOVERNMENT OF MAHARASHTRA
INDUSTRIES & LABOUR DEPARTMENT

REPORT
OF THE
WORKS STUDY TEAM,
ON
AUTOMATION
(OFFICE AUTOMATION)
IN
MAHARASHTRA STATE

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**THE WORKS STUDY TEAM
ON
AUTOMATION IN MAHARASHTRA STATE**

Appointed on : October 10, 1968

COMPOSITION

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*Prof. D. B. Sardesai
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Report Signed on : 16th April 1970

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CHAPTER I

PRELIMINARY

Our Constitution

We were constituted by the Government of Maharashtra, through its Resolution (Appendix-I) Industries and Labour Department No. MSC. 73668/119430/LAB-II, dated 10th October 1968. We are happy to note that the appointment of our Study Team was generally appreciated by Labour, Management as well as Industrial Community in Maharashtra. This is evident from the keen interest shown by all of them in our work. Since the appointment of our Study Team, quite a few knowledgeable persons and experts in the field have expressed their views on this subject in the Press as well as to many a audience at various levels. In fact, quite a few seminars, symposia, discussions and talks have been organised on the various aspects of Electronic Computerisation by certain Organisations and Institutions since the constitution of our Study Team, and this perhaps should be an indication of the increasing interest that has been aroused in our work.

1.1. Our enquiries lead us to believe that our Study Team (not of tripartite nature, but consisting of experts only) perhaps is the first of its kind in India constituted by any State Government, to assess the extent and impact of Automation (Electronic Computerisation) on the Industry and Labour in Maharashtra.

1.2. However, we are conscious of the fact that a little earlier after the subject of Automation was discussed at the 1966 Indian Labour Conference, a Special Session of the Standing Labour Committee was convened by the Union Labour Ministry at New Delhi on 18th July 1968 to discuss various aspects of the problem. The Department of Labour and Employment also have appointed in July 1969 a Tripartite Committee for assessing the effects of the introduction of Automation on Industry, Commerce, Administration, etc. and to report to the Government within a period of one year.

Our terms of reference

1.3. The broad terms of referenece, as contained in the Government Resolution, dated 10th October 1968 (Appendix-I) are as follows :—

(a) To assess the extent and impact of automation (electronic computerisation) on Industry and Labour in the State, including the extent of

retrenchment due to automation in the industry and the extent automation would affect potential employment and also the effects of automation on the Society and the economy in general ;

(b) the Survey should be restricted to electronic computerisation in the first instance and should cover automation in manufacturing processes in due course ;

(c) the Study Team should also consider the following aspects :—

(i) survey of establishments which “buy time” on automatised machines or computers,

(ii) inter-state effects of automation,

Within this broad outline, the Study Team framed its terms of reference covering the points referred to in the speech by the Honourable State Labour Minister, Shri Narendra M. Tidke. (See Appendix II).

The Study Team should—

(a) *Survey* (i) the extent of electronic computerisation in the State of Maharashtra and assess its impact on Industry and Labour with special reference to employment, including retrenchment and potential employment, occupations and working conditions, conditions of service and in general organisational structure and management, and also cover,

(ii) automation in Manufacturing Processes ;

(b) Ascertain the Inter-State effects of automation including electronic computerisation ; and

(c) Study effects of such advanced technology on the Society and economy in general, and report.

Our Procedure

1.4. We have adopted a three-fold approach to the method of work assigned to us i.e. to conduct (i) general survey, (ii) case studies and (iii) field investigation (in a limited way) enabling us to have a greater quantitative assessment, better qualitative analysis and deeper insight in the issue in question. At the outset, we issued letters to the organisations in Bombay such as I. B. M., World Trade Corporation and International Computers Limited which have, by and large, supplied computers to the establishments concerned, pursuing them to furnish the list of such Electronic Data Processing (EDP) organisations as well as the Unit Record Machines (URM) establishments so as to get a clear picture of the status of electronic

computerisation and data processing equipment in the State of Maharashtra. Certain information regarding the establishments hiring computer-time from the EDP installations in the State of Maharashtra was collected from the EDP installations themselves. Thus, after having a complete stock of EDP installations and URM Organisations and establishments hiring computer-time, we drafted *six* types of Questionnaires and issued them to the parties concerned. The idea obviously was to collect the factual and meaningful data which would enable us to reach proper findings and conclusions.

1.5. Most of the relevant literature on the subject of automation and electronic computerisation so far as it pertains to the subject, in general, and the Indian situation, in particular was perused by the Study Team to gain sufficient knowledge of the problems and the perspective of automation for India's economy and, more particularly, for the economy of Maharashtra.

1.6. Information regarding the practical working of these EDP installations and its various effects on the organisation and its multi facet nature was collected by approaching the EDP managements, the trade unions functioning in the EDP organisations, the Central organisation of employees as well as of workers, certain technical and professional institutions, eminent experts and independent persons having considerable perspective of the subject, through various Questionnaires and requesting them to offer their comments on the subject as based on their relevant experience. This has helped the Study Team to throw a spread-light on the subject matter in general, as well as, a spot-light on the details of the issues involved therein and thus gain deeper insights into the practical problems at stake.

1.7. In all, six types of Questionnaires had been framed, in an Alphabetical order. In all, we issued 276 Questionnaires to the various parties, of whom as many as 181 or 65 percent sent replies. These include 23 EDP Organisations, 22 Establishments hiring EDP time, 12 trade unions operating in the EDP Establishment, 15 Organisations of employers and workers and 18 independent persons, eminent experts, and 91 Unit Record Machine (URM) Establishments have responded to Questionnaires with fully or partially. The Questionnaires that we have prepared for our survey are given at Appendix "V" of our Report.

1.8. The details regarding the type of Questionnaire, to whom issued, how many in all (typewise) Questionnaires issued and response to the Questionnaires, are set out below :—

Serial No.	Type of Questionnaire	To whom issued	No. of Questionnaires issued	No. of replies received
1	2	3	4	5
1	A & B	E.D.P. Establishments	25	23
2	C	The Establishments who hire E.D.P. facilities.	34	22
3	D	The Trade Unions operating in the E.D.P. Establishments.	33	12
4	E	Central Organisation of Employers and Workers.	25	15
5	F	Independent persons/Experts/Institutions.	30	18
6	G & H	Establishments who have installed Unit Record Machines/Data Processing Equipments.	129	*91
Total			276	181

*Includes 13 respondents from A and B Questionnaires.

It must be appreciated that the total response to our questionnaires has been much better in quantitative as well as qualitative terms than we hoped. Thanks to the willing cooperation that we were able to get and we congratulate all our respondents.

1.9. The statement showing the names of the parties who replied to our various Questionnaires and submitted the Memoranda to us is given at Appendix "III" to our Report. The data thus supplied by the parties has been most useful to us in formulating certain postulates for arriving at the proper findings. The nature of this data not only includes the factual information regarding the status of Electronic Computerisation in Maharashtra, but it also provides, in brief, the view points expressed by the parties on the social, economic, technological and organisational implications of automation having a special bearing on the manpower utilisation in a given enterprise.

1.10. After collecting such data, the Study Team scrutinised the same, analysed the various problems, tabulated the results and prepared the draft, which task was mainly completed by Dr. V. G. Mhetras, Member, with the assistance of Prof. D. B. Sardesai, the associate of Prof. P. N. Mathur, Member.

Our Meetings

1.11. We convened a number of meetings for holding our deliberations. It was felt necessary that we should hold deliberation with the representatives of informal group of computer users as well as the representative unions operating in the EDP establishments. We approached the representatives of employers and workers' organisations for seeking their full support and whole-hearted co-operation in our work, at the same time, making them aware of the appointment of our Study Team by the Government of Maharashtra.

1.12. The date, the venue of our meetings, the number of members present as also our meetings with the various parties, the number of representatives (of computer users/unions operating in the EDP Establishment/Organisations of employers and workers) called on and present are set out in the table below :—

Serial No.	Date of meeting	Place of meeting	No. of members present
1	29-10-1968	.. Office of the Commissioner of Labour and Director of Employment, Bombay.	4
2	29-11-1968	.. Tata Computer Centre, Bombay	5
3	17-2-1969	.. Do.	5
4	20-6-1969	.. National Institute for training in Industrial Engineering, Bombay.	5
5	12-11-1969	.. Do. do.	5
6	13-11-1969	.. Samudra Tarang, Shivaji Park, Bombay	5
7	22-11-1969	.. Do.	5
8	5-12-1969	.. Do.	5
9	16-12-1969	.. National Institute for training in Industrial Engineering, Bombay.	5
10	23-2-1970	.. Datamatics Corporation, Colaba, Bombay	4
11	9-3-1970	.. Labour Cell, Bombay Labour Institute, Bombay	4
12	14-4-1970	.. Do. do	4
13	16-4-1970	.. Datamatics Corporation, Colaba, Bombay	5

1.13. *Meetings with various parties***Meeting with EDP Managers**

Serial No.	Date of meeting	Place of meeting	No. of members present	No. of representatives of E.D.P. Establishments called	No. of E.D.P. Managers present
1	13-12-1968	.. Associated Cement Companies Limited, Bombay.	5	23	18
2	17-2-1969	.. Do.	5	23	16

Meeting with the Representatives of the Unions Operating in EDP Establishments.

Serial No.	Date of meeting	Place of meeting	No. of members present	No. of Representatives of trade unions/ employers and workers' organisations called	No. of Representatives of trade unions/ employers and workers' organisations present
1	16-4-1969	.. Bombay Labour Institute, Bombay.	5	27	7

Meeting with the Representatives of the Organisations of Employers and Workers.

1	17-4-1969	.. Bombay Labour Institute, Bombay.	5	5	1
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1.14. Apart from the above meetings and discussions with the parties, there have been constant consultation amongst the individual members of the Study Team on quite a few occasion, which fact needs to be noted. Besides, there were two special meetings with Prof. Mathur and his associates in Poona.

Principal decisions taken by us during our meetings

1.15. Our *first* meeting was of a preliminary nature. In that meeting, we discussed and considered the terms of reference and chalked out a tentative programme of work assigned to us. We decided to frame Questionnaires for the proposed Survey on the basis of the finalised terms of reference for collecting factual data on which basis our findings and conclusions would rest. To this end, we decided to issue letters to I.B.M. World Trade Corporation and International Computers Limited for a list of Organisations in Maharashtra which had installed their computers as well as a list of Establishments having Unit Record Machines for ascertaining the total number of EDP Organisations and URM Establishments. In addition to this, we also decided to address letters to those Establishments which had installed computers and reported that they hired-out "computer time" to other Establishments in Maharashtra State.

1.16. In our *second* meeting, we finalised the terms of reference fully. With the frame-work of finalised terms of reference, we decided to study 'Office Automation' in the first instance, with special reference to EDP Equipment, and that, the field of automation in Manufacturing Processes would be taken up at a later stage. Secondly, we considered that, beside the preliminary survey for collecting data from EDP Establishments as well as those who hired computer-time, regarding the nature of business, size of organisation, type of EDP Equipment, nature of job applications on the computer, etc., the data may also be collected regarding employment and retrenchment, organisational structure, occupational composition, wage-salary scales, methods of payment, selection of EDP personnel, training and retraining and employees' attitude towards change. Finally, two sets of Questionnaires, one to be replied by the deputies of the Computer-users, and the other by the top managements of the concerned Organisations—were drafted and finalised. It was also decided to call a meeting of the informal group of computer users and EDP Managers to collect as much relevant factual data as possible and to obtain in full co-operation from the concerned organisations.

1.17. In our *third* meeting, the points raised by the EDP Managers in our first meeting held with them were discussed and it was decided to clarify to the extent possible, all the points raised by them in the meeting. It was also considered necessary, that the views of the trade unions operating in the EDP Organisations should be called for. Along with it we thought of approaching certain knowledgeable Institutions, such as, Indian Institute of Technology, (IIT), Bombay, Victoria Jubilee Technical Institute (V.J.T.I.), Bombay, Jammalal Bajaj Institute of Management, Bombay, University of Bombay, Bombay, Tata Institute of Fundamental Research (T.I.F.R.), Bombay, etc., for obtaining their studied

opinion on the subject of automation. We further decided that some professionals, experts as also certain academicians and personalities in public life who are not directly involved in the trade union or management activities but whose opinions in this matter, carry considerable weight, should also be contacted for ascertaining their views.

1.18. In our *fourth* meeting, we generally discussed the problem of scrutinising, analysing and tabulating of the factual data collected from the various parties. We also decided that the work pertaining to the scrutinising, analysing, and tabulating the data and preparing the Draft Report may be performed by Dr. V. G. Mhetras, Member, with the assistance of Prof. D. B. Sardesai, the associate of Prof. P. N. Mathur, Member. Besides, we decided that wherever the data supplied by the parties concerned was inadequate, and where additional data was required for more qualitative analysis, the parties should be pursued to supply sufficient and satisfactory factual data during the following four weeks.

1.19. Going through the whole Draft Report, para. by para. and Chapter by Chapter—in fact going through all the details carefully—occupied all our time of the next half a dozen Meetings or so. In the last three Meetings, the Revised Draft of the Report was reconsidered and was approved unanimously. In this context, we are indeed grateful to Dr. L. S. Kanodia—Member, for bringing uptodate the technical aspects of the material contained in our Report.

Deliberations with various parties

1.20. In our first Meeting with the informal group of computer-users, the nature and purpose of the fact-finding mission of the Study Team was explained to the EDP Managers who were present at the meeting. Consequently, two sets of tentative Questionnaires, framed by us during our *second* meeting, were handed over to the EDP Managers for their considered opinion and comments thereupon, if any, which were to be considered at the subsequent meeting with them.

1.21. In our second Meeting with the EDP Managers, the draft Questionnaires prepared by us were discussed and clarification sought by them were appreciated and their difficulties in duly filling the Questionnaires were resolved at our utmost efforts. In the light of the suggestions made by them, certain modifications were carried out in the draft Questionnaires and the copies of the modified Questionnaires were forwarded to the parties concerned later on with a request to furnish the required information. It was also announced to the participants present that, our Study Team would be meeting at the earliest the representatives of the trade unions functioning in the EDP Establishments, for their opinions in the matter.

1.22. In our meeting with the representatives of the trade unions functioning in the EDP Establishments, we explained the terms of reference, and the nature and scope of our work. They were also informed that we should study all the small and big EDP Organisations, as well as the Establishments hiring computer-time. It was also decided to take into account the valuable suggestions made by the trade union representatives as regards the impact of automation on pay structure, Industrial relations, reorganisation of managerial functions, work and functioning of the white-collar and blue-collar workers, displacement of jobs in the industry, potential employment, etc., while arriving at the findings and conclusions. The group was also assured that even if some of the unions had no full access to the management for securing such factual data, the Study Team would be able to persuade the EDP Organisations to provide such data to it, (Study Team) in which task our efforts have been amply rewarded. We also announced that we would be calling a meeting of the representatives of the Organisations of employers and of workers on the next day i.e., 17th April 1969 to have their views on the subject of automation and electronic computerisation and its impact on industry and labour in general and its repercussions on the State economy of Maharashtra in particular.

1.23. Our meeting with the representatives of the important organisations of employers and workers was informal in nature. The procedure which was adopted in the previous meeting with the representatives of trade unions was also followed in this case and suggestions made by these Organisations were given their due weightage in arriving at certain conclusions.

Literature on "Automation"

1.24. We have perused considerable literature on automation published in the foreign countries. The Study Team has also perused most of the existing literature on the subject regarding the Indian scene on automation. A selected Bibliography of the Indian and foreign literature considered by us is given at Appendix "IV" to our Report.

Our Acknowledgements

1.25. We wish to place on record our sincere thanks to the I.B.M. World Trade Corporation and International Computers Limited, the informal group of Computer-users and the EDP Managers, managements of the Organisations hiring computer-time, the trade unions operating in the EDP Organisations, all Central Organisations of employers as well as of workers, the Government Labour Office, academic and

professional institutions concerned with this sphere of knowledge, work and activity, experts, independent persons, and many a person and organisation whose unreserved co-operation has enabled us to accomplish our task.

1.26. We are thankful to the Tata Computer Centre, Bombay ; National Institute for Training in Industrial Engineering, Bombay ; Associated Cement Companies Limited, Bombay ; Bombay Labour Institute, Bombay ; and Gokhale Institute of Politics and Economics, Poona, for extending co-operation and hospitality in making required arrangements for holding our meetings.

1.27. We are also thankful to the Commissioner of Labour and Director of Employment, Bombay for providing additional staff from his office whenever required by us during the extra pressure of work.

1.27-a. Our special thanks are due to Dr. V. G. Mhetras, Member, for preparing the Draft as well as Final Report, and to Prof. D. B. Sardesai and Dr. M. V. Kirloskar for their valuable assistance in this respect. Finally, we are grateful to Shri P. J. Ovid, Member-Secretary for giving us all possible help, support and assistance in accomplishing this task.

1.28. We place on the record our appreciation of the sincere effort taken by Sarvashri M. V. Savdikar, Government Labour Officer, S. M. Bhade, Librarian, S. M. Rahim, Senior Labour Investigator and Sarvashri R. D. Joshi, A. K. George, D. M. Rawool and Smt. Pereira M., Stenographers. We cannot forget to acknowledge the ceaseless efforts and hard work done by Shri P. G. Pandit and Shri Y. G. Darne, Junior Labour Investigators for scrutinising, processing and compiling statistical and other data received by us and also in preparing the various tables and statements for our assignment. The indefatigable energy with which Shri K. D. Naik and Shri P. C. Nair accomplished the stenographic work, merits our full appreciation. All these staff-members willingly and untiringly worked for us throughout our tenure, even by sitting late hours and by working on Sundays and other Holidays without expecting any reward.

Time limit for submission of our Report

1.29. As per the Government Resolution, dated 10th October, 1968, we were required to act for a period of 6 months, at the first instance. But we were not able to submit our Report to Government within the stipulated time limit upto April, 1969 due to unavoidable circumstances. Therefore, we were compelled to ask for further extension upto 28th February, 1970, and furthermore upto 16th April 1970 on which date the Report was

submitted. The Government was pleased to grant extension of time limit for submission of the Report upto 16th April 1970 under Government Resolution Nos. MSC. 73668/118296-LAB. II, dated 22nd May 1969, MSC. 73668/136992-LAB. II, dated 23rd August 1969, MSC. 73668/148925-LAB-II, dated 4th November 1969 and MSC. 73668/102476-LAB-II, dated 24th January 1970. The last Government Resolution pertaining to the extension of time limit upto 16th April 1970 was accorded a Post-Facto sanction.

CHAPTER 2

AUTOMATION: ITS NATURE AND SIGNIFICANCE

The Beginning

Modern civilisation has been characterised by ways and means of increasing production and productivity. A variety of scientific and technological developments have in the past 300 years altered the speed of production at an unbelievable pace. Though the methods of increasing productivity have continued to be developed over many centuries, the genius of a significantly greater acceleration in this process can perhaps trace back to the First Industrial Revolution. The basic factors underlying this progress can be found in the constantly increasing mechanisation and sophistication of industrial processes.

2.1. *Two Aspects of Production Process.*—Production has two important facets, both equally important, viz., technology (speed and method of the production processes); and the control of the production processes itself. In this respect, the First Industrial Revolution can be said to be, by and large, founded on the first component viz., technology. During the last two decades, however, there has been increasing evidence of the manifestations of a revolution in the second field, viz., that of control and communication.

2.2. *The Meaning [See Annexure-2 (i)].*—“Automation” as construed and understood for two centuries usually referred to the speeding-up of production processes. The term perhaps acquired a definite meaning in a precise setting of automobile industry in the United States. D. S. Harder, one of the Vice-Presidents of Ford Motor Company, described it as “the automatic handling of parts between progressive production processes”. Since the concept of feedback-control and servo-mechanism were largely instrumental in the speeding-up of production processes and making them self-regulating, automation has often been associated with such mechanisms. Automation has also been associated with devices and automatic control systems which function with little or no human intervention once the operation is started, making their own adjustments and checking their own performance. Thus, it is a device which results in “maximum production at a least cost and with the minimum human effort”.

2.3. *New Way of Thinking.*—Basically, automation represents a new way of thinking about the total process of production; that it denotes both automatic operation and process of making operations automatic with

a resultant emphasis on self-regulation of the entire production process. It is a phenomenon of technological change and is considered to be "a veritable administrative revolution comparable to the Industrial Revolution of the nineteenth century"¹.

2.4. *Second Industrial Revolution.*—As a generalised approach to improving technical processes, automation is sometimes described as a "Second Industrial Revolution" replacing the manual control by machine control. It is a particular kind of development combining number of well-established principles of engineering and certain recently developed theories of communications. Particularly latter represent a great variety of inter-related problem of communications, of transmitting, receiving and interpreting 'messages' or what Professor Norbert Wiener calls "Cybernetics"².

2.5. *Third Phase.*—Automation is the third phase in the development of technology that began with the Industrial Revolution of the eighteenth century. The first came mechanisation which was a technology based on forms and applications of power. Second came mass production which was a technology based on principles of production organisation. Automation is a technology based on communications and control. Although it is distinct from mechanisation, it embodies within itself all the earlier technologies and their principles.

2.6. *Three Forms.*—Automation may assume three distinct forms viz., integration, feed-back control and computer technology. Integration involves processes in which the finished product is moved automatically untouched by human hands from one stage to another, for example, industries handling liquids, gases, powdered goods, such as, oil and chemical industries. Feed-back control is a mainly electronic process by which any error or diversion of machine from a planned performance is automatically corrected. These controls called 'servomechanisms' are highly developed in chemical and oil refining industries to open and close the thousands of valves and operate the multitude of mechanisms involved in these industrial processes. Thirdly, the computer technology depends on the use of electronically operated machines capable of recording and classifying information, and when required drawing conclusions from this information. According to Professor Crossman automation is "the mechanisation of human information processes"³.

¹ILO: *Labour and Automation*, Bulletin No. 5—Automation and Non-manual workers ILO (Geneva) 1967, p. 1.

²'Cybernetics' is a Greek word meaning thereby govern or control.

³Walter Buckingham 'Automation'—Its Impact on Business and People H/B., New York 1961, p. 73.

2.7. *The Computer.*—The computer is a relatively recent machine which has nevertheless made very significant impact on management and productivity especially in the more advanced countries. However, in contrast to the first industrial revolution this impact has been caused on account of the influence which has been exercised by the computer, on management control, rather than the physical speeding-up of the production process itself. In other words, computers are in a direct fashion influencing the second component of productivity viz., control and communication, mentioned earlier.

2.8. *Computer Operations :* [See Annexure-2 (ii)].—Briefly, the computer operations can be broken up into three elements, viz., (i) Input ; (ii) Storage and Processing ; and (iii) Output. Thus, firstly, the computer uses a variety of input devices to feed it with information or data. Some of these devices include : (1) Card Readers ; (2) Paper Tape Readers ; (3) Magnetic Tape Drives ; (4) Light pens used on special TV screen ; (5) Tele-type terminals and (6) Magnetic disc and drums. The central processing unit of the computer comprises the second element viz., that of storage (memory) and processing. Its memory can be as small as a few hundred words, or can, on the other hand, extend to several million words in a large scale computer system. Thirdly, the computer also has a variety of output devices, the most popular of which is the line printer. Some of these are enumerated as follows : (1) Line Printer ; (2) Card Punch ; (3) Paper Tape Punch ; 4. T. V. Screen or Oscilloscope and (5) Tele-type.

2.9. *Growth of Computerisation.*—Computerisation is making rapid strides in most of the advanced countries. Already there are over 40,000 computers operating in various fields such as guiding missiles and space vehicles, scientific work and technological design, economic activities and Governmental administration. Electronic computers are used today in thermo-nuclear reactor design calculations, control of projectiles in flight, statistical analysis of large volumes of data, numerical weather prediction, solving equations for chemical equilibrium, determination of crystal structures, and in thousands of other scientific problems. In the general field of commercial data processing, computers are being used in preparation of wage bills, job costing and routing accounting, insurance billing and premium calculations, travel space reservation, production scheduling and numerous other management problems. Other uses of electronic computers include information coding, storage and retrieval with applications in documentation, library science, criminology, and even arranging marriages. In a way it may be said that computer can control production machines, choose between alternative courses of action and correct themselves for changes in input, output, machine wear and so on. With automation machines can

start, stop, accelerate, decelerate, count, inspect, test, remember, compare, and measure dimensions of space, time, sound, temperature and other physical qualities. With feed-back, all these can be accomplished automatically.

2.10. *Information System.*—One of the most important characteristics of a computer is that it obtains, stores and processes information. Hence the term “information systems” today, is almost synonymous with computers. Today’s civilisation, it is said, is characterised more by information explosive, of communication, and information transmission than any other single development. The computer is a very important element in this, in as much as it has today become a hub of most large information transmission and processing centres in any organisation. The computer has made it possible to process information speedily, accurately and economically (and also logically). In cases where information has to be transmitted and results relayed instantaneously (perhaps within a second) the computer has no replacement. Such instances include complex atomic power plants, satellite control, process control, airline reservation systems, etc.

2.11. *Information Communication.*—Information and the information communication system of any organisation can be compared to the nervous system in the human being. Just as a human being cannot co-ordinate his activities and control his faculty, limbs, and facilities without a nervous system, any organisation, without a proper information system, would tend to perform and behave in an unco-ordinated manner. In the current tradition, it is, more or less, an accepted fact that an efficient organisation needs an efficient information system. A manager relies on information to make correct decisions. In the absence of upto-date information, the decision has necessarily to be very much sub-optimal since the manager has to rely more on intuition, guess-work and outdated information obtained through unscientific methods to make a decision which could perhaps influence the entire performance and future of the organisation. Information, within a company, is generated at all levels and in all departments. This information would include mechanewise performance of the production facility, manwise performance in terms of productivity, sales performance, statewide, regionwise, salesmanwise, etc., cost information, funds flow information, indeed, information is omnipresent, no matter what the activity, no matter what the type of the organisation.

2.12. *Management Information system (MIS).*—Better management information is quite an advance technique. The idea implies that if all routine paper works were processed through the computer department, management would have access to a distillation of significant facts on all aspects of the business. The computer based information system would help the management in decision-making. The MIS is an important tool for

effective communication of the relevant information about company's operations. The computer based MIS is also provided with the mathematical models for evaluating the alternatives open to the company after taking into account all the available information which a human being cannot do.

2.13. More and more organisations are now attempting to design their information systems based on scientific methodology. In most of them the computer forms an integral part of the information system. Information is derived from data, data is not synonymous with information i.e., one may have data regarding every sale contained in the sales invoices, but may not have the detailed sales analysis, which would be meaningful information to the Marketing Manager. *The same data can influence different types of information in different ways.* For example, information contained in an invoice would influence revenue, accounts receivable, sales projections, finished goods inventory, etc. In other words an organisation has to be viewed as an integrated being wherein the information system has also necessarily to be integrated. This is again analogous to the human nervous system. In this process of integration the computer is indispensable. It can use the same basic data and generate various information reports and exception statements that are necessary to run the large, complex business and Government organisations that function today.

2.14. *A Powerful Tool.*—Computer is a versatile and powerful tool for the mechanisation and automation of information processing. Information is the key factor based on which decisions are taken major and minor, strategic and tactical, policy-making and operation, etc. Thus, information is important in all fields of human endeavour, design and implementation of plans, the growth of the various sectors of the economy, several organs of Governmental administration, public utilities, manufacture and distribution of goods and services, etc. Correct decisions obviously depend upon relevant and precise information being made available in time and presented in meaningful form. There are numerous situations, where manual systems are inadequate and computers are the only means of accomplishing the desired objectives.

2.15. *Two Categories.*—Apart from computer applications for scientific work and technological design, computer applications in administrative and economic activities can be divided into two categories. In the first category fall the numerous decision-oriented technique applications, which are largely used for planning, directing and controlling, ultimately with a view to achieving better operating performance and increased utilisation of the various resources. Examples are resource allocation,

choice of products for manufacture and purchase, plant location, inventory control, project execution, traffic planning, scheduling of facilities such as airlines, wagons and ports, etc. The second category relates to such applications which are, by and large, labour saving types, taking over the work of clerical labour, but produce output at a faster rate and at a cheaper cost. In a well-designed system, the by-product information may be useful also for planning and decision-making. Examples are share accounting, financial accounting, billing, pay roll, etc.

2.16. *Types of Computers.*—Computers fall into two categories viz. Analogue and the Digital computers. Analogue computers represent continuous variables usually model a situation using electric and electronic networks. The amount and voltage in the network represent parameters being modelled by the computer and which are under investigation. Changes in voltages and currents are observed over time to study how the variables themselves would have changed under similar circumstances⁴. Digital computers, on the other hand, are completely different in nature. They process digits. Just as the slide rule can be said to be an Analogue computer the abacus can be said to be a digital computer.

2.17. *Size of Computers.*—Computers can be classified as small, medium or large. It is hard to strictly delineate any single criterion that could be used to classify all computers into one of these categories. The memory is often used as one such important criterion. Whereas small computers would normally have a memory of less than 4,000 characters, the medium computers would usually have memory of 4 to 40,000 characters. Large computers can today have memories of several million characters.

2.18. Most commercial data processing computer installations use small or medium size computers. On the other hand, Universities, Research and Development organisations, nuclear industries and oil industries and Aero-Space Industries, i.e., organisations which are very technologically oriented, depend on large computers. To mention some large computers these would include the : CDC 6600 ; CDC 7600 ; ICL 1906 ; IBM 360/95, etc.

2.19. *Indigenous Computer Makers.*—Two companies viz., IBM World Trade Corporation and the International Computers Limited, are manufacturing computers indigenously. IBM has been manufacturing the IBM 1401 computers. ICL has recently entered into collaboration with Bharat

⁴Analogue computers are particularly appropriate for solving certain types of problem—for example, design of a car suspension system—but their accuracy is sometimes limited.

Electronics Limited, to manufacture 1901-A computer system. Also at least four computers have been locally designed and fabricated. These include: TIFRAC and OLDAP manufactured by the TIFR, and the TDC-12 manufactured by the B.A.R.C., and the ISIJU manufactured jointly by the Indian Statistical Institute and the Jadhavpur University. The IBM 1401 is by far the most popular computer used in India. A typical 1401 installation may be described as follows:—

“the punch card unit can read 800 cards per minute and 250 words per minute. The Central processing unit can add upto 5000 numbers per second depending on their size. Information can be read from or written out the magnetic tapes at about 20,000 characters per second. The line printer can print 600 lines per minute, a maximum of 132 characters per line”.

However, large scale computers can today perform several million operations per second. It could add or subtract half a million numbers per second.

2.20. *Developments.*—It is almost universally accepted that the computer is a device capable of running under the control of a program contained within its own memory. The first large computer was ENIAC completed in 1946. However, it was not a stored program computer. The first stored program computer was EDSAC completed in early 1947 at Cambridge University. The first performed computation under control of a stored program was in 1949. The first high speed digital computer was the Whirlwind-I built at MIT during the late forties.

2.21. Industrially speaking, UNIVAC was the first computer manufacturer to market commercial data processing machine. UNIVAC I or the 1103 as its successor were some of the earliest machines commercially marketed. The first machine was delivered in 1951. In 1954 IBM announced its 705 computer and delivered the first machine in 1955. However, computers really started in roads in business industry beginning 1959, when the second generation transistorised machines were put on the market. Transistors were almost entirely instrumental in the computers advent as a data processing machine. The CDC 6600 contains over 5,00,000 transistors.

2.22. The IBM 1400 Series which proved that computers could be marketed by the thousands was announced in 1960. Since then within the brief span of 8 or 9 years many large corporations have entered into computer manufacturing. These include Control Data Corporation, Philco (Ford), Radio Corporation of America, General Electric, Burroughs, Honeywell, International Computers Limited, (ICL), etc.

2.23. In the sixties the computers have made rapid strides in the industrially more advanced countries. The *Table 2A* indicates the growth of computerization in the Western Europe since 1959.

TABLE-2A

*Trend of the Number of Computers in Use in Western Europe
(1959 to 1971)⁵*

Types			1959	1964	1966	1971
<i>For Scientific Use—</i>						
Office computers	..	..	20	190	320	460
Medium-size computers	..	..	25	240	480	1,000
Large computers	..	..	8	80	100	170
Total			53	510	900	1,630
<i>For Management—</i>						
Office computers	..	..	20	285	660	1,940
Medium-size computers	..	..	215	2,470	3,640	8,000
Large computers	..	..	12	235	320	530
Total			247	2,990	4,620	10,470
<i>For Industrial Automation</i>	..	..	8	89	175	575
Grand Total			308	3,589	5,695	12,675

Figures compiled by the DIEBOLD Group.

⁵[Organisation for Economic Co-operation and Development (OECD) *Manpower Aspects of Automation and Technical Change* (Supplement to the Final Report) European Conference, Zurich, 1st-4th February, 1966].

As regards the global population of computers, the latest information reveals that there exists over 53,000 computers, where the United States tops the list with 40,000 computers followed by West Germany 3,500; Japan 3,000; U. K. 2,800; France 2,200 and the U.S.S.R. 1,750 (About 100 computers are in operation in India).

2.24. *Inevitability.*—We consider that there is a certain amount of inevitability regarding automation and technological advance. The requirements of military security, the need in scientific calculations, such as, air-craft design, and the complicated mathematical and arithmetic equations in research have made the use of computer inevitable. Its use has also

become necessary in the compilations of Census as a timely aid to Government administration in formulating economic and social policies of the country. Historically, the process was speeded up in certain economically advanced countries of the West due to the ever increasing size and complexity of work and information-handling on one hand, and continuously growing labour shortage on the other. Besides, the growing competition in Market Economies and the urgency of raising productivity in industry and business have also helped the development of computer technology and its application in industrial and commercial processes; here, the aim has been to balance the forces of economic competition within the country as well as abroad. It may be noted here, that the computer can be fruitfully used for weather forecast, space exploration, conducting simulation studies for solving problems too expensive for experimental solution and too complicated for analytical treatment, defence of the country, and technological innovations.

2.25. *Challenge of Change.*—The computer is one element in the manifestation of change. Man adapts to change when such change is gradual. Rapid change, though often economically desirable, creates a variety of problems vis-a-vis adaptation of individuals and human society in general. Very often, rapid change is brought with suspicion. Suspicion is automatically linked to human resistance. In the First Industrial Revolution, the introduction of automated production processes including the steam engines were met with the same resistance at the hands of the Knights of labour and the Luddites in much the same manner. Such resistance can be seen in some spheres, to the introduction of 'office-automation', in the form of electronic digital computers. However, it is important to understand that such resistance could only be expected. It is desirable and indeed imperative that man learns to manage and adapt to change. The computer is an agency of change, and very rapid change at that. We have to review our vast experience of similar situations regarding change in the past and examine as to whether it is possible to institute policies with the objective of minimising the human problems arising out of rapid change without retarding the rate of change itself.

ANNEXURE 2(i)

AUTOMATION AS A CONCEPT : VIEWPOINTS

Paul E. Sultan and Paul Prassow in 'Labour and Automation'

"The conceptual confusion surrounding the word "automation" is such that it is used to characterise technology as both an evolutionary and a revolutionary process, to describe the novelty of arrangements that link one machine with another, and to denote the unusual capabilities of engineering forms, particularly those that improve upon the contributions otherwise made by labour. In brief, it is used to describe almost every economic change that might be contemplated, including changes in plant layout, product design, job design and methods for quality control. Because this label has been applied so indiscriminately, because we have not yet been

able to fashion a classification system appropriate for the analysis of the myriad forms that technical change is now assuming, and because we have not yet developed theoretical models that can allow in full for the consequences of these varying engineering forms, there exists a feeling that the subject has become a stalking horse for the pamphleteer or polemicist."

"Many efforts have been made to distinguish automation from other forms of technical change. One group sees it essentially in terms of organisation, and the other in terms of the engineering characteristics of automated equipment."

"*The elements common to many views of automation are.*—(a) the integration of production planning to fuse purchasing, production and distribution activities, and in the technical sphere the linkage of one machine activity to another.

(b) the application of instrumentation techniques that simulate human skills through both open and close-loop control systems. Both input and output behaviour are communicated to control systems which in turn induce necessary changes in the production process;

(c) the integration of informational technology involving market variables with process variables to influence production."

"Any automatic control mechanism involves automation, but when those control functions involve the use of computers, including the numerical control of production operations or other hybrid applications, we have cybernation."

"However appropriate it is to classify automated equipment in terms of the sophistication of its control system, or more specifically, whatever success we have in obtaining data about the manpower effects of these categories, the significance of technology may not be fully reflected by such performance capabilities or measurement prospects, but rather by the pace of its penetration and assimilation in industry. Unfortunately, the penetration and assimilation of technology is not simply a function of its engineering characteristics. This difficulty contributes to the conflicting views as to just what automation is, whether its impact is evolutionary or revolutionary."

"The contrasting view—namely that automation represents combinations of so novel a form and with such widespread application as to represent a sharp break with the evolutionary process appears to be gaining ground."

Clerk Committee on Manpower Policy of the United States Senate.—"This lack of understanding (of the impact of technological change) stems from a confusion of tongues—a failure to define terms and a tendency to lump all technological developments under one increasingly meaningless term: automation. A paucity of statistical data and a tendency to ignore that which does not square with cherished preconceptions is also to some extent responsible. A final element has been the natural tendency of every expert to examine only his own part of the elephant."

D. J. Davis in 'Automation in the Automation Industry'—"Automation is the result of nothing more than better planning, improved tooling, and the application of more efficient manufacturing methods which take full advantage of the progress made by the machine tool and equipment industries."

John Diebold in 'New Views on Automation.'—"It is no longer necessary to think in terms of individual machines; or even in terms of groups of machines; instead, for the first time, it is practical to look at an entire production or information handling process as an integrated system and not a series of individual steps. . . . Automation is more than a series of new machines and more basic than any particular hardware. It is a way of thinking as much as it is a way of doing."

Peter F. Drucker in 'The Practice of Management.'—"Automation is a concept of the organisation of work. It is therefore as applicable to the organisation of distribution or clerical work as to that of industrial production."

Herbert R. Northrup in 'Automation : Effects on Labour Force, Skills and Employment'.—“.....automation means continuous automatic production, linking together more than one already mechanised operation with the product automatically transferred between two or among several operations. Automation is thus a way of work based upon the concept of production as a continuous flow, rather than processing by intermittent batches of work.”

Ralph J. Cordiner in 'Automation in the Manufacturing Industries'.—“Automation can be defined as continuous automatic production, largely in the sense of linking together already highly mechanised individual operations. Automation is a way of work based on the conception of production as a continuous flow, rather than processing by intermittent batches of work.”

Jack Rogers in 'Automation : Technology's New Face'.—“(Automation) contemplates the whole sale reproduction of the sensory and mental functions of human fixed sequence—fixed operation variety of automatic production.”

Paul T. Veillette in 'The Rise of the Concept of Automation'.—“Automating control (and its auxiliary, inspection) means replacing man's sensory organs and brains by machines, while automating material handling means supplanting his muscles.”

James R. Bright in 'Industrial Relations in the 1960's Problems and Prospects'.—“Automation includes the mechanisation of more direct labour activities.....material movements..... control activity.....testing and inspection activities.....and the mechanisation of data processing through the computer.”

Peter F. Drucker in 'Harper's Magazine'.—“Automation is the use of machines to run machines.”

Diebold Group in 'Criteria and Bases for a Study on the Extent of Automation in American Industry'.—“Automation be restricted to control functions that are 'without human assistance during operations.”

Yale Brozen in 'Automation's Impact on Capital and Labour Markets'.—“Although automation may be more than an engineering revolution, in the economic sense it is nothing more than a continuation of an evolution which has been going on for centuries.”

Yale Brozen in 'Automation, The Impact of Technological Change'.—“To automate as completely as possible with present technology, only one major segment of the American economy manufacturing would require an expenditure well over \$ 2.5 trillion, assuming output is not increased.....this would required two centuries at current rates of modernisation ”.

Charles Killingsworth in 'Automation, Jobs and Manpower'.—“Automation appears to be spreading more rapidly than most major technological changes of the past. It is difficult, if not impossible, to measure the diffusion of technology in quantitative terms, of course. But I find these facts suggestive about a century was required for the general adoption of the steam engine in those activities where it could be employed ; the comparable time span for electric power was about 50 years. The first automatic accounting systems were installed in banks some seven or eight years ago. Today, about half of the banks are in the process of converting to this system.”

Dictionary definition in 'Labour and Automation'.—“The modern-day engineer's word for the state of being automatic. Once referred to machine tool applications, but has come to mean the act or method of making a manufacturing—or processing—system partially or fully automatic.”

Frank C. Woolard.—“With the aid of automation, I am of the opinion that we shall enter a new phase of fine living.”

President Reuther, of the American Congress of Industrial Organisations.—"Economic abundance is now within our grasp if we but have the good sense to use our resources and technology, fully and effectively, within a framework of economic policies that are morally right and socially responsible."

S.W.J. Wallis of the British Petroleum Co.—"A much wider use of instruments and control equipment has become an essential rather than a desirable feature of process operations."

R.H. Macmillan in 'Automation : Friend or Foe ?'.—"The ultimate objective of industrial control is the fully automatic factory. To achieve this, the operation of individual machines must be made automatic, and they must be automatically linked. If a hand operated machine is to be made fully automatic, all the functions previously unfilled by the operator must be taken over by various mechanical and electrical devices."

"Owing to the more uniform flow in a chemical plant under automatic control, it is possible to operate with less storage capacity; this in turn reduces the time lags and increases the speed of operation of the plant. It is true to say, in fact, that even if armies of labour were available, no modern oil refinery could be operated manually at anywhere near its present capacity."

"The first of automatic equipments is itself bound to be heavy. And it rises steeply with complication plant. It is true to say, in fact, that even if armies of labour were available, no modern oil refinery could be operated manually at anywhere near its present capacity."

"The first of automatic equipments is itself bound to be heavy. And it rises steeply with complication: a machine which is expected to be versatile in function will be more expensive than special purpose equipment. Here lies the greatest advantage which man still has over any automatic control yet devised; his astonishing adaptability."

"It is absolutely essential in an automatic plant for management to maintain good labour relations, for strikes are even more disruptive than in plant that is less highly organised. The chief problem is with the men whose skills are made obsolete by the installation of new equipment. They must be trained, before this happens, for alternative work that is more interesting and better paid."

"When installing and running an automatic line, it is most important to plan ahead to ensure smooth operation of the plant; maintenance must always be by anticipation, never by default."

"But automation clearly raises as many problems as it solves, and we have seen that the most severe of—these will be managerial and social rather than technical."

D. W. Hooper of National Coal Board and British Institute of Management.—"An electronic and automatic age is with us. It is not, I am quite certain, still many years in the future."

Karl Marx.—"Technological unemployment' is an inevitable consequence of such advances as the introduction of automatic control."

John Stuart Mill.—"While such progress may even benefit labour—and usually, in fact does so—this is not necessarily always the case. We have seen that this is still the only position which can reasonably be maintained."

"The second main reason for supposing a sudden shift to automatic production throughout industry to be most unlikely is the problem of education."

Aldai Stevenson.—"This is a time of transition . . . from the ancient problem of sharing scarcity to the modern problem of distributing abundance."

F. C. Woolward.—"Selling automation to existing supervisory staff is often more difficult than convincing the shopfloor worker that it is desirable."

F. G. Woolward in 'Machines in the Service of Man'.—"Automation is not a device with which to outlaw, displace or dispense with man . . . it is a means for increasing man's stature and extending his ability to produce in greater volume with less physical effort or mental strain."

Lord Halsbury.—"Automation is essential to the continued maintenance of our position in the world . . . we cannot afford not to exploit it as intensively as we can."

H. Nicholas in 'Transport and General Workers' Union.—"I am confident that the problems (attendant on automation) can be solved, but only if they are more widely known."

Charlie Chaplin in 'Modern Times'.—"One of the chief objections to work on a manual production line is the inevitable 'pacing' of the operative's work by the conveyor or by the time cycle of the machine; this common cause of mental distress is eliminated when such functions can be made automatic."

Sir George Thomson.—"It may be possible to strain monkeys to do the simple jobs that it is not economic to make automatic."

Henry Ford.—"The ideal factory worker would be a trained ape."

Lewis Carroll.—"Can you do Addition?' the White Queen asked.

'What's one and one and one and one and one and one and one and one and one and one and one?'

'I don't know,' said Alice. 'I lost count.'

'She can't do Addition,' the Red Queen interrupted.

'Can you do Substraction?'

James Clerk Maxwell.—"The four rules of arithmetic may be regarded as the complete equipment of a mathematician."

Professor B. R. Williams of University College of North Staffordshire.—"Official of the Ford Motor Company to the President of the C.I.O. : How are you going to collect Union dues from these machines ?

Walter Reuther : How are you going to get them to buy Fords ? "

"We are not on the threshold of an age of fully automatic production. We are moving that way, but slowly."

(By N. S. Ramaswamy—Member)

ANNEXURE 2 (ii)

COMPUTER—TERMINOLOGY

Hardware

Hardware is the collective term for the physical parts of a digital computer. The most important item of hardware is the *Central Processing Unit* (C.P.U.). This includes the *main store*, which holds both the data and the instructions, and contains large numbers of *locations* or *words*. A small computer may have 8,000 words, a fairly large one 64,000; these would be described respectively as an 8K machine and 64K machine. Each location consists of a number of *bits* of information represented by 'o' or 'i'. One word constitutes 4 to 8 characters. *Characters* are groups of 6 bits, groups of 8 bits are called bytes.

Also in the CPU there is the *control unit*, which receives instructions and causes the machine to carry out its functions, and the *arithmetic unit* which, under the command of the control unit, adds, subtracts—or otherwise calculates.

Information and instructions are fed into the CPU by means of *input units*. The two most common types are *paper tape readers* and *punched card readers*, through which paper tape or cards are passed at high speed, and the data—held on the tape or cards in the form of holes—are picked off by a photoelectric eye and transmitted to the main store. An operator punches the holes in the tape or cards by a *key* or *paper tape punch*—very like a typewriter. A computer operator communicates directly with a computer by means of a *console typewriter* linked to the CPU.

Having completed its calculations, the computer communicates the results through output units. The console type-writer can be an output unit; so can automatic paper tape and card punches, if the results are later to be fed back into the computer or into a data transmission unit. By far, the most common output units are *line printers* which can print out at between 300 and 2,000 lines per minute. A typical line printer can print at the speed of 600 lines per minute. This means the paper travels through the machine at a speed of 100 inches per minute and to permit printing which takes a total printing cycle of 1/10th of a second.

All these input and output devices are known collectively as *peripherals*; this term may also include *backing storage*. The main storage in the CPU is made of ferrite core—hence the name *core storage*—but these are rather expensive. Sometimes, there are *magnetic tapes* on which data are stored much as on tape recorders. Magnetic tapes are cheap, but it can take as much as 10 minutes to read a tape before one reaches a particular item of information. This disadvantage is overcome by recording magnetically on the surface of a *disc* or *drum* so that the pickup device goes straight to any location—hence the name *random access*.

Software

The term includes all the language, programmes, etc., needed to make the hardware function. A programme is a series of instructions to the computer, set out in an ordered sequence, which causes it to perform a task. The computer has its own language and it is orientated towards types of problems. Among these are *Algol* and *Fortran* for scientific problems, *Cobol* for writing commercial programmes and PL. i, which accommodates both. It is possible to get a programme from the Manufacturers, who nowadays provide numerous other programmes known as *package programmes* or *manufacturer's standard software*.

A computer is said to be operating in *real-time* when it controls an operation or process as it occurs. It is said to be *on-line* when the operation or process is directly linked into the computer, and *off-line* when there is no physical link between the computer and the machine it is controlling. Obviously, the increasing efficiency of methods of communication will encourage more on-line and real time computing over considerable distance.

Whenever, it is necessary to transfer information to and from a computer over considerable distances, the ordinary post can be used in many cases where speed is essential, GPO landlines will transmit data at between 20 and 2,500 bits per second; these services, which include, telex are known as *Datel*. Very much faster links will later be generally available, such as *wire* or *microwave*. A console typewriter placed at the end of such lines can communicate directly with a distant computer this technique is called *remote access*.

CHAPTER 3

COMPUTERISATION IN MAHARASHTRA

Current Status

The Electronic Data Processing (EDP) Installations in Maharashtra are of a very recent origin. They have history of little over 7 years or so; that except one installation at ESSO in October 1961 and one at the Tata Institute of Fundamental Research (TIFR) in May 1964, the rest have come up only after 1965. In fact, 2 EDP installations came up in 1964, 2 in 1966 and as many as 9 in 1967 and only 3 in 1968. Thus, at the opening of the year 1969, there were 26 Electronic Computers amongst 23 EDP Installations¹ in Maharashtra. Of these, 12 computers were in private sector, 8 in public sector, and the remaining 6 in Educational and Research Institutions. By the middle of 1969, their number increased to 31², of which 17 or 54.8 per cent. being in private sector, 8 or 25.8 per cent. in public sector, and the remaining 6 or 19.4 per cent. in Educational and Research Institutions. For India, as a whole, there were 109 computers (by Middle of 1969) of which 41 or 37.5 per cent. were in private sector, 42 or 38.5 per cent. in public sector, and the remaining 26 or 24 per cent. in Educational and Research Institutions. Comparably, *Table 3A* indicates that, in the current status of Electronic computerisation, for India, as a whole, the private and public sectors have assumed nearly equal importance, while in Maharashtra, the private sector, it seems, has made significant headway.

TABLE 3A
Current Status of Electronic Computers (in India)

Serial No.	Sector	In Maharashtra as on 1st January 1969	In Maharashtra by middle 1969		In India by middle 1969	
			Number	Per cent	Number	Per cent
1	Private Sector	.. 12	17	54.8	41	37.6
2	Public Sector	.. 7	7	25.8	23	38.5
3	Government Departments	.. 1	1		19	
4	Universities	.. 1	1	19.4	7	23.9
5	Engineering Institutes	.. 1	1		9	
6.	Research Organisation	.. 4	4		10	
Total		.. 26	31	100.0	109	100.0

¹One private sector company, 1 public sector undertaking and 1 research institution have 2 computers each.

²These include five computers: (1) *Bhor Industries Pvt. Ltd., Bombay*, (2) *Finlay Mills Ltd., Bombay*, (3) *Johnson & Johnson of India Ltd.*, (4) *Empire Dyeing and Mfg. Co. Ltd., Bombay* and (5) *(Sarabhai) Plastic Works, Bombay*.

Economic Sectors

3.1. The 20 EDP Installations in *Table 3B* cover 23 computers. The classification of these installations include 5 Manufacturing concerns, 4 Marketing and Distribution organisations, 3 Transport undertakings, 2 Banking and Insurance Companies, 4 Educational and Research Institutions, and 2 Computer Service Centres. As many as 10 or 50 per cent. of the total establishments have the legal status of 'Public Limited' Company; 3 are 'Private Limited' Companies, 3 Statutory Corporations, and the remaining 4 are Educational and Research Institutions. It may be noted here that excluding Educational and Research Institutions, rest of the EDP organisations have a certain number of branches (Banking and Insurance have a large number) in Maharashtra. They have regional offices and branches outside Maharashtra too³.

TABLE 3B

Classification of organisations having Electronic Computers.

Cat. No.	Type of organisation	No. of organisations	Legal Status			
			Private Limited	Public Limited	Statutory Corpsns.	Educational and Research
1	Manufacturing ..	5	..	5	..	..
2	Marketing and Distribution.	4	2	2	..	..
3	Transport ..	3	..	2	1	..
4	Banking and Insurance	2	..	..	2	..
5	Education and Research.	4	..	..	..	4
6	Computer Service Organisations.	2	1	1	..	..
Total ..		20*	3	10	3	4

³Details are discussed elsewhere in Table 3L.

*These 20 E. D. P. Organisations cover 23 computers out of the total of 26. Of the remainin 3 the data of 1 has been partially accounted for elsewhere in the study; the information supplied by 1 Organisation was rather too inadequate to be fruitfully utilised; and as the reply from 1 Organisation was not received within the time-limit, the same could not be included in the analysis.

Volume of Business

3.2. Of the total of 14 establishments in the first four types of organisations, 10 establishments (excluding one each from the respective categories) which have reported data for *Table 3C* account among themselves

for the total volume of business of Rs. 921 crores or Rs. 92 crores on average. A further classification of these 10 establishments into private and public sectors shows that, 7 private sector organisations have total volume of business of Rs. 665 crores or Rs. 95 crores on average, while the corresponding figures for the 3 public sector undertakings is Rs. 256 crores or Rs. 85 crores on average. It is clear that, these establishments which have gone in for office automation are fairly big firms with relatively large volume of business, although within themselves Marketing and Distribution organisations are the largest on average (volume of business Rs. 178 crores) followed by Transport undertakings which are of quite large size (volume of business Rs. 122 crores on average) followed further by Manufacturing concerns of fair size (volume of business Rs. 33 crores) on average.

TABLE 3C
EDP Installations in Maharashtra by Volume of Business

Cat. No.	Type of organisation	No. of organisations reporting data for this table	Total volume of business (Rs. in crores)	Private Sector		Public Sector	
				No. of organisations reporting	Volume of business (Rs. in crores)	No. of organisations reporting	Volume of business (Rs. in crores)
1	Manufacturing ..	4	131.00	4	131.00	..	..
2	Marketing and Distribution.	3	534.00	3	534.00	..	..
3	Transport ..	2	243.00	..	..	2	243.00
4	Banking and Insurance.	1	13.00	..	..	1	13.00
Total ..		10	921.00	7	665.00	3	256.00

Education and Research and Computer Service Organisations are not included in the table.

3.3. The Computer Census in Maharashtra shows that various types of machines manufactured by Control Data Corporation, HONEYWELL, IBM World Trade Corporation, International Computer Private Limited, MINSK have been installed by the organisations concerned. Except 3 HONEYWELL, 1 Central Data Corporation 3600 Series, 1 International Computers Private Limited, 1900 Series, and 1 MINSK, rest of the computers are of IBM-make, and are medium-size units with 4,000 to 40,000 characters core capacity. Most of the IBM Machines are of 1400 Series having equipped with peripheral devices⁴.

⁴ It was because until 1963 Indian industry was new to electronic computers and that the choice was influenced largely by IBM's recommendations.

Input-Output Devices

3.4. As regards input and output devices (*Tables 3D, and 3E*) all EDP installations have card inputs and line printers. Tape drives are in common use. Three installations are equipped with disk drives and include Banking and Insurance, Education and Research, and Computer Service Organizations. All but two installations are business data processing units. As regards the off line equipment the number of card punches with each organisation varies from 3 to 66 with the total of 281 in all. These vary from organisation to organisation depending on the extent of data input. Seven establishments have 3 to 10 such units, while the remaining 11 organisations have between 11 to 21⁵. Besides, these installations have more or less, similar number of card verifiers on average, totalling 214 in all. Interpreter, sorter and collator are the ancillary equipment in use. Nearly half of the EDP Installations which reported data also have reproducing punches and accounting machines.

⁵This excludes one big organisation which has as many as 68 such machines. Moreover shift-working and piece-rate system are possible in this sector.

TABLE 3D

*Input Output Devices and Off Line Equipment in use by EDP Installations
(Summation of all units/devices across all organisations)*

Cat. No.	Type of Organization	No. of organisations reporting data for this table	Input/Output Devices						
			Card Read Punch	Printer	Tapes drives	Disk drives	Console paper-tape punch	Perforator	Photo in-put
1	2	3	4	5	6	7	8	9	10
1	Manufacturing ..	5	5	5	12	....	2	....	..
2	Marketing and Distribution.	4	4	4	18	....	1	....	..
3	Transport ..	3	3	3	12	....	2	....	..
4	Banking and Insurance.	2	2	2	12	2	2	....	..
5	Education and Research.	4	4	5	20	3	5	4	2
6	Computer Service Organization.	2	2	2	10	2	1	....	..
Total ..		20	20	21	84	7	13	4	2

TABLE 3D—*contd.*

Cat. No.	Type of Organization	Off Line Equipment										
		Punch Equipment			U. R. Equipment							Sub-Total Other U.R. Machines
		Card Punch	Card Verifier	Sub-Total Punching machines	Inter-preter	Sorter	Collator	Repro- ducing Punch	Account- ing machine	Misce- llaneous		
1	2	11	12	13	14	15	16	17	18	19	20	
1	Manufacturing ..	47	35	82	1	9	2	1	3	..	16	
2	Marketing and Distri- bution.	45	30	75	2	5	2	2	1	..	12	
3	Transport ..	61	56	117	1	6	1	1	2	..	11	
4	Banking and Insu- rance.	84	67	151	..	2	..	1	1	..	4	
5	Education and Research.	17	5	22	1	2	1	2	1	13*	20	
6	Computer Service Organization.	27	21	48	2	3	2	2	2	..	11	
Total ..		281	214	495	7	27	8	9	10	13	74	

*Includes 3 Telex Printer, 3 Telegraph Transmeter, 6 data preparation units, and 1 Printing Card Punch.

TABLE 3E
*Number of Organisations having specified Input-Output Devices and
Off-Line Equipment.*

Cat. No.	Type of organisation	Input/Output Devices								
		No. of organisations	Card Read punch	Printer	Tapes drives	Disk drives	Console	Perforator	Photo in-put	
1	Manufacturing ..	5	5	5	3	..	2	..	..
2	Marketing and Distribution ..	4	4	4	4	..	1	..	..
3	Transport ..	3	3	3	3	..	2	..	..
4	Banking and Insurance ..	2	2	2	2	1	2	..	..
5	Education and Research ..	4	3	4	3	2	4	1	1	
6	Computer Service Organisations ..	2	2	2	2	1	1	..	..
Total ..		20	19	20	17	4	12	1	1	

TABLE 3E—contd.

Cat. No.	Type of organisation	Off-Line Equipment								
		Card punch	Card verifier	Interpreter	Sorter	Collator	Reproducing punch	Accounting Machine	Misc.	
1	Manufacturing	5	5	1	5	2	1	3	1	
2	Marketing and Distribution	4	4	2	4	2	2	1	..	
3	Transport	3	3	1	3	1	1	2	..	
4	Banking and Insurance	2	2	..	1	..	1	1	..	
5	Education and Research	3	3	1	2	1	2	1	1	
6	Computer Service Organisations	2	2	2	2	2	2	2	..	
Total		19	19	7	17	8	9	10	2	

3.5. As regards the choice of computer model, its peripherals, etc., it should be noted that until 1963, Indian industry was new to electronic computers and that, the choice was influenced largely by the IBM's recommendations. Within the limitations, however, the considerations have been the immediate availability of a reliable and suitable model in the market at a reasonable price, technical capability of hard-ware such as building provision for expansion without changing the existing equipment, fast tape drives and disk drives based on large input and output volume, the supplier's reputation for hard-ware and soft-ware and research and quick services.

Cost of Computerisation

3.6. In India, the cost of the medium size EDP equipment that has been purchased, ranges generally from Rs. 25,00,000 to Rs. 30,00,000 ; including its peripherals. It requires a monthly maintenance of Rs. 7,000 to Rs. 10,000 or yearly Rs. 1 lakh on average. Some of the HONEYWELL, and MINSK models cost somewhat less* and their monthly maintenance ranges between Rs. 5,000 to Rs. 7,000 or yearly Rs. 75,000 on average. The same equipment could also be taken on rental basis. The one time charges which need to be paid, in such case, amount to Rs. 1½ to Rs. 2 lakhs. The monthly hire charges of a typical computer would range between Rs. 50,000 to Rs. 65,000 or Rs. 6 to 8 lakhs annually. Besides, the hire charges for UR machine amount to another Rs. 10,000 to Rs. 12,000 per month or Rs. 1 to 1½ lakhs per year. A small-size computer would generally cost between Rs. 10,00,000 to Rs. 15,00,000 and would require a monthly maintenance of Rs. 4,000 to Rs. 6,000. The same equipment could also be available on monthly rental of Rs. 20,000 to Rs. 30,000. A large-size equipment, on the other hand, viz., CDC 3600 Series with a very large core capacity and peak operating speed, would cost Rs. 2 crores and more in 1964⁷. Usually a medium-size unit, such as, IBM 1400 Series with 4 to 12K characters core capacity and relatively slow operating speed are acquired by large firms in business and industry.

Total Investment

3.7. It is of special significance that, in case of computer installations, the investment in terms of fixed costs, such as, the cost of the purchased machine and/or one time charge paid for machine taken on rental form a small part of the total real investment. In case of machine on hire, the investment in equipment is generally made by the manufacturer himself

* It is because they have been obtained under special arrangements between the Government and the respective supplier countries.

⁷ However, if acquired today, such a machine would cost between 60 to 70 lakhs.

and, as such, he bears the risk of technological change resulting in getting the machine obsolete. In this background, we present, in *Table 3F* the total investment and running expenditure of 22 (out of 26) electronic computers in Maharashtra⁹. Of these, 10 computers were purchased at a total cost of Rs. 2,78,55,014 or Rs. 27.8 lakhs on the average. These 10 machines pay on an average a monthly maintenance of Rs. 9,302 or yearly Rs. 1.1 lakh each. Besides, it is estimated that one CDC 3600 computer of TIFR costing Rs. 2 crores would require probably 3 per cent. of the purchased cost as an annual maintenance i.e., Rs. 6 lakhs. As many as 12 computers have been taken on rental basis by paying a *one time* charge of Rs. 21,26,971 which cover the shiftment, remodelling/reconditioning charges and freight, while a sum of Rs. 98,59,788⁹ per annum is spent on rental of both computer and unit record machine; however, a bulk of it i.e., Rs. 84,62,760 or 86 per cent. is spent as rental of the computer. Individual variations reflect the difference in equipment, type, make and peripherals added to each installation. It may be further pointed that, if investment on equipment that has been hired can be computed at 50 months' rental then it works out Rs. 4.1 crores, in addition to a sum of Rs. 3 lakhs per installation or Rs. 60 lakhs of 20 installations. Thus, for all 20 installations, in Maharashtra the estimated investment would be Rs. 2.78 + Rs. 2.0 + Rs. 4.10 + Rs. 0.60 = Rs. 9.48 crores¹⁰ with a estimated running expenses of Rs. 28.32 lakhs per year. Half the machines being on rental the running expenses are Rs. 1.157 crores per year (Rs. 17,16,324 + Rs. 98,59,788) excluding that on electricity, air-conditioning, etc., which is also not a small sum.

⁹ The cost of one computer CDC 3600 purchased by TIFR is mentioned separately. The three others which include 2 computers belonging to the IBM World Trade Corporation and 1 designed and fabricated by the BARC as the product of scientific research are excluded from this analysis, for they do not admit of suitable comparisons.

¹⁰ It may be worthwhile to note here that the total maintenance of the 10 computers in the purchased equipment sector for *five* years period would come to Rs. 55,81,620; and including the cost of the equipment of Rs. 3,34,36,634 or per capita Rs. 33,43,663. On the other hand, the total rental cost of 12 computers in the hired equipment sector including one time charges paid would come to Rs. 5,14,25,911 or per capita Rs. 42,85,492. Thus, the percentage ratio of the purchased equipment to hired equipment would work at 100 : 128.

¹⁰ Or Rs. 10 crores including Rs. 52 lakhs as the cost of 2 computers belonging to IBM World Trade Corporation.

TABLE 3E

Total Investment and Running Expenditure on Electronic Computer¹

Cat. No.	Type of organisation	No. of Computers	Purchased Equipment			Hired Equipment			
			Total cost of Computer including Peripherals	Average monthly cost of maintenance	No. of Computers	One Time Charges paid	Computer hire and maintenance charges (monthly)	UR Hire and Maintenance charges (monthly)	Total hire and maintenance charges for EDP and UR (monthly)
1	2	3	4	5	6	7	8	9	10
1	Manufacturing ..	..	..	..	5	6,44,680	2,07,330	41,271	2,43,601
2	Marketing and Distribution.	..	..	..	4	11,46,205	2,66,961	47,532	3,14,543
3	Transport ..	1	26,00,000	26,335	2	3,36,036	1,16,901	18,000	1,34,901
4	Banking and Insurance	4	1,29,00,000	34,692	..	..	..	..	..
5	Education and Research.	5	1,23,55,014	32,000	..	..	..	..	..
6	Computer Service Organisation.	..	..	..	1	..	1,14,038	9,566	1,23,604
Total ..		10 ^a	2,78,55,014 ^b	93,027 ^c	12	21,26,971 ^d	7,05,230	1,16,419	8,21,649
Yearly charges ..		..	..	11,16,324	..	..	84,62,760	13,97,028	98,59,788

¹ Excluding 3 computers—2 belonging to IBM Corpn., and 1 computer constructed by BARC.

² Excludes cost of 1 CDC 3600 computers of TIFR costing Rs. 2 crores and 6 lakh yearly maintenance charges.

³ Includes estimated cost of 4 computers—1 in Banking and Insurance and 3 in Education and Research Orgns.

⁴ Includes monthly maintenance charges of 1 UR Machine on rental.

⁵ Data available for 10 FDP installations.

Major Objectives

3.8. Usually management have taken recourse to office automation for various reasons. *Table 3G* shows that as many as 14 out of 16 EDP Organisations reporting data resorted to computerisation with *three* objectives in mind. *Firstly*, that the volume of data was too large for manual processing; *secondly*, to reduce time-lags in receipt and procession of data; and *thirdly*, to introduce modern management control system. Some 11 organisations or nearly 69 per cent of the total introduced automation for computation required could only be done by computer; and only 8 organisations or 50 per cent did so to decrease cost. The situation probably reflects that, while taking certain jobs to the computer, cost considerations received considerably low priority, as compared to management's desire to introduce modern management control system.

A somewhat descriptive account of these objectives in quantitative terms would run as follows :—

One large scale manufacturing organisation where 60 per cent sales is done in the last 10 days of the month, there is a peak in input flow, and the data is processed on the computer to complete the job in time.

In an Airline Industry, Revenue Accounting is the most complex job, and the documents are so designed that without mechanisation the accounting work cannot be accomplished in time.

An electricity supply utility undertaking has to send out about 12,000 bills daily which involve complicated calculations. The errors in the bills have to be minimised to avoid consumer inconvenience and associated expenditure in dealing with correspondence. Besides, to save on working capital, the time lag between reading meters and sending out the bills has also to be minimised. Apart from all these pre-requisites in consumer billing, the prime consideration for selecting the mechanism for processing and preparation of bills is to reduce the costs to the consumers.

TABLE 3G

Major Objectives in Going in for a Computer

Cat. No.	Type of organisations*	Volume of data is too large for manual processing	Computation required could only be done by computer	To reduce time lags in receipts and processing of data	To decrease cost	To introduce modern management control system	Total in group
1	2	3	4	5	6	7	8
1	Manufacturing ..	5	3	4	3	5	5
2	Marketing and Distribution.	3	4	4	2	4	4
3	Transport ..	3	2	3	2	3	3
4	Banking and Insurance.	2	1	2	1	1	2
5	Computer Service Organisations.	1	1	1	..	1	2
Total ..		14	11	14	8	14	16
Percentage ..		87.5	68.8	87.5	50.0	87.5	100.0

*Educational and Research Institutions have been excluded because of their non-commercial nature and special objectives of Research and Training.

3.9. The Bombay Divisional Office of the LIC has the total business in force of about 11 lakhs policies. The Organisation's objective of better and quicker service to its policy holders, it is said, has necessitated the conversions of records to the computerised system (Under the consolidated functions approach, the job has to be accomplished over a period of time.¹¹).

¹¹ The policies are taken into convenient blocks of 25,000 to 50,000 for conversion to the computerised system.

Feasibility studies

3.10. Almost all the EDP Organisations have undertaken feasibility studies one way or the other before installing the computer. However, the basic and overwhelming character of feasibility study appears to be 'techno-commercial' rather than 'socio-economic'. The rapid changes taking place in industry, the need to discard rule-of-thumb methods and switch over to modern scientific analysis of complex problems of industry and business has been given priority by a few organisations. Some establishments wanted the use of more sophisticated equipment like the computer to ensure for the future information support and for maintaining the growth rate under changing economic-conditions, since with the expanding business, the conventional methods or Data Processing could not cope-up with the tremendous increase in work-load. Nearly one-fourth of the EDP Organisations have replaced their Data Processing Machines by electronic computers.

1.5

3.11. These feasibility studies have been conducted sometimes by the Head Office of the Company in the country or abroad, and at times with the help of Senior Officers in co-operation with the Commercial Organisations, viz., IBM, ICL and the like. The employers and managements consider that the only appropriate agency to decide feasibility is the management of the organisation itself, which can undertake the study in consultation with certain specialised agencies like IBM, ICL, Datamatics, etc., although, the final decision should be taken after due consultation with labour. Almost all Labour Unions have, however, suggested for the purpose, a Tripartite Body preferably at the national level¹² with the representatives of Government, employers as well as workers. Most of them have insisted that the Board must consult the Trade Unions concerned on the proposal of management, and without reaching prior agreement with them (Labour Unions), no proposal must be sanctioned, and that, such Board should take into account, before giving the clearance, the effect of electronic computerization on the employment potential and job satisfaction, and also observe the human values. However, a few experts to whom we approached, expressed that feasibility studies may be conducted jointly by the management and the labour representatives in association with an impartial expert in that field concerned, preferably sponsored by the Government Agency, so that the techno-commercial expertise available with the IBM, ICL, etc., would be supplemented and even balanced by essential socio-economic, and organisational facets of the situation.

¹² In fact such national level board is already in existence in Union Labour Ministry since October, 1966.

TABLE 3 H.

Understanding between the EDP Organisations and the Trade Unions.

	No. of organisations
1. Agreement was reached	5
2. Though no formal agreement was reached but no objection from Union or Unions was informed.	3
3. Not found necessary or for no representative union ...	2
4. Had earlier unit record machines so not found necessary...	3
5. No agreement—union not co-operative	1
6. Not applicable	2
Total ...	16

Labour Response

3.12. As regards the understanding between the management and the Unions regarding computer installation, *Table 3H* shows that only in 5 organisations out of 16 reporting data, agreement was reached between the parties, and in 3 more organisations, the Unions concerned were informed and that they had no objection although the managements had not entered into any formal agreement with the Unions. A few EDP organisations felt that since they had no Representative Union in the organisations they did not consider it necessary to consult the labour union while 3 other organisations which had the Data Processing Machines earlier switched over to Electronic Computerisation without consulting the unions. In one case, no agreement was reached as the management found that the union was not co-operative. In the remaining two cases these conditions, however, do not apply.

3.13. We may mention here the repercussions of such attitudes of management on the employees and their unions and in turn on the organisations concerned. Thus, amongst the EDP organisations under study 3 (2 in Marketing and Distribution, and 1 in Banking and Insurance Categories) experienced a measure of labour unrest on account of reduction in the staff or a fear of it. In *one* case, there were 3 one-day token strikes in 3 years following the installation of electronic computers, while in other *two* cases there were some mild resistance outside Maharashtra although the same was overcome after the management's assurance to the unions that the installation of computer would not result in the retrenchment of the existing staff. Yet in one more organisation there were demonstrations outside Maharashtra (at Calcutta, Delhi and Madras) from time to time.

3.14. Apart from the labour's resistance to office automation, in certain cases, which probably has certain bearing of installation of computers, it takes quite some time to install the equipment even when the decision has been taken much earlier. The data at our disposal indicates that even after deciding in favour of installation of computer, it takes a little over couple of years on average, for the decision to materialise in practice and install the equipment, although, in some cases, it may take less than a year, while, sometimes, it may take more than 2 to 3 years or even more.

Time-Lag

3.15. If related to the installation of UR machine, the EDP installations, provide an interesting picture of the 'time-lag' between the two installations period. Thus, *Table 3I* shows that in the case of 9 EDP organisations, the 'time-lag' has been less than a year; for 2 more organisations, 2 to 5 years; for another 5 organisations, 8 to 13 years, and for the remaining 4 organisations, a long lapse of 18 to 41 years¹³. If the real time is properly calculated then for the last range, the 'real time-lag' would be about 9 to 12 years. It is also worthwhile to learn that except the EDP installations in Educational and Research Institutions, all of which fall in the first range of 0-1 year, as many as seven EDP installations of the remaining 16 account for the time-lag of well over 10 years and more.

TABLE 3I

Years Elapsing between Installation of U. R. Machines and computers.

Cat. No.	Type of organisation	No. of organisations	Years			
			0 to 1	2 to 5	8 to 13	19 to 41
1	Manufacturing	5	1	1	2	1
2	Marketing and Distribution ..	4	1	1	2	..
3	Transport	3	1	..	..	2
4	Banking and Insurance ..	2	1	..	..	1
5	Education and Research ..	4	4	..	..	..
6	Computer Service Organisations	2	1	..	1	..
Total ..		20	9*	2	5	4

*In fact, 2 EDP installations came up in 1965, 4 in 1966; as many as 9 in 1967 (of which 6 were installed in the later period of the year) and only 3 in 1968.

¹³ It may be noted here that, the real time lag may have to be calculated only after 1956 since it is during that year the electronic computer made first entry on the Indian scene; the first modern computer was installed at the Indian Statistical Institute at Calcutta in 1956.

3.16. However, once the computer is installed, not much further time is lost in setting the Equipment to production-run since the major 'hindrances'-technical, human, and some times, social (or even political) would have been cleared (or atleast, dealt with) by that time. In this respect, *Table 3J* reveals significantly that no EDP organisation took more than 6 months to start its first production-run, and that, as many as 13 Installations or over 68 per cent. of the total of 19 organisations reporting data, started their first production run within less than a month's time. Only 3 installations-2 from Banking and Insurance, and 1 from Manufacturing categories-constituting less than 16 per cent. of the total EDP establishments needed some 4 to 6 months' period to begin their first production-run. For the remaining 3-all from Marketing and Distribution category the corresponding 'time-lag' has been between 2 to 3 months¹⁴.

TABLE 3J

No. of months Elapsing between installation of the Computer and first production run

Cat. No.	Type of organisation	No. of organisations reporting data	Period		
			0 — 1 month	2 to 3 months	4 to 6 months
1	Manufacturing	5	4	..	1
2	Marketing and Distribution	4	1	3	..
3	Transport	3	3	..	..
4	Banking and Insurance	2	..	..	2
5	Education and Research	3	3	..	..
6	Computer Service Organisation	2	2	..	..
Total ..		19	13	3	3
Percentage ..		100	68.42	15.79	15.79

¹⁴ Even though Table 3J indicates that the first production run was possible for all organisations within six months' time it should be noted that this is generally preceded by a long period ranging from 6 months to 2 years of training of personnel, development of computer programmes, modifications in the operational systems, etc. In fact to reduce this time of testing and training the manufacturers of computers themselves generally recommend advance preparation for the new machine in terms of training etc.

Uses of Computer

3.17. We have already pointed out that the computer is a versatile and powerful tool for the mechanisation and automation of information processing. It is particularly adopted at storing masses of details information, at making repetitive calculations and at printing out results at high speed. Infact, the computers can be profitably used when there is large volume of data which cannot be processed manually and when the data is of complex nature and when it needs handling by machine, or when the computation cannot be made by the manual method within a reasonable time. As an aid to proper decision-making and managerial control, the computer can provide the management with Decision Models—mathematical formulation for solving difficult problems and for simulation of complex events may be in the areas of finance, equipment and other strategic questions.

3.18. The computer has made very powerful mathematical approaches, e.g., programming practical. Thus, an optimal (cotton) blending plan which requires the knowledge of the spinning characteristics (viz., fineness, strength, staple length, count, colour, moisture contents, maturity, etc.) the cost and the stock of the different raw cottons, is possible only by means of computer application. Moreover, though mathematical programming which is concerned with the allocations of scarce resources for which there may be a number of competing demands; the computer can be of great aid to management. For instance, the complex oil refinery problems may involve a hundred or more constraints on the uses of resources and no manual method could cope with such a degree of sophistication. Moreover, in case of a very complicated accounting system where there are many variables to be taken into account before a choice is to be made, the computer can render considerable help in making better choice. In transportation, planning the optimum route of a fleet of lorries making delivery calls can be extremely complex and is often done by rule-of-thumb or by adjusting last week's delivery schedule according to guess-work. A computer brings the computation back into the realms of reality.

3.19. The computer has enormous potentiality for helping top management to make better capital investment decision. It can also be very profitably utilised for the sales and market analysis. For instance, sales managers need an enormous variety of control information, sales per day, week, month, year; sales compared with the last similar period or with the budget; the performance of each representative; sales by region and area; sales to each customer; discounts allowed; sales by product or product line. The computer is an ideal tool for making these detailed

repetitive calculations and reports, and calculating the statistical significance of trends and variations. A marketing data-base should ideally include the whole range of internal data on products, customers, sales structure and performance. The various effects of different market models (alternative packages, distribution of effective interests among dealers, deliveries, etc.,) can be studied by the computer very much to the advantages of the company.

Job Priorities

3.20. It appears that some of these aspects of computerization have been appreciated while deciding the initial job priority by the management. The factors which generally weighed their decision, however, were the overall usefulness or utility of the equipment and this included the maximisation of results with reference to the objectives concerned, increased productive efficiency and reduction in price, production planning and inventory control and sometimes, immediate availability of the computer. Besides, the organisations, which had the conventional machines or data processing equipment, transferred the jobs provisionally handled by the DPM to the Electronic Computer on a priority basis. The factors which influenced their decision in this respect were (a) increased volume of activities ; (b) profitability and better efficiency and saving in interest ; (c) improved managerial control ; (d) availability of trained staff ; (e) future organisational planning and (f) rational integration of various Departments.

Job Applications

3.21. As regards computer applications, our Survey reveals that, amongst the more widely selected jobs for computerisation are : pay roll, financial accounting, share accounting, management accounting, production statistics, billing, inventory control, PERT/CPM and linear programming. In the Insurance and Banking organisations, file maintenance, premium/loan interest, billing, renewal commission and bonus commission billing constitute major jobs. In Railways, large number of operations such as freight traffic and passenger traffic, engine statistics and train statistics, goods accounts, passenger accounts and store accounts and wagon control account for major time utilization of the computer. The Educational Research Institutions, however, use their computer mainly for the Scientific and Research work, processing of examination results, etc. The T.I.F.R., Bombay proposes in the immediate future to use their computer for computer aided design, speech synthesis, music generation, picture, processing, natural language behaviour, etc.

Minor Job Applications

3.21-A. In the Commercial Organisations, Market statistics, purchase bills, forecasting/credit control, budgeting and production control constitute, at present, the job applications of minor significance and are done less usually. In Railways and Transport Organisations, inventory transactions, monthly operations statistics, etc., coal wagon statistics, financial accounting and management accounts, etc., constitute minor jobs as yet. The Educational and Research Organisations, though they use their computer for scientific and research jobs of their faculty and research students, sell-computer-time to outside users for Linear Programming and other commercial applications.

3.22. The relative importance of some of these jobs (that can be compared) in the total scheme of computer utilization, both in terms of usage consideration (based on¹⁵ computer time) as well as benefit consideration (based on benefits accruing) is shown in *Table 3K*. Thus, from the usage consideration, firstly, pay roll, financial accounting, production statistics, and inventory control constitute the *more usual* applications with aggregate 42 job-users¹⁵, amongst whom 23 (55% use these as 'major' applications¹⁶, while the remaining 19 (45%) use them as relatively 'minor' applications. Secondly, billing, share accounting, management accounting, PERT/CPM, and linear programming form the fairly usual applications and aggregate 31 job-users. For 18 job-users (58%) amongst them, these are 'major' applications (except linear programming) while for the remaining 10 job were (28%), these are relatively 'minor' applications. Thirdly, market statistics, purchase bills, forecasting/credit control, production control and budgeting are the less usual applications (except budgeting and to a certain extent, forecasting/credit control) with 16 job-users only, of whom 7 at the most use these applications as 'major', while as many as 9 treat them as 'minor' applications¹⁷.

¹⁵ For the purpose of this section, 'job-user' means a EDP installation doing in a particular job mentioned in *Table 3K*. In other words, the 16 companies reporting data for 14 number of jobs classified and reviewed would give maximum number of job-users of $16 \times 14 \times 246$.

¹⁶ These were selected by computer managers on the basis of the extent of usage by each organisation reporting data.

¹⁷ From the usage consideration, however, there are other jobs that are currently done on the computer as 'major' applications by one or two EDP establishments only and which are relevant (peculiar) to their nature of business. These include the applications, such as, freight traffic and passenger traffic, store accounts, work-shop accounts, and passenger accounts, goods statistics, engine statistics, wagon statistics and control, and train documents and statistics. These also include branch clearing and government transactions, incentive bonus and payments, planning of equipment, profitability studies, scientific research, operations research and the like.

TABLE 3K

EDP Organisations currently doing selected Jobs† on the Computers by
USAGE of Computer Time and Benefit Consideration*

Serial No.	Type of job	Usage Consideration ¹			Benefit Consideration ²			
		Time			Rs.			
		1969	1969	1969	1969	1969	1969	
		Total ³	Major	Minor	Total ³	Major	Minor	
<i>I More usual—</i>								
1	Pay Roll ..	..	11	5	6	11	5	6
2	Financial Accounting ..	..	11	7	4	9	7	2
3	Production Statistics ..	..	10	5	5	8	8	..
4	Inventory Control ..	..	10	6	4	8	7	1
	Total ..	..	42	23	19			
<i>II Fairly usual—</i>								
1	Billing .. ..	..	7	5	2	7	5	2
2	Management Accounting ..	..	7	5	2	6	6	..
3	Share Accounting ..	..	6	3	3	5	..	5
4	Linear Programming ..	..	6	2	4	5	5	..
5	PERT/CFM ..	..	5	3	2	3 ⁴	3 ⁴	..
	Total ..	..	31	18	13			
<i>III Less usual—</i>								
1	Market Statistics ..	..	4	1	3	6 ⁵	3 ⁵	3 ⁵
2	Purchase Bills ..	..	4	1	3	4	..	4
3	Forecasting/Cr Control ..	..	4	3	1	4	3	1
4	Production Control ..	..	2	..	2	2	2	..
5	Budgeting ..	..	2	2	..	2	2	..
	Total ..	..	16	7	9			
	Grand Total ..	..	89	48	41	80	56	24

* Refers to 16 Organisations only.

† These were selected by the Computer Managers on the basis of extent of usage.

¹ This is classified by the total time used on the computer for the application in question.

² This is classified by the total benefits, tangible and intangible accruing out of the application in question which is a subjective evaluation.

³ Refers to total users of this application.

⁴ Should be treated as *less usual* application.

⁵ Should be treated as *fairly* application.

3.23. From the *benefit* consideration too, pay roll, financial accounting, production statistics and inventory control constitute more or less *usual* applications with aggregate 36 job-users, amongst whom 27 (75%) only use them as 'major' applications. *Secondly*, billing, share accounting, market statistics, management accounting and linear programming also form the *fairly usual* applications with aggregate of 29 job-users. For 19 job-users (66%) these are 'major' applications (except share accounting) while for the remaining 10 job-users (34%), these are relatively 'minor' applications. *Thirdly*, budgeting and production control, purchase bills, forecasting credit control and PERT/CPM constitute the *less usual* applications of minor significance, although forecasting/credit control, and PERT/CPM are of some material value¹⁸.

3.24. Further *Table 3K* reveals that firstly, share accounting which is 'fairly' important application from usage consideration becomes totally 'minor' application from benefit consideration. *Secondly*, market statistics which is almost entirely 'minor' application from usage consideration becomes 'fairly' important application from benefit consideration. Moreover, budgeting and production control figure only in a minor way in the total scheme of computer utilization. *Thirdly*, linear programming which is relatively 'minor' application from usage consideration becomes fully 'major' application from benefit consideration. *Fourthly*, management accounting, inventory control and forecasting/credit control and PERT/CPM which constitute fairly 'major' applications from usage consideration, become almost fairly 'major' applications from benefit consideration¹⁹.

3.25. From the point of view of the character of these applications such as, 'information oriented' and 'decision-oriented' (*Table 3Ka*) budgeting, production control, inventory control, forecasting/credit control, PERT/CPM and linear programming may be treated as 'purely' 'decision-oriented' applications, while production statistics, market statistics and management accounting may be considered as 'decision-oriented' applications only if they figure as 'major' applications, preferably, from benefit consideration. It appears that, except inventory control, and, to a certain extent, linear programming, rest of the 'purely' decision-oriented applications do not as yet play any prominent role in the scheme of computer utilization by the users of these applications. Comparatively, however, production statistics and management accounting seemed to have received some clear-cut preference as 'decision-oriented' applications from their users.

¹⁸ However, of 15 aggregate users, 10 or 67 percent treat these as 'major' applications and the remaining 5 or 33 percent as 'minor' applications.

From the *benefit* consideration, however, there are some jobs that are currently done on the computer as 'major' applications, by a few FDP establishments only, and which have bearing on the nature of installation and character of business.

¹⁹ All this analysis is based on the aggregate number of job-users of these applications.

TABLE 3Ka¹

EDP Organisations (users currently doing selected jobs on the Computer by usage of Computer Usage and Benefit Considerations.

Serial No.	Type of job	Usage consideration time 1969			Benefit consideration Rs., 1969		
		Total	Major	Minor	Total	Major	Minor
<i>A. Purely decision oriented—</i>							
1	Budgeting	2	2	..	2	2	..
2	Production control	2	..	2	2	2	..
3	Inventory control	10	6	4	8	7	1
4	Forecasting/Cr. control	4	3	1	4	3	1
5	PERT/CPM	5	3	2	3	3	..
6	Linear programming	6	2	4	5	5	..
Total ..		29	16	13	24	22	2
<i>B. Decision oriented, if used as Major (Benefits).</i>							
1	Production statistics	10	5	5	8	8	..
2	Market Statistics	4	1	3	6	3	3
3	Management Accounting	7	5	2	6	6	..
Total ..		21	11	10	20	17	3
<i>C. Information oriented—</i>							
1	Pay Roll	11	5	6	11	5	6
2	Financial Accounting	11	7	4	9	7	2
3	Share Accounting	6	3	3	5	..	5
4	Billing	7	5	2	7	5	2
5	Purchase Bills	4	1	3	4	..	4
Total ..		39	21	18	36	17	19
Grand Total ..		89	48	41	80	56	24

¹ Please see foot-note for Table 3K.

3.26. As regards the job-applications on the UR machines in the EDP installations, the available data reveals that, of 10 EDP organisations reporting data, 6 were doing specific jobs, viz., purchase statistics, financial accounting, machine logs, fixed deposits, control totals, and pay roll on UR machines only, while 4 organizations were using UR machines only as a peripheral equipment of computer system, for sales investment, consumption analysis, goods-receipt notices and policy-processing.

Utilization of EDP Facilities

3.27. The extent of electronic computerization in industry or business depends, among other things, on the firm's propensity to 'computer-utilization' for its own business (including its branches) on the one hand, as well as its ability to sell 'computer-time' to the customers, on the other. As for the organization's own jobs, the branch offices within the state or region, by and large, draw upon the EDP facilities provided by the main office. In this respect *Table 3L* gives an indication of the extent to which the operating branches of the EDP organisations reporting data have been utilising the EDP facilities of the Head offices concerned. The Table explains that in the Manufacturing, Marketing and Distributions and Computer Service Organisations Sectors, almost all the Branches make use of EDP facilities (as output) of the Head Quarters. Educational and Research Institutions do not have Branches outside Maharashtra and that all the Branches in the State avail of the EDP facilities of the Head Office. In the Transport Sector, however, only 2 out of 5 Branches in Maharashtra take advantages of the EDP facilities of the Central Office; while two main organisations along with all the 14 Branches outside Maharashtra have had no such advantages at all²⁰. It is also revealed that in Banking and Insurance only 2 out of 182 Branches within the State utilise the EDP facilities of their Divisional Centres and that 2 organisations outside Maharashtra together with their 1045 use no EDP facilities.

²⁰However, on All-India level the most impressive use of computers (in private and public sector) in all India, is to be found in the integrated operation of the 14 computers controlled by the Railway Board in New Delhi.

TABLE 3L
Branches using EDP Facilities

Cat. No.	Type of organisation	No. of organisations reporting data for this table	In Maharashtra			Outside Maharashtra		
			No. of organisations	No. of branches	Branches using EDP facilities	No. of organisations	No. of branches	Branches using EDP facilities
1	Manufacturing ..	5	5	11	11	4	51	58
2	Marketing and distribution.	3	3	6	5	2	21	21
3	Transport ..	3	2	5	3	2	14	....
4	Banking and Insurance ..	2	2	182	2	2	1,045	....
5	Education and Research..	4	4	4	4	..	..	....
6	Computer service organisation.	2*	2	2	2	1	5	5
Total ..		19	18	210	27	11	1,136	74

*One of the service organisation has 4 computers outside Maharashtra also.

Selling Computer-Time

3.28. As regards the 'selling' of computer-time, *Table 3M* reveals some interesting facts. Some 8 out of 20 EDP establishments give their computer time on hire to outside organisations. It is significant to note that all the EDP establishments in the Manufacturing, Transport, Banking and Insurance categories use the computer entirely for their own organisation jobs, and do not hire out computer time to others; while all the Marketing and Distribution firms as well as Computer Service Organisations, and half of the 4 Educational and Research Institutions hire out their computer time to other organisations. The two Computer Service Organisations in particular, hire-out almost the whole of the computer-time to outside firms. In fact, it is their sole object and purpose.

3.29. As for the extent of effective computer-time given on hire, *Table 3M* further reveals that 2 of the 4 firms in the Marketing and Distribution category allow 1% to 10% of their effective computer-time on hire, while the remaining two (as also the two Educational and Research Institutions) hire out 16% to 32% of the effective computer-time to the outside organisations. Two Computer Service Organisations, however, give the computer-time on hire to the extent of 92% to 95%, and use the remaining time mostly for the internal purpose, such as, training, job testings, systems work, etc.

TABLE 3M
Number of Installations Giving Computer Time on Hire to Outside Organisations

Cat. No.	Type of organisation	Total No.	Total number of organisations giving computer on hire	Percentage of time loaned outside		
				1 to 10	16 to 32	92 to 95
1	Manufacturing	5	..	..	..	..
2	Marketing and Distribution ..	4	4	2	2	..
3	Transport	3	..	..	..	..
4	Banking and Insurance ..	2	..	..	..	..
5	Education and Research ..	4	2	..	2	..
6	Computer Service Organisations.	2	2	..	..	2
Total ..		20	8	2	4	2

Current utilisation

3.30. The current utilisation of computer-time for various business and office applications was one of the most delicate questions before the Study Team, since the managements of a few EDP organisations had some reservations about giving complete data in a specified form. Anxiety was also expressed in some measure as regards the 'admissibility' of such data for making any 'valid' inter-organisational comparisons, because of the organisation peculiarities. Moreover, part of the data was supplied with certain 'qualifications' having bearing on the current objectives and established goals of the organisations concerned. It is with this background of 'limitations' that the data so received in response to the Questionnaire issued to the EDP organisations, along with some information collected from legitimate and dependable sources, has been processed with great care and is presented with due caution and adequate qualifications wherever necessary.

3.31. Thus, *Table 3N* gives the percentage—range of current utilization of the Electronic Computer in relation to the established goals of the organisations concerned i.e., achievement level related to current goals. The statistics reveals that 2 organisations out of 20 did not reply²¹, and two more found difficulties in the assessment of current utilization of their own EDP facilities. Of the remaining three, 2 are Marketing and Distribution Agencies (which also hire out computer-time) and one is Computer Service Organisation itself. Of the remaining 16 organisations, 1 Manufacturing firm has utilised only 25-30 per cent. of the computer-time; 4 organisations—2 from Marketing and Distribution and 1 each from Manufacturing and Education and Research categories have reached 60-65 per cent. utilisation of their EDP facilities; 2 organisations—1 Manufacturing and 1 Transport undertaking have realised 75 to 85 per cent. utilization; while as many as 9 organisations—1 each from Manufacturing, and Computer Service Organisations; 2 each from Transport, and Banking and Insurance companies; and 3 Educational and Research Institutions have accomplished full utilization of electronic computer in relation to the goals set by the organisations concerned²².

²¹One of them is a very recent EDP installation and may be presumed to be falling below the range of 60-65% utilizations.

²²For the purpose of evaluating the extent of computer utilization, we have only taken achievement against the goal set by the company itself, which do not have any relations to the total number of clock hours or meter hours worked on the computer.

TABLE 3N
*Classification of Installations According to Current Utilization of the
 Electronic Computer in relation to the established goals of the
 Organisations*

Cat. No.	Type of organisation	Total number of organisations	Not replied	Difficult to assess	Per cent. achievement			
					25—30 *	60—65 **	75—85 †	100 ‡
1	Manufacturing	5	1	..	1	1	1	1
2	Marketing and Distribution ..	4	1	1	..	2	..	..
3	Transport	3	..	..	..	..	1	2
4	Banking and Insurance ..	2	..	..	..	..	..	2
5	Education and Research ..	4	..	..	..	1	..	3
6	Computer Service Organisation ..	2	..	1	..	..	..	1
Total ..		20	2	2	1	4	2	9

*Poorly.

**Partially.

†Fairly satisfactory.

‡Full.

3.32. The EDP facilities are considered to be 'poorly' used where the achievement ranged between 25-30 per cent. utilization level; they are 'partially' used, where the achievement ranged between 60-65 per cent. utilization level; 75-85 per cent. achievement level is considered as 'fairly satisfactory' utilization. A 100 per cent. achievement, of course, constitutes full utilization level. With these assumptions, 9 EDP organisations out of 18 reporting data or 50 per cent. of the total, have reached a 'full' utilization level; these include 3 Educational and Research Institutions, 2 Transport undertakings, both of the 2 Banking and Insurance Companies, 1 Manufacturing concern, and 1 Computer Service Organisation (and none of the Marketing and Distribution Organisations). Two establishments—1 each from Manufacturing and Transport categories—have reached 'fairly' satisfactory utilization level; while as many as 4 organisations—2 from Marketing and Distribution, and 1 each from Manufacturing and Education and Research categories are using the EDP facilities only 'partially'. The remaining 1 organisation has used its EDP facilities probably poorly. Thus, it would appear that 11 out of the total of 18 organisations reporting data, or about 61 per cent. of them have achieved 'fairly satisfactory' level of computer-utilization (of course, in relation to the established goals of the organisations at present). Correspondingly, in the industrial and business sector, in particular (excluding 4 Educational and Research Institutions and 2 Computer Service Organisations) only 7 out of 12 organisations, or 58 per cent. of them have attained 'fairly satisfactory' level of computer-utilisation. In the public sector (Transport, Banking and Insurance categories) however, 4 out of 5 organisations said to have accomplished the goal of 100 per cent. computer-utilization.

3.33. Moreover, *Table 30* reveals that, in the sector where EDP equipment is purchased, 6 out of 8 organisations reporting data, or 75 per cent. of them have accomplished 'fairly satisfactory' level of computer utilization; while in the sector where EDP equipment is obtained on hire, only 5 organisations, or 45 per cent. of total 11 organisations of which data is available fall in the corresponding category of computer utilization. In the private sector, only 2 out of 8 organisations for which data is available or have realised 'fairly satisfactory' level of computer utilisation.

TABLE 30

TABLE

Classification of EDP Installation according to their utilization in

Cat. No.	Type of organisation	Not replied	Difficult to assess	Computer purchased				Total
				Per cent. achievement				
				25—30 **	60—65 †	75—85 ‡	100 ¶	
1	Manufacturing	..	..	..	..	..	..	..
2	Marketing and Distribution.	..	..	..	..	..	..	..
3	Transport	..	..	..	..	1	..	1
4	Banking and Insurance	..	..	..	..	..	2	2
5	Education and Research.	..	..	..	1	..	3	4
6	Computer Service Organisation.	..	1	..	..	..	..	1
		..	1	..	1	1	5	8

*Data for 1 organisation only is available. **Poor. †Partial. ‡Fairly good, ¶Full.

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Relation to the Established Goals of the Organizations.

		Computer on hire				
Not replied	Difficult to assess	Per cent. achievement				Total
		25—30 **	60—65 †	75—85 ‡	100 ¶	
1	....	1	1	1	1	5
1	1	....	2	....	....	4
....	....	....	1 ³	....	2	2
....
....
....	....	....	....	....	1	1
2*	1	1	3	1	4	12

3.34. Since the reasons for computerization by the various organisations have been a matter of organisational 'preference' more or less of subjective nature, ascertaining of the extent of computer-utilization on the basis of the organization's established goals and the present objectives do not provide very useful material for a quantitative assessment of the situation²³. Such a material also conceals to a certain extent, an element of 'superfluity' especially in the context of certain limiting factors operating in the economy though largely of techno-social origin.

A Special Study

3.35. Our analysis based on the special data collected regarding the meter hours rented on 16²⁴ IBM Computers per month (in Bombay Region) would show that monthly rental time per EDP installation works out at 190 meter hours. Or a special analysis of 13 worked up computers lead us to the conclusion that, an average monthly rental time per installation works out at 235 meter hours or 400 physical hours. This would mean that the Index of utilization is about 70 per cent.

3.36. Furthermore, *Table 3P* throws a spread-light on the extent of computer utilisation in Maharashtra in terms of clock hours worked per day, per installation. Thus, of 17 EDP organisations—2 Manufacturing concerns and 2 Education and Research Institutions—work their computers for 8 hours shift per day. Two organisations, one manufacturing and one Research and Education, work their computers between 8 hours to 12 hours (1 to 1½ eight hour shift) per day. It is noteworthy that, as many as 8 computer installations or 48 per cent. of the total utilise between 13-16 hours (more than 1½ shift to 2 shifts) per day; these installations include 1 Manufacturing firm, 2 Marketing and Distribution Agencies and all the 3 Transport Undertakings and 2 Banking and Insurance Companies. 3 computer installations—one each from Manufacturing, Marketing and Distribution and Computers Service Organisation have been using their computer round the clock.

²³In this context, special efforts were made by the Study Team especially by two of its members viz. Prof. N. S. Ramaswamy and Dr. L. S. Kanodia through formal and informal discussions with the computer users, and that, their persuasive efforts have resulted in commendable success.

²⁴Of the 16 computers, 3 were installed very recently.

TABLE 3P
Extent of Computer Utilization

Cat. No.	Type of organisation	No. of organisations reporting data	No. of Clock hours worked per day			
			8 and below	8 — 12	13 — 16	24
1	Manufacturing ..	5	2	1	1	1
2	Marketing and Distribution.	3	..	..	2	1
3	Transport ..	3 ^{1,2}	..	..	3	..
4	Banking and Insurance ..	2	..	..	2	..
5	Education and Research ..	3	2	1	..	..
6	Computer Service Organisations.	1	..	..	..	1
Total ..		17	4	2	8	3

3.37. Among the types of organisations, 2 of the 5 Manufacturing concerns use their computers for one shift only²⁵, while 2 more use them between one to two shifts and the remaining one for all the three shifts. In the Marketing and Distribution Category, 2 computers work for about 1½ to 2 shifts, and the remaining 1 for all the three shifts. For Transport, and Banking and Insurance Categories, all the computer installations included in the above Table have been working for 1½ to 2 shifts. Educational and Research Institutions, however, do not seem to utilise their computer time adequately. They seem to be using their computers for less than 8 hours shift per day usually much less²⁵. Thus, out of 3 computers, 2 work only for 1 shift and less, and the remaining one for a little over one shift. One computer service organisation providing data uses its computer for all 24 hours.

²⁵It may be noted that sometimes the computer is idle except for a small number of meter hours per month, however, it may be partly due to administrative difficulties faced by the organisation concerned.

Fuller Utilization

3.38. As regards the full utilization of computer system, in the context of the established organisational goals, at present *Table 3Q* gives some useful indications. Thus, 3 organisations, which have not reported data for this Table, have each over 9 to 24 months' existence by 1st March 1969; these include 1 Manufacturing concern, 1 Marketing and Distribution agency, and 1 Computer Service Organisation. Six computer installations—3 out of 4 Educational and Research institutions, 2 of the 3 Transport undertakings, and 1 Manufacturing firm seem to have achieved their goal 100 per cent., though within the wide range of 13 to 56 months' time each (longer time for Educational and Research organisations as a whole), or within about 27 months on average. Another 4 EDP installations—2 from Banking and Insurance and 1 each from Marketing and Distribution and Computer Service organisation categories—are said to have already achieved correspondingly 100 per cent. of their goal within 16 to 38 months' time each; or within some 28 months on average. However, to achieve *full-utilisation* according to their present plans, they would require total of 28 to 77 months time each, or 48 months median time. Three more organisations—1 each from Manufacturing, Marketing and Distribution, and Transport Categories—which have at present achieved 60-85 per cent. of their computer system in terms of their organisational objectives, have already taken 14 to 36 months time each, or 24 month on average, and would require anything between 17 to 63 months, or 43 months time. The remaining 4 organisations—2 from Manufacturing, and 1 each from Marketing and Distribution and Education and Research categories—have achieved only 20 to 65 per cent. of their computer system in relation to the organizational goals, but have existence of time varying widely between 2 months and 87 months. Moreover, these organisations do not think that it is feasible to give a firm forecast regarding the full utilisation of their computer system. Thus, it would appear that of 20 EDP establishments, 3 did not report data for this table; as many as 10 organisations have achieved 100% of their utilization level, although out of them, 4 would require as per their present plans, some 20 more months' time on average to achieve full or near full utilization of their computer system; 3 more still would require correspondingly 19 more months on average. The remaining 4 organisations also give an indication of their ability or inability to reach the higher level of computer utilization. The *Table 3Q* further indicate that in the industrial and business sector in particular, it may be that some organizations achieve their goals probably within about 15 months time or so; while some may not be able even to forecast such a period after 2 or 7 years of computer installation. For many others, however, it may be that they take about 4 to 5 years to reach the fuller-utilization level of the computer system.

TABLE 3Q

TABLE

Extent of Computer Utilization since Installation and

Cat. No.	Type of organisation	Total No. of organisa- tions	No. of organisa- tions not reporting data	Period upto* 1st January 1969	100 per cent.	
					No. of organisa- tions reporting data	Period upto* 1st January 1969
1	2	3	4	5	6	7
1	Manufacturing	5	1	9	1	15
	
2	Marketing and Distribution ..	4	1	20	..	..
3	Transport	3	..	..	1	15
		..	..	..	1	14
4	Banking and Insurance ..	2	..	..	..	..
	
5	Education and Research ..	4	..	..	1	13
		..	..	..	1	48
6	Computer Service Organisation.	2	1	24	1	56
	
	Total ..	20	3	53	6	161
	Average ..	..	..	18	..	27

*Figures in columns 5, 7, 9, 10, 12, 13 and 15 indicate

3Q

Expected time for full-utilization of Computer System

utilization with current goal and future goals			Partial utilization between 25 to 85 per cent.				
No. of organisations reporting data	Period upto* 1st January 1969	Period from installation till utilization*	Achievement 60 to 80 per cent.			Achievement 25 to 65 per cent	
			No. of organisations reporting data	Period upto* 1st January 1969	Period from installation till utilization	Total No. of organisations reporting data	Period upto* 1st January 1969
8	9	10	11	12	13	14	15
..	..	..	1	14	17	1	24
..	..	..	..	..	..	[1	2
1	36	48	1	23	50	1	87
..	..	..	1	36	63	..	..
..
1	24	39	..	..	..	..	..
1	38	77	..	..	..	..	..
..	..	..	..	..	..	1	5
..
1	16	28	..	..	..	..	..
4	114	192	3	73	130	4	118
..	28	48	..	24	43	..	29½

the period in months.

CHAPTER 4

Personnel in the EDP Department

The staff in the EDP Department are an important element in the progress of Electronic Computerization in industry or business. Infact, the EDP Department forms the nucleus of any programme of office—automation in any organization¹. The EDP Personnel may be conveniently grouped into *five categories* : I-Key Punch Operators and Punch Supervisors ; II-UR Machine Operators and UR Section Supervisors ; III-Computer Programmers and Systems Analysts ; IV-Computer Operators, and Person-in-Charge; and V-Checkers and coders and the Miscellaneous. *Table 4A* shows the composition of the EDP Personnel totalling 1,159 men and women employed by all the 20 Organizations having Electronic Computer System. The Key Punch Operators and Computer Programmers and Systems Analysts constitute the two most important categories which together employ as many as 687 persons, or 59·4 percent of the total of 1159². Taken individually, the former accounts for 518 or 44·8 percent, and the latter for 169 or 14·6 percent. of the total respectively. The Checkers and Coders and UR Machine Operators come next and account together for 152 persons or 13·1 percent of the total, in that their individual share being 92 and 60 persons, or 7·9 percent. and 5·2 percent respectively. The other 'specific' categories have been only of a minor significance.

TABLE 4A

Percentage Distribution of Employees in each Operational Category.

Cat. No.	Job Category			Total Employees	
				Number	%
I.	1.	Key Punch Operators	.. ..	518	44·8
	2.	Punch Supervisor	.. ..	19	1·6
II.	3.	UR Machine Operator	.. ..	60	5·2
	4.	UR Section Supervisor	.. ..	19	1·6
III.	5.	Computer Programmers and Systems Analysts	..	169	14·6
IV.	6.	Person in Charge	.. ..	29	2·5
	7.	Computer Operators	.. ..	33	2·8
V.	8.	Checkers and Coders	.. ..	92	7·9
	9.	Miscellaneous	.. ..	220	19·0
				1,159	100·0

¹It may be noted here that, since the installation of Computers there has been considerable increase in their employment, in that, over a thousand and more people have been accommodated in this Department, nearly 31 per cent. of them being the new recruits.

²These two categories are quite 'significant' from the point of view of their employment potential in the EDP Department.

Recruitment

4.1. As regards the recruitment of EDP staff, 30 to 50 percent of all the 20 Establishments have chosen the required personnel from within the organization only, while 10 to 25 percent of these Establishments have selected them only from the outside labour market. In other cases, a combination of both these methods is followed while recruiting the EDP personnel. In this context, *Table 4B* reveals that those who are recruited from inside the organisation are trained or transferred from within the (EDP or former UR Machine Section) itself, and constitute a fairly large total of 803 (out of 1159), or 69.3 percent of the entire EDP staff of all the Establishments having Electronic Computers. The same proportion is well-maintained within the more important operational categories of EDP Department, except for the Key Punch Operators where it is only 54 percent as compared to 71 percent for Computer Programmers and Systems Analysts, 75 percent for UR Machine Operators and 89.1 percent for Checkers and Coders respectively³.

TABLE 4B
Employment in EDP Departments of Organisations

Cat. No.	Job Category	Total employees in EDP unit	Trained or transferred from within	Recruited from outside	Per cent in each job Category	
					Trained from within to total in EDP Unit	Per cent of recruited from outside
I.	1. Key Punch Operators ..	518	280	238	54.0	46.0
	2. Punch Supervisor ..	19	16	3	84.2	15.8
II.	3. UR Machine Operator ..	60	45	15	75.0	25.0
	4. UR Section Supervisor	19	16	3	84.2	15.8
III.	5. Computer Programmers and Systems Analysts.	169	120	49	71.0	29.0
IV.	6. Person in Charge ..	29	20	9	69.0	31.0
	7. Computer Operators ..	33	28	5	84.8	15.2
V.	8. Checkers and Coders ..	92	82	10	89.1	10.9
	9. Miscellaneous ..	220	196	24	89.1	10.9
		1,159	803	356	69.3%	30.7%

³It may be mentioned here that, of the total 803 EDP personnel trained or transferred from within the Establishment itself, Key Punch Operators account for 280, or only 34.88 per cent. The corresponding figures for more important categories would be; for Computer Programmers and Systems Analysts, 120 or 14.94%; UR Machine Operators, 45 or 5.6%; and for Checkers and Coders 82 or 10.21% respectively.

Computer Programmers and Systems Analysts

4.2. As regards the proportion of the transferred and trained from within Computer Programmers and Systems Analysts to their total employment in the EDP Department of the Establishments, *Table 4C* further reveals that, excluding 7 EDP Organizations—3 Transport undertakings and 4 Educational and Research Institutions—which together constitute relatively small proportion of this trained personal, the proportion is usually maintained within the range of 80 to 86.3 percent or little over 83 percent on average, in the Manufacturing, Marketing and Distribution, and Banking and Insurance categories of EDP Organizations. Only the Computer Service Organisations account for a smaller proportion i.e. 33.8 percent correspondingly, evidently because they are new establishments and do not form part of any larger organization and hence had to depend on recruitment from open market.

TABLE 4C

Employment of Programmers and Systems Analysis at the EDP Installations

Cat. No.	Type of Organisation	No. of installations	No. of Programmers and Systems Analysts	Of which trained from within	Per cent Trained from within to total	Average No. of programmers for installation (orgn.,)
1	Manufacturing ..	5	50	42	84.0	10
2	Marketing and Distribution.	4	40	32	80.0	10
3	Transport ..	3	11	11	100.0	4
4	Banking and Insurance ..	2	22	19	86.3	11
5	Educational and Research ..	4	16	6	37.5	4
6	Computer Service Organisations.	2	30	10	33.3	15
Total ..		20	169	120	71.0	8.5

4.3. Similarly, a closer observation, especially, of the pattern of employment in the category of Computer Programmers and Systems Analysts (*Table 4C*) reveals that, the 20 EDP installations employed together 169

such personnel or about 8 to 9 persons per installation. Amongst the categories of EDP establishments, however, the averages range between the minimum of 4 for Transport and Education and Research Categories to the Maximum of 15 for Computer Service Organizations, for the Manufacturing, Marketing and Distribution, and Banking and Insurance categories, the corresponding average being around 10. It appears that the Educational and Research institutions have engaged a relatively much small number of Computer Programmers and Systems Analysts, probably because, that the nature of their functioning is such that individual researchers know quite a bit of programming themselves, and therefore their requirements could be well satisfied with some assistance of the regular cadre of programmers and systems analysts.

4.4. Generally, the EDP organizations experience the paucity in the market of good programmers and well-qualified and experienced system staff. Our enquiry, however, revealed that, EDP Establishments, by and large, did not encounter serious problems concerning recruitment and training of staff. The difficulties were mostly overcome by recruiting the required computer personnel from within the Organizations itself and that they were given requisite training with the assistance of IBM or similar other Organizations in the country or abroad (especially at the higher level personnel like Chief Programmers, Punch Supervisors, etc.) and thus they met the requirements of the EDP Establishments.

From URM to EDP

4.5. Incidentally, it may be mentioned that, there is a feeling of anxiety in the UR Machine staff, that as and when some of the existing jobs on UR machines are progressively transferred on to the computer, the utilization of the sorter and the accounting machine will, to some extent, be reduced, and to that extent, the Job potential will be curtailed. However, to us it appears that it is very unlikely that such a situation would result in any redundancy, since the operators have to be there, though, perhaps, at a lower utilization index. In this context, *Table 4D* clearly indicates that there is a certain amount of inflexibility regarding the man and machine ratio in the punching unit as well as in the UR Section as a whole. Although, there are variations within the organizational categories, the man and machine ratio for the punching unit is around 1:1, and it is difficult to alter. In other UR unit, the corresponding ratio is rather higher, since it includes the supervisory and connected staff attending to more than one job at the same time, and discharging supervisory and sometimes, other duties, over the punching section also, thus maintaining the man and machine ratio in the overall UR section, around 1:1 or so.

TABLE 4D
Men and Machines in UNIT RECORD Department at the Computer Installations.

Cat. No.	Type of organisation	No. of organisations	Total number of punching and verifying machines	Other unit record machines	Personnel in punching unit	Personnel on other unit record machines including supervision	Man to machine ratio		Overall in UR section
							In punching unit	In other U.R. unit	
1	2	3	4	5	6	7 = $\frac{5}{3}$	8 = $\frac{6}{4}$	9 = $\frac{5+6}{3+4}$	
1	Manufacturing	5	82	17	75	22	0.91	1.29	0.98
2	Marketing and Distribution ..	3	75	12	81	19	1.08	1.58	1.15
3	Transport	2	117	11	187	26	1.60	2.36	1.66
4	Banking and Insurance ..	2	151	4	121	18	0.80	4.5	0.90
5	Education and Research ..	4	22	19	15	2	0.68	1.10	0.41
6	Computer Service Organisation ..	2	48	11	39	11	0.81	1.00	0.85
Total ..		18	495	74	518	98	1.05	1.32	1.08

Conditions of Service

4.6. As regards the work environment and conditions of service of the EDP Personnel, some useful data has been available, indicating the nature and character of the impact. Their physical working conditions in the EDP Department are, by and large, more congenial to better work-performance. Though the work has become somewhat simpler and calls for substantially higher skill—requirements⁴, particularly so, for Computer Programmers and Systems Analysts. Besides, the data regarding personnel criteria for these categories of computer personnel reveals that, good educational background, adequate specialised training, some relevant experience, fair ability to assume responsibility and suitable chances of promotion are the qualities that are required for high level of efficiency and effective performance of Computer Programmers and Systems Analysts. A measure of training, experience and opportunities for promotion also figure importantly in the case of Punch Operators as well as Machine and Computer Operators. Moreover, mental make-up and personality character have a greater bearing on the category of computer Programmers and System Analysts ; and Organisations, by and large, not used the criteria such as, age composition, physical requirements, etc. in the selection of other personnel in EDP Department.

Economic Benefits

4.7. As for the economic benefits, the EDP personnel, in general, have been placed comparatively in a much advantageous position. *Table 4E* shows that in 7 out of 10 organizations, the Computer Personnel has secured higher wages ; in nearly half of the Establishments they get better incentives and in a little over third of them, they enjoy an additional advantage of fringe benefits. In a way, the Table indicates a marked trend towards higher wages coupled, sometimes, with better incentives like overtimes, and fringe benefits such as, holiday allowances, transport facilities, training, etc.

⁴Only 6-7 organisations supplied somewhat proper data in this regard.

***TABLE 4E**
Conditions of Service of EDP Personnel

Serial No.	Category	Higher wages			Better incentives			Fringe benefits		
		Yes	Same	NR	Yes	Same	NR	Yes	Same	NR
1	Computer programmers and system analysts.	7	1	1	4	3	2	3	3	3
2	Punch operators/machine operators.	7	2	..	5	4	..	4	3	2

* Table pertains only to 9 organizations which supplied the particular data.

NR = Not replied.

4.8. A somewhat detailed analysis of the pay-scales of the computer personnel is attempted in *Table 4F*. For the administrative—supervisory category, the minimum educational qualification is a graduate degree and more (with adequate experience) where the salary scales usually range between Rs. 1,000 to Rs. 1,500 per month (sometimes on a lower side). But with the additional experience gained in the field, the scale might as well fall on the higher side of the range (and may be Rs. 2,000 per month or more). For Project Planners and Systems Personnel who are graduates in technical subjects, the corresponding range of salary scales would be between Rs. 850 and Rs. 1,350 p.m. Here some allowance may be made for a certain amount of training and experience in the organization. Although graduation is a minimum qualification, there are some with post-graduate degree amongst the Programmers, whose pay-scales range varies between Rs. 600-1,100 p.m. Console Operators may be S. S. C. trained, or graduates and fall between the range of Rs. 350-550 p.m. although in certain cases, the Graduate Console Operators have secured a salary range between Rs. 500-1,100 p.m. A Matriculate Operator of Peripheral Equipment who has the qualification of S. S. C. or its equivalent falls in the scale of Rs. 130-300 per month, where the corresponding salary range for the Graduate may be between Rs. 300-350 per month. A Tape Librarian may be S. S. C./or Graduate whose range of pay-scales is between Rs. 350-700 p.m. Lastly, the Key Punch Operators who are S. S. C. qualified may get as their salary-scale, anything between Rs. 150 to Rs. 350 or so, per month. It should be however, noted here, that in all the above categories, there exist lower as well as higher salary scales due possibly to the organizational peculiarities and personnel structure existing in the establishment. However, we have taken the range for modal group⁵.

TABLE 4F

Conditions of Service by qualification and range of pay scales

Category	Minimum educational qualifications	Range of salary scale (Rs. per month)
I. Executive and supervisory	Graduate ..	1,000 — 1,500
II. Project planners, Systems designers, analysts ..	Graduate ..	850 — 1,350
III. Programmers	Graduate ..	600 — 1,100
IV. Console operator	S. S. C./Matriculate.	350 — 550
V. Peripheral equipment operators	S. S. C./Matriculate.	130 — 300
		300 — 500
VI. Tape librarians	S. S. C./Graduate ..	350 — 700
VII. Key punch and UR operators	S. S. C. ..	150 — 350

90-95 per cent. of the cases surveyed fall into the range mentioned herein.

⁵It may be realised that the salary scales differs so widely between the organizations probably accounting, atleast partly, for the longer experience, value of fringe benefits (excluded from the above scale) method of wage-fixation and wage regulations etc. However, the available data being very scanty, considerable limitations have been imposed on its interpretation.

Criteria for Selection

4.9. As regards the criteria, such as, qualification, experience, etc., while recruiting EDP Personnel, there is at present no ready-made solution or a model agreement and, we feel that such criteria need to be evolved in mutual consultation between management and unions, of course in co-operation with the experts in the field. However, as for the Punch Operators, the S.S.C. qualification and some proficiency in Punch Operation; for Punch Supervisors, some additional experience and supervisory ability; and for the Systems Analysts, a graduate with Special skill in analytical data-formulation may be considered as adequate. The Mathematical background may not be essential for Systems Analysts although understanding of business and Computer-use is desirable.

4.10. Training is an important aspect of any effective computerisation system. It is because the computer system is never static and that it is reviewed continuously and becomes sophisticated as the data base gets refined and the people using the system get trained and inducted. At present, we find that all the EDP organizations concerned do not provide the necessary training facilities nor do the Universities expose the students adequately to the new computer technology. As a result, probably, the trained personnel in terms of number and quality are so inadequate in the Government and in the public sector undertakings, as well as, in the Universities, that, the computers are both under-utilized and, sometimes, not properly utilised too.

4.11. The problem can be satisfactorily met with by providing adequate and suitable training programmes at various levels of computer personnel. In this context, there are several privately operated computer training schools which offer courses to the students attending day or evening classes in Bombay. All Educational Institutions which have a computer and most Government Installations allocate time in varying degrees for the training of computer programmers and technicians. Sometimes, courses are offered by the Computer Manufacturing Companies in all the major cities of India (including Bombay and Poona). The I.B.M., for example, has conducted a number of different Seminars on computers in the more recent times. The Indian Statistical Institute in Calcutta also specialises in teaching 'computer science'. Besides, one overseas tutorial college regularly advertises Corresponding Courses in Computer Programming and Computer Technology in the Indian National Press. Over and above, another more enterprising Private Computer Training School in Europe advertises not only computer training programmes but undertakes to find comfortable board and lodging for Indian students and to assure them of a full social life.

4.12. We however, think that a somewhat integrated education and training structure may be more suitable and helpful in the proper progress of computerisation in the country. It may be suggested that at the lower levels of computer personnel viz. Key Punch Operators, the training programme should be oriented more towards "on the job training" and may be conducted through Evening Courses of about 50 to 60 hours duration for S.S.C. and above grade trainees. At the middle level of computer personnel i.e., Programmers and Systems Analysts, it may be necessary to have a more comprehensive courses instead of a few weeks training programmes and sandwich courses. Such a course may be extended over to a period of ('one year Full-Time' or 'Two Years Part Time') Programmes so that, after successful training of the programme, the person is able to handle the Computer system independently. At the higher level too, there should be a Two Year Course after B.Sc. which should be available for one year for M.Sc., students, and should be equivalent a M.Sc., Degrees in Computer Science. (This need not be an electronic course in Engineering).

CHAPTER 5¹

IMPACT OF COMPUTERIZATION: WORK ORGANISATION AND MANAGEMENT

Usually, automation—especially office automation provides a new and more dramatic dimension to personnel and manpower policies of the undertaking. The Studies by and large, reveal that it is in the group of “clerical workers” that the most striking impact of automation and advanced technology has so far been apparent. Operators of office machines, book keepers and other workers maintaining financial and other records feel its impact, in the first instance. The extent to which the effect is spread depends upon the economic sociological and cultural conditions, in which automation or computerisation takes place.

Advantages to Employees

5.1. The managements think that most generally computerisation would lead to opening up of more job opportunities (in the skilled work force) with increased remuneration and promise of higher standard of living, better working conditions, shorter working hours and consequently more leisure, upgrading of skills and opportunity for promotion and learning. The general staff and especially, the clerical employees would be relieved from doing dull and monotonous work, or performing routine and repetitive jobs. In the changed environment due to automation on the other hand, the ‘organization men’ would be doing a more systematic and analytical stimulating work, full of interest and challenge, suitable to their qualifications, aptitude, and leadership qualities, thus, providing a measure of satisfaction. Besides, in the field of Education and Science, the precise calculations will now be handled more sophisticatedly. Our Fact Finding Survey, however, reveals that the views and expectations are valid only partially.

Working Conditions

5.2. Thus *Table 5A* is an attempt to ascertain the impact of office-automation on the working conditions of the various categories of personnel in the organisation². The Table makes it clear that there is hardly any change worth the name. The working conditions in terms of physical environment, hours of work, conditions of safety or shift work (which has been facilitated in a couple of cases) have remained, more or

¹ The data presented in this Chapter is largely based on the reactions of the EDP managers to computerization in their respective organizations and hence certain obvious limits of objective analysis.

² It may be noted here that, changes in working conditions are only applicable to those persons who were working before and after the introduction of the computer, and not to the new entrants in the organization.

less, unchanged; that in about 8 Establishments out of 9, the conditions continue to be the same. It is probably because the greater part of Electronic Computerization has come to industry and business in the State only very recently only about 3-4 years old—and it may be rather too early to measure it in such precise terms. It perhaps, may take a few more years before any impact is felt substantially.

TABLE 5A

*Impact of Computerization on Working Conditions—All Categories of Employees Except that of Miscellaneous**

Serial No.	Working conditions	No. of organisations reporting†	Yes	Same	Not applicable
1	More leisure .. ..	....	1	8	2
2	Shift work .. ..	....	2	6	3‡
3	Greater safety .. ..	....	1	8	2
4	Pleasant physical environment ..	....	1	8	2

*These include Executive and Administrative personnel, Clerical staff, Technical staff (outside EDP department).

†The table pertains to 11 organizations only.

‡Includes one not replied by one organization.

Occupational Nature

5.3. As regards the impact of Office-Automation on the occupational nature in the organizations, *Table 5B* gives a somewhat diffused picture of the situation. For administrative personnel, and, to a certain extent, for clerical staff, work has become somewhat simpler, while for the executive cadre as well as technical staff in the organization it has not changed very significantly, although a visible trend seems to be moving in that direction. The work of the *organization-men* is also undergoing a slow but a steady change, in that, it is perhaps showing a tendency of becoming, in some measure, more supervisory than executive. Especially, for the administrative personnel and, to a certain extent, for executive cadre such tendency is becoming more clear as compared to clerical staff and technical-men in

the organization. Moreover, the skill requirements for the organization—men due to the introduction of electronic computer have not assumed any different character compared to the state of affairs before office-automation, and wherever such tendency is observed, it is only of marginal nature.

TABLE 5B
Impact of Computerization on the Occupational Nature in the Organization

Serial No.	Category	No. of Organizations †	Nature of Work Became Simpler Due to Introduction of EDP			Nature of Function Supervisory			Skill Requirement and Higher Efficiency on account of introduction of EDP		
			Yes	Same	NA**	Yes	Same	NA**	Yes	Same	NA**
1	Executive Personnel.		4	5	1	5	4	1	2	7	1
2	Administrative Personnel.		6	3	1	7	2	1	2	7	1
3	Clerical Staff ..		5	3	2*	4	4	2	3	6	1
4	Technical Staff (other than EDP).		3	5	2*	3	5	2*	2	6	2

*Includes one—not replied by one organization.

†This Table pertains to 10 organizations only. The rest did not fill in the particular Schedule.

**NA = Not Applicable.

Conditions of Service

5.4. Only 9 organizations supplied data regarding the change in the conditions of service of office employees due to the introduction of electronic computer. *Table 5C* reflects the nature and the extent of such change on the organizations. It shows that introduction of EDP has not caused any significant changes in the conditions of service of executives and administrative personnel, although in few cases there has been some upgradation in the salary levels, incentives and fringe benefits. In this way, the conditions of service concerning these aspects have by and large remained unchanged.

TABLE 5C

*Change in conditions of service due to introduction of EDP**

Category	Higher wages			Better Incentives			Fringe benefits			
	Yes	Same	Not replied	Yes	Same	Not replied	Improved	Same	Not replied	
I. Executive Cadre	..	2	6	1	1	7	1	1	7	1
II. Administrative Personnel.		2	6	1	2	6	1	1	7	1
III. Clerical Staff	..	4	5	..	3	6	..	2	7	..
IV. Technical Staff (Other than EDP).		2	7	..	1	7	1	1	7	1

*This Table is pertaining only to 9 Organisations. The rest did not fill in the particular schedule.

5.5. In short, it is true, to a certain extent, that the introduction of computer demands new and higher skills, and that, it is rewarded with higher pay. Thus, while a few workers get more interesting and better paid jobs, many more remain at the conventional levels. Although in certain sections pay-rise is associated with automated jobs, there has been little evidence where increase in the pay of lowpaid employees has occurred as a general impact. Little evidence also exists at present time, that automation has direct effect on the hours of work and that our study shows that the weekly hours of work for the clerical staff have remained by and large unchanged. Although the physical working conditions of the EDP personnel have been on the whole beneficial and the technical jobs have raised the skill requirements in those occupations, the office employees as such have yet to feel the beneficial impact of electronic computerisation. In the EDP Section one finds that the employee is surrounded by the sophisticated machinery and is usually found observing control panels which record activities of the automated systems. Nevertheless, work under the conditions of automation involves nervous tensions and monotony which are still in many cases characteristic of modern industry.

Advantage to Management

5.6. Certain advantages to managements flowing from computerization are accurate and timely information being made available to them, leading to improved communications and better decision-making prospects—without much difficulty or loss of time. Under the conditions of automation, management can exercise effective control perhaps through figures rather than visual control. Improved efficiency through speed, accuracy and logic, and

considerably improved methods of presentation are apt to assist management's action and their future plans. Besides, in the linear programming or operation research, advanced management techniques are now made possible under the computer system.

5.7. In this respect, our data shows that, managements have derived considerable advantage of office-automation ; in that the impact of electronic computer on the decision-making function of management seems to be pronounced, especially in the sphere of communication in industry and to a certain extent, on organizational planning. The *Table 5D* reveals significantly the fact that in 9 out of 10 organisations reporting data, the system of communication in the establishments concerned has improved beyond doubt, to the advantages of administrative, managerial and supervisory cadre. A measure of improvement could also be seen with regard to the clerical staff and, to a certain extent, the technical-men in the organization where electronic computer has been an aid to management. It is to be realized that although with the introduction of EDP there has been improvement in decision-making and organizational planning, the casual link between them is largely of an indirect nature, and sometimes it is only a supportive relationship to the top level management. Certainly, organizational planning has been greatly facilitated in all the 10 organisations reporting data, where computer has been of significant help to the Executives, Administrators and Supervisors. The Technical staff as well as clerical category of personnel have also received a measure of benefits from electronic computer.

Besides, the contribution of technical staff to the organizational planning seems to have been facilitated in some measure due to the introduction of electronic computer³.

TABLE 5D

Impact of Electronic Computer on Decision Making Function in the Organisation. (After Computerisation)

Job Category	Decision Making				
	Communication			Planning	
	Improved	Same	Not replied	Facilitated.	Same Not replied
I. Administrative/Managerial ..	9	1	..	10	..
II. Supervisory ..	9	1	..	10	..
III. Clerical Staff ..	7	2	1	3	6
IV. Technical (Other than EDP) Staff.	5	3	2	5	3

This table pertains to 10 organizations only. The rest did not fill in the particular Schedule.

³ We feel that the contribution of clerical staff in this respect is, largely of doubtful character.

Personnel Criteria

5.8. As regards the personnel criteria for Executives and General Administrators, very scanty data was supplied to the Study Team and therefore only limited observation can be made in the respect. The personnel criteria for them could be well-imagined; that Electronic Computerisation has not yet caused any significant changes in them. These men at the higher and top levels require general grasp of the situation, the ability and mental make-up to take quick decisions and implement them effectively. They have to assume responsibility for decision-making and create an image of the organization in the public. Infact, it is these men who set the tone and temper of organizational work; and this certainly calls for considerable experience of dealing with people, and a personality character of a very high order. At the relatively lower levels of organizational management, however, these personnel criteria will be applicable in a considerably diluted form. 1.3

5.9. As regards the consequences of EDP Installation on the organizational efficiency, *Table 5E* throws some light. Thus, in about 12 to 16 organizations out of 16 to 18 of the total, the picture which has emerged, indicates that the major advantages have been in the areas of improvement in information, increased efficiency in the maintenance of office-records, and the coupling of different processes⁴. As regards improved supervision and training, the relative advantage would appear to be of a very minor nature. It may be that, because of the combined nature of the relevant question, the responses have been mixed up, and that they conceal the clarity and pronounced reality of the situation⁵. In the sphere of reduction in cost, also the relative advantages seem to be of a very minor nature and the staff economies appear to be of little or no consequence at all. Only 3 organisations stated positively that they have been confronted with the labour discontent while implementing the programmes of office-automation. On the other hand, as many as 13 organizations stated that they have had no labour problem at all in relation to the introduction of EDP⁶. 11 organizations could not make definite statement regarding staff economies, while 10 Establishments claimed, non-applicability of training and supervision aspects to their institutional structure and framework.

⁴The different functions in any organization are invariably coupled: viz, invoicing is coupled to accounts receivable, and finished goods to stock control. With the aid of a computer, it is hence, possible to couple the control of the different functions.

⁵It is evident from the fact that 10 out of 20 respondents consider the question as *not applicable*.

⁶Some of these organizations probably have underestimated the role of labour in this respect, which situation conceals the danger of labour discontent in the near future. This point is elaborated elsewhere in the Report.

TABLE 5E

Consequences of EDP Installation in Organization

Serial No.	Consequence on	Yes/ Contem- plated	No/ No problems	Indefi- nite/ Not Stated	Not Appli- cable
1	Improvement in Information	.. 16	..	1	3
2	Improvement in Efficiency in Maintenance of Office Record.	14	1	2	3
3	Coupling of Different Processes	.. 12	2	4	2
4	Improvement in Supervision and Training.	5	1	4	10
5	Reduction in Cost	.. .. 6	2	9	3
6	Staff Economies	.. .. 2	4	11	3
7	Labour Discontent	.. .. 3	13	..	4

This table pertains to all 20 Organisations.

CHAPTER 6

IMPACT OF COMPUTERISATION—EMPLOYMENT ASPECTS

The Implications

One of the most important aspects of office automation is its impact on labour and especially on employment, including retrenchment and potential employment. It is in this context that the Indian worker is genuinely concerned with employment effect of automation. Shakespeare has also said that, "You take my life when you take the means whereby I Live".

6.1. The employers usually contend that the impact of automation on displacement of labour, if any, is a short-term effect, and opportunities in future will grow in quite much proportion. The trade unions on the other hand, feel that, as a labour saving device of a giant magnitude, its existence makes great difference to the employment situation without it; that the same work will certainly occupy large number of human labour with it. The Labour Movement in the country also entertains considerable fear and anxiety regarding retrenchment of labour force, or atleast its potential shrinkage, if computers were to be installed especially for office operation.

6.2. It is true that some applications of automation displace labour. However, unlike the United States, there has been no retrenchment in India due to automation, as the labour which is displaced or rendered surplus is absorbed in the expansion scheme or is given alternate employment in the same Company. In most cases, they are absorbed in alternate jobs; but it should be noted that, in such cases, some future job opportunities may be lost¹. More often the *problem may be that of one who does not get a job*, rather than of one rendered surplus. In other words, on the general plan, the problem is not of those displaced to-day, but of the millions who are unemployed waiting to be employed.

6.3. In the following few tables, we have presented the relevant data regarding employment, retrenchment and reduction in potential recruitment in the 14 EDP Organisations which we surveyed for the purpose of our

¹In this context, even in U. S. A., there is no agreement among the experts that "silent firings" (those not hired in the future who might have been hired had the new technology not been introduced) resulting from automation has been an evidence as a major cause of unemployment. Professor Goodwin suggests, that the direct cause-and-effect relationships between automation and unemployment are not readily observable.*

* Cf. OECD : *Requirements of Automated Jobs*,
Washington, 1964—Final Report and Supplement,
Paris, 1965, p. 21.

study. We are, however, aware of the limitations of such theoretical modelling and statistical analysis, and we have therefore, to emphasize that the trends reflected in such an analysis on the whole should be understood to be only indicative and not conclusive. To this end, *Tables 6A to 6E* provide somewhat practical basis for measuring the extent of such impact on the various types (categories) of organizations viz. Manufacturing, Marketing and Distribution, Transport, and Banking and Insurance³. The *Tables 6B* and *6C* provide a valuable account of individual EDP organizations grouped alternately on the bases of Analysis by Results, and by time of Installation, respectively, thus throwing spot light on the situation.

6.4. Thus, (*Table 6A*) between 1965 and 1969, in the Manufacturing organizations, total office employment increased from 7,728 to 10,794 i.e. by 3,066 or 39.7 per cent; while the clerical employment increased from 2,787 to 3,557 i.e. by 770 or 27.6 per cent only; the ratio of the clerical to the office employees declined from 36.1 per cent. to 33 per cent. or by 3.1 per cent during the period. This indicates the decline of 3.1 per cent. of the clerical to the office employees during the same period of four years³. Correspondingly, however, in the Marketing and Distribution sector, the total office employees declined from 4,376 to 4,135 i.e. by 241 or 5.5 per cent; while the clerical employment was reduced from 2,010 to 1,605 i.e. by 405 or as much as 20.1 per cent; or that the corresponding ratio of clerical to office employees came down from 45.9 per cent. to 38.8 per cent. or by 7.1 per cent. over the same period of 4 years (i.e., by 1.8 per cent. on an average per year, representing the potential decline in the clerical employment at the current level viz., 1969). An alternative way of looking at the situation would be that there appeared to be a decline in the ratio of clerical employment in 1965 and 1969 to total office employment in the year 1965 as the base, would show a decline from 45.9 to 36.8 i.e. 9 per cent. for four years or 2.5 per cent on an average per annum.

¹Educational and Research Organizations have been excluded from the Study as they do not admit of such analysis.

²One organization in the Manufacturing Category, however, showed a different trend, in that both the office employees as well as clerical employees increased; but the ratio of the latter with the former declined by 3.2 percent. over the period of 4 years.

³One organization in this Category, however, revealed a different trend, in that the office employees as well as the clerical increased but the ratio of the latter with the former declined by 3, 6 percent. over the period of 4 years. Moreover, we have reason to believe that in all except one organisation in this sector, a portion of decrease in office as well as clerical employment might have been due to factors other than those which are usually associated with office automation.

TABLE 6A

TABLE

Office Employment in Maharashtra in Organizations having EDP

Code No.	Total office employment				Of which	
	1965	1969	Absolute increase + or decrease -	Percentage increase + or decrease -	1965	1969
1	2	3	4 = 3 - 2	5 = $\frac{3 - 2}{2} \times 100$	6	7
	927	1,056	+129	+13.9	550	592
	371	596	+225	+60.6	310	527
A	1,868	3,513	+1,645	+88.1	155	429
	2,655	2,589	-66	-2.5	1,610	1,700
	1,907	3,040	+1,133	+59.5	162	309
	7,728	10,794	+3,066	+39.7	2,787	3,557
	1,381	1,191	-190	-13.8	720	547
B	1,114	795	-319	-28.6	617	405
	679	675	-4	-0.6	427	404
	1,202	1,474	+272	+22.6	246	249
	4,376	4,135	-241	-5.5	2,010	1,605
	4,605	5,940	+1,335	+29.0	1,395	1,168
C	1,16,744	1,16,744	Nil	Nil	8,656	7,488
	29,000	29,000	Nil	Nil	6,000	6,000
	1,50,349	1,51,648	+1,335	+0.9	16,051	14,656
	4,107	8,272	+4,165	+101.4	2,284	4,806
D	11,114	10,941	-173	-1.6	11,114	10,941
	15,221	19,213	+3,992	+26.2	13,398	15,747
GRAND TOTAL ..	1,77,674	1,85,826	+8,152	+4.6	34,246	35,565

*Since the figures for the total as well as clerical employees are the same, these columns are

6A

Installations (Excluding Research and Service Organizations)

Clerical employment		Clerical as percentage to total office employment		Difference between column numbers 10 and 11
Absolute increase + or decrease -	percentage increase + or decrease -	1965	1969	
$8 = 7 - 6$	$9 = \frac{7 - 6}{6} \times 100$	$10 = \frac{6 \times 100}{2}$	$11 = \frac{7 \times 100}{3}$	$12 = 11 - 10$
+42	+7.6	59.3	56.1	-3.2
+217	+70.0	83.5	88.4	+4.9
+274	+176.8	8.3	12.2	+3.9
+90	+5.6	60.6	65.7	+5.1
+147	+90.7	8.5	10.2	+1.7
+770	+27.6	36.1	33.0	-3.1
-173	-24.0	52.1	45.9	-6.2
-212	-34.4	55.4	50.9	-4.5
-23	-5.4	62.9	59.8	-3.1
+3	+1.0	20.5	16.9	-3.6
-405	-20.1	45.9	38.8	-7.1
-227	-16.3	30.3	19.7	-10.6
-1,168	-13.5	7.4	6.4	-1.0
Nil	Nil	20.7	20.7	Nil
-1,395	-8.7	10.7	9.7	1.0
+2,522	+110.4	55.6	58.1	+2.5
-173	-1.6	100.0*	100.0*	Nil
+2,349	+17.5	88.0	82.0	-6.0
+1,319	+3.8	19.3	19.1	-0.2

not applicable.

6.5. In the Transport Undertakings, total office employment increased from 1,50,349 to 1,51,684 i.e., by 1,335 or by 0.9 per cent. only. The clerical employment declined from 16,051 to 14,656 i.e., by 1,395 or 8.7 per cent., thus, bringing down the corresponding ratio of clerical employees to office employees from 10.7 per cent. to 9.7 per cent. i.e., by one per cent. during 4 years or by 0.25 per cent. on an average per year.

6.6. Lastly, in the Banking and Insurance, the Office employment rose sharply during these 4 years from 15,221 to 19,213 i.e., 3,992 or 26.2 per cent., while the clerical employees increased from 13,398 to 15,747 i.e. 2,349 or by 17.5 per cent and that, the ratio of clerical employees to the office employees declined from 88.0 to 82.0 per cent. i.e., by 6 per cent. during the same period ; i.e., 1.5 per cent. on an average per year. In this respect, it would be clear that amongst all the 4 categories of organizations, taken individually, there has been a decline in the potential of clerical employment ranging between 1 per cent. to 7.1 per cent. over the total period of 4 years as a whole. Further, it would appear from *Table 6A* that in the Marketing and Distribution, and Banking and Insurance Sectors, as a whole, and one organization from Transport Sector, the employment trends give somewhat adverse indication of the situation. Thus the total office employment of all the 14 organizations under study increased from 1,77,674 to 1,85,826 i.e., by 8,152 or by 4.6 per cent. The clerical employees also showed an increase from 34,246 to 35,565 i.e., by 1,319 or 3.8 per cent. Though, however, the ratio of clerical to the total office employees declined slightly from 19.3 per cent. to 19.1 per cent. i.e., by 0.2 per cent., over the period of 4 years or by 0.05 per cent. on an average per annum⁵.

Analysis by Results : Alternate Approach

6.7. *Table 6B* reveals the impact of office automation on office employment in Maharashtra in 14 EDP Establishments (excluding 6 Research and Service Organizations) based on the Analysis of Organizations by Results. Thus, in an alternate way the 14 organizations could be divided into 5 Groups viz., A, B, C, D and E. Group 'A' consists of 4 Manufacturing Organizations where the general trend in office employment as

⁵It may be pointed out here that our analysis of Manufacturing Organizations and to a certain extent Transport Undertakings has certain limitations, since the comparisons between total office employment and total Clerical employment of the respective Organizations have not been made out. However, they are all growing organizations, along with the progress of the State's economy as a whole and that the picture would not be very much different from one obtained from the present data.

well as in clerical cadre shows a relative increase⁶ between 1965 and 1969. The corresponding ratio of clerical employees to the total office employees also reveals the same trend during the same period, although, amongst these organizations clerical potential has increased at a declining rate.

⁶In one organization in this group the total office employment declined by 66 or 2.5 percent. over the period of 4 years.

TABLE

*Office Employment in Maharashtra in Organizations having
(Analysis)*

Code No.	Total office Employment				Of which	
	1965	1969	Absolute increase + or decrease —	Percentage increase + or decrease —	1965	1969
1	2	3	4 = 3-2	5 = $\frac{3-2}{2} \times 100$	6	7
A 14	2,655	2,89	-66	-2.5	1,610	1,700
12	371	596	+225	+60.6	310	527
13	1,868	3,513	+1,645	+88.1	155	429
15	1,907	3,040	+1,133	+59.5	162	309
B 21	1,381	1,191	-190	-13.8	720	547
22	1,114	795	-319	-28.6	617	405
23	679	675	-4	-0.6	427	404
C 11	927	1,056	+129	+13.9	550	592
24	1,202	1,474	+272	+22.6	246	249
41	4,107	8,272	+4,165	+101.4	2,284	4,806
D 31	4,605	5,940	+1,335	+29.0	1,395	1,168
32	1,16,741	1,16,744	Nil	Nil	8,656	7,488
42	11,114	10,941	-173	-1.6	11,114	10,941
E 33	29,000	29,000	Nil	Nil	6,000	6,000
GRAND TOTAL ..	1,77,674	1,85,826	+8,152	+4.6	34,246	35,565

*Since the figures for the Total as well as Clerical Employees are the same, these columns are

6B

*EDP Installations (Excluding Research and Service Organizations)
by Results)*

Clerical Employment		Clerical as Percentage to total Office Employment		Difference between column numbers 10 and 11
Absolute increase + or decrease —	Percentage increase + or decrease —	1965	1969	
$8 = 7 - 6$	$9 = \frac{7 - 6}{6} \times 100$	$10 = \frac{6}{2} \times 100$	$11 = \frac{7}{3} \times 100$	$12 = 11 - 10$
+90	+5.6	60.6	65.7	+5.1
+217	+70.0	83.5	88.4	+4.9
+274	+176.8	8.3	12.2	+3.9
+147	+90.7	8.5	10.2	+1.7
—173	—24.0	52.1	45.9	—6.2
—212	—34.3	55.4	50.9	—4.5
—23	—5.4	62.9	59.8	—3.1
+42	+7.6	59.3	56.1	—3.2
+2	+1.0	20.5	16.9	—3.6
+2,523	+110.4	55.6	58.1	+2.5
—227	—16.3	30.3	19.7	—10.6
—1,168	—13.5	7.4	6.4	—1.0
—173	—1.6	100.0*	100.0*	Nil
Nil	Nil	20.7	20.7	Nil
+1,319	+3.8	19.3	19.1	—0.2

not applicable.

6.8. On the other hand, the Group 'B' which comprises of 3 Marketing and Distribution organizations reveals altogether reverse trends. Thus, these organizations have registered a fall in the total office employees as well as clerical employees, leading, therefore, to a corresponding fall in their respective ratios as also in the ratios of clerical to the office employees between 1965/69 respectively. Thus, taking the year 1965 as the base, the respective ratio of the clerical employees in 1969 to the total office employees correspondingly would show a faster decline in the potential of clerical employees. Moreover considering 1965 as the base year, the ratio of clerical employees for 1969 to office employees in 1965 would reveal a greater reduction⁷.

6.9. The Group 'C' consists of 3 organisations from mixed categories of Manufacturing, Marketing and Distribution and Banking and Insurance. The trends appears to be mixed ones as a combination of 'A' and 'B' in that the total office employees as well as the clerical employees have shown a rising trend, although the rate of rise in the latter was relatively slow compared to the rate of rise in the former except from one organization in Banking and Insurance category, where the correspondingly rate has been somewhat higher, consequently, leading to a sectoral rise in the ratio between the clerical employees to the total office employees during the corresponding period of 4 years.

6.10. The next Group 'D' consists of 3 organizations—2 from Transport, and 1 from Banking and Insurance. In this mixed category various different trends have been indicated, that sometimes there is an increase in the office employees but decline in the clerical employees, thus leading to a fast or slow decline in the ratio of the clerical to the total office employees between the years. Sometimes, there is no change in the total office employees but the clerical employees showed a decline, thus leading to a decline in the ratio of the clerical employees and total office employees during the years. At times, total office employees and the clerical employees together have shown a slow decline over the years leading to some decline in the corresponding ratio of office employees and clerical employees between the years. In the one organization in Group E, however, there was no change in the Office employees as well as in the clerical employees between the above period.

“Span” and “Speed” of Automation

6.11. While analysing the impact of office automation on the employment and the reduction of labour force in the EDP organizations, it is necessary to ascertain a casual link between the span of automated jobs

⁷Also there was a decline of 2.8 per cent. for 3½ years for one organization preceding 1965.

and speed of computerization on the one hand, and the reduction or displacement in the labour component of the organizations on the other. An attempt to establish such casual relationship is made in analysing *Table 6B* with *Table 6C*. Thus, *Table 6C* reveals that in the Group 'A' there are only 12 job-users of 8 'major' applications and 14 job-users of 11 'minor' applications. Within the category of 'major' applications, there are only 4 *purely* information-oriented jobs and 2 purely decision-oriented applications along with 2 more of a mixed variety; while within the 'minor' application, the corresponding figures are 5, 5 and 1 respectively. An analysis of this shows that, only a few applications have been taken up on the computer in the average span of about 14 months, where the computer time utilization has been somewhere between 25 to 85 percent. (with reference to the current organizational objectives) which has resulted into a trend characterised by a slow increase at diminishing rate in the office employment as well as in clerical employees of these organisations, taken individually.

TABLE

Selected jobs currently done on the computer

		MAJOR														
		Information oriented jobs					Purely decision oriented jobs					Decision oriented if used as Major				
		Pay Roll.	Financial Accounting.	Share Accounting.	Invoicing and Billing.	Purchase Bills.	Budgeting.	Production Control.	Inventory Control	Forecasting Credit Control	PERT/CPM.	Linear Programming.	Production Statistics.	Market Statistics.	Management Accounting.	Total.
Code No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	14	+														1
	12												×			1
	13		+	+					×				×			4
	15	+	+			+			×	×					×	6
		2	2	1	—	1	—	—	2	1	—	—	2	—	1	12
B	21		+						×	×			×	×	×	6
	22	+	+		+				×	×		×	×		×	8
	23	+	+		+		×		×	×			×	×	×	9
		2	3	—	2	—	1	—	3	3	—	1	3	2	3	23

6C

by way of usage and benefit consideration

MINOR

Information oriented jobs					Purely decision oriented jobs						Decision oriented if used as Minor				Year of installation	Installation period upto January 1969	Percentage of utilization
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
Pay Roll.	Financial Accounting.	Share Accounting.	Invoicing and Billing.	Purchase Bills.	Budgeting.	Production Control.	Inventory Control.	Forecasting Credit Control	PERT/CPM.	Linear Programming.	Production Statistics.	Market Statistics.	Management Accounting.	Total.			
	+						x	x	x	x				5	Nov. 1968.	2	25-30
+		+	+				x							4	Oct. 1967.	15	100
+				+										2	Jan. 1967.	24	60
		+				x						x		3	Nov. 1967.	14	85
<hr/>																	
2	1	2	1	1	—	1	2	1	1	1	—	1	—	14			
<hr/>																	
+										x				2	Jan. 1966.	36	100
									x					1	May 1967.	20	—
										x				1	Oct. 1961.	87	65
<hr/>																	
1	—	—	—	—	—	—	—	—	1	2	—	—	—	4			

TABLE 6C

		MAJOR														
		Information oriented jobs					Purely decision oriented jobs						Decision oriented if used as Major			
Code No.		Pay Roll.	Financial Accounting.	Share Accounting.	Invoicing and Billing.	Purchase Bills.	Budgeting.	Production Control.	Inventory Control.	Forecasting Credit Control.	PERT/CPM.	Linear Programming.	Production Statistics.	Market Statistics.	Management Accounting.	Total.
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	11			+	+							×				3
C	24		+		+								×	×		4
	31	+	+		+		×						×			5
		1	2	1	3	—	1	—	—	—	1	—	2	1	—	12
	32a															
	33a															
D	41b															
	42b															
GRAND	TOTAL ..	5	7	2	5	1	2	—	5	4	1	1	7	3	4	47

a I—Major jobs done on the Computer by Railways are as follows :—

- (1) Freight Traffic ;
- (2) Passenger Traffic ;
- (3) Incentive Bonus to W/staff ;
- (4) Engine Statistics ;
- (5) Coal Wagon Control ;
- (6) Suburban Train Statistics ;
- (7) Goods Accounts ;
- (8) Passenger Accounts ;
- (9) Store Accounts.

contd.

MINOR

Information oriented jobs					Purely decision oriented jobs					Decision oriented if used as Minor.							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Year of installation	Installation period upto January 1969	Percentage of utilization
Pay Roll.	Financial Accounting.	Share Accounting.	Invoicing and Billing.	Purchase Bills.	Budgeting.	Production Control.	Inventory Control.	Forecasting Credit Control.	PERT/CPM.	Linear Programming.	Production Statistics.	Market Statistics.	Management Accounting.	Total.			
+	+			+			×			×	×	+		7	Apr. 1968.	9	
+		+					×							3	Feb. 1967.	23	60
															Jan. 1966.	36	75
2	1	1	—	1	—	—	?	—	—	1	1	1	—	10			
															Oct. 1967.	15	100
															Nov. 1967.	14	100
															Dec. 1966.	24	100
															Nov. 1965.	38	100
5	2	3	1	2	—	1	4	1	2	4	1	2	—	28			

II—Minor jobs done on the Computer by Railway are as follows :

- (1) Inventory Transaction ;
- (2) Monthly Operation Statistics ;

b Major jobs done on the Computer by the companies in Insurance and Banking Organisations —

- (1) File Maintenance ;
- (2) Premium and Loan Interest Billing ;
- (3) Renewal Commission and Bonus Commission Billing.

+ Refers to the Information oriented jobs.

× Refers to the Purely decision oriented jobs.

6.12. In Group 'B', on the other hand, a different picture has emerged, not without reason. To this end, in the 'major' category, there are as many as 23 job-users of 10 applications, while in the 'minor' category there are only 4 job-users of 3 applications. Further, in the 'major' category, there are 3 purely information-oriented jobs while another 4 are purely decision-oriented applications in addition to 3 jobs of mixed variety. The corresponding figures for 'minor' category are 1 and 2 (for the first two) respectively. Moreover, it shows that more jobs have been computerized in the 'major' category over a period of 3 to 4 years on an average with the extent of computer time utilization ranging between 65-100 percent; thus leading to a larger reduction in the office employment as well as clerical employees and thereby a faster decline in their respective ratio over the same period correspondingly.

6.13. In the Groups C & D (Analysis by Results), to a certain extent, a mixed trend is revealed, in that, in the 'major' category there have been 12 job-users of 8 applications and in the 'minor' category there have been 10 job-users of 8 applications. Thus, in the 'major' category, there have been as many as 4 purely information-oriented jobs, and only 2 purely decision-oriented applications along with 2 more jobs of a mixed variety. The corresponding figures for the 'minor' category are 4, 2 and 2 respectively. This has been achieved by computerising the above jobs over a period of about 23 months or so, on average, where utilization of computer time ranges between 60 to 75 percent thereby leading to a relatively larger reduction in the potential clerical employment over the period of 4 years, although in some cases there has been an increase in the office employment as well as clerical employment while in some other cases there has been declined in the latter.

6.14. Furthermore, *Table 6D and 6E* read together, provide an interesting analysis of the earlier Survey of 14 Computer installations. Of these, 2 installations existed before 1965; 3 came up during 1966; as many as 7 during 1967, and 2 more in 1968. Correspondingly, the employment trends reveal that, between 1965-69 (for the earlier two computer installations, together), the total office employment declined from 11,793 to 11,616 or by 1.5%; but the clerical employment declined somewhat faster from 11,541 to 11,345 or by 1.7%, thus leading to a decline in the clerical potential by 0.2% over the period of four years.

TABLE 6D

TABLE

Selected jobs currently done on the computer

		MAJOR														
		Information oriented jobs					Purely decision oriented jobs					Decision oriented if used as Major				
Code No.		Pay Roll.	Financial Accounting.	Share Accounting.	Invoicing and Billing.	Purchase Bills.	Budgeting.	Production Control.	Inventory Control	Forecasting Cr. Control.	PERT/CPM.	Linear Programming.	Production Statistics.	Market Statistics.	Management Accounting.	Total.
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Before and During. 1965																
	23	+	+		+		×		×	×			×	×	×	9
A	42b															
		1	1		1		1		1	1			1	1	1	9
1966																
	21		+						×	×			×	×	×	6
B	31	+	+		+		×						×			5
	41b															
		1	2		1		1		1	1			2	1	1	11

6D

by way of usage and benefit consideration

MINOR

	Information oriented jobs	Purely decision oriented jobs	Decision oriented if used as Minor
1	Pay Roll.		
2	Financial Accounting.		
3	Share Accounting.		
4	Invoicing and Billing.		
5	Purchase Bills.		
6	Budgeting.		
7	Production Control.		
8	Inventory Control.		
9	Forecasting Cr. Control		
10	PERF/CPM.		
11	Linear Programming.		
12	Production Statistics.		
13	Market Statistics.		
14	Management Accounting.		
15	Total.		
	Year of installation		
	Installation period upto January 1969		
	Percentage of utilization		

×	1	Oct. 1961.	87	65
		Nov. 1965.	38	100

Mon-
ths.

1	1
---	---

+	×	2	Jan. 1966.	36	100
			Jan. 1966.	36	75
			Dec. 1966.	24	100

1	1	2
---	---	---

TABLE 6D

		MAJOR														
		Information oriented jobs					Purely decision oriented jobs					Decision oriented if used as Major				
Code No.		Pay Roll.	Financial Accounting.	Share Accounting.	Invoicing and Billing.	Purchase Bills.	Budgeting.	Production Control.	Inventory Control.	Forecasting Credit Control.	PERT/CPM.	Linear Programming.	Production Statistics.	Market Statistics.	Management Accounting.	Total.
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1967																
C	13		+	+					×				×			4
	24		+		+								×	×		4
	22	+	+		+				×	×		×		×		8
	12												×			1
	32a															
	33a															
	15	+	+			+			×	×					×	6
		2	4	1	2	1			3	2		1	4	1	2	23
1968																
D	11			+	+						×					3
	14	+														1
		1		1	1						1					4
GRAND TOTAL		5	7	2	5	1	2		5	4	1	1	7	3	4	47

a I—Major jobs done on the Computer by Railways are as follows :—

- (1) Freight Traffic ;
- (2) Passenger Traffic ;
- (3) Incentive Bonus to W/staff ;
- (4) Engine Statistics ;
- (5) Coal Wagon Control ;
- (6) Suburban Train Statistics ;
- (7) Goods Accounts ;
- (8) Passenger accounts ;
- (9) Store Accounts,

-contd.

MINOR																	
Information oriented jobs					Purely decision oriented jobs					Decision oriented if used as Mjnor.							
Pay Roll.	Financial Accounting.	Share Accounting.	Invoicing and Billing.	Purchase Bills.	Budgeting.	Production Control.	Inventory Control.	Forecasting Credit Control.	PERT/CPM.	Linear Programming.	Production Statistics.	Market Statistics.	Management Accounting.	Total.	Year of installation	Installation period upto January 1969	Percentage of utilization
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
				+										2	Jan. 1967.	34	60
+		+					×							3	Feb. 1967.	23	60
									×					1	May 1967.	20	—
+	+	+					×							4	Oct. 1967.	15	100
															Oct. 1967.	15	100
															Nov. 1967.	14	100
				+		×						×		3	Nov. 1967.	14	35
3	3	1	1		1	2		1				1		13			
+	+		+			×			×	×	×	+		7	Apr. 1968.	9	..
	+					×	×	×	×					5	Nov. 1968.	2	25—30
1	2		1			2	1	1	2		1	1		12			
5	2	3	1	2		1	4	1	2	4	1	2		28			

II—Minor jobs done on the Computer by Railway are as follows :

- (1) Inventory Transaction ;
- (2) Monthly Operation Statistics ;

b Major jobs done on the Computer by the companies in Insurance and Banking organisations :—

- (1) File Maintenance ;
- (2) Premium and Loan Interest Billing ;
- (3) Renewal Commission and Bonus Commission Billing.

+ Refers to the Information oriented jobs.

× Refers to the Purely decision oriented jobs.

TABLE

Office Employment in Maharashtra in Organizations
(Excluding Research and

Code No.	Total office Employment					Of which	
	1965	1969	Absolute increase + or decrease —	Percentage increase + or decrease —	1965	1969	
	2	3	4 = 3 - 2	5 = $\frac{3 - 2}{2} \times 100$	6	7	
1965							
23	679	675	-4	-0.6	427	404	
A 42	11,114	10,941	-173	-1.6	11,114	10,941	
	11,793	11,616	-177	-1.5	11,541	11,345	
1966							
21	1,381	1,191	-190	-13.8	720	547	
B 31	4,605	5,940	+1,335	+29.0	1,395	1,168	
41	4,107	8,272	+4,165	+101.4	2,284	4,806	
	10,093	15,403	+5,310	+52.6	4,399	6,521	
1967							
13	1,868	3,513	+1,645	+88.1	155	429	
24	1,202	1,474	+272	+22.6	246	249	
22	1,114	795	-319	-28.6	617	405	
C 12	371	596	+225	+60.6	310	527	
32	1,16,744	1,16,744	Nil	Nil	8,656	7,488	
33	29,000	29,000	Nil	Nil	6,000	6,000	
15	1,907	3,040	+1,133	+59.5	162	309	
	1,52,206	1,55,162	+2,956	+1.9	16,146	15,407	
1968							
D 11	927	1,056	+129	+13.9	550	592	
14	2,655	2,589	-66	-2.5	1,610	1,700	
	3,582	3,645	+63	+1.8	2,160	2,292	
GRAND TOTAL ..	1,77,674	1,85,826	+8,152	+4.6	34,246	35,565	

*Since the figures for the total as well as clerical employees are the same, the columns are

6E

*having EDP Installations
service Organisations)*

Clerical Employment		Clerical as Percentage to total Office Employment		Difference between column numbers 10 and 11
Absolute increase + or decrease —	Percentage increase + or decrease —	1965	1969	
$8 = 7 - 6$	$9 = \frac{7 - 6}{6} \times 100$	$10 = \frac{6}{2} \times 100$	$11 = \frac{7}{3} \times 100$	$12 = 11 - 10$
—23	—5.4	62.9	59.8	—3.1
—173	—1.6	100.0*	100.0*	Nil
—196	—1.7	9.79	97.7	—0.2
—173	—24.0	52.1	45.9	—6.2
—227	—16.3	30.3	19.7	—10.6
+2,522	+110.4	55.6	58.1	+2.5
+2,122	+48.2	43.6	42.3	—1.3
+274	+176.8	8.3	12.2	+3.9
+3	+1.0	20.5	16.9	—3.6
—212	—34.3	55.4	50.9	—4.5
+217	+70.0	83.5	88.4	+4.9
—1,168	—13.5	7.4	6.4	—1.0
Nil	Nil	20.7	20.7	Nil
+147	+90.7	8.5	10.2	+1.7
—739	—4.6	10.6	9.9	—0.7
+42	+7.6	59.3	56.1	—3.2
+90	+5.6	60.6	65.7	+5.1
+132	+6.1	60.3	62.9	+2.6
+1,319	+3.8	19.3	19.1	—0.2

not applicable.

6.15. Between these installations, however, in case of older one, most of the jobs (7 out of 10) appear to be decision-oriented, but the clerical employment decline by 5.4% between 1965-69 thus reducing the ratio of clerical potential by 3.1% during that period, although there has been 65% achievement of computer utilization; while in other case, most of the job-applications on the computer conceal a large element of clerical content and still the corresponding fall in the clerical employment as well as clerical potential appears to be of a much smaller dimension, i.e. 1.6% only. There has also been 100% achievement in the computer utilization in relation to the current goals of the organizations. In other words, with a relatively 'longer span' of computerization and 'deeper penetration', the fall in the clerical employment as well as clerical potential does not appear to be very fast. It is probably because both these cases, very largely conceal the higher reduction in the clerical employment that had already taken place before 1965. In one case, in fact, the organization has virtually stopped recruiting new employees since 1965, i.e. almost immediately after it installed the computers.

6.16. As for the 3 computer installations which came up in 1966 they have achieved 75% to 100% computer utilization. The corresponding employment situation for the group as a whole shows that both the total office employment as well as the clerical increased, but the latter increased at a slower rate, in turn leading to a smaller decline in the clerical potential by 1.3% between 1965-69. Amongst these, 2 organizations reveal a remarkable fall of 6.2% and 10.6% in the clerical potential during the four years. It seems that, if information-oriented applications are computerised, even with the lower percentage utilization it probably leads to a much greater fall in the clerical employment, and also in turn, in the clerical potential as compared with a relatively higher percentage of computer utilization and progressive computerization of decision-oriented applications.

6.17. As for the 7 computers which were installed in 1967, 3 of them have been from Manufacturing Category where some of the information-oriented jobs have been computerised along with decision-oriented jobs, and where even 60% to 85% of computer utilization has not resulted in the curtailment of clerical potential; while, on the other hand, 2 installations from Marketing and Distribution categories (probably similar level of computer utilization also similar span of time) which have taken decision-oriented applications along with information-oriented jobs have still shown a fall of 3.6% and 4.5% respectively in the clerical potential during the period of four years between 1965-69. In other words, though these installations have been a couple of years old, the trends appear to be very significant, and that, the situation, on the whole, has been rather 'negative', although, to a small extent.

6.18. As for the year 1968, both the computer installations fall in the manufacturing category. In this context, though, the span of computerization has been very short, it appears that a higher speed of computerization—in one case, at least—has resulted in considerable adverse effect in the clerical potential while in the other case, the adverse effect has not been evident. In fact sometime will have to elapse before any such effect of computerization could be ascertained.

6.19. Thus, in the whole sector of 14 computer installations the total office employment as well as the total clerical showed a small rise of 4.6% and 3.8% respectively; but the clerical potential showed a small decline of 0.2% over these years. Putting all these trends together, it appears that, except for manufacturing category, when purely information-oriented jobs have been progressively taken over by the computer—although along with the decision-oriented applications—with a relatively longer span of computerisation and greater extent of computer-time utilization, the clerical potential tends to be negative at a relatively faster speed.

6.20. Somewhat similar trends—although to a lesser extent are revealed where certain specialised or peculiar jobs are computerised by the organizations (cross-industrial mix) in the Group D. & E. i.e. Transport, and Banking and Insurance Categories of the EDP Establishments.

Adjustment Programmes for Displaced Personnel

6.21. In the industrially advanced countries the programme of adjustments to automation generally includes easy and successful transfer of persons from old to new employments and locations with the minimum of personal sacrifice and injury; widespread sharing of benefits of higher productivity through higher expenses on personal and social consumption, leisure for personnel and creative occupation; full employment with an opportunity for the free choice of employment and the most productive use of personal capacity. Sometimes a typical programme may include, expansion of severance pay; widened opportunities for transfer, upgrading, training, promotions broadened seniority provisions to assure better protection to workers, revision of job classification, appropriate wage increase accounting for greater skills and new responsibilities, and to ensure workers a fair share of the increased productivity, and wider guarantee of annual wage provision.

6.22. These principles and method however have their limits of application to the Indian situation. The general trend in our country, at best, favours principle of “automation without tears”; that no lay offs are made and that the reduction in manpower requirement is met through labour force attrition⁶. New employees may not be hired as far as possible and

⁶In this respect, the reduction in the labour force through voluntary quits, retirements or deaths is termed as natural attrition.

that the old ones be trained from within. A plant wide adjustment regarding lay-off and seniority can also be made. Re-employment references may be provided in other plants of the Company or new recruitment be considered only after the displaced persons are redeployed.

The Indian Scene

6.23. In this respect, Table 6F provides a somewhat interesting picture of the method of adjustment of 741 employees who were displaced from their jobs in 6 EDP Establishments—3 Marketing and Distribution Organizations, (1) Transport Undertaking, and (2) Banking and Insurance Companies⁹. Thus, only 46 employees or 6.2 percent of the total were absorbed in expansion activities, while as many as 531 or 71.7 percent—the largest share—of the total were provided alternate jobs. 93 employees, constituting 12.5 percent of the total were retrained and put in the computer section itself, and the remaining 71 persons or 9.6 percent of the total were absorbed elsewhere in the organization. Within, the organizational categories, almost all those who were absorbed in Expansion belonged to the Banking and Insurance Organizations. Of all those who were provided alternate jobs, only 15 or 2.8 percent of them were in the Marketing and Distribution organizations ; 150 or 28.3 percent in the Transport Undertaking and all the remaining 366 or 68.9 percent worked in Banking and Insurance organizations. 21 persons or 22.6 percent were retained and put in the Computer section in Marketing and Distribution organizations, while the corresponding figure for Banking and Insurance comes to 72 employees or 77.4 percent of the total in this group. Moreover, all the 71 men who were absorbed elsewhere in the organization belonged to the Marketing and Distribution category.

6.24. As for the individual shares of these three organizational categories, in the scheme of things is concerned, the Table shows that, 108 employees or 14.6 percent of the total were adjusted in the Marketing and Distribution Organizations ; 150 employees or 20.2 percent of the total were adjusted (all of them were provided alternate jobs) by one Transport undertaking while as large a number as 483 or 65.2 percent of the displaced employees were adjusted in 2 Banking and Insurance organizations. Further, amongst the various methods of adjustment, in the Marketing and Distribution category, only one person was absorbed in the expansion, 15 or 13.9 percent were provided alternate jobs ; 21 or 19.4 were retained and put on the Computer Section itself, while as many as 71 or 65.8 percent of the total in this category were absorbed elsewhere in the organiza-

⁹The categories of EDP Establishments, viz. Manufacturing firms, Education and Research Institutions, and computer Service Organizations did not pose this issue.

TABLE 6F

Method of Adjustment of Displaced Staff in the Organisation.

Cate. No.	Type of organisation	No. of organisations reporting	Absorbed in expansion	Provided alternate jobs	Retrained and put in the computer section	Absorbed elsewhere in organisation	Total
2	Marketing and Distribution ..	3	1(0·9) (2·2)	15(13·9) (2·8)	21(19·4) (22·6)	71(65·8) (100)	108(100·0) (14·6)
3	Transport	1	.....	150(100·0) (28·3)	.....	.....	150(100·0) (20·2)
4	Banking and Insurance ..	2	45(9·3) (97·8)	366(75·8) (68·9)	72(14·9) (77·4)	..... .....	483(100·0) (65·2)
	Total ..	6	46(6·2) (100·0)	531(71·7) (100·0)	93(12·5) (100·0)	71(9·6) (100·0)	741(100·0) (100·0)

tion. It is already pointed out, that all the 150 displaced employees in the Transport undertaking were provided alternate jobs. In the Banking and Insurance Category, only 45 or 9·3 percent were absorbed in expansion, while 366 or 75·8 percent of the total in this category—the largest percentage—were provided alternate jobs. The remaining 72 or 14·9 percent of them were retrained and were put in the Computer Section itself. It may be noted here that, while making the manpower adjustment in the organization, there was neither any transfer to new jobs, nor was there any retrenchment of the staff concerned as the methods of adjustment of work force to office-automation. Furthermore in this case we see that only 15 percent of the displaced persons could be absorbed in the new computer set up while for 80 percent the organisation has to make alternate arrangement such as absorption in the expansion etc.

6.25. Besides, 8 EDP Establishments reported that there was some increase in the staff in their organizations, in that, 2 of them replied that the increase was due to the expansion of business in general, while the remaining 6 associated the increase in the staff to the introduction of Electronic Computer.

6.26. Sometimes, Management contends that increase in the activities of business necessarily means increase in employment in the manufacturing side of business as opposed to the office¹⁰.

Recruitment in Future

6.27. As for the increase in the staff associated with office automation, it is observed that the strength of EDP personnel increased considerably during the years, and that over a thousand and more people have been accommodated in this Department, nearly 31 percent of them being the new recruits. In the general office employment and especially in the clerical cadre, however, there has been no increase by and large. One EDP Manufacturing organization showed 10 percent increase in the clerical cadre during these years, while one undertaking from Banking and Insurance Category revealed no additional employment since 1965. On the other hand, the total employment shrunk by 48 in 1968/69 compared to the situation in the previous year.

¹⁰In the absence of adequate data on the subject at the disposal at the Study Team, no comments are made in this regard.

CHAPTER 7

HIRING OF COMPUTER-TIME

The Genesis

It has been already noted that the organizations which generally install Electronic Computers are relatively big firms with very large volume of business. The initial investment on the project is of a very high order and the regular expenditure on maintenance quite substantial. At the beginning, these exist large idle capacity which can be effectively utilised by giving the computer-time on 'hire' to the organizations needing such facility¹. The medium-sized firms, on the other hand, cannot afford to install a computer and bear the heavy financial burden, and therefore, whenever they need the EDP facilities, they "buy" computer-time from the computer service installations.

7.1. In Maharashtra, 29 such computer-time 'buyers' were approached by the Study Team to which only 17 organizations responded; of these, 4 organizations supplied very scanty data and hired computer-time only sporadically, and that, these are excluded from the scope of this Chapter. The data which is analysed here, therefore, pertains to 13 organizations whose response to the Questionnaire was fairly satisfactory.

7.2. As for the legal status of these 13 organizations, one is a proprietorship concern; 2 are 'private limited' companies and the remaining 10 belong to the 'public limited' company category. All these establishments are situated within the area of Greater Bombay.

7.3. The computer facility of "buying" time seems to have been used since 1966. Table 7A shows that 4 establishments began buying computer-time in 1967, while another 5 or nearly half of the respondents have started using the facility only since 1968. In this way, there seems to be some 'time-lag'—say of a year or more—between the installation of a computer and its effective use by the outside organizations.

7.3A. In the sphere of labour management relations and particularly regarding labour problems in the organization before using EDP facility on hire, the replies from the respondent firms indicate, that 4 of them do not have any labour problem as such, while another 4 do not contemplate any such confrontation with labour at present. In one case the question did not apply, while the remaining 3 respondents did not reply at all.

¹Besides 'computer-time', this facility includes help in punching of data cards, use of the soft-ware of the system standard and computer programmes from Library, operator's services help in programming for the 'customer' and so on.

TABLE 7A

Year since the Organizations started using EDP facilities

Type of organizations	No. of organisations reporting data	1966	1967	1968	Not stated
1. Mills	4	—	2	2	—
2. Engineering.. ..	5	2	1	2	—
3. Chemical and Pharmaceutical ..	2	—	—	1	1
4. Consultancy and Research ..	2	—	1	—	1
Total ..	13	2	4	5	2

Major Objectives

7.4. The major objectives and reasons for hiring EDP facilities as reported by these organizations seem to be more or less similar as indicated in question 4 of the questionnaire B; that the volume of data is too large for manual processing; that computerisation required could only be done by the computer, that time lag in processing the data needs to be minimised, that cost must be reduced or that the modern management control needs to be desirably introduced².

Job Applications

7.5. As regards the types of jobs done on the computer, *Table 7B* needs to be appreciated that quite a few organizations bring purely "decision-oriented" jobs to the Computer, though at times the users have hired the computer-time also for routine jobs like share-accounting. However, the increased use of techniques, like linear programming, Pert/CPM, market statistics and production control is encouraging. In addition, the jobs like cost accounting, technical applications, engineering designs, structural analysis and analysis of survey data etc., also find some place in the scheme of hiring computer-time.

²The other reasons include, the exploring the potential of EDP, that present needs do not justify buying of a computer and that the EDP facility is available easily. Besides the needs of these organizations in terms of computer-time required are too meagre to go in for Computer installation of their own.

TABLE 7B

Types of Jobs done on the computer on Hire Time Basis

Serial No.	Character and Type of Job	No. of organizations
<i>Pure Decision Oriented</i>		
1	Production Control	3
2	Inventory Control	3
3	Linear Programming	8
4	PERT/CPM	3
<i>Decision Oriented if used as "Major"</i>		
1	Production Statistics	2
2	Market Statistics	4
<i>Information Oriented</i>		
1	Pay Roll	1
2	Share Accounting	5
3	Invoicing and Billing	2

Utilization of Computer Time

7.6. As regards utilization of computer on hire basis, *Table 7C* reveals that the 13 organizations buying computer-time utilize approximately 207.75 clock hours of computer time per month³. Of these, only one organization, which uses facility almost daily, seems to be buying as much as 100 clock hours per month of computer-time or 48 percent of the total. As many as 8 organizations use the facility sporadically and account for 55.5 hours of computer-time or about 27 percent of the total. The remaining 4 organizations buy the computer-time either weekly or monthly while their range of utilization varying between $\frac{1}{4}$ of an hour to 10-11 clock hours in that span of time.

³If some allowance is to be made for the non-responding organizations it may be estimated that they might have hired computer time anywhere between 100-150 clock hours per month or so.

TABLE 7C

Utilization of Computer on hire basis

	Mode of utilisation			No. of organisation	Range of clock Hours	Approximate* total monthly utilisation in hours
1. Daily	1	4	100.00
2. Weekly	2	.25—10	41.00
3. Fortnightly
4. Monthly	2	.25—11	11.25
5. Sporadically	8	.01—36	55.50†
				13		207.75

*Data relate to 'Clock' Hours and not to 'Meter' Hours. The calculations in the column relate to total hours specified by each organization converted to monthly basis 25 days or 4 weeks working.

†Since sporadic users presented some difficulties in getting the monthly figures, the hours quoted were assumed to have been worked for in one month only.

7.7. The sporadic buyers use the facility when they have specific problems. Although most of them have either separate Department or trained personnel in the Department using computer facility, there is a good deal of operational or mental work involved before taking any problem to the Computer⁴.

7.8. Moreover, considering the total monthly time which we have estimated to be about 200 clock hours, and making some allowances to organizations for which we do not have data, it can be safely assumed that the outside agencies are making only a limited use of the computer facility and that the extent to which they use this facility in terms of clock hours rests only on fringe.

7.9. As for the consequence of hiring EDP facility by these organizations, save the staff economies, there appears to be a positive improvement in information and cost reduction. *Table 7D* reveals the same trend. Thus in all the 11 organizations responding to our Questionnaire, there was an improvement in information and as many as 9 organizations, there was reduction in cost. The staff economies were reported only by 2 organizations, its impact being only of a marginal character.

⁴Same with the case of routine or standard jobs wherein only separate work is involved in preparing error free such of data cards.

TABLE 7D

Consequences due to Hiring of EDP Facilities

	Yes	No.	Not applicable
1. Improvement of information	11	—	2
2. Reduction in Cost	9	2	2
3. Staff Economies	2	9	2

7.10. As regards the nature of Computer Department/Section in the organizations hiring EDP time, *Table 7E* reveals that in 10 out of 13 organizations there was a separate computer-section aligned with the Department variously known as Systems Department, Management Service Group, Standards Department, etc. Moreover, almost all the organizations (12 out of 13) use programmes developed by their own Programmers and Systems Personnel. This probably suggests that the use of standard programmes provided by the computer manufacturers, has not yet impressed the computer-time 'buyers'⁵. The case of Consultancy and Research Organizations is, however, different since their programme needs cannot be catered from outside⁶.

TABLE 7E

Nature of Computer Department in Organizations hiring EDP time.

Type of organisations	Separate Computer Section/Department			No Separate Department		
	No. of organisations	Programs by own staff	Programs of EDP or manufacturer	No. of organisations	Programs by own staff	Programs of EDP or manufacturer
1. Mills	4	4	—	—	—	—
2. Engineering	5	4	*1	—	—	—
3. Chemical and Pharmaceutical.	1	1	—	1	1	—
4. Consultancy and Research.	—	—	—	2	2	—
Total ..	10	9	1	3	3	—

*Uses both of the EDP and their own.

⁵Nevertheless, if there is a good Library of standard programmes at the Computer Centre it should be welcomed by organizations buying computer-time for routine or standard jobs.

⁶As a general observations, it would be of interest that in U. S. A. most of the Computer Service Centres have a large number of variety of Computer Programmes, and that, computer centre is run, more or less on closed-shop basis.

7.11. Besides, as many as 9 organizations use their own pre-printed and unprinted stationary, while the remaining 4 use the stationary of the EDP Centre as well.

7.12. *Table 7F* which deals with the personnel in the 10 computer-units or Departments of the organizations hiring computer-time reveals some interesting facts. Thus, each organization on an average engages more than one Systems Analyst, about 2 Programmers⁷, one or 2 'Other'⁸ Staff and one person-in-charge.

TABLE 7F

Personnel in Computer Unit or Department of Organisations Hiring Computer Time.

Type of organisations	No. of organisations reporting data	Systems Analysts	Programmers	Person in charge	Others	Total
1. Mills	4	6	6	4	6	22
2. Engineering ..	5	8	13	5	37	63
3. Chemical and Pharmaceutical.	1	2	2	1	—	5
4. Consultancy and Research.	—	—	—	—	—	—
Total ..	10	16	21	10	43	90

*Includes associated unit record machine staff.

Training of Personnel

7.13. As regards the training of Personnel in the Computer Units of these organizations, there is an evidence of greater awareness in various organizations, in that these organizations send their staff for training in Computer Programming Courses offered by various technical institutes. There is also likely to be a growing need for specialised training in computer techniques in the near future.

⁷Thus, it would appear from Table 7G elsewhere that of the total of 16,056 employees in these 13 organizations, 37 or less than 2½ per cent. were directly connected with preparing the 'job' for the computer and these include major category of Systems Analyst and Programmers.

⁸It is apparent that 5 engineering firms have as many as 37 other staff which includes UR machine staff associated with computer-unit. It is an indication that the engineering companies at present are using UR machine of their own probably employing of about 6 persons on average and that the computer unit comprises of staff of 5 or 6 persons.

Impact on Employment

7.14. As regards the structure of office-employment of these 13 organizations, certain facts in *Table 7G* provide some useful indications⁹. Thus, of the total 16,056 office employees, 7,895 or 49.2 per cent. fall in Mills-sector, while 7,689 or 47.9 per cent. belong to Engineering group. Chemical and Pharmaceutical accounts for only 448 or 2.8 per cent., while Consultancy and Research constitutes only the smallest fraction, i.e. 0.1 per cent. of the total. Secondly, Technical and Supervisory personnel together constitute 3,973 or 24.7 per cent. of the total office employment, while the corresponding share of the rest, i.e. Subordinate, Others and Clerical together is 12,083 or 75.3 per cent. respectively, and this group can potentially be affected with the introduction of office-automation depending on the types of applications that are computerised. Furthermore, in the latter group, Mills-sector is predominant with the total of 7,380 or 61.1 per cent. of the group total, Engineering sector comes next with 4,282 employees or 35.4 per cent. of the total. The corresponding figures for chemical and Pharmaceutical are 413 or 3.4 per cent. only. The Consultancy and Research groups play no significant role at all.

⁹However, it should be noted that, the between and within percentages have considerable limitations of comparisons for two reasons: *firstly*, the reported cases come from different groups of industries, and that, they do not represent the same proportion as in the 'population' and *secondly*, their total use of computer is so small as to make any appreciable effect on the employment of clerical and other staff engaged by them.

TABLE

Office Employment in Organisations

Cat. No.	Type of organisation	No. of organisations reporting data	Technical	Supervisory
1	2	3	4	5
1	Mills	4	316(4.0) (10.2)	199(2.5) (22.6)
2	Engineering	5	2,749(35.8) (88.9)	658(8.6) (74.7)
3	Chemical and Pharmaceutical	2	11(2.5) (0.4)	24(5.4) (2.7)
4	Consultancy and Research	2	16(66.7) (0.5)	....
Total ..		13	3,092(19.2)	881(5.5)
Percentage ..			(100.0)	(100.0)

Note :—Figures in the bracket indicate percentages.

Percentages after the figures indicate inter-category comparisons within the same type percentage below the figures indicate inter organisational comparisons within the same

7G

Hiring Computer-Time

Sub-total	Subordinate	Others	Clerical	Sub-total	Grand total
6	7	8	9	10	11
515(6·5)	57(0·7)	6,307(79·9)	1,016(12·9)	7,380(93·5)	7,895(100·0)
(13·0)	(6·3)	(83·7)	(28·0)	(61·1)	(49·2)
3,407(44·3)	725(9·4)	1,231(16·0)	2,326(30·3)	4,282(55·7)	7,689(100·0)
(85·7)	(79·5)	(16·3)	(64·0)	(35·4)	(47·9)
35(7·8)	127(28·3)	....	286(63·8)	413(92·2)	448(100·0)
(0·9)	(13·9)		(7·9)	(3·4)	(2·8)
16(66·7)	3(12·5)	....	5(20·8)	8(3·33)	24(100·0)
(0·4)	(0·3)		(0·1)	(0·1)	(0·1)
3,973(24·7)	912 (5·7)	7,538(46·9)	3,633(22·0)	12,083(75·3)	16,056(100·0)
(100·0)	(100·0)	(100·0)	(100·0)	(100·0)	(100·0)

of organisations.
category of employment.

7.15. The most vulnerable category is that of pure 'clerical' employees which forms 3,633 or 22.7 per cent. of the total office employees (and about 30 per cent. of Subordinate, Others and Clerical categories together). Here, the lion's share goes to the Engineering Sector, which amounts to as many as 2,326 employees or 64 per cent. of all clerical employees. 1,016 clerical employees or 28 per cent. of the corresponding total belong to Mills-sector. The Chemicals and Pharmaceuticals employ only 286 clerks who constitute only 7.9 per cent. of the total clerical employees.

7.16. Moreover, within the employment structure in Mills-sector and Engineering group, Technical and Supervisory personnel accounts for 3,407 or 44.3 per cent. of the total office-employment in the Engineering Group; while the corresponding figures for Mills-sector would be only 515 or 6.5 per cent. of the total. On the other hand, in the purely 'clerical' cadre the Engineering Group constitutes only 2,326 or 30.3 per cent. of the total office-employees in this group; but still it is the largest proportion in the total, compared with the corresponding figure 1,016 or 12.9 per cent. in Mills-sector. On the whole, it is in these two sectors of our industry that, the total of 3,342 clerical employees, which constitute 43.2 per cent. of the total office-employees, in Mills-sector and Engineering Group together, or account for 92 per cent. of the total clerical employees of all the 13 Organisations may be exposed to the effects of automation, provided these Organisations mainly go in for computerisation of purely information-oriented applications and that too at a progressively fast speed.

7.17. As regards the future recruitment, 7 out of 13 organisations did not offer any specific remarks. Only 1 organisation contemplated decrease in the recruitment of technical staff. 3 more organisations did not think so because the system is used for decision-making as aid to better management, where human beings cannot do the job, and that, it is not used for rationalisation. On the other hand, 2 organisations contemplated increase in recruitment in future through the company's growth.

CHAPTER 8

STATUS OF DATA PROCESSING EQUIPMENT UNIT RECORD MACHINES (URM)

Survey of URM

While deliberating on the impact of Electronic Computers on the Maharashtra's economy, the Study Team considered it worthwhile to undertake a survey of the Organizations having Unit Record Machines so that the data so obtained would be of complementary nature for ascertaining the total impact of automation on the office Organisations in the State. Thus, 116 Organisations in the State were approached through Questionnaire method (*Table 8A*), of which 52 Establishments responded quite adequately, while another 9 Establishments had already supplied the relevant material which have been utilised in the earlier portion of the Report. 10 Organisations declined to reply considering that their activities had no direct bearing on the proposed study, while another 7 Organisations have only one or two Machines each and, therefore, very inconsequential in their impact. Thus, it is clear that nearly two-thirds of the total Organisations responded to the Study Team favourably while only one-third of them did not respond at all.

TABLE 8A

Response to Questionnaires G and H sent to 116 Organisations

Cat. No.	Type of organisation	Total parties	Adequately responded	Responded to Qstn. A/B/C	Declined consider- ing no direct bearing	Have only one or two machines	Non response
1	Manufacturing ..	63	27+1	5	..	3	27
2	Service and Marketing ..	12	8	..	..	1	3
3	Transport ..	5	2	..	..	..	3
4	Insurance and Banking ..	9	6	1	..	..	2
5	Education, Research and Training Institutions.	27	7+1	3	10	3	3
	Total ..	116	50+2	9	10	7	38
	Percentage ..	100.0	44.9	7.7	8.6	6.0	32.8

Legal Status

8.1. The Table 8B provides the Classification of 50 URM Organisations. There have been 2 Partnership firms, 9 Private Limited Companies, as many as 23 Public Limited concerns, 8 Statutory Corporations and the remaining 8 include Governmental Departments. As many as 27 or more than half fall in the Manufacturing Category, while the remaining Organizations include 8 Service and Marketing Agencies, 7 Education and Research Institutions, 6 Insurance and Banking Companies and 2 Transport Undertakings. The Table also shows the Statutory Corporations and Governmental Departments comprise 16 units and account for nearly one-third of all the URM Establishments.

TABLE 8B

Classification of Organisations having installation of Unit Record Equipment

Cat. No.	Type of organisation	No. of organisations	Partnership	Private limited	Public limited	Statutory Corporations	Other including Government Department
1	Manufacturing	27	1	6	17	..	3
2	Service and Marketing	8	..	3	2	3	..
3	Transport	2	..	..	1	1	..
4	Insurance and Banking	6	..	..	3	3	..
5	Education and Research	7	1	..	..	1	5
Total		50	2	9	23	8	8
Percentage		100	4	18	46	16	16

Volume of Business

8.2. As regards the volume of business of these URM Organisations, Table 8C reveals that 34 Establishments which reported data in this respect account for the total volume of business of Rs. 44,381 lakhs (or nearly 444 crores), or little over 13 crores each approximately. It is further revealed that the Organisations in the Manufacturing and Service and Marketing Categories appear to be relatively smaller ones having less

than 10 crores worth volume of business each. On the other hand, the Transport Undertakings and Insurance and Banking Companies are quite sizeable Organisations with the average volume of business of about 35 crores each. It probably implies that these large size Organizations in the Transport and Insurance and Banking Categories which are making use of Unit Record Equipment, at present, may go in for Electronic Computerization in near future ; while the smaller Organizations in the Manufacturing and Service and Marketing Sectors of the State's economy might be contended with the hiring of 'computer time' for certain jobs.

TABLE 8C

*Organizations having installation of Unit Record Equipment
(Volume of Business)*

Cat. No.	Type of organisations	No. of organisations Reporting data for this Table	Total volume of Business (Rs. in lakhs)	Average volume of Business (Rs. in lakhs)
1	Manufacturing	24	21,639·0	901·6
2	Service and Marketing	5	4,805·0	961·0
3	Transport	2	7,540·0	3,770·0
4	Insurance and Banking	3	10,397·0	3,465·7
Total		34	44,381·0	1,305·3

Financial Commitment

8.3. As regards the financial commitment in the URM sector of Maharashtra's economy, *Table 8D* reveals certain significant facts. Thus, there are 16 URM Organisations where equipment is purchased while in case of 34 such Organisations the UR Equipment has been hired, or that the latter constitutes a little over two thirds of the entire URM Sector. A more detailed analysis of the cost structure of UR Equipment in these sectors separately shows that, in the Purchased Equipment Section, the 16 Machines account for a total cost of Rs. 33,08,881 or Rs. 2,06,805 each on average. Besides, the total monthly maintenance of these 16 Machines amounts to Rs. 19,979 or Rs. 1,248 each on average.

TABLE 8D
Total Investment in Punched Card Machines

Cat. No.	Type of organisation	Purchased Equipment					Hired Equipment				
		No. of organisations	Total Cost	Av. P. Price	Total monthly maintenance	Av. M. M. Cost	No. of organisation	One-time Charge paid	Average one time Charge	Total monthly maintenance	Average monthly maintenance cost
1	Manufacturing ..	3	7,40,479	2,46,826	5,668	1,889	24	5,31,102	22,129	1,83,049	7,627
2	Service/Marketing ..	3	4,50,700	1,50,233	3,127	1,042	5	59,700	11,940	1,12,738	22,548
3	Transport ..	1	3,83,000	3,83,000	2,000	2,000	1	20,000	20,000	6,024	6,024
4	Insurance/Banking ..	2	8,61,055	2,87,018	3,775	1,258	3	3,10,518	1,03,506	65,754	21,918
5	Education and Research.	6	8,73,647	1,45,608	5,409	902	1	1,100	1,100	32,812	32,812
	Total ..	16	33,08,881	2,06,805	19,079	1,248	34	9,22,420	27,130	4,00,377	11,776

8.4. Amongst the various categories of Organisations the Table would show that the average monthly maintenance cost in the Manufacturing and Transport Sector is round about Rs. 1,900 to Rs. 2,000 while in other Categories the average monthly maintenance cost has not exceeded Rs. 1,258. In case of Education and Research Institution, however, the average monthly maintenance has been kept up at the lowest figure of Rs. 900 or so. On the other hand, in the Hired Equipment Sector, 34 Machines account for one time charge paid of Rs. 9,22,420 or Rs. 27,130 each on average. The total monthly maintenance on all these 34 Machines amounts to Rs. 4,00,377 or Rs. 11,776 each on average.

8.5. Amongst the various Categories or Organisations, however, the average one time charge paid in the Manufacturing as well as Transport Sectors comes to Rs. 20,000 to Rs. 22,000 each; while in the other Sectors excluding Insurance and Banking, the corresponding figure ranges between Rs. 11,000 to Rs. 12,000 or so. Besides, the average monthly maintenance cost varies between minimum of Rs. 6,024 in the Transport Sector to maximum of Rs. 32,812 each in the Education and Research Sector. In the case of Service and Marketing Agencies as well as Insurance and Banking Companies, the corresponding average is around Rs. 22,000 as against the corresponding figures of Rs. 7,627 for the Manufacturing Sector.¹

8.6. Further, it would be interesting to note that the total investment and the running expenditure so far incurred (upto 1st January 1969) by the 46 Organisations reporting data amount to Rs. 2,64,59,739 (Rs. 2.65 crores or so). Amongst 14 Organisations in the Purchased Equipment Sector (7 of which had also hired portion of their equipment) spent Rs. 42,77,217 or Rs. 3,05,516 each; while in the Hired Equipment Sector, 39 Organisations (including 7 in the Purchased Sector) incurred correspondingly expenditure of Rs. 2,21,82,522 or 5,68,782 each. Somewhat greater details would show that in the Purchased Equipment Sector the average expenditure incurred by each URM Organization amounts to Rs. 3,05,516 which includes Rs. 2,32,624 as the cost of the equipment plus Rs. 72,892 (at the monthly rate of Rs. 1,427 as the maintenance cost upto January 1969). Correspondingly in the Hired Equipment Sector, the total expenditure incurred by 33 URM Organisations comes to Rs. 5,68,782

¹It should be worthwhile to note here that monthly maintenance and one time charge has direct bearing on number and type of machines in any installation and the sectorwise differences only indicate the differences in type and variety of equipment used. For example in Research Organisation the input data may not be extensive but further tabulation may be more and so would call for just one or two punching machines whereas in a business firm which analyses market statistics or bills there is large amount of data and a limited processing calling for more punch machines. Thus, the differences are in no way due to any other special characteristics of the sector as such but would depend on type of jobs done on the machines.

which includes Rs. 27,293 as the one time charge paid and the total maintenance of Rs. 5,41,489 (at the monthly maintenance rate of Rs. 8,553) upto 1st January 1969 respectively.

The Objectives

8.7. Before going in for Data Processing Equipment, Managements have kept various objectives in minds. Table 8E shows that as many 46 out of 50 URM Organisations reporting data had three major objectives in mind. Firstly, that the volume of data was too large for manual processing; secondly, to reduce time-lag in receipt and processing of data, and thirdly, to introduce modern management control system. Some 19 Establishments or nearly 41 per cent. of the total who went in for data processing equipment because that the job could be done only by UR Machines, and 7 organisations or about 15 per cent. resorted to it to decrease cost. The situation, thus, reflects the fact that, while taking certain jobs to the UR Machines, cost considerations have received extremely low priority as compared to the management's desire to introduce the modern management control system.

TABLE 8E

Major Objectives for going in for Data Processing Equipment

Cat. No.	Type of organisation	No. of organisations	No. of respondents	Volume of data too large	Job can only be done by machine	To reduce time lag	To decrease cost	To introduce modern methods
1	Manufacturing ..	27	27	17	13	27	3	25
2	Service and Marketing ..	8	6	5	2	5	....	2
3	Transport ..	2	2	2	1	2	....	2
4	Insurance and Banking ..	6	5	4	1	4	3	4
5	Education and Research ..	7	6	4	2	2	1	1
Total ..		50	46	32	19	40	7	34

Understanding with Labour

8.8. On the other hand, *Table 8F* provides some relevant data regarding the understanding of management with the labour union while installing the UR Machines. There too, it appears that out of the total 46 Organisations reporting data, in only 7 cases or 15.2 per cent. of the total there was understanding with the labour union, and in as many as 35 cases or 76 per cent. of the total Organizations reported no such understanding with the labour union; it might be that these unions were not well recognised by the Managements concerned or that, they were unable to exert pressure on them. A similar trend is also reflected by and large, in the Manufacturing, Service and Marketing and as well as in Insurance and Banking Sectors. It further appears that in Manufacturing, out of 27 Organisations, 6 had understanding with the labour unions, while in the Service and Marketing Sector, out of 8 such Organisations only one cared to establish relationship with the unions. In rest of the cases, the unions did not find any significant place in the decision-making regarding installation of UR Machines in the Establishments concerned.

TABLE 8F

Understanding with Labour Union

Cat. No.	Type of organisation	No. of organisations responding	Yes	No	Not applicable	No labour Problem hence no
1	Manufacturing	27	6	21	....	....
2	Service and Marketing	8	1	6	1	....
3	Transport	2	..	2	....	....
4	Insurance and Banking	5	..	4	1	....
5	Education and Research	4	..	2	....	2
Total		46	7	35	2	2

Installation of URM

8.9. Considering the types of Organization—Categories such as Manufacturing, Service and Marketing, etc., the data makes it clear, (Table 8G) that Unit Record Machines existed in all the categories of organizations except Manufacturing, much before the Computers came to be installed in those respective sectors. In fact, as many as 10 out of 22 UR Machines in these categories taken together were installed before 1960 i.e., a few years earlier than installation of the EDP Equipment in this sector of economy. On the other hand, in the Manufacturing sector only 2 out of 27 UR Machines were installed in 1960 and the rest of them have come up only after 1964. Besides, as many as 13 UR Machines or about 50 per cent. of these have been installed only during 1967-68. On the whole, it seems that the Manufacturing Organisations being relatively smaller, and the volume of data that required to be processed not being very large, these firms have been making use of traditional method of office work, that with a relatively conservative employer and traditional management, the use of UR Machines has not been very popular until very recently, when the young professional managers have started taking recourse to UR Machines in this sector.

TABLE 8G

Year of Installation of Unit Record Machines

Cat. No.	Type of organisation	Year of Installation											Not specified	Total
		1950	55	60	61	62	63	64	65	66	67	68		
1	Manufacturing ..	..	..	2	..	..	..	2	4	4	6	7	2	27
2	Service/Marketing ..	..	1	3	..	..	1	1	..	1	..	1	..	8
3	Transport ..	..	..	1	..	..	..	..	..	..	1	..	..	2
4	Insurance and Banking ..	..	1	1	..	..	..	2	..	1	..	1	..	6
5	Education and Research ..	1	2	..	..	..	..	1	1	1	1	..	..	7
Total ..		1	4	7	..	..	1	4	7	6	9	8	3	50

8.9a. Although some of the URM Installations in Maharashtra are relatively old (i.e., before 1960) a large number of them have sprung up only during the last 5 years or so². Table 8G, which provides the data for 47 URM Organisations, shows that some 12 UR Machines were installed before 1960 and the rest of them came up only after 1963. Five UR Machines were installed between 1961-64 and as many as 30 or over 60 per cent. of the total were installed during the last 5 years. The Table also reveals the fact that a large number of UR Machines came to be installed in Maharashtra almost during the same period as that of the growth of Electronic Computer Installation in the country in general and the State of Maharashtra in particular.

The Time-Lag

8.10. As regards the time-lag between the decision-making and actual installation of UR Machines, Table 8H reveals a significant trend, that of all the 41 URM Organisations³ reporting data, 11 Organisations or nearly 27 per cent. took 1 to 6 months, while another 16 Organizations or 39 per cent. took a much longer time, i.e., 7 to 12 months on an average. Besides, for as many as 14 Establishments or 34 per cent. of the total, a corresponding time-lag was 13 to 45 months, quite a long period indeed.

8.11. Amongst the Categories of Organisation—excluding Manufacturing—between 40 to 60 per cent. of the URM Installations have taken more than 6 months, while in case of Manufacturing, as many as 84 per cent. of the total number of URM Installations account for a longer time lag of more than 6 months.

First Production Run

8.12. However, once the UR Machine is installed, not much further time is lost in setting the equipment to production. In this respect, the Table 8I which provides data for 30 URM Establishments reveals significantly that, as many as 17 URM Establishments or over 56 per cent., started their first production run almost immediately while another 8 Organisations or nearly 27 per cent. took 1 to 3 months' time, and only the remaining 5 took a longer time than 3 months' usual period. There is a further indication that, in the Manufacturing category, none of the 19 Organisations reporting data took more than 3 months to start their first production run, while in the remaining cases there have been a few Establishments which have taken such a longer period—say 3 months, to start their first production run.

²It may also be expected that these who did not respond (33%) a majority of the installations might be quite old.

TABLE 8H

*Time Lag between the date of decision and the date of installation
of Unit Record Machines (in months)*

Cat. No.	Type of organisation	Total No.	1-3	4-6	7-9	10-12	13-24	25-36	37-45	Total specified	Period not stated
1	Manufacturing ..	27	2	2	6	7	3	4	1	25	2
2	Service and Marketing ..	8	2	1	1	..	1	..	..	5	3
3	Transport ..	2	..	..	..	..	..	..	1	1	1
4	Insurance and Banking ..	6	2	..	..	1	1	..	1	5	1
5	Education and Research ..	7	2	..	..	1	1	..	1	5	2
Total ..		50	8	3	7	9	6	4	4	41	9

Current URM Applications

8.13. The Table 8J gives a fairly clear picture of the selective jobs which are currently done on the Unit Record Machines by the Organisations. Thus, there were 166 total job-users of 12 job-applications of which 89 or 53·6 per cent. were Information-Oriented and the remaining 77 or 46·4 per cent. were Decision-Oriented. Amongst the more popular applications included financial accounting and pay roll (information oriented); production statistics and inventory control (decision-oriented). The rest of Jobs such as billing, purchase bills, management accounting, budgeting, etc., although significant in their own way, do not figure very importantly in the total scheme of URM Jobs. A comparative analysis of all these URM Jobs based on 'time-usage' and 'benefit consideration' reveals no worthwhile change in the pattern of these applications, except that under benefit consideration the 'minor-jobs' in the information oriented sector account for as much as 56·8 percent compared with the corresponding figures of 47·2 percentage under time-usage consideration. On the other hand, as regards the purely 'decision oriented jobs' under time-usage consideration the 'minor applications' account for 32·1 percent as against the corresponding figure of 21·6 percent under 'benefit consideration'. Any changes in other trends have been of very marginal character and of no worth while consequence at all.

8·14. A further analysis of these URM jobs in somewhat greater details brings out the fact that the trends regarding these jobs under information oriented sector follow closely the over all pattern, both under time-usage consideration as well as benefit consideration. However, in the pure decision oriented sector the 'major jobs' under usage consideration constitutes only 52·8 percent and 'minor jobs' 47·2 percent under 'usage-consideration' as against the corresponding figure of 71·8 percent and 28·2 percent respectively. Thus, it appears that certain jobs which are of minor importance for the users of these applications assume greater importance under benefit consideration. It may also be seen from Table 8J that of the total jobs covered under usage consideration and benefit considerations aggregate to 166 and 172 of which 113 or 68·1% and 121 or 70·3 percent respectively³.

³It is to be, however, remembered that, since UR Machines are mostly used for internal use the margin between usage consideration and benefit consideration should be minimum.

TABLE 8I

*Time Lag between date of installation and date of First 'Production Run'
on the UR Machine (Effective Use)*

Cat. No.	Type of organisation	No. of organisations	Time lag between year of Installation and date of First production run (effective use)				Total 7 = 4 + 5 + 6	Period not specified
			Almost immediately	1—3 months	More than three months			
1	2	3	4	5	6	7	8	
1	Manufacturing	27	12	7	....	19	8
2	Service/Marketing	8	1	....	1	2	6
3	Transport	2	1	....	....	1	1
4	Insurance and Banking ..	6	1	1	2	4	2	
5	Educational and Research Institutions.	7	2	....	2	4	3
Total ..		50	17	8	5	30	20	

TABLE 8J

Number of organisations (Users) currently doing selective jobs on the UR Machines by usage and benefit consideration

Serial No.	Type of Job	Usage Consideration Time*			Benefit Consideration Rg.**		
		Total***	1969 Major	Minor	Total	1969 Major	Minor
A Purely Decision Oriented.							
1	Budgeting ..	9	2	7	9	5	4
2	Production Control ..	6	3	3	7	4	3
3	Inventory Control ..	18	12	6	20	17	3
4	Forecasting Credit ..	3	2	1	3	2	1
	Sub Total ..	36	19	17	39	28	11
	Percentage ..	21.7	16.8	32.1	22.7	23.1	21.6
B Decision Oriented if used as Major.							
1	Production Statistics ..	25	21	4	24	21	3
2	Market Statistics ..	7	3	4	8	4	4
3	Management Accounting ..	9	6	3	9	5	4
	Sub Total ..	41	30	11	41	30	11
	Percentage ..	24.7	26.5	20.7	23.8	24.8	21.6
C Information Oriented.							
1	Pay Roll ..	27	20	7	27	16	11
2	Financial Accounting ..	31	26	5	32	29	3
3	Share Accounting ..	7	5	5	8	3	5
4	Billing ..	13	8	5	13	9	4
5	Purchase Bills ..	11	8	3	12	6	6
	Sub Total ..	89	64	25	92	63	29
	Percentage ..	53.6	56.7	47.2	53.5	52.1	56.8
	Grand Total ..	166	113	53	172	121	51
	Percentage ..	100	100	100	100	100	100

*This is classified by the total time used on the UR Machines for the application in question.

**This is classified by the total benefits, tangible and intangible accruing out of the application in question.

***Refers to users of this application.

TABLE 8 Ja

No. of Organisations (Users) currently doing selective jobs on the Unit Record Equipment by usage and benefit consideration

Serial No.	Type of Job	Usage Consideration 1969		Benefit Consideration Rs.** 1969	
		Total ***	Major	Total	Major
1	Pure Decision Oriented	36 (21·69)	19	39 (22·67)	28
2	Decision Oriented if used as major	41 (24·70)	30	41 (23·84)	30
3	Information Oriented	89 (53·61)	64	92 (53·49)	63
Total ..		166	113	172	121
Percentage ..		(100·00)	(68·1)	(100·00)	(70·3)

*This is classified by the total time used on the computer for the application in question.

**This is classified by the total benefits, tangible and intangible accruing out of the application in question.

***Refers to users of this application.

Branches Using URM Facility

8.15. Table 8K which deal with the number of Branches using URM facility shows that, the 49 URM Establishments reporting data have, within Maharashtra, 130 Branches in all, of which only 49 or about 38 percent of them make use of DP facility of their respective Central offices. Among various Categories of Organisations, however, Manufacturing and Service and Marketing Establishments used the URM facility of the Central Offices quite adequately, in that they together account for 75 percent to 89 percent of their total Branches within Maharashtra making use of such URM facility. In the rest of the Categories, only 10 percent to 20 percent of the Branches within Maharashtra make use of the DP facility of their respective Central Offices concerned. Furthermore, the Table also makes it clear that, of the total 235 Branches, 49 URM Establishments are outside Maharashtra, and none of them use the URM facility provided to them by their concerned Central Offices in Maharashtra. It may be due to various reasons; that the Branches outside Maharashtra have their own separate arrangement in this respect; that they may not find it convenient to send their data or use effectively the printed output of main office. Moreover, the UR Machines do not have that wide applicability as that of the computer, and that, it is not suitable for decision-oriented jobs which the Computer alone can tackle.

TABLE 8K

Number of Branches using UR Machine Facility

Cat. No.	Type of Organisation	No. of organisations reporting data	In Maharashtra		Percentage	Outside Maharashtra	
			Total number of Branches	Branches using DP facility		Total number of Branches	Branches using DP facility
	1	2	3	4	$5 = \frac{4}{3} \times 100$	6	7
1	Manufacturing	26	35	20.6	74.28	80	....
2	Service and Marketing	8	9	8	88.89	16	....
3	Transport	2	19	2	10.53	22	....
4	Insurance and Banking	6	30	6	20.00	116	....
5	Education and Research	7	37	7	18.92	1	....
	Total ..	49	130	49	37.69	235	....

URM Work Load

8.16. As regards the use of URM in terms of number of cards used per month, the *Table 8L* shows that 50 URM Establishments amongst themselves employ 340 Punch Operators, or 7 per Establishment on average, and that they handle the total of 4,757,000 cards per month or about 14,000 cards each. It would appear that the Establishment in Service and Marketing and Transport sectors have 8 to 9 Punch Operators each on average and handle the average monthly work load of 10,000 cards each or so, which is about 65 percent of the overall average monthly work load for the entire URM sector.

8.17. Besides, a number of Punch Operators for each organisation varies from nearly 5 each in Manufacturing, and Education and Research Categories to the average of 15 in the Insurance and Banking sector. The Table also shows that little over 50 percent total URM Establishments, utilised 50,000 cards and less each, while the remaining URM Establishments used more than 75,000 cards each. From the standard practices, it would appear that in the URM Sector of the State's economy, the utilization of UR Equipment is around 65 percent of the average standard.

Utilization of URM

8.18. *Table 8M* gives the indication of the percentage utilization of data processing facility by the URM Establishments. Thus, of 39 Organisations reporting data, only 4 Organisations used 22 to 50 percent each of the available data processing facility each, while another 5 Organisations used 60 to 75 percent of such facility each. However, as many as 30 Organisations or nearly 77 percent of the total have reached 80 to 100 percent utilization of the available data processing facility. Thus, it would seem, that just about one fourth of the total Organisations used DP facility less adequately, while more than three fourths of them have reached adequate level of utilization of UR Machines. Moreover, amongst the various Categories of these Organisations reporting data, however, the Service and Marketing Agencies, as well as Educational and Research Institutions have reached only full utilization level while in the Manufacturing and Insurance and Banking Sectors only about two-third of the total Organisations reporting data have reached near full utilization of the available data processing facility.

TABLE 8L

Use of UR Machines in term of number of cards used per month

Cat. No.	Type of Organisation	Organisations using specified number of cards (000 cards)					Total cards used in (000) actual	No. of organisa- tions	No. of punch operators	Average monthly work load handled by opera- tor in (1000) cards
		20	50	75	100	101 and more				
	1	2	3	4	5	6	7	8	9	10 = 7/9
1	Manufacturing ..	3	12	4	4	4	1,880	27	125	15.0
2	Service and Marketing ..	2	1	..	2	3	792	8	74	10.7
3	Transport ..	..	1	..	1	..	136	2	16	8.5
4	Insurance and Banking ..	1	2	..	..	3	1,330	6	88	15.1
5	Education and Research ..	3	1	..	1	2	619	7	37	16.7
	Total ..	9	17	4	8	12	4,757	50	340	14.0

URM Personnel

8.19. The personnel employed in the URM Department constitutes an important element in the progress of Data Processing Equipment. The *Table 8N* shows that the 50 Organisations under study employ the total number of 756 personnel, of which 340 or 45 percent are employed as Key Punch Operators. Another 164 persons or 21.7 percent of the total find jobs as URM Operators in the Section. All other categories of personnel such as Punch Supervisor, URM Supervisor, Checkers and Coders, taken separately, do not constitute any sizeable Section and all of them with the total of 252 constitute only 33.3 percent or one third of the entire URM Department's personnel. The *Table 8N* further reveals that amongst the total of 354 persons trained from within the organization, Key Punch Operators account for 116 or 31.9 percent, while 92 URM Operators constitute 25.3 percent of the corresponding total. The rest of the categories are relatively smaller ones and have minor significance.

TABLE 8 M

Utilization of UR Machines

Cat. No.	Type of Organization	Total No.	% Utilisation			Total	Not specified
			20 to 50	60—75	80—100		
1	Manufacturing ..	27	3	4	18	25	2
2	Service and Marketing ..	8	..	..	6	6	2
3	Transport ..	2	..	1	1	2	..
4	Insurance and Banking ..	6	1	..	2	3	3
5	Education and Research ..	7	..	..	3	3	4
Total ..		50	4	5	30	39	11

TABLE 8N

Number of personnel in UR Departments

Serial No.	Job category		Total employees	% to total	Number trained from within	% to total
1	Key Punch Operators	.. ..	340	45.0	116	31.9
2	UR Machine Operators	.. ..	164	21.7	92	25.3
			504	66.7	208	57.2
3	Punch Supervisors	.. ..	19	2.5	12	3.3
4	UR Machine Supervisors	.. ..	32	4.2	22	6.0
			51	6.7	34	9.3
5	Checkers	.. ..	59	7.8	38	10.4
6	Coders	.. ..	32	4.2	19	5.2
7	Others	.. ..	71	9.4	42	11.6
			162	21.4	99	27.2
8	Person in charge	.. ..	39	5.2	23	6.3
	Total	.. ..	756	100.0	364	100.0

8.20. The *Table 8-O* further reveals that those who are recruited from inside the Organisations are trained or transferred from within the URM Establishment itself and constitutes a fairly large total of 364 (out of 756) or 48.15 percent of the entire URM staff of all the Establishments using Data Processing Equipments. In case of the Key Punch Operators, only 116 out of 340 or 34.12 of the total in this Category, are trained from within compared with the URM Operators totalling 92 out of 164 or 56.1 percent respectively, as trained from within the Organisation. In the rest of the Categories, the corresponding percentages are much higher than the over all ratio, these being small Categories⁴.

⁴ However, the training needs are proportionate to number of employees of a given category for example we need more punch operators but their training is relatively easy than that of other UR Operator or supervisor. We have to train persons on all machines and so training needs should not be examined only in relation to a particular category being small or big.

TABLE 8-O

Number of personnel in Unit Record Machine Departments

Serial No.	Category	Total organisations reporting for the category	Total employees in the category	Of which		% trained/transferred inside to total
				Trained from within	Recruit from outside	
1		2	3	4	5	6 = 4/3 × 100
1	Key Punch Operators..	47	340	116	224	34.12
2	Punch Supervisors ..	10	19	12	7	63.16
3	UR Machine Operators..	43	164	92	72	56.10
4	UR Section Supervisors.	24	32	22	10	68.75
5	Checkers ..	17	59	38	21	64.41
6	Coders ..	15	32	19	13	59.37
7	Others ..	18	71	42	29	59.15
8	Person in Charge ..	36	39	23	16	58.97
			756	364	392	48.15

8.21. As regards, the consequences of the use of Data Processing reveals certain significant facts. Thus *Table 8P* shows that in 43 out of 50 organisations or 86 percent reported improvement in information. 28 Organisations or 56 percent reported coupling of processes. While there were staff economies and reduction in costs in about 11 to 15 Establishments; another 15 UR Organisations reported that there were neither staff economies nor reduction in costs. As for the Manufacturing Category, 26 UR organisations reported improvement in information and 19 coupling of processes. In this category, therefore, 11 to 12 organisations or nearly 42 percent of them reported neither staff economies nor reduction in costs. In other sectors, however, the impact of the Data Processing Equipment on the above aspect has been somewhat unevenly spread over.

TABLE 8P

Effect of the Use of Data Processing Equipment

Cat. No.	Type of Organisations	Improved information		Reduction in Cost		Staff economies		Coupling of processes		
		Yes	No	Yes	No	Yes	No.	Yes	No	
1	Manufacturing ..	..	26	1	7	11	5	12	19	4
2	Service and Marketing	..	6	..	1	3*	..	3	5	..
3	Transport ..	..	2	..	2	..	1	..	..	2
4	Insurance and Banking	..	1.5	..	4	..	3	1	3	2
5	Education and Research	..	4	..	1	1	2	..	1	..
Total		..	43	1	15	15	11	16	28	8

* Include one indefinite.

Employment Trends

8.22. It is being increasingly realised that the most important aspect of automation is its impact on labour and especially on employment, including retrenchment and potential employment⁵. The *Tables 8Q* and *8R* provide a somewhat practical basis for measuring the extent of such impact on the various types of organisations viz., Manufacturing, Service and Marketing, Transport, Insurance and Banking and Education and Research. The *Tables 8S* and *8T* further provide a more detailed account of the individual URM organisations grouped suitably on the basis of analysis by results and thereby throw a spotlight on the situation. Thus, the *Table 8Q* provides a detailed analysis of 6 organisations (out of 12), which have had UR Machines before 1960 and which show the possible impact of UR Equipment on the various aspects of the Employment over the 4 years' period between 1961-65.

⁵The limitations of statistical analysis of this type mentioned in Chapter 6 (T. No. 6A and B) are equally applicable to this section of Chapter 8.

TABLE

Office Employment in Maharashtra in the Organisations

Type of Organisation	Total Office Employment		Absolute increase + or decrease —	Percentage increase + or decrease —
	1961	1965		
1	2	3	4	5
Manufacturing	506	506	Nil	Nil.
Service and Marketing	3,150	3,329	+ 179	+ 5.7
Transport	1,946	2,481	+ 535	+ 27.5
Banking and Insurance	1,931	2,639	+ 708	+ 36.6
Education and Research	302	706	+ 404	+ 133.8
Total	7,835	9,661	+ 1,826	+ 23.3

TABLE

(16)

1	1965		4	5
	2	3		
Manufacturing	8,505	9,426	+ 921	+ 10.8
Service and Marketing	815	1,846	+ 1,031	+ 126.5
Transport	1,001	950	— 51	— 5.1
Banking and Insurance	439	463	+ 24	+ 5.5
Education and Research	12	17	+ 5	+ 41.7
Total	10,772	12,702	+ 1,930	+ 17.9

8Q

with Unit Record Equipment (6 Organisations).

Clerical Employment		Absolute increase + or decrease	Percentage increase + or decrease —	Clerical as Percentage to total office employment		Difference in Columns Nos. 10 and 11
1961	1965			1961	1965	
6	7	8	9	10	11	12
52	52	Nil	Nil	10.3	10.3	Nil
2,567	2,463	— 104	— 4.1	81.5	74.0	— 7.5
521	636	+ 115	+ 22.1	26.8	25.6	— 1.2
945	1,507	+ 562	+ 59.5	48.9	57.1	+ 8.2
77	123	+ 46	+ 59.7	25.5	17.4	— 8.1
4,162	4,781	+ 619	+ 14.9	53.1	49.5	— 3.6

8R

Organisations)

1965	1969			1965	1969	
6	7	8	9	10	11	12
2,104	2,033	— 71	— 3.4	24.7	21.6	— 3.1
280	640	+ 360	+ 128.6	34.3	34.7	+ 0.4
640	606	— 34	— 5.3	63.9	63.8	— 0.1
334	352	+ 18	+ 5.4	76.1	76.0	— 0.1
2	6	+ 4	+ 200.0	16.7	35.3	+ 18.6
3,360	3,637	+ 277	+ 8.2	31.2	28.6	— 2.6

TABLE
Office Employment
In Organisations having Installation of U. R.

Code No.	Total Office Employment		Absolute increase + or decrease —	Percentage increase + or decrease —	Clerical Employment	
	1961	1965			1961	1965
1	2	3	4	5	6	7
A 406	1,895	2,594	+ 699	+ 36·9	936	1,497
B 124	506	506	<i>Nil</i>	<i>Nil</i>	52	52
501	302	706	+ 404	+ 133·8	77	123
C 402	36	45	+ 9	+ 25·0	9	10
301	1,946	2,481	+ 535	+ 27·5	521	636
202	3,150	3,329	+ 179	+ 5·7	2,567	2,463
Total ..	7,835	9,661	+ 1,826	+ 23·3	4,162	4,781

8S

in Maharashtra

Machines before 1960 (Analysis by Results)

Absolute increase + or decrease —	Percentage increase + or decrease —	Clerical As Percentage to total office Employment		Difference in Column Nos. 10 and 11
		1961	1965	
8	9	10	11	12
+ 561	+ 59.9	49.4	57.7	+ 8.3
<i>Nil</i>	<i>Nil</i>	10.3	10.3	<i>Nil</i>
+ 46	+ 59.7	25.5	17.4	- 8.1
+ 1	+ 11.1	25.0	22.2	- 2.8
+ 115	+ 22.1	26.8	25.6	- 1.2
- 104	- 4.1	81.5	74.0	- 7.5
+ 619	+ 14.9	53.1	49.5	- 3.6

TABLE

Office Employment in Maharashtra in the Organisations with

Code No.	Total Office Employment		Absolute Increase + or Decrease —	Percentage Increase + or Decrease —	Clerical Employment	
	1965	1969			1965	1969
1	2	3	4	5	6	7
502	12	17	+ 5	+ 41.7	2	6
117	83	99	+ 16	+ 19.3	44	69
A 111	600	605	+ 5	+ 0.8	75	84
206	789	1,818	+ 1,029	+ 130.4	262	621
115	710	784	+ 74	+ 10.4	102	115
106	830	858	+ 28	+ 3.4	58	61
104	45	66	+ 21	+ 46.7	26	33
B 102	1,972	2,353	+ 381	+ 19.3	298	311
204	26	28	+ 2	+ 7.7	18	19
404	439	463	+ 24	+ 5.5	334	352
125	107	115	+ 8	+ 7.5	79	75
C 123	222	249	+ 27	+ 12.2	139	138
110	1,858	2,053	+ 195	+ 10.5	796	732
121	1,898	2,085	+ 187	+ 9.9	348	286
D 119	180	159	— 21	— 11.7	139	129
302	1,001	950	— 51	— 5.1	640	606
Grand Total.	10,772	12,702	+ 1,930	+ 17.9	3,360	3,637

8T

Unit Record Machines after 1960 (Analysis by Results)

Absolute Increase + or Decrease —	Percentage Increase + or Decrease —	Clerical Percentage to total office employment		Difference in columns Nos. 10 and 11
		1965	1969	
8	9	10	11	12
+ 4	+ 200.0	16.7	35.7	+ 19.0
+ 25	+ 56.8	53.0	69.7	+ 16.7
+ 9	+ 12.0	12.5	13.9	+ 1.4
+ 359	+ 137.0	33.2	34.2	+ 1.0
+ 13	+ 12.7	14.4	14.7	+ 0.3
+ 3	+ 5.2	7.0	7.1	+ 0.1
+ 7	+ 26.9	57.8	50.0	— 7.8
+ 13	+ 4.4	15.1	13.2	— 1.9
+ 1	+ 5.5	69.2	67.8	— 1.4
+ 18	+ 5.4	76.1	76.0	— 0.1
— 4	— 6.1	73.8	65.2	— 8.6
— 1	— 0.7	62.6	55.4	— 7.2
— 64	— 8.0	42.8	35.6	— 7.2
— 62	— 17.8	18.3	13.7	— 4.6
— 10	— 7.2	77.2	81.1	+ 3.9
— 34	— 5.3	63.9	63.8	— 0.1
+ 277	+ 8.2	31.2	28.6	— 2.6

Individual Peculiarities

8.23. The trends in the individual URM organizations indicate somewhat dis-similar patterns amongst themselves; for instance, in the Service and Marketing Category, the total office employment increased by 5.7 percent during 61-65, the total clerical employment declined by 4.1 percent during the corresponding period, or that the clerical potential (i.e. the ratio of clerical to the office employees, during this period) also declined by 7.5 percent. On the other hand, in the rest of the Categories of URM Organizations, the total office employment as well as the clerical employment increased positively, but the clerical potential correspondingly showed a decline of 1.2 percent and 8.1 percent respectively (i.e. the Transport and Education and Research Categories); but it increased by 8.2 percent in the Banking and Insurance Category during the same period.

Overall Trends

8.24. The over all trends for all these Categories taken together however, reveal that the total office employment increased from 7,835 to 9,661 i.e. by 1,826 or by 23.3 percent between 1961-65, while the total clerical employment increased (rather slowly) from 4,162 to 4,781 i.e. by 619 or 14.9 percent only. The clerical potential, therefore, declined from 53.1 percent to 49.5 percent i.e., 3.6 percent over the period of 4 years i.e. nearly by 1 percent per year during the same period⁶.

8.25. Furthermore, the overall analysis from the point of view of employment potential of these Organisations shows that the Service and Marketing Category is a positively vulnerable sector of the State's economy⁷. The other Categories such as Transport and to a very small extent, Education and Research⁸ are also vulnerable somewhat similarly⁹. However, the overall picture as is pointed out earlier, seems to be a negative one.

8.26. A similar analysis (*Table 8R*) of the group of 16 URM organizations (out of total of 35 for Maharashtra as a whole) which had obtained UR Machines after 1964 also reveals a similar story. Thus, the trends in

⁶The Table 8S provides an Analysis by Results in details of the 6 URM organisations—one each in one Category except Banking and Insurance wherein there are 2 URM organisations. However, there is no significant change in the analysis already given above in Table 8Q.

⁷Where total office employment increased but total clerical employment declined during the same period of 4 years.

⁸This Sector accounts for only 4 p.c. of the total office employment and less than 2 p.c. of the clerical employment.

⁹Where the total office employment increases faster than the total clerical employment during the same 4 years.

employment, taken individually, indicate diverse patterns, in that, while the total office employment, except in Transport Category, increased positively during 65/69, the total clerical employment also increased (except in the Manufacturing and Transport Categories), but the clerical potential declined in the Manufacturing, Transport, and Banking and Insurance Categories, while it showed slight increase in the Marketing and Distribution and in the Research and Education (which constitutes a very negligible portion of the total employment¹⁰). However, Manufacturing by itself is a very large sector accounting for 80 percent of the total of all these 16 URM Organisations, and if Transport and Banking Categories are added to it, they would constitute over 90 percent of the total sectoral employment. The negative trends in these sectors taken together are a matter of some anxiety. Thus, the overall analysis would show that the total office employment increased from 10,772 to 12,702 i.e., by 1,930 or 17.9 percent, but the clerical employment increased (rather slowly) from 3,360 to 3,637 i.e., by 277 or by 8.2 percent during the same period. The clerical potential, therefore, declined from 31.2 percent to 28.6 percent or by 2.6 percent over the period of 4 years (i.e. by $\frac{1}{2}$ % or more per year).

Alternative Approach

8.27. Table 8R provides a detailed analysis of 16 cases grouped on the basis of 'analysis by results' principle. Thus, Group 'A' consists of 6 URM organisations including 4 in the Manufacturing Category (such as Engineering and Chemo-pharmaceuticals)*.

8.28. On the other hand, Group 'B' which consists of 4 organisations including 2 in Manufacturing Category (Engineering Units) shows that while the office employment increased faster, the clerical employment increased, but slowly, thus, leading to the decline in the clerical potential during 65/69.

8.29. Group 'C' which consists of 4 Manufacturing Organizations (also Engineering and Chemo-pharmaceutical concerns) reveals diverse trends in the employment structure, in that, the office employment increased but the clerical employment declined, thus, leading to a fall in the clerical potential for the organizations concerned.

8.30. The last Category includes 2 organisations which reflects individually mixed tendencies in the employment trends. The overall analysis of all these

¹⁰Since the employment potential in the Education and Research has been very negligible the increase in the office as well as clerical employment by a few persons would have no consequence whatsoever, on the total employment pattern.

*In this group, the trends in the office employment, clerical employment, as well as, in the clerical potential have shown a somewhat positive tendency.

16 URM Organisations, however, reveals a negative picture as pointed out earlier in Table 8R.

Overall Picture

8.31. Combining the *Tables 8Q* and *8R* on the basis of *comparative time analysis principle*, the total picture of 22 organisations also reveals negative trends, in that, the total office employment for the entire URM sector increased from 18,607 to 22,363 i.e., by 3,756 or 20.2 percent. On the other hand, the total clerical employment increased (slowly) from 7,522 to 8,418 i.e., by 896 or 11.9 percent thereby leading to a decline in the relative clerical potential from 40.4 percent to 37.6 percent i.e., by 2.8 percent or 0.7 percent annually on average¹¹.

Staff Adjustment

8.32. A Study of URM Organisations on the displacement and redeployment of the personnel shows that there were 14 Organisations reporting displacement of staff in their Establishments. The Table 8U is indicative of the quantum of displacement and method of redeployment of this personnel. Thus, there were 157 total men and women who were displaced due to the introduction of UR Equipment. The Table subsequently shows that as many as 73 persons or 46.6 percent of the total were transferred to Data Processing Section, while another 41 or 26.1 percent were transferred to new jobs. Those who were absorbed in expansion accounted for 39 or 24.8 percent while those who were provided alternate jobs were 4 persons or 2.5 percent of the total. The Table further reveals that not a single person was retrenched and that, only adjustments in other areas were made. There was not much data reported regarding the make of UR Equipment on the labour discontentment in the undertaking. In majority of the cases, it appears that there was no discontentment in some other cases, the question did not arise at all.

TABLE 8U
Method of Adjustment of displaced staff

					Per cent.
(i) Absorbed in expansion	..	..	..	39	24.8
(ii) Provided alternate jobs	..	..	..	4	2.5
(iii) Transferred to D.P. Section	..	..	..	73	46.6
(iv) Transferred to new jobs	..	..	..	41	26.1
(v) Retrenched	..	..	..	..	....
				157	100.0

¹¹And this reduction in the clerical potential may not be very significant in terms of statistical analysis.

ANNEXURE 8 (i)

A NOTE ON AUTOMATION AND APPLICATION OF COMPUTERS

BY

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Context of Developing Country.—The question of automation has an entirely different meaning in developing countries. Conditions with regard to capital availability, unemployment, population pressure, technological know-how, social and cultural values are so different that it will be unfortunate if the models adopted by advanced nations are imitated by the developing nations. By and large, the advanced nations have surplus capital and their labour cost is high. Typically in a developing country, there is scarcity of capital and abundant manpower. Looking at it from the national point of view, our immense manpower resource is not being utilised fully. Under the existing framework, wherein a certain amount of capital is required to create employment, the magnitude of capital required will be colossal—far beyond the capacity of any developing country. Also, we do not have any organisation to put them to work on projects involving provision of infrastructure facilities, as is being done in some other countries.

Problem of Unemployment.—Secondly, automation displaces labour. Labour rendered surplus is either given alternated employment in the same company or retrenched. In most cases, they are absorbed in alternate jobs; but it should be noted that, in such cases, future job opportunities are being lost. Looking at it from the community point of view, the labour rendered redundant still continues to be a cost on the community if alternative productive employment is not possible. In India, we have 15 million unemployed to-day, and the absolute figure seems to be increasing every year, since the number of jobs generated by the economy, every year are less than the new entrants to the labour force. Further a still larger number are employed only part of the year. Again, in the agriculture and household sectors, there is disguised unemployment, where a larger number than necessary are engaged in production. Thus, we have an acute unemployment problem.

Dualistic Development.—However, in a developing economy, we have the “dualistic” development where primitive methods and advanced technology co-exist. For instance, investment in bullock carts is not far behind of railways, and when we are proud of our atomic energy establishments, let us not forget that cow dung is one of the main sources of fuel in our villages. This is inevitable. But we have to learn quickly the know-how of automation technology in all the major sectors. We cannot sit back and wait till we have enough capital and tolerable levels of unemployment in order to acquire this. Therefore, we should automate representative sectors of activities, necessary know-how and skill irrespective of capital and labour considerations. For instance we should go in for a few units of computers, adopt instrumentation in process industries and automate manufacture of specific key industries.

Automation in Manufacturing.—Obviously, some of the process industries like refineries have to be necessarily automated, since process control by automatic devices is the only way to achieve optimum results. There are numerous other situations such as signalling in railways, power generation, handling in ports, steel making etc., where automation should be adopted.

Export Industries.—We are losing ground in our exports, mainly because of high costs. A typical situation is the cashew and coir industry. Both have labour intensive methods today. While coir exports have already been severely affected, cashew industry is being threatened. If the quantities of export earning are crucial, here is an area to be considered for mechanisation, which will reduce cost.

Thus, automation should be *selective*. The overall strategy of this approach would be.

(a) adopt automation, where manual methods are not feasible, or are absurdly uneconomic to meet the requirements of quantity, quality, speed and safety.

(b) adopt automation in export-oriented industries, where automation is a more suitable alternative to subsidies.

(c) adopt automation to learn the know-how in sophisticated sectors.

(d) avoid automation where manual methods can do an equally (or near equally) good job with regard to requirements, but at a higher cost.

Computer based Information System.—The advent of electronic computers for handling and processing of information, is another phase of automation. The growth in this area during the last 10 years is almost staggering. In fact, Computerisation is making rapid strides in most of the advanced countries. Already there are over 40,000 computers operating in various fields, such as, guiding missiles and space vehicles, scientific work and technological design, economic activities and Governmental administration.

India has made a beginning with about 100 computers in operation, which is a small number considering the enormous potential for their application. For considering the economic aspects, computer applications can be classified into three categories: (a) Scientific and engineering design; (b) Analysis and decision making; (c) Labour saving.

There is no question that computers should be used for scientific and engineering design work. In most cases manual methods just cannot do the calculations, while in others, it will take days to solve a problem. Design of structurals, equipments, etc., result in economies in materials and production cost. Automatic control of aircraft, process industries, etc., can also be included in this category. One of the objections against central planning was that the volume of work and centralization of decision making would need a bureaucracy of monstrous size. But computers have almost solved the computation problems of national and regional planning. Innumerable national level problems, such as, Input-output analysis for resource allocation, Plant location and economies of scale; Rationalisation of transport, National income and trade statistics, etc., can be solved by the computer, which cannot be done manually satisfactorily.

In all such cases, the attempt is to process information so as to make it adequately meaningful and timely with the result that the decisions become more rational. Productivity of the situations is increased as a result of such scientific decisions. Also the objective is not to bring about any labour saving in the direct sense. Only in the third category viz. Labour Saving can there be debate on the desirability of using computers.*

Selective Spheres of Computer Application.—Under conditions of scarcity of capital and mass unemployment in our country, it is only logical that computer applications which are mainly of a labour-saving character, should not be resorted to. On the other hand, it is obvious that we should make extensive and intensive use of computers, where operating efficiency could be improved by way of increased utilisation of resources such as capital, physical facilities and organisational complexes, thereby not involving displacement of labour. Also, in most of such cases, computers are indispensable and manual systems cannot do the same, whatever be the number of men employed. A few areas, where such decision-oriented applications of computers can be profitably employed given below:—

Statistical data.—A number of central and state level agencies such as the Directorate of Technical Development, Reserve Bank, Income-Tax Departments, Central Statistical Organisation, etc., are collecting a large amount of data. Unfortunately, the existing data collecting machinery and the processing systems are so antiquated and inefficient that up-to-date information is not available in time to the various authorities and the public at large for policy formulation and operational decisions. More often, the data are published so late that they are no longer useful, except for academic research. Computer based information system would be a great aid in this respect.

Planning.—The most important key sector, where a network of computer-based information systems are essential, is our planning process—both for evolving the numerous areas of planning and in implementing them. Any purposeful plan should be based on relevant and adequate information. It is well-known that our existing information systems are woefully in-adequate and ill-equipped. Perspective projections for the various sectors of the economy, allocation of resources for the respective regions and industrial and infra-structure sectors, choice of plant location, preparation of material balances, etc., are some of the vital areas, where computers are the only solution.

*Even here, it can be argued that the volume of work is so large that manual methods will be absurdly uneconomic and inefficient. However, in the majority of cases, computerisation is to be discouraged. Applications in this category are billing, accounting, pay roll, etc.

Transportation.—Another key sector, in which computers can be used extensively is transportation—railways, road transport, shipping. Some of the areas of applications are traffic planning and control, wagon movements, loading and unloading programmes, forecasting, choice of location, transshipment, inventory control, construction work, etc. Though a few computers are in use in the railways, the types of applications taken on in some cases are not the right ones. Appropriate use of computers can bring about increased utilisation of capacity of all kinds, savings in capital and quicker movement of goods at a cheaper cost. With regard to movement of commodities between raw material producing areas, production centres, warehouse, ports, consuming centres, etc., it is possible to plan rationally the locations and sizes of these centres, as also their movements in terms of choice of supply points, quantity to be moved and transport to be utilised. Food grains, fuel oils, cement, coal, jute bags, cotton, tea etc. are commodities amenable to planning and programming.

Power Grids.—The existing power grid systems in the various parts of the country can be connected to common grids and computers can be employed to plan, schedule and control load-sharing and distribution, thus improving utilisation of the generating units and distribution network.

Industrial Complexes.—There is a vast scope for employing decision oriented applications in most of the medium and large-scale industrial complexes, whereby utilisation capacity can be increased, which has the same effect of an additional investment. Steel and heavy engineering, cement and heavy chemicals, engineering and electronics, are such major sectors, where computers could be employed usefully for decision oriented applications.

Construction work.—Construction work constitutes another large sector, in which the time taken for the execution of projects can be reduced considerably with the help of PERT/CPM used in conjunction with computers. By doing so, many organisations have effected a substantial reduction in project execution time. Widespread use of these techniques will make capital more productive, thus improving the rate of growth.**

Planning and Decision-making Applications.—It is already pointed out that, in a country with high unemployment—both overt and disguised—it is natural and valid to examine computer applications from the point of view of their impact on labour and employment. At the other end, there is a good case for consideration that whatever applications can bring about increased utilisation of physical resources (non-manpower) in our existing context of scarcity of resources of all kinds, should be encouraged. Taking these two factors into account, it is perfectly justified that the computer should be used selectively in these areas which do not involve labour redundancy and which help in increased utilisation of physical resources. Typical examples of this type of applications are given.

Under this category comes (the so called) planning and decision making applications using sophisticated techniques such as Linear Programming, Simulation, PERT/CPM etc. Very generally, these techniques help in the managerial planning, decision making, control and planning process, as a result of which the decision becomes more effective, rendering increased utilisation of resources of all kinds. For all such applications it will not be possible to do manually (except perhaps one can argue that this can be done in same applications, by an absurdly great input of manpower and time)—for such applications use of the computer is imperative.

A Few Illustrative Techniques.—To give below a few illustrations, this category of applications include :

PERT.—PERT is short of Project Evaluation and Revenue Technique (also called Critical Path Method). It is a planning technique which helps progressive planning and controlling project execution time and cost. Every year—both in the private and public sector—large outlays are made as investments in all the sectors in the economy. When this

**It can be seen from what has been stated above that, in all these applications, what is being attempted is increased utilisation of resources, which is important under existing conditions of scarcity of resources. Labour also should not have any objection to decision oriented applications.

investment bears fruit after completion of the project, the productivity increase takes place. It is easy to see that earlier the projects are completed, better would be the utilisation of the capital and faster will be the rate of growth. If one takes a glance at our performance during the last twenty years it would show that most of the projects, whether they be manufacturing establishments or infra-structural facilities (roads, dams, bridges, ports etc.) project execution time has been anything between 2 to 3 years more than what would normally be expected. Studies have shown that even a 10 % reduction in time would result in a saving of an amount which would far exceed the present annual investment. One could use PERT in projects like Steel Plants, Fertiliser plants, now being put up etc. There is absolutely no case of labour redundancy in this type of application.

Linear Programming.—Linear Programming (hereafter referred to as LP) is one of the techniques amongst a whole gamut of techniques called Operations Research. This particular technique has a variety of applications, some of which are briefly described here below :

Plant locations, warehouse locations, locations of Port etc. are to be decided upon taking into consideration all factors (labour, raw material, mode of transport and power). Theoretically any number of feasible solutions will be available and one has to choose a set of solutions which are feasible, economically viable, and socially desirable. In such decisions one has to look a number of years ahead under conditions of uncertainty. Versatilities of the computer makes it possible to minimise cost under the day to-day and future needs and considerations.

Another application of LP is for the choice of what products to make, and how much to make and when to make. For instance there is a whole range of products that are to be made in industries like fertilisers, engineering, cables etc. The condition is that at a given demand is to be satisfied under constraints such as raw material availability, manufacturing capacity etc. A solution has to be found satisfying the constraints and conditions well as minimising the cost, increased utilisation of physical resources and maximising profits. The computer is an excellent device which will analyse all the possibilities and give out the optimum solution for long range and short range solutions for day to-day decisions.

A variation of the above application is the raw mix to be employed so as to minimise cost as well as to meet demand. Typical example is that of oil refineries, blast furnace charging cotton blending etc. For example it is true that a saving of Rs. 50 lakhs per million tons of steel produced is easily feasible by using such techniques.

While the ratio of turnover to inventory is anything between 6 to 12 in Western countries, it is hardly 2.5 in India. The amount of money locked up in inventories is inordinately high. Even a 10 % reduction in inventory would release enormous capital equivalent to the annual private sector budget in the whole of India. Inventory control techniques are an excellent example of computerisation. This is more relevant to large scale organisations such as defence, railways, road transport organisations, steel plants, heavy engineering and electricals and the like.

Another area where computer-based techniques can be used is traffic planning in both railways and road transports. In this manner, it would be possible for increasing the utilisation of our existing resources by as much as 10 to 20 %, a figure far in excess of existing rate of increase in capacity. With this one can visualise the extent of benefits that would accrue to organisations like railways, port trust, transport undertakings etc. On specific example of this is traffic planning and traffic regulations in metropolitan areas like Bombay and Calcutta. Instead of investing on roads an investment in control would have a much better pay off.

Power Load Scheduling.—India has a large integrated power system for the distribution of power which is now being converted into a national system. Losses in the transmission of power are enormous. Line and generator losses can be minimised by the use of automated load despatch systems. In fact the saving accruing would more than pay off by the use of computer within 2 or 3 years. This cannot be done manually. Similar examples can be cited in the control of rolling mills, blast furnaces and atomic power stations.

The above are only typical examples of nationwide applications and in none of which there is any question of redundancy of labour. At the national and state level planning for optimised utilisation of resources through inter-industrial analysis, input and output, material balances etc. can be done by the computer based information system. To-day the data which we have is meagre and on top of this our processing system is archaic that the outputs of this process can hardly be considered rational. Here is another area where all the states metropolitan development authorities can develop computer based information system for planning and resources allocation.

To sum up the whole discussion, and repeat in a partially planned economy like ours, only the following selective approach seems feasible—

(a) to computerise all areas where manual systems are of no avail and where utilisation of physical resources is the prime consideration ;

(b) to computerise only certain export-oriented sectors, where computers can do a better job than the manual system taking into account cost, quality and delivery considerations;

(c) to computerise such of those areas, where we are to learn a new technology, irrespective of other considerations ; and

(d) to restrict computerisation, where manual systems can do a reasonably satisfactory job, even at a higher cost.

Above all this kind of rational approach, to planning and decision—making cannot be fruitful unless there is proper and adequate understanding of the scope and nature of computerisation on the part of managements—both of the private and public sectors. The main problem has been one of educating them (at all levels) to the new technology so that they are equipped psychologically and technically to computerise in the right manner. Thus the employees in general have to be prepared and told about the objectives of and scope for computerisation. Secondly, managers, who will be using the computer, have to be trained on the potential areas of applications in their respective functions so that they are ready to take decisions, using computer as a tool. Thirdly, a sufficient number of specialists have to be trained intensively so that they could select and design decision-oriented applications. Only after getting ready a sufficient number of appropriate applications the computer should be installed. Without this kind of preparation, the potential for using computers for the right applications in a developing country cannot be tapped.

CHAPTER 9

COMPUTERISATION : ECONOMIC AND SOCIAL CONSEQUENCES

The rapid technological developments during the last two decades have been made possible by the electronic computer. This latest device, which helps man to act better, faster and at longer range, is distinguished by its fanatistic speed, accuracy and its capability to store, process, and retrieve large volumes of data.

Changing Economic and Social Relations

9.1. However, throughout history such technological developments have frequently necessitated readjustments in the economic and social relations. Man has always sought to improve the techniques of production, and along with them to create social relationships wherein these techniques could be used to the maximum economic advantage. Therefore, it is only natural that the introduction of automation creates new problems on the economic and social plane. Thus, while the economic effects refer to redundancy of labour force, occupational adjustments, allocation of gains, transfer and retraining problem, investments required and the effects on management's policies, the social effects—and which are less easily measurable—include worker and union relations and attitudes and problems of group relationship, job-satisfaction, utilization of leisure and the like.

Optimum Resource Utilization

9.2. It is generally accepted in the advanced countries that technological progress is essential to sustain and increase economic growth which is very basic to the creation of adequate employment opportunities for a growing labour force. There the computer is rather an instrument of growth; and its application to industry, commerce and agriculture, education, health and Government, science and technology is very vital to the conditions of progress. In the developing countries, however, automation assumes a different dimension and takes place in a different context. The issues posed by it relate to the level of technology and the degree of economic development of the country, its current rate of economic growth and the rate of expansion of labour force. In the current context of Indian economy—characterised by a chronic shortage of capital on the one hand, and large labour surplus on the other—computerisation needs to be perceived primarily as a problem of proper and optimum utilization of both these resources, capital as well as manpower.

Capital Investment

9.3. Automation represents not only a higher technology, but also highly capital intensive techniques that are built in its sophisticated machinery. We have to import this machinery in the initial stages or at least so long as these machines are not domestically produced. This implies an increase in capital requirements for any given level of output and sometimes in foreign capital. In the face of capital shortage or foreign exchange scarcity, this is not easy to meet. The requirements of foreign capital for automation are not simply costs incurred once and for all at the time of installation, but in addition, maintenance components have to be imported year after year and their costs are substantial. Moreover, since automation and computer technology is fast changing, the level of obsolescence is very high. Furthermore, the maintenance and running of automated plants and computer establishments may require in the beginning, employment of foreign technicians and engineers whose emoluments present another strain on foreign exchange resources. It is argued, in this context, that the underdeveloped countries are short of capital and investments in machines of high magnitude will strain our limited resources, and that, its use in certain spheres of our industry may not be justified on economic grounds.

9.4. It is further argued as a sector of labour movement that the investment of capital in computerisation may not result in corresponding benefits which could offset the strain involved in such capital investment. To some extent, it may hold in export-oriented industry where we have to face severe foreign competition in order to maintain our balance of trade; the existing situation, however, shows that our export situation depends not so much on our cost-structure, but on other non-economic aspects of foreign policy. The export industries have not shown any special advantages of automation for their bulk export or they are not relied on automation for their excellent performance. Besides, the imported machinery and spare parts would add more to the production cost for the home as well as foreign markets. There is also not much hope that automation by producing cheaper goods would contribute to the development of our national market and increase our competitive capacity in the foreign markets, and that, the benefits, if any, will be only marginal. Furthermore, there is no built-in guarantee at present that the benefits of low cost, if at all, will be necessarily passed on to the consumer in any equitable way.

Social Productivity

9.5. Moreover, while considering the rate of return on capital required for automation, it should be borne in mind that it is not only the economic productivity of the individual firm that is to be taken into account, but also

the social productivity, viz., whether the use of same resources will not bring a higher return elsewhere in the economy, should be duly considered. It may happen that labour saving and the economic calculations of benefit might leave out of their purview the sufficient costs of manpower displacement and unemployment which might be out of proportion.

Limiting Factors

9.6. It is already pointed out earlier that electronic computerization is representative of a fast appearing technological change in the industrial and business world. In order to ascertain its total impact on the economy as a whole, the 'speed' and 'span' of computerization becomes very important. Among the factors conditioning the speed of penetration, capital investment including foreign exchange, trained personnel and labour relations seem to be of great relevance. The attitudinal change and gearing of educational system to the computer needs is a factor having great bearing on the span and speed of computerization.

Impact of Computerization

9.7. The impact of computerization differs from country to country, from one industry to another, as also from one region to other region. For a developing country generally, the change is likely to be moderate. Particularly, for the economy of Maharashtra, the impact of computerization has been relatively small, uneven and diffused. Admittedly, a general dearth of capital would limit the speed of computerization; but the availability of foreign exchange, except in the initial years, has not posed any unsurmounting difficulties. Training of a requisite quality is a problem to a certain extent, however, a number of institutions, in the field are imparting a degree of technical competence or making efforts to train the personnel required. There has been an element of indiscriminate resort to computerization, thereby leading to certain disturbing social consequences; but the situation is not beyond control where computerization cannot be used advantageously.

Gradual Spread

9.8. From the existing attitudes and responses to computerization, it appears that its introduction may spread out to office-organization in a gradual way, and that, there may be enough opportunities to cushion any sudden impact in a given sector. Since most of the EDP Establishments in Maharashtra are 4 to 5 years old, it is difficult to ascertain the inter-industrial impact because of their unlike characteristics. It may be, however, said that in certain sectors, development achieved through technological advance is essentially in the nature of service to mankind, for instance, the introduction of computers in the fields of national defence, scientific

discoveries, education, training and research, where we cannot afford to use the age-old methods of work. It is also hoped that if the computer is introduced at the very beginning of the organizational existence, its impact may be felt slowly and gradually over a period of time. Similar would be the case of an organization which has built-in system of methods improvement and continuity in modernization programme.

A Seemy Side

9.9. It is true that owing to the systems of machine control and elimination of dangerous task, computerization provides greater safety. In offices it can ensure efficient record maintenance and provide a tool for various forms of management control. It is contended that there is considerable saving on storage of information and also in the cost of processing data. The employers also contend that automation would improve the conditions of work, reduce the working hours, enable the workers to enjoy leisure and increase their wages¹ and open out new avenues of employment resulting from the increased demands in goods and services; and thus it would be beneficial by and large, to the community as a whole. Infact, computerization should result in the availability of quicker and improved services at reduced prices and higher economic gains in the long run; but there exist no sufficient evidence to warrant such a conclusion from the limited experience of computerization that we have in India and more particularly in Maharashtra. The trade unions, on the other hand, have doubts of their own regarding these advantages which are said to accrue to the community in terms of better products available in plenty, as well as, the economic gains resulting therefrom.

Manpower Effects

9.10. The man-power effects of computerization imply changes in labour requirements along with job profile and change in skills, problems of absorption and redeployment and retraining and above all integrative adjustment in the labour relation, as a whole. The technological change often tends to bring in its wake substantial benefits, such as, rising standard of living, greater leisure, reduction in the arduous work and more pleasant working conditions; but it equally presents problems to workers and management, in plant, in industry and occupations where large number of people are likely to be displaced from their jobs; and this possibly is the greatest disadvantage that tends to result from computerization. This is so when the economy does not keep pace with employment dislocation, and that the job opportunities do not grow as fast as

¹However, it appears that the general assumption that automation would lower prices and raise wages is a very facile simplification of a very complex phenomenon, and that, such presumption has not been brought out by the facts, especially in the developing countries.

necessary. Besides, it is contended that it may lead to unemployment of the employable, which a country like India with its surplus labour can hardly afford to ignore. Even from the community's point of view, the labour rendered redundant still continues to be a cost to the community if alternate productive employment is not possible².

Labour Protest

9.11. The labour sector is very much apprehensive of these human and social costs involved in an all-out automation and indiscriminate application of electronic computer to the various categories of industrial process and office-work. Considerable fear and anxiety exist in their mind regarding the loss of employment, displacement of labour, retrenchment of the existing staff and contraction in the cadre, reduction in the existing or future employment opportunities or stagnation in promotional prospects, hardship due to unsuitable transfers and the absence of suitable alternative jobs, etc. Their apprehension is, perhaps, based on the bitter experience of the working class in the industrial and business sectors where computerization in their view has had adverse effect on the man-power situation. A section of labour-movement considers that for an under-developed country like India which has huge backlog of unemployment and under-employment, automation or computerization presents a 'painful luxury'.

9.12. On this background the unions' resistance, in general, is understandable. Sometimes, they have agitated for 'job security' and 'assured employment' position during the phase of adverse impact of automation. Very often they have ventilated their feeling regarding the management's failure to take the unions into confidence and consult and associate them with the programme of automation and the process of change, especially when they (unions) think that the workers' jobs are at stake.

Issues Involved

9.13. Incidentally, we may mention here that the issues involved in the labour unrest before and after the installation of computers were related basically to the possible unfavourable impact of automation on the current or future employment and to 'job-security' in the prevailing economic conditions in the country. The problem of increasing numbers of educated youth coming into the labour market and seeking suitable gainful employment has also been figuring importantly in the unions' thinking in the matter. In the Oil Companies, especially, the unions organised

²In India millions are unemployed and underemployed and that the argument that redundant labour will not be retrenched and will be absorbed in expanding activities does not change the situation essentially since the future job opportunities are lost.

agitation over the matter of 'job-security' as a result of which a Commission on Enquiry was appointed by Government of India³. The Unions are, therefore, generally oppose to the introduction of computerization atleast at this stage of economic growth of our country and until such time the full employment is achieved. To this end, they have demanded certain priorities while accepting even selective automation. One Union expressed that "if once the gates are opened for the computer in any Department of civilian sector, then it will force its way in other Department as well". They have, therefore, suggested that the plans for the introduction of automation or computerization should be deferred for another 10 years.

Unfavourable Reactions

9.14. In general, the Labour Movement entertains a feeling that computerization instead of resulting in overwhelming advantages in the existing Indian situation would lead to some of the basic over-all national dis-advantages in terms of curtailment of the existing employment or reduction in the potential employment in future. They think that the problems of retrenchment and redundancy, displacement and forced transfers, stagnation and reduction in the promotional opportunities in the organisation, if not dealt with satisfactorily, would aggravate the unemployment situation leading to more frequent outburst of Labour Unrest, since there are no alternative jobs available to cushion the adverse impact of computerisation. A more knowledgeable leadership in labour movement concedes to the thinking that computerization by itself is not contributing to this present state of unemployment in the country, nor is its total business likely to make in itself to the staggering figures of unemployment. However, we think that Labour Unions have usually raised protest against computerization partly due to their innocence regarding its overall impact, and partly because they have no such data available with them nor do they have any ready access to it⁴. In some cases, the management have not taken the Unions into confidence, and that it has created a certain amount of misunderstanding and organizational strains.

³A Commission on Enquiry was appointed by Government of India in July, 1967 under the Chairmanship of Shri B. N. Gokhale, the former judge of Maharashtra, High Court and which submitted its report at the end of April, 1969. One organization felt that the reduction in staff was due to some facts such as product availability, changed pattern of distribution, emergence of local and such other factors and not due to computerization. It is, however, contended by the union that the change in the pattern of distribution itself has been the result of rationalisation of organization.

⁴A section of Trade Union Movement is, however, opposed to office automation rather consistently.

Our Assessment

9.15. We think that the impact of electronic computerization would be felt gradually only over a period of time as the economy is geared progressively to the computer requirements. There may be some sectoral decreases in recruitments in the existing employment as well as in the new recruitment as the jobs currently done by conventional machines are put on the computer progressively in future. However, the nature and extent of such impact would depend upon the (i) the nature and growth of business; (ii) the speed of industrialization; (iii) the nature of Governmental regulations; (iv) the rate of economic growth in general; and (v) a given sectoral growth in particular. Thus, the development of our business and industry may conceal a possibility of getting a sizeable number of new and additional jobs in future⁵.

Picture of Maharashtra

9.16. We present in *Table 9A* the general picture of employment trends in Maharashtra during the period under study i.e., 1965-69, both in private and public sectors of our industry and business. Thus, the total employment which stood at 21.43 lakhs in March, 1965 increased to 24.40 lakhs i.e., by 13.86 per cent. over the period, or nearly 3½ per cent. per annum⁶. Moreover, given the population growth of about 2 per cent. on an average per annum, the real growth rate in employment for the State as a whole, would work out at 1½ per cent. on average per annum.

9.17. Correspondingly, the employment in the private sector showed a very small increase of 0.62 lakhs i.e., a gross increase of 6 per cent. over the period of 4 years or 1½ per cent. on an average per annum. As against this, the employment in the public sector increased by 2.12 lakhs i.e., the gross increase of 21.77 per cent. over the period of 4 years, or 5.3 per cent. on average per annum.

9.18. Thus, a somewhat comparative picture of the State's economy reveals the significant fact that, although the private sector constitutes nearly 50 per cent. of the State's industrial economy, the employment position over the period under study has remained more or less stagnant. On the other hand, the picture of the public sector seems to be somewhat brighter⁷.

⁵On the other hand, there has also been a fall in the employment during the last few years in certain sectors of our economy even without the computers being installed.

⁶The specific analysis of the five relevant sectors viz., Manufacturing, Electricity, Gas, Water Supply, etc., Transport, Communications, Trade and Commerce; Services of our State's economy does not in any way show a different picture.

⁷We have reason to believe that the trends in employment on the manufacturing side, if analysed, may not reveal in any way a very different picture, since the total employment in the whole computerised sector constitutes only a small proportion of the employment for the total economy of Maharashtra.

TABLE 9A

Employment in Maharashtra

(Figures in Lakhs)

Serial No.	Industry	Employment as on 31st March					
		Private		Public		Total	
		1965	1969	1965	1969	1965	1969
1	Agriculture, Plantation, Forestry, etc.	0.01 (100.00)	0.01 (100.00)	0.19 (100.00)	0.31 (163.16)	0.20 (100.00)	0.32 (160.00)
2	Mining and Quarrying ..	0.18 (100.00)	0.14 (77.78)	0.04 (100.00)	0.04 (100.00)	0.22 (100.00)	0.18 (81.82)
3	Construction ..	0.18 (100.00)	0.15 (83.33)	1.15 (100.00)	1.26 (109.57)	1.33 (100.00)	1.41 (106.02)
	Sub-Total ..	0.37 (100.00)	0.30 (81.08)	1.38 (100.00)	1.61 (116.67)	1.75 (100.00)	1.91 (109.14)
4	Manufacturing ..	8.03 (100.00)	8.31 (103.49)	0.70 (100.00)	1.05 (150.00)	8.73 (100.00)	9.36 (107.22)
5	Electric, Gas, Water Supply, etc.	0.21 (100.00)	0.18 (85.71)	3.37 (100.00)	3.99 (118.40)	3.58 (100.00)	4.17 (116.48)
6	Transport and Communication.						
7	Trade and Commerce ..	0.66 (100.00)	0.81 (122.73)	0.29 (100.00)	0.36 (124.14)	0.95 (100.00)	1.17 (123.16)
8	Services ..	1.04 (100.00)	1.33 (127.88)	5.38 (100.00)	6.46 (120.07)	6.42 (100.00)	7.79 (121.34)
	Sub-Total ..	9.94 (100.00)	10.63 (106.94)	9.74 (100.00)	11.86 (121.77)	19.68 (100.00)	22.49 (114.39)
	Grand Total ..	10.31 (100.00)	10.93 (106.01)	11.12 (100.00)	13.47 (121.13)	21.43 (100.00)	24.40 (113.86)

Source.—“ Directorate of Employment ”

Employment Review 1961-68
 ” ” 1968-69

Note.—Employment here is No. of employees on last working day of the quarter 1st January to 31st March of every year.

Future Recruitment

9.19. As regards the impact of electronic computerization on the future recruitment say within the next 3 to 5 years, the views expressed by the parties have been somewhat diverse, since they seem to be based on the insufficient information that the labour sector has on the one hand, and an equal inability of the managements and employers to allay the natural fear and anxiety of the employees about the facts of office-automation of their own organizations, on the other. One EDP Establishment expects about 10 to 15 per cent. increase in the employment in their organisation during the next 3 to 5 years, although with the conventional methods the potential would have gone up nearly by 40 per cent. or so. In another EDP Organisation, however, there has been considerable growth in new business during the past 4 years and yet there has been no appreciable increase in the total office-employment in keeping pace with the rate of growth and investment in the business concerned. By and large, the employment situation appeared to be stagnant.

9.20. While it is contended that computerization increases, to a certain extent, the job potential in future, it is, however, difficult to ascertain as to how-much of it is due to computerisation, and how-much of it is because of the overall expansion of business activity.

Inter-State Effects of Automation

9.21. In order to ascertain the Inter-State effects of automation, a comparative study of nature, character and extent of computerization among the states becomes necessary. We have, therefore, tried in this section to present a general picture of 'speed' and 'span' of computerization in the various regions of India.

Extent of Computerization

9.22. At present there are about 100 working computers in India, of which about one-fourth are in Bombay Region (Maharashtra), 15 to 16 per cent. each in the Regions of Calcutta, Madras and Delhi and the remaining about 28 to 30 per cent. are distributed outside these Regions. Two major companies—IBM and ICL—have supplied computers in the country. Between them, IBM represents nearly two-thirds of the total EDP Installations, with 1401 and 1620 models generally.

Computer Application

9.23. As regards the computer applications, accountancy procedures predominate in most business houses, while a few computer installations are made use of to a Total Management Information System (MIS) and have reached a considerable degree of sophistication. The most impressive use of computers in the country is to be found in the integrated operations of 14 computers controlled by the Railway Board. However, the

Educational Institutions and Research Organisations have started making increasing use of it, in the more recent period.

Computer-Utilization

9.24. As regards the hours worked and spare time available, our special survey reveals that the Calcutta Region had the greatest usage, representing 42 per cent. of the all-India rented time, while correspondingly the Bombay, Madras and Delhi Regions account for 38 per cent., 11 per cent. and 9 per cent. respectively. Furthermore, a closer observation of 38 computer installations on all India level gives us an average monthly time usage per installation of 210 meter hours. Considering the efficiency of converting clock hours into meter hours, in practice, the attainable figure may reasonably be between 60 to 80 per cent. of the clock hours. Even then, our study reveals a utilization rate of about 50 per cent. This means about 50 per cent. spare meter time is available on an average, on every computer in India. Our conservative estimate also shows that the rented machines are generally found to be more heavily utilised than purchased computers.

Our Observation

9.25. Since the Study Team had considerable limitations on collecting detailed information of all other computers having a bearing on the Inter-State effects of Automation—both economic and social—we have restrained ourselves even while making a few observations on this aspect of automation. Thus, as a result of computerization the potential employment may or may not decrease depending on the speed of industrialization, the level of economic development and the general prosperity in Region concerned. There may exist, in some measure, regional disparities in wage levels and standard of living; but then computerization may not be the main and the only cause of such situation. On the other hand, computerization might serve as a catalyst of a Modernisation process especially in the Regions where potentialities of industrial progress are in existence, in large, measure. It might, however, lead to a certain amount of friction between Head Office and the Branch Office if they are situated in the two different States. As for the State of Maharashtra, however, since large number of computer installations have their central office in Bombay and the Branches organisations spread over in other States, the adverse impact, it is expected, is not likely to be felt for some time in future or that it will be much more mild and gradual. Computerization in the State of Maharashtra has not yet created a very serious problem, fraught with unsurmountable difficulties, the situation, however, needs be kept under constant watch at least in certain sectors like Marketing and Distribution and to a certain extent, of Banking and Insurance while automation or modernisation makes rapid progress in our industry and economy in general.

CHAPTER 10

FUTURE OF COMPUTERS

Indigenous Experiments

The first Indian-made electronic digital computer was commissioned in January, 1969. The computer TDC-12 was designed and built by the Electronics Division of the Bhabha Atomic Research Centre at Trombay. It was built at a cost of Rs. 7.08 lakhs involving a foreign exchange component of Rs. 1.35 lakhs.

10.1. From 1971 onwards the Bharat Electronics Limited, (BEL) will be in a position to turn out a computer every month or every two months. According to their Programme, International Computers Limited, (ICL) would turn out 56 computers valued at over Rs. 7 crores during the next 4 years; thus, the price of the computer would be round about 17 lakhs. The capital cost of BEL's Joint Venture is Rs. 6 crores. The BEL will produce about 60 per cent. of the components consisting mostly of what are known as "peripherals". At present, in the ICL alone some 3,000 persons are engaged on writing software for the existing machines and applications. Todate, the library of programmes prepared for the 1900 Series computers, for example, exceeds 4 million instructions. Moreover, there are more than 20,000 Indians who have been trained and oriented in various fields of electronics, precision mechanism, programme, managerial techniques, etc. Over 350 Indian vendors have been developed by IBM alone to supply its component requirements, some of which are highly critical and precise.

A few Estimates

10.2. The estimation of Bhabha Committee on Electronics in 1965 shows that during the decade (1975) the country would need 5,000 small and 500 medium-size computer systems costing on an average Rs. 50,000 to Rs. 15 lakhs each respectively. As against this, a recent study by a Group of Experts (1967) is understood to have revealed that the demand during this period is unlikely to be more than 1,000 small and 300 medium-size machines. A survey by the Electronics Committee of the Government of India estimated a total investment of about Rs. 110 crores on computers by 1978¹.

¹ The current rate of investment is of the order of Rs. 15 to Rs. 20 crores; the foreign exchange component of it being of the tune of 15 to 20 per cent.

The Current Situation

10.3. It is contended that in the present conditions it may not be advisable to go straight to the costly process of assembling machines with hundred per cent. imported components and the heavy drain of our foreign exchange resources. In this context, a more enlightened section of our labour movement do not have objection to electronic computerisation under certain conditions ; but that they do not favour installation of the computers made in foreign land, as they consider it not desirable from the defence, economic, as well as from long term techno-social considerations. This implies the manufacturing of computer-hardware, as well as the development of software—in the country itself. It is however, feared that for sometime to come, at least, India will have to depend on the foreign expertise and know-how, and as the experience is gained, we should be able to reach higher levels of self-sufficiency in all the aspects of computer production.

10.4. Fully indigenous production of all parts—CPU as well as peripherals will take sometime, and will necessitate considerably large investment. To catch up with the latest technology of the hardware—and especially the Central Processing Unit (CPU)—would also call for immense resources in carrying out research design and development. It is possible to first strengthen the ancillary base and then go in for, step by step, to the production of CPU. Simultaneously, we can develop software indigenously. It, however, calls for quality consciousness and high precision standards to be maintained. The process is tedious but there is no shortcut to it.

The Perspective

10.5. The weight of the material that is supplied to us by all to whom we approached is also on the side of progressively indigenous manufacturing of such equipments as early as possible. It would not only be helpful in making adjustments of the displaced personnel and reduction in employment potential, but it is equally desirable in the interest of the progress of the economy and the advance of the country as a whole, and generally in tune with the principle of self-reliance of the nation. It may be that, in the beginning, India would have to depend upon foreign know-how for the production of the hardware, the software can be developed within our country. To begin with, it is contended that, we may enter into foreign collaborations in a limited way and try to manufacture the hardware in the country itself. The employers and management, generally, welcome manufacturing of EDP equipment by Indian industry and reducing progressively the dependence in this respect on the foreign help and assistance. They further feel that the Government should encourage the indigenous

industry in this respect, since there is taking up the challenge of manufacturing more sophisticated machineries in the electronic industry. The requisite amount of training and research that is necessary in this field also finds favourable support from all the sections of industry and labour. They have emphasised, in particular, the advantages flowing from the indigenous manufacturing of EDP Equipments. These, include the encouragement of (i) indigenous ancillary industry in the country; (ii) providing additional avenues of employment to the skilled and the highly skilled people; (iii) a progressive reduction in the dependence on foreign countries for the foreign exchange resources, and reliance for the spare parts on the foreign manufacturers; and (iv) the development of technical know-how in this sphere in the country itself.

Computer Environment

10.6. Today no organisation—industrial or commercial—can exist in isolation. While on the one hand, it is influenced by the environment in which it functions, on the other hand, the rapid growth of technology, the expansion of economic markets, and rapid political and social change, besides the development of modern management systems are influencing the environment itself. In the new environment, the organisation has to adapt itself to the new problems and conditions of industry and business, and computerisation is one such problem which tends to alter the existing environment, itself to a considerable extent.

Unlike Situations

10.7. We should like to emphasise, that a developing country like ours, with surplus labour on the one hand, and dearth of capital resources on the other, presents a quite different picture of the situation which does not admit of easy comparison with the advanced countries. Increase in population and thereby in the labour force has added to the difficult problem of growing unemployment and underemployment. A fear of enforced idleness exists which they think might result from computerisation amongst the vast sections of unskilled and semi-skilled workers. It seems that, in order to avoid the adverse manpower effects of automation, it is necessary that the growth-rate of the economy must be sufficient not only to generate new jobs for those made a redundant by technological change, but also to absorb the new entrants into the labour force. Under the circumstances, indiscriminate resort to computerization holds the threat of bringing about a lop-sided growth, the social consequences of which will indeed be distributing. That is why computerisation in a country like ours should take into account not only the needs of the company as an organization, but also its economic and social effects on the community as a whole; in that the pace of technological advance has to be regulated to minimise the possible hardship to the workers.

Labour's Look

10.8. It is in this context that the responses of the labour movement to computerisation need to be given a considerable weightage and hence the importance of labour relations in the progress of computerisation in the country. The evidence that came before us shows that, the trade unions functioning in the EDP Establishments have shown very live interest regarding automation, both at the level of their Executive Committee as well as General Body Meetings. A burning problem which concerns them directly and intimately, it has been discussed thoroughly or debated fearlessly, and that all the Unions concerned have taken a definite stand regarding office-automation. By and large, there is considerable resistance to *all-out* automation, although they do not oppose automation or technological development blindly. They are opposed to computerisation in jobs which could be done by conventional methods within a reasonable time, and with a reasonable degree of accuracy and at a reasonable cost. The basic fear not generally well-founded—has arisen because the massive changes have occurred relatively in recent periods in the advanced countries as a result of revolutionary technological break-through, and the man's inability to make quick adjustments to them. To counter-act such a situation, they have suggested that the automation in the existing economic and social conditions obtaining in the country should be extremely *selective* and should be permitted only in the sector where the objectives of research and training, defence and scientific advance must receive our priority consideration in the total process of economic development, and where the adjustments which it necessitates can be made with the minimum dislocation and hardships to the workers.

Labour-Management Friction

10.9. Incidentally, we may point out that, sometimes friction developed in some EDP Establishments between the management and the labour unions on the issue of electronic computerization, the most significant aspect of which seems to be the union's feeling that the management proceeded with automation without taking them into confidence or consider their view-point and without satisfying them that the interests of the employees would not be *jeopardised*; sometimes, the management did not even care to consult the unions before installing the computer. In short, the unions have entertained a feeling of being 'hurt' and that they have not been given their due 'status' in the organization and its system of labour relations².

²Some unions feel that the management consider below their dignity to consult the labour unions in the matter.

The Union's Plea

10.10. The Union's plea, therefore, is that they should be brought into the picture at the decision-making stage itself, and not after computerisation is already decided upon; that the discussions should cover all the aspects which are likely to be the source of mis-understanding and conflict and should include, redundancy and displacement, retrenchment and compensation, recruitment of the new workers, and their working conditions, method of promotion, arrangement for training, assessment of performance, etc., as also the jobs to be computerised, its phasing, its impact on employees, the ways of cushioning the impact, and above all, the total perspective of overall future development. Besides, the unions consider that the differences between the management and labour over automation should not be equated, with industrial disputes to be bargained over and settled; but they should consider automation as an item of organizational planning in which the workers have a vital and direct stake. Further, the problems of rationalization and automation should not be treated *on par*, although certain basic guarantees regarding the man-power aspects, such as, employment, job-security, income security, training security, sharing of gains, etc., should find a due place in these agreements.

Some Suggestions

10.11. The Trade Unions have further suggested that, if the routine clerical jobs are not computerised, office-automation may not create very serious problems. *Secondly*, retrenchment of the existing labour force on account of computerisation should be categorically ruled out. *Thirdly*, while alternative jobs are being provided for easing out tension, the Voluntary Retirement Scheme (as a practical measure) may be encouraged, with the scope of new recruitment being limited outside the existing labour force. *Fourthly*, new programmes of manpower training may be undertaken enabling the redeployment of the displaced personnel; and this implies proper planning and the phasing out of the whole scheme, selecting the areas where computerization may be introduced with priority and rationalization of the entire organization in the light of the new perspective.

10.12. Thus, the weight of evidence, in general favours only the introduction of automation and computerisation in the appropriate selective spheres of our industry and business activity, although the employers prefer to have a free hand in it when certain conditions are fulfilled and automation is mutually agreed upon. To make it more safe less painful and quickly adjustable, creation of favourable atmosphere is considered as a necessary pre-requisite. While allaying the fear of the employees regarding the adverse effects of computerization, the employers should also ensure that the interest of the community is safeguarded.

Institutional Set-up

10.13. As for the institutional arrangement, the employers have suggested mutual bipartite negotiations for reaching agreement on computerization. Trade Unions, and labour movement, on the other hand, prefer a Tripartite national level, as well as, State level bodies to lay down the guide-lines and the standing committees at appropriate level supported by expert's advice. Emphasis is also laid on the need for a national policy on automation, computerization within the framework of a proper centre-state relationship (labour being a subject in the concurrent list). It is further suggested that computerization is best introduced by prior agreement with the Trade Unions concerned and in co-operation with the employees of the undertaking. This would help to reduce tension and strain associated with automation.

Meeting Ground

10.14. Infact, there always exists a certain amount of inevitability regarding technological change, and we have no choice except of regulating its 'speed' and selecting the spheres of its operation on a priority basis. Thus, if the employers take labour unions into confidence, consult them, and reach a mutual agreement with them, having sufficient regard for the interest of the society at large, much of the current misapprehensions, misunderstanding and resistance will be reduced and the well-meant progress of computerisation greatly facilitated. In order to achieve these desirable results it is contended that an integrated policy regarding automation, rationalization or modernisation should be clearly enunciated and rigidly followed, both at the national as well as state levels.

World of Computers

10.15. According to a widely accepted forecast, in 1980 more than 1,00,000 computers will be installed in US and most of them will be used for business application³. The forecast expects that during the next 3 to 5 years the computer is likely to be increasingly used to finance and administration, research and engineering, planning and control and production, distribution and marketing. According to the same survey in 5 years, the percentage of systems (integrated throughout all functions and divisions) will increase from 4 to 28%, and overall systems, "integrated across multiple functional areas", from 26% to 64% where the largest number of machines are employed, nearly half a million people are now working in the field of computers and business machines. Studies also reveal that, in advanced countries like UK, USA., the demand for additional manpower

³cf. Neal J. Dean : "Computer Comes of Age" in *Harvard Business Review*, Jan.-Feb. 1968.

in the service sector will increase faster as against a moderate increase in manpower requirements in production and manufacturing. The overall demand for less skilled workers will not decrease during middle 1970's, although it will decline somewhat as a percentage of the total.

The Changing Role

10.16. The computer has changed the nature of many business operations since it first appeared in industry after World War II. It is taking over the job of recording, sorting, calculating, classifying and summarising information. In the United States, in some Companies, it is already playing a vital part in pricing, product development, customer service, and financial planning, as well as in day-to-day operations.

A Fundamental Change

10.17. More fundamental changes are expected to be brought about by the technical development—changes in the nature of information process, in the selection and training of data processing personnel, in the organization of data processing units, and most importantly, in relationship between management and data processing. The total development towards what is known as 'adaptive dissemination', which system is already a feature of US Government Administration. Through improvement in communication system, the span of control can be widened leading to a more efficient organization and considerable savings.

In 1970s

10.18. Moreover, remote peripheral units can be coupled to a computer by ordinary telephone lines by dialing, as one would for a telephone call. In the 1970s this could be the standard means of obtaining access to a computer. Thus, in the early 1970s therefore we can expect computers working in *real-time* to begin to eliminate paper work on a significant scale.

Towards Centralised Computer System

10.19. The tendency towards centralisation to work into few large computer centres rather than a large number of new small offices is revealed in some of the advanced countries as regards office-automation. Such tendency has not been yet very significant. It is suggested that India should go in for very large, though relatively few systems. To use them economically, these systems should be installed at major industrial or Government centres and the computer-time would be shared by a number of users (*see* Annexure 10(i) to this Chapter).

ANNEXTURE—10 (i)

A CENTRALISED TELE-PROCESS TIME SHARING COMPUTER

vs.

BUDGET PROCESSING COMPUTER SYSTEM

By

Professor P. N. Mathur—Member

Introduction.—Electronic Computers have come to stay in India. Since the first Computer was installed in 1962, over a 100 Computers have been installed in a little over 7 years. At least 2 Manufacturers viz., IBM and ICL have established manufacturing facilities in the country for the fabrication and maintenance of electronic digital computers. Whereas IBM has been partially fabricating second generation 1,400 computer systems, ICL has been given a licence to manufacture third generation integrated circuit 1,901 computer systems in collaboration with Bharat Electronics Ltd., Bangalore.

It is estimated that the current investment in electronic data processing in India is of the order of Rs. 50.75 crores (it is difficult to make precise estimate since most of the machines are rented and different factors can be used for capitalising the same). Moreover, most of these machines require a fair amount of foreign exchange. It is very important, if not imperative for us to consider the different strategies that are available to the country today with regard to the introduction of automation. This Note is an attempt to discuss the relative economies of two alternative strategies that are available viz., (a) installation of a few remote access time shared computer systems; and (b) the installation of many small size in-house computer system.

Computers can be classified in a variety of ways. One common form of classification is "small" "medium" or "large". Most commercial data processing systems, whether in USA or elsewhere, use small or medium size computers. This is true of India also. On the other hand, large size computers are usually restricted to Research and Development Organisations, Universities and Defence Establishments.

Computer Power and Cost.—The power of a computer does not vary directly with its costs. Infact, it gives increasing returns to scale. In other words, one gets more than proportionate added computer power for every rupee added to the value of the computer. Very loosely, it is sometimes claimed that the power of a computer varies as the square of its costs. In other words, the cost per unit computation in larger size computer is very small compared to that of a small computer.

Why In-House Computers.—Despite these economies of scale, it is important to note that there has been a proliferation of small and medium size machines in almost every country. It is perhaps important for us to briefly discuss some of the reasons that might have contributed towards such proliferation : (i) since companies had, by and large, to have their own computer systems to be able to use one, they were forced to go in for smaller machines, they simply could not afford a large one ; (ii) many companies were unable to occupy a large computer full time ; hence they preferred a smaller one ; (iii) the use of Service Bureaus which could afford large computers was restricted, perhaps on account of the confidential nature of data being processed on the computer. Generally most of the companies were unwilling to physically transmit data to and fro from their office to the Service Bureau computer facilities ; (iv) in commercial applications where most programmes were input and output bounded, it did not generally matter whether one had a small or a large computer since the productivity was governed not by the speed of the central processing unit, but by the speed of the input and output devices making the productivity of small and medium size machines comparable to that of large computer facilities.

The Computer Grid.—It may be useful to draw a parallel between the suggestions made herein for computers with that of the generation and supply of electricity. The computer is a source of computing power. The electric generator is a source of electric energy. Initially, if one had to use electricity he had to have his own generator. Today, when one talks of using

electric energy one does not usually associate such usage with the acquisition of an electric generator. One usually assumes that all one has to do is to obtain a line from a large centrally located generator and use the power therein. Indeed, today, not only do we have single generators supplying multiple users, we have power grids. In other words, we have several generators simultaneously supplying several users. We have regional grids, and in advanced countries national grids. With international treaties, it is possible to have international grids. The same trend can perhaps be extrapolated to the computer world. Several academicians and research workers in the field of automation foresee national computer grids. It is envisaged that several large computer facilities will be linked with one another, simultaneously satisfying the computation need of the several users. One can today very legitimately talk of computer grids regionally and even nationally, in a manner similar to which we can talk about electricity grids.

These developments are briefly enumerated below :—

(i) The ability for one machine to have several channels together with interrupt facilities— in other words, it is now possible for the same computer to simultaneously control and operate several input and output devices i.e., the same computer can operate several printers, card readers and tape units at the *same* time.

(ii) *Teleprocessing*.—Existing channels of communication are adequate for inputting data to a computer from remote points. They are suitable for use as communication devices. To be able to use the computer, one does not have to be standing next to it. All one needs is a communication channel linking him to the computer.

(iii) *Time-sharing*.—Time sharing is a relatively recent concept, and if one glances from the proceedings of Seminars devoted to computation, it is evident that it has been the single most significant development in the field of computers for a long time. In time-sharing, one can have multiple users of the same machines at the same time. This does away with major objections to centralised computer facilities viz., that to use a centralised facility one had to wait for a considerable period of time before one could access the machine.

Of the 23 computers in the State of Maharashtra, 14 are of one common type used in business organisations for their data processing problems. These machines have obvious limitations of capacity and computation power for the solution of large problems, wherein one would have to store a large programme and do a lot of arithmetic. Examples of such problems are to be found in the field of operations research, engineering, defence, etc., and as such most of the computation facilities that are available with the organisations in the State have very limited capability with regard to the solution of complex problems. In fact, it is quite common for companies having their own small computer facilities to use the services of a large computer facility viz., one that is available at the Tata Institute of Fundamental Research (TIFR) which has a CDC 3600 machine. On the other hand, it is widely acknowledged that in the Indian context the greatest savings lie in the solution of the more complex problems rather than doing routine accounting. Besides, such application viz., those which require the services of the large computer, commercial problems such as, pay roll preparation, invoice printing, maintenance of literature, etc., have marginal utility, if any, with regard to the savings that accrue from their automation. An IBM 1401 computer system could be acquired for between Rs. 20 and Rs. 50 lacs depending upon the size and configuration. A large multiple channel teleprocessing, time-sharing, computer system would, on the other hand, cost between Rs. 1 and Rs. 2 crores. It would, however, have the capability of simultaneously serving 50 to 200 users.

Centralised Computer Systems.—Most time-shared computer systems are different from the usual computers available in as much as they have to be designed specially for the purpose. Though, most computers including the CDC 3600 and IBM 7090 can be adapted for time sharing, such adaptation is automatically linked with increased cost. Further, the efficiency of the machine is considerably reduced when it is time-shared. Machines that have been specially designed for time-sharing include the GE 245; GE 645; IBM 360/67, PDP 8; ICL 1906A and some machines made by SDS. Basically when one is talking about the both remote access and time-sharing, one has to add a facility of the following features to existing computer systems : (i) terminal units at the users end which may include one or more of the following : (a) tele-printer; (b) TV scope; (c) card-reader; (d) printers; (ii) communication channels between the users and the central computer facility. This can consist of coaxial cables, and

some broad band with existing telephone or telegraph lines; (iii) Equipment for changing signals from digital to analogue and *vice versa* which is usually accomplished by modem units; (iv) Equipment at the computer which co-ordinates the receipt of messages simultaneously from different users and stores these messages to the computer in various intermediate buffers.

Further, the computer has its variety of added features which may include added facilities like mass memories, large disk drives, drums, special paging devices, specially designed interrupt features and a supervisor to transfer control from one programme to another.

In today's machines, it is possible to have 40 to 200 users simultaneously using the computer via terminals, depending on the different types of applications that are being performed on the machine.

Additional Feature and their Cost.—A time sharing computer system usually must be provided with large disk storage devices, which may have a capacity of anywhere above 400 million characters. This is necessary because most programmes and data are stored on disk packs instead of on tapes. It is briefly estimated the equipment at the user's end can be acquired for anywhere between Rs. 20,000 to Rs. 2 lacs depending on the equipment one desires. Another cost that exists in such systems, in addition to hardware costs, is the cost of transmitting data. This depends on the charge levied by P. and T. Department if one has to lease a P. and T. line for this purpose. However, before one can talk about the capacity and the stability of communication channels it would be necessary to have the Ministry of Communication and P. and T. Department conducting a detailed feasibility study regarding the existing cables and performance of existing telephone and telegraph lines. Perhaps, if their technical ability can satisfy the needs of computer users, special rates could be negotiated on the bulk-time basis with the P. and T. Board. In this connection, references may be made to the rates prevailing in U.K. where they range between at about £ 200 per annum for unlimited trunk calls from mid-night to 6-00 a.m. The computer system of the nature described above, will have anywhere between 10 to 40 times the capability of existing computer systems.

With regard to productivity, on the other hand, one has to talk about added costs that are entailed regarding the terminals and communication devices. However, it is generally considered that the economics always favours the establishment of large computer centres. In a country which has a shortage of capital, one has to make all possible savings that can accrue on capital equipment, particularly when it involves foreign exchange. On the other hand, opponents of the in-house computer system are not necessarily incorrect when they say that a centralised computer is a major handicap in some cases. They say that one has to bear the cost of communications, risk, and the possibility of revealing the confidential information and perhaps bear the grave consequences of a complete break-down, if the centralised computer facility fails. Of course, the last argument is specially important if the centralised computer facility has no back-up arrangement. Hence it is perhaps to consider the feasibility of having 2 computers at the same location such that the second one can take over the function of other if one fails. It is believed that in advanced countries one generally concedes the superiority of such large computer systems with regard to the applications where input/output is relatively limited, in other words, where computation needs are large. In contrast to this, the use of such facility is fraught with danger, if one is talking about high volume of data and results being transmitted, in which case the in-house computer facility is usually preferred.

Under Indian conditions since it is easy to demonstrate that the former categories of applications are particularly important, it is imperative to review the facilities of establishing such large computer facilities. Due care must be exercised in this connection since one may also consider the advantage of secrecy and ownership pride that are offered by in-house computer systems with regard to commercial data processing. However, the arrangements of keeping secrecy can be ensured in the Central Unit as they are enforced in all industrial statistics.

CHAPTER 11

SUMMARY OF FINDINGS AND CONCLUSIONS

Technological Developments

The scientific and technological developments in the world today are confronting human society in varying degree. The environmental change along with its new conceptual systems, technologies, machines and tools is coming to our industrial life at an increasing pace. Automation is one such change of which the transfer machine, the servomechanism and the computer are major symbols.

Meaning of Automation

11.1. We understand automation as a self-regulatory process of mechanical sophistication characterised by the use of automatic control devices and electronic equipment which replace human regulation and control of machines and the system of communications. In this, the electronic computer is a self-controlled device capable of obtaining, storing and processing information at an unbelievably fast speed, accuracy, efficiency and logic.

The Computers

11.2. The computers are already operating in various fields, such as, guiding missiles and space vehicles, scientific work and technological design, economic activities and Governmental administration. It is a versatile and powerful tool indispensable in certain fields of our national and economic activities strategic, tactical, policy-making or operational—for accomplishing the desired objectives. Moreover, in the industrial and business sector, computer forms an integral part of the modern Management Information Systems (MIS) which is an important technique of effective communication and co-ordination of data and of decision-making.

11.3. Most commercial data processing computer installations use small or medium size machines, while Universities, Research and Development organizations, and the nuclear, oil and aerospace industries—being very much technological oriented depend on large computers.

The Growth

11.4. Although, the first electronic computers were built-up and completed during the late 1940s, they really started making in roads in business and industry in 1959. In the 1960s, they have made rapid strides in the industrially more advanced countries. Thus, at present, there exists all over the world, over 53,000 computers—40,000 in USA, 3,500 in West

Germany ; 3,000 in Japan ; 2,800 in U.K. ; 2,200 in France and 1,750 in USSR. About 100 computers are in operation in India.

Inevitability

11.5. We consider that there is a certain amount of inevitability regarding automation and technological change, and the computer is one element in the manifestation of change ; that resistance to change is normal human characteristics and its expression in our industrial life is found in the labour's protest to 'office-automation' in the form of electronic digital computer. We, however, think it desirable that man learns to manage and adapt to change. We also believe that man has infinite capacity to adapt to change, and he does so when such change is gradual, individually beneficial and socially desirable.

The Computer-Scene in Maharashtra

11.6. At the beginning of 1969, there were 26 electronic digital computers¹ (in 23 installations in Maharashtra) accounting for about *one-fourth* of the total working computers in India. Of these, 12 computers were in the private sector, 8 in the public sector, and the remaining 6 in Educational and Research Institutions. The Electronic Data Processing (EDP) Organisations in the industrial and commercial sector are fairly big firms with relatively large volume of business, each of Rs. 92 crores on an average. About 80 per cent. of the total computers in the State are medium size IBM Machines, most of them being the second generation computer system in 1400 Series. They are equipped with peripheral devices and have relatively slow operating speed. The initial choice of the model has been largely influenced by IBM's recommendations, although immediate availability, reliability, suitability of the model and the supplier's reputation were also some of the weighty considerations. Normally, a medium size computer (including its peripherals) costs about Rs. 25 to Rs. 30 lakhs and requires, on an average, a monthly maintenance of Rs. 7,000 to Rs. 10,000. It is also available on rental for roughly 1/50th of the price of the computer. In this respect, our estimates work out at nearly Rs. 10 crores, being the investment on all the computer installations in the State's economy.

Major Objectives

11.7. The use of computers in commercial applications stems from *three* major objectives, *firstly*, the volume of data is too large for manual processing ; *secondly*, to reduce time-large in receipt and processing of data ; and *thirdly*, to introduce modern management control system. Nearly 70 per cent. of the EDP Organizations responded that the computations required could only be done by the computer, and only about

¹Five more computers have been added in the recent months.

50 per cent. had cost considerations in mind. In a few cases, there may be a somewhat mistaken belief in economic and social gains, or a sense of status or prestige. About one-fourth of the EDP Establishments have arisen out of the replacement of their Unit Record Machines. Besides, the feasibility studies, which preceded the computer installations generally, were overwhelmingly techno-commercial in nature rather than socio-economic in character, and they were conducted in co-operation with IBM, ICL, etc.

Installing of Computers

11.8. Moreover, the actual installation of computer takes a couple of years time after taking a decision about it; but once the computer is installed, the equipment is set to production within a month or two usually. By and large, labour has responded fairly well to the computer-installation, and that, only a few organizations have experienced a measure of labour protest or some mild resistance, in the form of token strike, mass demonstration or labour union's representation to the Government.

Nature of Computerisation

11.9. Office automation has been introduced in certain manufacturing organisations, such as, the engineering, pharmaceutical and petro-chemical complexes; in the Marketing and Distribution sector like the oil companies and electricity undertakings; in certain sections of Rail-Road, transport and civil aviation; in educational, training and research institutions.

Character of Applications

11.10. In the Commercial Data Processing sphere or under the computer-based Management Information System (MIS), the *more usually* selected jobs for computerisation are pay roll, financial accounting, production statistics and inventory control; while billing, share accounting, management account, PERT/CPM and linear programming constitute *fairly usual* job applications. Market statistics, purchase bills, forecast/credit control, production control and budgeting, however, figure in a minor way. In the Insurance and Banking Sector, file maintenance, premium loan, interest billing, renewal commission and bonus commission billing constitute major jobs. In the sphere of transport, freight and passenger traffic, engine and train statistics, goods and store accounts, passenger, accounts and wagon control occupy the major time of the computer. The Educational and Research Institutions use their computer facility mainly for scientific and research work and processing of examination results, etc. It would appear that, in the general commercial and industrial sector, the decision-oriented applications do not as yet play a prominent role.

Branch Offices and Computer Facility

11.11. The EDP Organizations propensity to computer utilization is an important element in ascertaining the impact of computerisation on the various sectors of economy. Our Survey reveals that, in the sector of Manufacturing, Marketing and Distribution, and Computer Service Organizations, almost all the Branches within and outside the State make use of the EDP facilities (as output) of the Head-Quarters in the State. In other sectors, the Branches within the State alone use the EDP facilities provided by the Head Office. Although some organizations, 'sell' a few hours of their computer-time to outside organizations, those in Manufacturing, Transport and Banking and Insurance Categories utilise their computers entirely for their own work.

Extent of Computer-utilization

11.12. The current utilization of computer-time varies from organization to organisation and from one Category to another. In relation to the established organizational goals, over *two-thirds* of the EDP Installations have achieved *full or fairly satisfactory* level (75% to 85%) of computer utilisation. In quantitative terms (especially in the Hired Equipment sector), an average monthly rental per installation ranges between 190 to 235 meter hours which corresponds to about 400 physical hours. Moreover, 48 per cent. of the total EDP installations in the State work for 13 to 16 hours a day; while another 18 per cent. use their computer round the clock. The Educational and Research Institutions, however, do not use their computer facility very adequately. Incidentally, we find that the EDP Organizations may take 3 to 5 years to reach a one shift (176 meter hours) utilisation of the computer.

Employment in EDP Department

11.13. The EDP Departments of all Computer Organizations in the State have employed, among themselves, 1,159 people of whom two most sizeable categories viz. Key Punch Operators, and Computer Programmers and System Analysts together account for as many as 687 persons or 59.4 per cent. of the total. Those who are trained or transferred from within, constitute 69.3 per cent. and are fairly well distributed among the various job categories within which Punch Operators and Programmers/System Analysts account for 54 per cent. and 71 per cent. respectively. The Transport, and Educational and Research sectors employ about 4 Programmers and System Analysts on average per installation, as against the corresponding figure of 8 to 9 persons in the other sectors.

Conditions of work and service

11.14. The work environment and the conditions of service in the EDP Departments were, by and large, more congenial to better work performance, in that the work has become somewhat simpler and calls for substantially higher skill requirements, particularly for computer programmers and system analysts. In a general way, the EDP personnel has been placed in comparatively much advantageous position in terms of higher wages, better incentives and additional advantages of fringe benefits, etc. Currently there is no Model /Norm regarding the criteria for their selection, but we feel that such criteria may be evolved in mutual consultation with the management and the unions, of course in co-operation with the experts in the field.

Training Aspect

11.15. Although increasing efforts are being made in more recent years to provide adequate training facility qualitatively as well as quantitatively, much remains to be done in this field. Since the training is an important aspect of any effective computerisation system, we think that adequate and suitable training programmes in an integrated way should be provided at all the levels of computerisation personnel. Thus, at the lower level viz. punch operators, such programme should be oriented more towards "on the job training"—while at the middle level i.e., programmers/system analysts, more comprehensive (training programme) may be necessary so as to enable them handle the computer system independently. At the higher level too, we consider that there should be a Two-Year full-time Course (or one year after M.Sc.) leading to an equivalent M.Sc. degree in computer Science.

Effects on Work Organisation

11.16. Automation and especially office automation provides a new and more dramatic dimension to personnel and manpower policy of the undertaking; in that the "clerical workers" feel its impact in the first instance. For them our Survey reveals, the work has become somewhat simpler and a similar tendency is indicated at the higher levels of the organization. A few workers have secured more interesting and better paid jobs; but most have remained at the conventional levels. The hours of work have also remained more or less unchanged. On the whole, the office employees have yet to feel the impact of electronic computerisation. However, since computer has come to the State's economy only very recently, it may, perhaps, take few more years before its impact is felt.

Advantages to Management

11.17. In our view, office automation gives management a certain advantage of communication, organisational planning and control and decision making, and to a certain extent, increased production and higher productivity; in short, the advantage of speed, quality and economy. Our Survey also reveals that the major advantages have been in the areas of improvement in information, increased efficiency in the maintenance of office-records and the coupling of different processes. In other areas, however, the effects do not as yet appear to be substantial.

Impact on Labour

11.18. One of the most important aspects of office-automation is its impact on labour and especially on employment. It is true that some applications of automation displace labour. Our Survey, however, reveals that those who were displaced or rendered surplus were generally absorbed in alternate jobs or in the expansion schemes of the undertaking. In the process however, *some* future job opportunities might have been lost.

Employment Situation

11.19. Certain *indicative* trends are revealed through analysis of the employment situation in the EDP organisations in Maharashtra. Thus in the Manufacturing category, both the office and the clerical employment increased by 39.7 per cent. and 27.6 per cent. respectively—the latter increased relatively slowly, thereby showing a decline in the *clerical potential* (the Ratio of the clerical to the corresponding office employees) by 3.1 per cent. between 1965–69. In the Marketing and Distribution sector, however, both the office and the clerical employment declined by 5.5 per cent. and 20.1 per cent. respectively—the latter declined faster thus reducing correspondingly the clerical potential by 7.1 per cent. over the same period³. In the Transport sector, the office employment showed a very slight increase of 0.9 per cent. only, while there was a decline by 8.7 per cent. in the clerical employment thereby bringing down the clerical potential by a narrow margin of 1 per cent. during the same period. Lastly, in the Banking and Insurance Sector, the office employment increased by 26.2 per cent., while the clerical employees increased only by 17.5 per cent., thereby leading to a relative fall in the clerical potential of 6 per cent. during the period of 4 years. The picture for the entire computer

³Alternatively, the ratio of the clerical employment in 1965–69 to office employment in the year 1965 as the base, would show a decline of 9 per cent in 4 years, or 2.25 per cent on average per annum.

sector of Maharashtra, however, reveals that both office as well as clerical employment showed an increase of 4·6 per cent. and 3·8 per cent. ; or in absolute terms from 1,77,674 to 1,85,826, and from 34,246 to 35,565 respectively—the latter increased relatively slowly, indicating thereby very slight fall in the clerical potential of 0·2 per cent. between the period of 4 years, or 0·05 per cent. on average per annum.

Indicative Trends

11.20. While ascertaining the casual link between the 'span' of computed application and the rate of computerisation on the one hand, and the reduction and displacement in the labour component of the Organisation concerned on the other, our analysis shows that where only a few jobs were computerised during the average span of 14 months or so, and where the computer utilisation ranged normally between 60 to 85 per cent. (with reference to the organization's goals), the trend was characterised by a slow increase, at diminishing rate both in the office as well as clerical employment of these Organizations. *Secondly*, where certain jobs (more information-oriented than decision-oriented) were computerised over a period of 3 years and more, with 65 to 100 per cent. computer utilization, the trend in the office as well as the clerical employment showed relatively faster decline. *Thirdly*, mixed trends were revealed where the various elements in the 'span' and 'speed' of computerisation have combined. In other words, a relatively longer 'span' of computerisation with deeper 'penetration' trends to result in relatively a greater fall in the clerical employment as well as in the clerical potential ; that, where information oriented applications are computerised even with lower percentage of computer time utilization, it probably leads to a much greater fall in the clerical employment and also in terms of clerical potential as compared with relatively higher percentage of computer-time utilisation with progressive computerisation of decision-oriented applications. In the cases of recent installations, however, somewhat negative trends are indicated.

Methods of Adjustment

11.21. Besides, our Survey also reveals a somewhat interesting picture of the method of adjustment of 741 employees who were displaced in six EDP Establishments. Of these, only 6·2 per cent. were absorbed in expansion activities, while as many as 71·7 per cent.—the largest share—were provided alternate jobs. About 12·5 per cent. were retrained and put in the computer section itself, and the remaining 9·6 per cent. were absorbed elsewhere in the Organization. Moreover, within the various categories of Organizations, the Transport sector provided alternate jobs to all their displaced personnel, while the corresponding figure for Banking and Insurance, and Marketing and Distribution sectors have been 75·8 per

cent. and 19·4 per cent. respectively. On the other hand, in the Marketing and Distribution sector as many as 65·8 per cent. was absorbed *elsewhere* in the organization, while Banking and Insurance absorbed only 9·3 per cent. in the expansion, but retrained 14·9 per cent. of their displaced personnel and put them in the computer section.

11.22. Although, there have been a few stray cases of increase in the staff associated with the office automation, the situation has not been in any way indicative of a general trend, and wherever such trends were observed, the increase appeared to be of very marginal nature.

Hiring of Computer Time

11.23. The computer establishments are relatively big firms having a large volume of business, considerable initial investment on the project, and substantial regular expenditure on maintenance. As such, the medium size firms cannot afford such a venture and therefore, they buy 'computer time' of the Computer Service Installation when the need arises. Our Survey reveals that most of these firms are 'public limited' Companies and are situated within the Greater Bombay area. They have started buying computer facility only since 1966 and more or less for the same reasons for which larger firms have installed the computers. Thirteen organizations reporting data for our Survey use amongst themselves only approximately 200 clock hours of computer-time per month for job applications such as linear programming, share accounts, market statistics, inventory control, etc. There has not been much labour resistance since they have been making very limited use of such computer facility. Consequently, there appears to be positive improvement in information and cost reduction; but no staff economies are indicated.

Employment Aspects

11.24. As regards the employment component, we find that Mills Sector and Engineering Companies—both of which share nearly equally—together account for 97·1 per cent. of the total of over 16,000 office employees (the other sectors figure only very insignificantly). The Subordinate, others and clerical (pure) that account for over 75 per cent. of the total, may be exposed to the effects of office automation provided these organizations mainly go in for computerisation of purely information-oriented applications, and that too, at the progressively fast speed.

11.25. Besides, these organizations are attached with separate computer sections employing trained system Analysts and Programmers and the other staff. Most of them use their own programmes, in that, standard programmes provided by the computer manufacturers have not received their suitable preference.

URM Sector

11.26. Since the Works Study Team considered it worthwhile to Survey the organizations having Unit Record Machines (or Data Processing Equipment), a few interesting results have been noted here. Thus 50 URM organizations—out of 78 which responded to our Questionnaires—were studied in somewhat greater details. 46 per cent. of them were ‘public limited’ companies, while the Statutory, Corporation and Government Departments constituted nearly *one-third* of total URM Sector. For 34 organizations, the volume of business amounted to each over Rs. 14 crores on an average—within wide individual variations ranging between Rs. 9 crores for Manufacturing, and Service and Marketing Categories to Rs. 38 crores for Transport, and Insurance and Banking Companies³.

The Investment

11.27. Sixteen organizations (or 32 per cent.) have purchased the DP Equipment, while 34 organisations (or 68 per cent.) have hired it. According to our estimates, the total investment in Data Processing Equipment of both these sectors comes to Rs. 2.5 crores approximately, and with another Rs. 2.5 crores or so, as the investment estimates for 50 more DP Organizations (for which we do not have adequate data) the total investment in the URM Sector of the State’s economy may roughly work out to Rs. 5 crores.

The Objectives

11.28. By and large, the URM organizations went in for DP Equipment nearly for the same reasons as in the case of EDP Establishments. Besides, there seems to be an element of substituting labour by UR Machines, since only about 40 per cent. of the total URM organizations responded that the job could be done only by the DP Equipment. This probably implies the volume of data, and the efficiency in terms of time for the results to be useful. Cost considerations also revealed very low priority. Few URM Organizations had understanding with labour and their unions while installing the UR Machines, and especially in the industrial and business sectors.

Developments

11.29. Before the advent of Computer, UR Machines existed in all the Categories, except the Manufacturing Sector; but an overwhelming majority has sprung up only in the last 4 to 5 years (almost concurrently with EDP Installations). The reasons may be found in relatively small

³Incidentally, we think that 10 to 15 relatively large organizations might go in for computers in the near future, while the rest may be contented with the ‘hiring’ of computer-time facility.

volume of data, traditional structure of organizations and the late development of scientific and professional management in the State's economy. Generally, it takes only a few months to install the UR Machines and that the equipment can be put to production almost immediately.

Job-Applications

11.30. Amongst the computer--jobs, information--oriented applications, such as, financial accounting and pay roll, account for a greater proportion (54 per cent.) as compared to the decision-oriented applications, such as, production statistics and inventory control. The other jobs such as billing, purchase bills, management accounting, budgeting, etc., figure in a minor way in the total scheme of things. We also find that, as the management becomes conscious regarding the better use of DP Equipment, the shift from information-oriented jobs to decision-oriented applications is indicated.

Level of Utilization

11.31. Forty-nine URM organizations have amongst themselves 284 branches in Maharashtra (49) as well as outside (235). Only 38 per cent. of the branches within the State used DP Equipment of their respective Central Offices in the State, but branches outside the State did not use the DP facility of the Head Office. The utilization of Machines for the State as a whole is around 65 per cent. of the average standard. 77 per cent. of the URM Organizations reporting data have reached 82 to 100 per cent. utilization of the available DP Facility; in other words, more than *three-fourths* have reached an adequate level of utilization of UR Machines. The Service and Marketing Agencies, and the Educational and Research Institutions appear to be relatively more conscious in this respect than the Manufacturing and Insurance and Banking Sectors.

Some Features

11.32. The URM Sector of 50 organizations employed 756 people total, of which 45 per cent. were employed as Key Punch Operators. Another 21.7 per cent. found jobs as UR Machine Operators, while rest of the categories taken separately, did not constitute any sizeable proportion. Little over 48 per cent. of the total URM Personnel is trained or transferred from within the Establishment concerned, and the rest were recruited from outside. Among those who are trained or transferred from within, Punch Operators account for nearly 32 per cent., while URM Operators constitute over 25 per cent. of the corresponding total. 86 per cent. of URM Organizations reported improvement in information, while 56 per cent. reported coupling of process, and about 25 per cent. to 30 per cent. gained staff economies and reduction in cost.

Employment Side

11.33. With regard to the impact on employment, displacement, etc., we find that, where the DP Equipment was installed before 1960, the clerical potential declined by 3.6 per cent. between 1961-65. For those who had DP Equipment installed between 1961 and 1965, the corresponding figure works out at 2.6 per cent. between 1965-69. However, the trends in individual organization indicated a somewhat dissimilar pattern among themselves. The total picture on the whole revealed that both office as well as clerical employment increased by 20.20 per cent and 11.9 per cent. or in absolute terms from 18,607 to 22,363 and from 7,522 to 8,418 respectively—the later increased relatively slowly, thereby showing a fall in the relative clerical potential by 2.81 per cent. (from 40.41 to 37 per cent.) between the span of four years (on the basis of comparative time analysis principle).

Manpower-Adjustments

11.34. Besides, analysis of 14 URM Organizations which reported displacement of staff bring us to the conclusion that, while making manpower adjustments, 46.6 per cent. of the total displaced personnel were transferred to URM Section, while another 26.1 per cent. were given new jobs; 24.8 per cent. were absorbed in expansion, and the remaining 2.5 per cent. were provided with alternate jobs. It appeared that not a single person was retrenched by these organizations, while making manpower adjustment to the introduction of Data Processing Equipment in this Sector of our industry in business.

Economic and Social Consequences (of Office-Automation)

11.35. Throughout history, technological developments have frequently necessitated readjustments in the economic and social relations in our industrial life. In the advanced countries, automation in the form of electronic computer is rather an instrument of growth, and its use is very vital to the conditions of national progress. In the developing countries, however, automation assumes a different dimension and takes place in different context. In the present conditions of Indian economy characterised by chronic shortage of capital on the one hand, and large labour surplus on the other—computerisation needs to be perceived primarily as a problem of proper and optimum utilization of both these resources.

Capital Investment

11.36. As regards capital investment, automation not only represents a higher technology, but also highly capital intensive techniques that are built in its sophisticated machinery. It requires considerable initial investment on the project and substantial regular expenditure on maintenance.

Then, there is a very high rate of obsolescence and equally high degree of dependance at least at the initial stages—on the foreign technical know-how. There is also the problem of acute shortage of foreign exchange resources. It is, therefore, argued that such investments in automation would cause considerable strains on our capital resources. One manufacturer, however, claims a net export surplus of such equipment. Besides, considerations of social productivity—whether the use of same resources will not bring a higher return elsewhere in the economy—cannot be easily overlooked.

Some Arguments

11.37. Moreover, it is said that automation involves considerable social cost of manpower displacement, unemployment, retrenchment, etc. Arguments are also advanced that, capital investment of high magnitude in computerisation may not result in corresponding benefits which could offset the strains involved in such investments, that even in the sphere of export oriented industry, their excellent performance does not only depend on industry's cost structure, but on some other factors as well. There seems also not much hope—it is expressed—that automation would contribute considerably to our competitive advantage through the development of national and international markets. Again, there is no built-in guarantee, at present, that the benefits of low cost, if any, will be necessarily passed on to the consumer in any equitable manner.

Manpower Effects

11.38. Manpower effects of computerisation imply changes in labour requirements, along with job profile and changes in skills, problems of absorption and re-deployment, and retraining and above all, integrative adjustment in the labour relations as a whole. The greatest disadvantage that tends to result from computerisation is possible impact on the displacement, unemployment and reduction in the potential employment of the employees. We think that since the economy does not keep pace with employment dislocation and that, job opportunities do not grow as fast as necessary, problems of displacement and redundancy continue to cause us considerable anxiety, in that they do not admit of any easy solution immediately. A section of labour movement considers automation or computerisation as a "painful luxury" in the present circumstances. They have strong apprehensions regarding the human and social costs involved in an all-out automation and indiscriminate application of computers to the various categories of industrial processes and office-work. Since they have not been consulted in this respect by the managements concerned, it has created certain amount of misunderstanding and organisational strains in labour-management relations. They entertain a fear that computerisa-

tion would lead to overall national disadvantages in terms of curtailment of the existing employment or reduction in the potential employment in future—and more so in office-work, in that they feel—“if once the gates are opened for the computer in any department of civilian sector, it will force its way in other departments as well”. They have, therefore, agitated for “job-security” (or “at least assured employment”) during the phase of adverse impact of computerisation. And their attitude in the above back-ground is understandable.

Labour's Look

11.39. However, the most significant aspect of labour's protest and resistance to computerisation lies in their feeling that Managements have proceeded with automation without taking them into full confidence and without giving due weight to their view point. They entertain a feeling of being ‘hurt’ and that, they have not been given their due ‘status’ in the organization and its system of labour relation. They have therefore, suggested that the Union should be brought into the picture and associated at the decision-making stage itself regarding computerisation, and not after the computerisation has already been decided. They have further suggested that Management should consult the Union on all aspects of automation and that computerisation should not be treated *on par* with rationalisation. To this end, they have made certain comments that, if the routine clerical jobs are not computerised, office-automation may not create very serious problems. Secondly, retrenchment of the existing labour force on account of computerisation should be categorically ruled out. Thirdly, while alternative jobs are being provided for easing out tension, the Voluntary Retirement Scheme (as a practical measure) may be encouraged, with the scope of new recruitment being limited outside the existing labour force. *Fourthly*, new programmes of manpower training may be undertaken enabling the redeployment of the displaced personnel; and this implies proper planning and the phasing out of the whole scheme, selecting the areas, where computerisation may be introduced with priority, and the rationalisation of the entire organisation in the light of the new perspective.

A Few Reactions

11.40. Although labour movement in general has resisted an all-out automation, the more knowledgeable section does not oppose automation or computerisation blindly. Their protest is mainly against computerising the jobs which can be done by the conventional methods within reasonable time, with reasonable degree of accuracy and at reasonable cost. To this end, they have suggested that automation under present conditions, should be selective, in that the objectives of defence and scientific advancement,

training and research should receive our priority considerations. From the point of social policy, we consider that the principles and methods of manpower adjustment developed in the advanced countries have their limits of application to the Indian situation. The general trend of opinion in the country, at best, favours principles of "automation without tears", in that no lay-offs are made, and that the reduction in manpower requirement is done generally through (natural) labour-force attrition. Thus, the new employees may not be hired as far as possible, and the old ones from within be trained.

Institutional Arrangements

11.41. As for the institutional arrangement, the employers have suggested mutual bipartite negotiations for reaching agreement on computerisation. Trade Unions and labour-movement, on the other hand, prefer a Tripartite national level—as well as State level bodies to lay down the guide-lines and the standing committees at appropriate levels supported by expert's advice. We think that computerisation is best introduced by prior consultation with the Trade Unions concerned and in co-operation with the employees of the undertaking, of course, within the safeguards for the community's interest.

Some Implications

11.42. In fact, there always exists a certain amount of inevitability regarding technological change, and we have no choice except of regulating its speed and selecting the spheres of its operation on a priority basis, phasing of the programme and the gradualness of the process. Thus, if the employers take labour unions into confidence, consult them, and reach a mutual agreement with them, having sufficient regard for the interest of the society at large, most of the current misapprehensions, misunderstanding and resistance will be reduced and the well-meant progress of computerisation greatly facilitated. In order to achieve these desirable results, it is contended that an integrated policy regarding, automation, rationalisation or modernisation should be clearly enunciated both at the national as well as state levels.

The Meeting Ground

11.43. It is true that, owing to large-scale unemployment and under-employment in our economy, there is a natural protest against computerisation, in that, when workers conceive the computer as robbing of their jobs, and if they demand for job security and employment assurance, they cannot be blamed for being selfish or short-sighted. However, while taking a serious note of the implications of unrestricted use of computerisation under the local conditions in formulating the labour-policies, we

may not be to yield to a negative attitude on the part of a section of our trade unionism and labour-movement. Infact, labour has been usually fair in this respect, and that, they have resisted change only when the managements have given very low priority to the employment aspects of computerisation. To us it appears that greater opposition to computerisation comes from the type of unemployment and job-insecurity it creates and the way in which the programme is planned, phased out and put into action. Thus, the labour's approach to introduction of computerisation is conditioned by the manner and circumstances in which it is introduced rather than what is introduced or adopted. We therefore, consider that the issues arising out of it need to be considered with sympathy, understanding and imaginativeness on the part of the management.

Employment Equilibrium

11.44. In a developed country, the economy usually operates at the *full-employment* or the *near full employment* level, where abundance of capital resources help in pushing the economic expansion ahead and in creating continuously the alternative choices in the 'labour shortage' sectors. On the other hand, in a developing country like ours where the economy operates at the much lower level of *under employment* equilibrium, and where the paucity of capital resources is a 'limiting' factor in creating adequate employment opportunities to the growing labour force, automation needs to be perceived in a different context. Moreover, the speed of change, and the total economic, social and cultural environment in which such change takes place must also be taken into consideration. In that, while introducing the programme of computerisation, we have to ensure simultaneously that employment opportunities do not suffer much.

A Different Context

11.45. It is, therefore, difficult to compare the electronic computerisation in the developed countries with our own; and considerations for going in for computers have to be sought in a different context. Our commitments in formulating a progressive social policies require that we should provide gainful employment to our labour force to the largest extent possible. Thus, computerisation should not be at the cost of labour, and that, its benefits should be shared by employer, worker and the consumer. In a way, it should be governed by the principles of progressive national policy; in that it should be economically feasible and socially guided, so that our resources are more rationally allocated and properly utilised.

Compulsive Element

11.46. On the other hand, it may be conceded that certain level of technological advance is necessary for rapid industrialisation and faster

economic progress. Also, there are certain compulsive factors such as, security and defence of the country; scientific developments and research; technological innovations and modernisation. Besides, there are certain jobs where the human being is totally incapable of doing it because the process and the magnitude of the job is beyond human ability; or that he is unable to do it within a reasonable time with reasonable efficiency; and at reasonable cost. It is also necessary to reduce human drudgery in certain process; and thus 'make human use of human beings'. Moreover, there may be certain economic compulsion of overwhelming character, as in case of export oriented industries which have to meet severe competition in the international market, and in all such cases resort to computerisation cannot be avoided. Over and above, we have to reckon with 'dualistic' development⁴ in our industrial economy, and which factor is likely to continue for quite some time in future. In short, the problem is one of reconciling apparently conflicting objectives, priorities and perspective regarding our economic and social policies of rapid industrialisation and promotion of social justice. In the main, the problem is regulating properly the phase of advance of automation or computerisation on the one hand, and safeguarding and protecting the interest of the workers and promoting the good of the community as a whole on the other. In this context, we have to realise that in the developing country like ours, the progress of automation or computerisation is limited by the general availability of capital resources including foreign exchange, trained personnel and conditions of labour relations, the attitudinal responses and above all the gearing of educational system to the computer needs.

Spread in Maharashtra

11.47. In the current tradition, and with the limited experience of computerisation in the country, in general, and in the State of Maharashtra, in particular, we think that automation will spread to, the various sectors of the economy only gradually. As for Maharashtra, the impact of computerisation has been relatively small, uneven and defused. There has been little or no indiscriminate resort to computerisation and the situation, on the whole, is moderate.

11.48. The general picture of employment trends in Maharashtra during the period under study, both in the private and public sectors of our industry and business, reveals that the total employment during this period increased by 3½ per cent. per annum more in the public sector (5.3 per cent.) than in the private sector (1½ per cent.), although both these sectors share nearly equally, the employment in the State. However, the

⁴Thus, the traditional labour intensive sector which provides employment to large labour force continues to exist and in fact thrives, side by side with the development of the modern large-scale capital intensive sector.

real growth rate of employment (considering the given population growth of about 2 per cent. on an average per annum) for the State as a whole would work out at $1\frac{1}{2}$ per cent. on an average per annum. With this background, we think that situation in the next 4 or 5 years is not likely to be very bright in any way. In the organisations which have built-in system of method improvement, and in newly started organisations, its impact will be felt only slowly. Since computerisation tends to provide for greater safety, ensure higher standards of efficiency and provide better tool of managerial control, the progress will have to be channelised properly so as to avoid, or atleast minimise its adverse impact on labour, industry and the community.

Some Indications

11.49. We think that the impact of Electronic computerisation would be felt gradually only over a period of time, as the economy is geared progressively to the computer requirements. There may be some sectoral decreases in recruitments in the existing employment, as well as, in the new recruitment, as the jobs that are currently done by conventional machines are put on the computer progressively in future⁵. However, the nature and extent of such impact would depend upon the (i) the nature and growth of business; (ii) the nature of computer-applications and the speed of automation; (iii) the progress of industrialisation; (iv) the nature of Governmental regulations; and (v) the rate of economic growth in general and in a given sector in particular. Thus, in order to maintain the balance of employment in the economy, the growth rate has to be sufficient, not only to generate new jobs to adjust the displaced personnel but also to absorb the new entrants into the labour force. The developments in certain sectors of our business and industry probably contain a possibility of getting a sizeable number of new and additional jobs in future.

Inter-State Impact

11.50. In the Inter-State context of things, we find that out of about 100 working computers in India at present, nearly *one-fourth* are in Bombay (Maharashtra) region; 15 to 16 per cent. each in the regions of Calcutta, Madras, and Delhi; and the remaining about 28 to 30 per cent. are distributed outside these regions. Among the computer applications, accountancy procedure predominates in most business houses, while a total Management Information System (MIS) with a degree of sophistication find favour only with a few EDP Organisations. The use of computers by the Educational and Research Institutions should be better planned and there is a scope for extensive use through mutual

⁵On the other hand, there has also been a fall in the employment during the last few years in certain sectors of our economy, even without the computers being installed.

co-operation. It is also found that the rented machines generally are put to greater use than the purchased ones. Thus, the Calcutta region represents 42 percent of All-India rented time, while correspondingly Bombay, Madras and Delhi regions account for 38 per cent., 11 per cent. and 9 per cent. respectively. Individually, in Maharashtra, the average monthly time usage per installation works out at about 210 meter hours or about 400 physical hours.

Certain Implications

11.51. In the very nature of our assignment, we have had considerable limitations on collecting Inter-State data regarding the effects of automation, both economic and social. However, we may observe that given the speed of computerisation, its manpower effects in any region would largely depend upon the rate of industrialisation, the level of economic development, and the general prosperity of the region concerned. Under certain favourable conditions, computerisation may serve as a catalyst of a modernisation process. Usually, the effects would be more visible in the State where Branch Offices of the EDP Installation from other States are located. Since Bombay region has very few such Branch Offices, at present, the adverse Inter-State impact is likely to be small, mild and gradual.

Self-Reliance

11.52. While bearing in mind certain National considerations, including our emphasis on the principle of self-reliance and considering the weight of socio-economic forces in the growth and progress of computer economy, we consider that India's demand for EDP equipment during the later part of 1970s may not exceed 300 medium-size, and about 1,000 small-size machines, and probably, this number may be considerably small, if the 'Centralised Computer System' gains acceptance and popularity. The total investment on such a venture may roughly be Rs. 100 to Rs. 110 crores at constant (current) prices with about 15 to 20 per cent. of it as the foreign capital element. However, this assumes a certain degree of commitment to self-reliance and favourable response by all who are concerned with making of economic and social policies of the country. As regards the techno-commercial aspect of computer manufacturing, we think that, except the manufacturing of some peripheral equipment like tape drives and disks, which calls for a high magnitude of capital investment and to still avail of the economies of scale, huge expenditure on research design and development of engineering and electronic skills, and above all the maintenance of quality consciousness and high precision standards, we should be able to make considerable

head-way in the development and manufacture of the Central Processing Unit (CPU), Punch Card Machines and Unit Record Machines in the near future.

Overall Picture

11.53. Maharashtra today represents a picture of an economy operating at various levels of technological development. The State economy has invested Rs. 10 crores in some 30 working computers covering some 2 lakh office-employees working in its various sectors of business and industry. Another 100 and more URM Installations account for about Rs. 5 crores investment covering at 80 to 90 thousand office employment. We may add to this 20 thousand employees, belonging to the 'computer time-hiring' sector.

The Prospects

11.54. The situation, in general, is not very satisfactory in respect of quality and types of computer applications adopted, the available training facilities, the attitudes of labour and management towards computerisation, and above all, our total approach to 'problem solving' in this sector of the State's economy. It calls for not only an understanding of the benefits of computerisation, but also the mechanics of introduction of this highly technical instrument of change in an environment of apprehension, distrust and insecurity. We think that the basic problem is one of educating management, training the workers, securing co-operation of the labour movement, and above all, enlightening the Governmental administration at all levels, on this matter, so that all are equipped psychologically, socially and technologically to the proper use of EDP Equipment. There is also considerable scope for qualitative improvements in terms of computerisation of jobs; in that the decision-oriented application should receive preference even at the beginning. We should like to emphasis here that computer application must not be blindly imitated, but must be tailored to the needs of the entire range of our industry and business. It is to be realised that the greatest benefit to be derived by the use of computer is not through clerical savings but by exploiting its computational ability for improved decision-making in certain foreseeable areas, such as, production programming, inventory control, resource allocation, job-costing, etc.,—in general, for working out an optimum solution for maximising returns and benefits. Here the techniques of Linear programming, Queing, Simulation, PERT/CPM can be very fruitfully used. In a wider perspective, the requirements of military security, the need in scientific calculations, such as air-craft design, and the complicated mathematical and arithmetic equations in research especially in economic planning have made the use of computer

inevitable. Computerisation implies an element of universality. Thus, resource allocation, plant location, project execution, traffic planning, scheduling of facilities such as airlines, wagons and ports are the job-applications which can be computerised. Computers can be used with considerable advantage in oil refineries, power generation, steel making and a numerous other industrial activities. In all these cases, the ultimate aim is to achieve better operational performance and the increased utilization of the various resources. In Governmental administration computerisation is essential in certain spheres, such as the handling and maintaining National Income and trade statistics, design and implementation of National and State Plans, input-output analysis for resources allocation, and in host of other requirements necessary for formulating the economic and social policies of the country. Further, the computer can be fruitful in weather forecast, space exploration, conducting simulation studies for solving problems too expensive for experimental solution and too complicated for analytical treatment, defence of the country and technological innovations. Besides, computers can also be used in information—coding, storage and retrieval with applications in documentation, library science, criminology, manpower studies and the like.

Selective Automation

11.55. Within this broader framework, we consider that from the economic and social viewpoint, as well as from national considerations, computerisation should be selective and should be introduced in phases. The process should be necessarily gradual and spreadover a period of time so as to minimise its adverse effect on current employment, if any, including displacement and retrenchment, and potential employment in future. The progress in this respect should be smooth; the whole programme of computerisation in any given organization may have to be introduced in consultation with the trade union concerned and carried out in suitable stages. The efforts also will have to be made to enlist the effective co-operation of the employees and to ensure their full participation at the very outset as well as throughout the process. To this end a well planned out phased programme in the context of employment, training, and cost aspects of the whole scheme, should serve a very useful purpose in reducing much of the labour's protest and resistance to electronic computerisation in our industry and business. We think that labour and management can work out agreement on the issue of office-automation, in mutual faith keeping in mind of course the general well-being of the community at large. However, in the ultimate analysis the progress of computerisation depends on good and progressive management, trained workers and strong and responsible trade union as well as enlightened Government policies.

Towards the Future

11.56. In 1970s, Electronic Computers are likely to be increasingly used to finance and administration, research and engineering, planning and control of production distribution and marketing. The computer-based Management Information System may gain considerable importance especially in the sphere of commercial data processing. However, the technological advance is catching us when we are unprepared in point of our social philosophy, economic organisation and political action to meet the exigencies which it creates. Nevertheless we have to realise that it is on the advanced technology that we largely depend for the realisation of the fruits of civilization, and it is for us to convert the same into an instrument of economic growth and social progress, organisationally feasible, individually beneficial and socially desirable.

This Report has been finalised and signed by us today.

Members

(Professor : P. N. Mathur).

(Professor : N. S. Ramaswamy).

(Dr. L. S. Kanodia).

(Dr. V. G. Mhetras).

Associated Members

(Professor : D. B. Sardesai).

(Dr. M. V. Kirloskar).

Member-Secretary

(Shri P. J. Ovid).

Bombay, April 16, 1970.

APPENDIX I

Survey regarding impact of automation (Electric Computerisation) on the Industry and Labour in Maharashtra State :

GOVERNMENT OF MAHARASHTRA

INDUSTRIES AND LABOUR DEPARTMENT

Resolution No. MSC. 73668/119430-LAB-II

Sachivalaya, Bombay-32, dated 10th October 1968

Read—

- D. O. letter, No. CL/AUT/SVY/1568/PJO/R, dated the 19th August 1968, from the Deputy Commissioner of Labour, Bombay.
- D. O. letter, No. 3050/1968, dated the 22nd August 1968, from the Director, Gokhale Institute of Politics and Economics, Poona-4.
- D. O. letter, No. CL/AUT/SVY/1568/R, dated the 26th August 1968, from the Deputy Commissioner of Labour, Bombay.

RESOLUTION.—Government is pleased to constitute works study Team consisting of the following personnel for conducting the Survey to assess the extent and impact of automation in the Maharashtra State :—

- (i) Prof. P. N. Mathur, Gokhale Institute of Economics and Politics, Poona.
- (ii) Prof. N. R. Ramaswamy, The National Institute for Training in Industrial Engineering, Bombay.
- (iii) Dr. V. G. Mhetras, Bombay Labour Institute, Bombay.
- (iv) Shri P. J. Ovid, Deputy Commissioner of Labour, Bombay, Member Secretary,
- (v) Dr. L. S. Kanodia, nominee of the Tata Computers Services Centre, Bombay.

2. The Broad terms of reference of the survey should be to assess the extent and impact of automation (electric computerisation) on industry and labour in the State, including the extent of retrenchment due to automation in the industry and the extent automation would affect potential employment and also the effects of automation on the Society and the economy in general. Within these broad terms of reference the Study Team may frame its terms of reference. The survey should be restricted to electric computerisation in the first instance and should cover automation in manufacturing processes in due course. In the meanwhile the Study Group should collect necessary data in respect of manufacturing processes.

The Study Team should also consider the following aspects :—

- (i) survey of establishment which “ buy time ” on automatized machines or computers.
- (ii) inter-state effects of automation.

3. The Study Group should complete the Survey within a period of six months and submit its report to Government.

4. The Survey should be undertaken with the help of the existing staff from the office of the Commissioner of Labour and Director of Employment, Bombay.

By order and in the name of the Governor of Maharashtra,

B. R. CHINCHOLIKAR,
Under Secretary to Government.

APPENDIX II

Extract from speech by Mr. Tidke, Minister for Labour, Government of Maharashtra, 10th September 1968

(*Occasion : Release of " International Experience in Automation " by Shri Rajabhau Kulkarni.*)

The subject of automation has assumed considerable importance in recent years in our discussions regarding industrial and economic development of the country as well as the formulation of social policy. Automation is identified with a new kind of advanced technology ; and its impact on the ' human resource ' in business and industry is more profound and extensive than is usually understood. Automation represents a second Industrial Revolution moving in the direction of using automatic control devices and electronic equipment to replace human regulation and control of machines and the system of communications. As a development in science and technology it has the basic effect on our economy, on the organisation of work and the life of the society. Automation is a major technical challenge, and although, it has certain of its distinguishing marks, it seems to be a part of the long continuum of man's mechanisation of his work—transforming himself from the machine operator to the supervisor of an automatically controlled operating system.

There is a certain inevitability about the technological change ; and this is true of developing as well as developed countries. The problem has made appearance on the Indian scene and is likely to cause some structural change in the country's economy. However, many of the issues posed by automation and related technological change vary, of course, with the degree of economic development of the country, the current rate of economic growth, and the rate of expansion of the labour force in the economy as a whole.

There is an increasing tendency to over-emphasise the favourable effects of automation on production, method of work and improved work-environment ; and usually instances are cited from the advanced countries like U.S.A., Great Britain, Japan and Germany. The import of these ideas in the Indian situation, however, is greatly limited by the conditions obtaining in our economy. Although, it is understood that technological factor is important in the economic growth and development, its validity may be closely related to the economy which is operating at the *full-employment* or the *near-full-employment* level, where capital is abundant in order to push the economic expansion ahead, and where alternative choices can be continuously created in the ' labour shortage ' sectors. With a developing country it is a different story. Thus, in a populous country like India with a relatively small industrial sector, where there exists a large man power surplus, where the economy is characterised by growing unemployment, where capital supply is greatly ' scarce ' for purchasing very costly machinery and where chronic deficit characterises the country's balance of payment, automation as a factor in economic growth, is likely to receive a less important consideration. Its ' span ' of application and the speed of ' penetration ' has to be properly regulated so as to maximize its relative advantages, such as, more production, reduction in cost, higher wages and improved standard of living and minimise its great disadvantages, viz., displacement of human labour and the consequent shrinkage of employment, and the reduction in the future employment potential etc. It is generally conceded that automation results in considerable reduction in employment ; but it is argued that the unlimited demand for goods and services will tend to prevent unemployment. In case of developing country like ours, however, the same may not be true, since the job opportunities under such circumstances do not grow as fast as necessary ; and that, there is considerable shrinkage of the potential employment opportunities, either in the same undertaking or in the same industry. To the developed countries with ' labour shortage ', automation may be a ' boon ' in disguise, as it does not create very serious problems of redundancy, displacement or unemployment, and shrinking of future job-opportunities. In India, these effects are likely to assume serious proportions, and, therefore, although technological advance is important to economic growth, its baneful social effects have to be prevented or kept within the desired limits. It is in this perspective, that we will have to think of the introduction of automation in Indian Industry and business.

On the one hand, automation gives management, a certain advantage of communication, organizational co-ordination and control, and quick decision making, increased production and higher productivity, or in-short the advantage of speed, quality, and economy; it provides the workers with shorter working hours and more leisure, more safe and pleasant conditions of work, and above all, simpler job, more pay, and better incentives. It is in this context, that the community's interest need to be protected. Thus the scheme of priorities will have to be governed by certain "compulsive" factors human, economic or social. Thus, automation may be permitted in certain jobs, where the human being is totally incapable of doing it because the processes and the magnitude of the job is beyond human ability; or that he is unable to do it within a reasonable time, with reasonable efficiency, and at reasonable cost. It is also necessary to reduce the human drudgery in certain processes; or what Norbert Wiener, the Scientific father of automation says, that we must make "human use of human beings." *Secondly* where economic compulsions are of over-whelming character, as in case of industries, engaged in export and which have to meet severe competition in the international market, automation may be permitted to that extent. *Thirdly*, where redundancy and displacement and shrinkage of potential job opportunities call for a serious consideration, employer or management should not be allowed to over shadow the plight of the common man, who is searching for a place in the growing economy of the country. It is to be remembered that unemployment and poverty are the dangerous enemies of any successful functioning of democracy; and that democracy is meaningful to its people only when all of them are gainfully employed and that the spectre of poverty is largely eliminated from their daily living experience. and *fourthly*, programme of automation must serve the social good or the larger interest of the community as a whole. It is, therefore, very necessary that automation is highly selective.

At the understanding level, automation should be introduced only after *full* consultation with the employees and trade union and under an agreement mutually entered into by the parties concerned only after following the 'guide lines' provided by an appropriate tripartite committee at the national level. And this procedure would protect the national interest. Besides, it may happen, that a trade Union or employees may agree with the employer to the introduction of automation, and that such a step may not be in the interest of the community. And in such cases automation should not be permitted. Therefore, each case will have to be finally decided by an appropriate Government which will be safeguarding the community's interest. On the other hand, the workers may oppose automation, but if it is in the community's interest and would promote social good, such programme of automation should be allowed to be through. Thus we cannot give full freedom to the employer to introduce automation; nor can we give the workers a complete veto to oppose it and hence the Government intervention in the situation.

In this context, I have suggested during discussions at the National Tripartite Level that there should be, at the national level, a Tripartite Committee, assisted by experts, to examine the issues in all its aspects and lay down the "guide lines" which may be helpful to regulate the introduction of automation in our business and industry. Besides, a continuous review of the working of automation, and its economic, social, individual and other effects on labour, industry and society should be undertaken by the Tripartite Committee so as to enable it to 'keep watch' on the effects of automation. It is only in this way, that we can convert automation into an instrument of economic growth and social progress, without the loss of human values and social considerations.

APPENDIX—IIa

National Commission on Labour on Automation and Computerization

(A Selective Approach)

The National Commission on Labour supported the theory of dualism meaning thereby that the traditional labour-intensive sector which provides employment to a large labour force continues to exist, and in fact thrives, side by side with the development of the modern largescale capital-intensive sector. This dualism will have to continue for quite some time to come even if it means subsidising the traditional labour-intensive industries. We are of the view that if this approach is followed, the effect of selective introduction of labour-saving techniques on total employment is not likely to be as harmful as is usually apprehended provided the rate of growth is sufficient to absorb the surplus labour. In saying this, we do recognise the hardships which unemployment may cause to individual workers affected by the introduction of new techniques. Their problem has to be tackled on a human plane rather than mixed up with that of the economic choice of technology. We are, therefore, of the opinion that while automation has to be highly selective at the current stage of our development and for long to be socially guided, relief to individual workers displaced in this course must be guaranteed. Any scheme for automation should satisfy the following conditions :—

- (i) It accommodates all labour that may be rendered surplus ;
- (ii) It results in higher productivity and efficiency ;
- (iii) It improves the level of earnings of the workers by ensuring them an equitable share in the gains due to automation ; and
- (iv) It leads to reduction in costs and benefits the community. (Para. 18.25).

All things considered, catching up with the level of automation and technology already reached in industrially advanced countries is not feasible and desirable under the present conditions in all or even in most of the production processes of the country. But a phased introduction of more advanced technological and labour-saving techniques and devices has to be initiated guaranteeing simultaneously that employment opportunities do not suffer. The phasing has to be gradual so long as the economy does not enter an expansionary phase in which the rate of growth will be adequate to absorb the labour force. Such an approach does not totally preclude automation and rationalization in the immediate present. Rather it emphasises the principles of selectivity and gradualness with primary emphasis for the time being on securing of efficiency and higher productivity by organizational rather than mechanical devices. (Para. 18.28).

Since the existing conditions in the country are not propitious for introducing automation in any large measure, we have advocated a selective approach. Automation has been generally favoured for industries which have to cater to foreign markets, but automated desk work is not considered desirable. All that we recommend is that selective computerisation may be adopted. The aim of policy should be to ensure that while the economy as a whole gradually moves on to higher levels of technology, employment in the aggregate also shows a marked rise.

—(*Report of the National Commission on Labour, 1969* ; Chapter 18 ; especially paras 18.25 ; 18.28).

APPENDIX—III

The statement showing the names of the parties (Questionnairewise) from whom replies to the questionnaires were received

Questionnaires A & B

E.D.P. Establishments

Serial No.	Name of the Party
1	Air-India, Bombay.
2	Armament Research and Development Establishment, Poona.
3	Associated Cement Companies Ltd., Bombay.
4	Bhaba Atomic Research Centre, Bombay.
5	Bombay Suburban Electric Supply Ltd., Bombay.
6	Burmah-Shell Oil Storage and Distributing Co., Bombay.
7	Caltex (India) Ltd., Bombay.
8	Central Railway, Bombay.
9	Eso Standard Eastern Inc., Bombay.
10	Glaxo Laboratories (India) Ltd., Bombay.
11	IBM World Trade Corporation, Bombay.
12	Indian Institute of Technology, Bombay.
13	Institute of Tropical Meteorology, Poona.
14	Kirloskar Oil Engines Ltd., Poona.
15	Life Insurance Corporation of India, Bombay.
16	Philips India Ltd., Bombay.
17	Premier Automobile Ltd., Bombay.
18	Reserve Bank of India, Bombay.
19	State Bank of India, Bombay.
20	Tata Computer Centre, Bombay.
21	Tata Institute of Fundamental Research, Bombay.
22	University of Bombay, Bombay.
23	Western Railway, Bombay.

Questionnaire 'C'

(Organisations hiring E.D.P. Time)

Serial No.	Name of the Party
1	Bharat Bijlee Ltd., Bombay.
2	Blundell Eomite Paints Ltd., Bombay.
3	Central India Spg. & Wvg. Manufacturing Co. Ltd., Bombay.
4	Concrete Association of India, Bombay.
5	Hindustan Lever Ltd., Bombay.
6	Jal N. Bharucha, Bombay.
7	Kamani Engineering Corporation Ltd., Bombay.
8	Larsen & Toubro Ltd., Bombay.
9	Mirex Heat Transfer Pvt. Ltd., Bombay.
10	Mukund Iron and Steel Works Ltd., Bombay.
11	Rajbahadur Motilal Mills Ltd., Poona.
12	Ralliwolf Ltd., Bombay.
13	Research and Marketing Services, Bombay.
14	Richardson Hindustan Ltd. Bombay.
15	Swadeshi Mills Ltd., Bombay.
16	Tata Mills Ltd., Bombay.
17	Voltas Ltd., Bombay.

Questionnaire ' D '

(Trade Unions Operating in E.D.P. Establishments)

Serial No.	Name of the Party
1	All India Air-Craft Engineers' Association, Bombay.
2	All India National Life Insurance Employees' Federation, Bombay.
3	Central Railway Mazdoor Sangh, Bombay.
4	Glaxo Laboratories Employees' Union, Bombay.
5	Indian Flight Navigators' Guild, Bombay.
6	Indian Pilots' Guild, Bombay.
7	Mill Mazdoor Sabha, Bombay.
8	Petroleum Employees' Union, Bombay.
9	Petroleum Workmen's Union, Bombay.
10	Philips Employees' Union, Bombay.
11	Voltas & Volkart Employees' Union, Bombay.
12	Western Railway Employees' Union, Bombay.

Questionnaire ' E '

(Organisations of Employers and Workers)

Serial No.	Name of the Party
1	All India Manufacturers' Organisation, Bombay.
2	All India Plastic Manufacturers' Association, Bombay.
3	Bharatiya Mazdoor Sangh, Bombay.
4	Bombay Chamber of Commerce and Industries, Bombay.
5	Employers' Federation of India, Bombay.
6	Engineering Association of India, Bombay.
7	Federation of Electricity Undertakings of India, Bombay.
8	Hind Mazdoor Sabha, Bombay.
9	Indian Merchants' Chamber, Bombay.
10	Indian Motion Picture Producers' Association, Bombay.
11	Indian Roads and Transport Development Association, Bombay.
12	Indian Tobacco Merchants' Association, Bombay.
13	Maharashtra Chamber of Commerce, Bombay.
14	Maharashtra Rajya Trade Union Committee, Bombay.
15	National Federation of Petroleum Workers' (India).

Questionnaire ' F '

(Independent persons|Experts|Institutions)

Serial No.	Name of the Party
1	Shri Chansarkar, M. A., Nagpur.
2	Shri Deshpande, A. S., Bombay.
3	Shri Gajanan Gokhale, Bombay.
4	Shri Gokhale R. G., Bombay.
5	International Computers (India) Pvt. Ltd., Bombay.
6	International Computers Indian Manufacture Ltd., Bombay.
7	Shri Khanolkar, V. A., Bombay.
8	Shri Manohar Kotwal, Bombay.
9	Shri Raja Kulkarni, Bombay.
10	Shri Ram Mahadik, Bombay.
11	Shri Mohandas S. R., Bombay.

Questionnaire ' F '—*contd.*

Serial No.	Name of the Party
12	Dr. Punekar S. D., Bombay.
13	Shri Sapre, S. A., Bombay.
14	Silk and Art Silk Mills Association, Bombay.
15	Silk and Art Silk Research Association, Bombay.
16	Shri Sundaram G., Bombay.
17	Shri Subramaniam K. N., Bombay.
18	Shri Bagaram Tulpule, Bombay.

Questionnaires G and H

(Organizations having installations of Unit Record Machines/Data Processing Equipment)

Serial No.	Name of the Party
1	Atlas Capco (India) Pvt. Ltd., Bombay.
2	Automobile Product of India Ltd., Bombay.
3*	Bank of India, Bombay.
4	Batilboy and Co. Pvt. Ltd., Bombay.
5	Beacons Pvt. Ltd., Bombay.
6	Bombay Dyeing and Mfg. Co. Ltd., Bombay.
7	Bombay Electric Supply and Transport Undertaking, Bombay.
8	Bombay Metal and Alloys Mfg. Co. Pvt. Ltd., Bombay.
9	Boots Pure Drug Co. (India) Ltd., Bombay.
10*	Bureau of Commercial Intelligence and Statistics, Bombay.
11	Bureau of Economic and Statistics, Old Custom House, Bombay.
12	Carbide Chemicals Co. Ltd., Bombay.
13	Central Water and Power Research Station, Poona.
14	Chemo-Pharma Laboratories Ltd., Bombay.
15*	Chowgule and Co. Pvt. Ltd., Bombay.
16	Ciba of India Ltd., Bombay.
17	Colgate-Palmolive (India) Pvt. Ltd., Bombay.
18*	Commissioner of Income Tax, Bombay.
19*	Commissioner of Police, Bombay.
20	Consolidated Pneumatic Tool Co. (India) Ltd., Bombay.
21	Cooper Engineering Ltd., Poona.
22*	Deccan College, Poona.
23*	Demographic Training and Research Centre, Bombay.
24	Devidayal Cable Industries Ltd., Bombay.
25	Dinars Club (India) Pvt. Ltd., Bombay.
26*	Director General of Observatories, Poona.
27	Duncan Brothers and Co. Ltd., Bombay.
28*	Dyna-craft Machine Co. Ltd., Bombay.
29	Fertilizer Corporation of India Ltd., Bombay.
30*	Forbes-Forbes Campbell and Co. Ltd., Bombay.
31	Gammon India Ltd., Bombay.
32	Godrej and Boyce Mfg. Co. Pvt. Ltd., Bombay.
33*	Gokhale Institute of Politics and Economics, Poona.
34	Goodlass Nerolac Paints Ltd., Bombay.
35	Greater Bombay Milk Scheme, Bombay.
36	Greaves Cotton and Co. Ltd., Bombay.
37	Guest Keen Williams Ltd., Bombay.
38	Hindustan Antibiotics Ltd., Poona.
39*	Imperial Tobacco Co. of India Ltd., Bombay.
40	Indian Cancer Society, Bombay.
41*	Indian Cancer Research Centre, Bombay.
42*	I.C.I. (India) Pvt. Ltd., Bombay.

Questionnaires G and H—*contd.*

Serial No.	Name of the Party
43	Indian Oil Corporation Ltd., Bombay.
44*	Indian Oxygen Ltd., Bombay.
45*	Indian Posts and Telegraphs Department, Bombay.
46*	Industrial Investment Trust Ltd., Bombay.
47	Institute of Card Punching and EDP System, Bombay.
48	Institute of Tropical Meteorology, Poona.
49	Insurance Association of India, Bombay.
50*	Inter Publicity Pvt. Ltd., Bombay.
51	Johnson and Johnson of India Ltd., Bombay.
52*	Kamal Typewriter Co., Bombay.
53*	Laxmi College of Commerce, Bombay.
54*	Liberty Commercial Institute, Bombay.
55	Maharashtra State Board of Secondary Education, Poona.
56	Maharashtra State Road Transport Corporation, Bombay.
57	Mahindra and Mahindra Ltd., Bombay.
58*	Model Vital and Health Statistics Unit, Nagpur.
59	Nagpur Municipal Corporation, Nagpur.
60	Nathani Steel Yard, Bombay.
61*	National Organic Chemical Industries Ltd., Bombay.
62	National Rayon Corporation Ltd., Kalyan, District Thana.
63	New India Assurance Co. Ltd., Bombay.
64	Regional Provident Fund Commissioner, Bombay.
65	Sandoz (India) Ltd., Bombay.
66	Scindia Steam Navigation Co. Ltd., Bombay.
67	Shrikant Typewriter Institute, Bombay.
68	Shreeram Mills Ltd., Bombay.
69	Siemens India Ltd., Bombay.
70	South India Insurance Co. Ltd., Bombay.
71	Standard Batteries Ltd., Bombay.
72*	Swan Mills Ltd., Bombay.
73*	Swedish Match Co., Bombay.
74	Tata Engineering and Locomotive Co. Ltd., Poona.
75*	Tata Institute of Social Sciences, Bombay.
76	Unit Trust of India, Bombay.
77	University of Poona, Poona.
78	Western India Match Co. Ltd., Ambarnath, Thana.

*Data could be used only partially.

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GOVERNMENT OF MAHARASHTRA
WORKS STUDY TEAM ON AUTOMATION IN MAHARASHTRA STATE
QUESTIONNAIRE 'A'
for
The Survey of the Current Status
of
Electronic Data Processing Equipment (E.D.P.) in Maharashtra

- Note*,—(1) This Questionnaire is for all Organizations/Offices using EDP Equipment of their own or on hire-time basis.
- (2) The details, filled in, should be as on January 1, 1969.
- (3) Tick () whichever is relevant in case blocks are given to answers in this Questionnaire.
- (4) Use separate sheet of paper to answer questions where the space provided is not sufficient.

I. Details regarding the Organization

1. Name of the Organization ..

2. (a) Nature of Business (give synopsis)

(b) Total Volume in appropriate units
i.e., total sales in Rs. number of
policies etc.

3. Legal status of the Organization ..

(a) Proprietorship

(b) Partnership

(c) Private Limited Co.

(d) Public Limited Co.

(e) Statutory Corpn.

4. Registered Office Address ..

Telephone No.

Telegram

5. (a) No. of Branches ..

	Total No.	Within Maharashtra	Outside Maharashtra
(a)			
(b) No. of Branches using EDP facilities as output.			

6. (a) EDP Installation at ..

Registered
Office

Branch.

Factory

(b) Address of EDP Installation ..

Telephone No.

Telegram

7. (a) Person in-charge of the EDP Installation. Name

Designation

Telephone No.

(b) To whom does the person in-charge of the EDP installation report to Name

Designation

Telephone No.

8. Total number of Office Employees. (Please fill in the following table):—

Serial No.	Category	Within Maharashtra				Outside Maharashtra			
		Male		Female		Male		Female	
		Per- manent	Tem- porary	Per- manent	Tem- porary	Per- manent	Tem- porary	Per- manent	Tem- porary
A	Technical								
B	Clerical*								
C	Supervi- sory.								
	Total ..								
D	Subordi- nate.								
E	Others ..								
	Total ..								
	Grand Total								

If information by categories asked for is not available, totals may be given.

*Clerical employees include those engaged in Book-keeping and Accounting, Computing and Statistical Compilation, Posting, Checking and Maintaining Records, Sorting, Routing, Filing, Typing and Routine Correspondence, Secretarial Assistance etc.

II. Description of the EDP Equipment

*9. (a) Computer Manufacturer (i) I.B.M. (ii) I.C.I. (I.C.T.)

(iii) C.D.C. (iv) Honeywell

(v) Minsk (vi)

(b) Model (i) No

(ii) Core Capacity ..

(iii) Additional storage Model No.

(c) Input/Output Devices.

Serial No.	Devices	Model No.	No. of Units	Remarks, if any
1	Card Read Punch			
2	Printer			
3	Tapes			
4	Disk			
5	Console			
6				
7				
8				
9				
10				

*If EDP facilities of other organisations are used, write the name of that organisation in Question No. 9 of this Questionnaire, fill in the details of that installation.

(d) Off Line Equipment

Serial No.	Equipment	Model No.	No. of Units	Remarks, if any
1	Interpreting Card Punch			
2	Card Punch			
3	Card Verifier			
4	Interpreter			
5	Sorter			
6	Collator			
7	Reproducing Punch			
8	Calculating Punch			
9	Accounting Machine			
10	.. ..		
11	.. ..		
12	.. ..		
13	.. ..		

- (e) Back up storage (i) Tape Reels
- (ii) Disk Packs
- (iii)

10. (a) If the equipment purchased or hired ?

(i) Purchased

(ii) Hired

(iii) Both—(Please explain)

(b) If purchased—

(i) Total cost of computer equipment and its peripherals (including importation charges) .. Rs.

(ii) Total cost of Unit Record Equipment. Rs.

(iii) Average monthly cost of maintenance. Rs.

(c) If hired—

(i) One time charge paid .. Rs.

(ii) Average monthly hire (including maintenance) charges of computer equipment and its Peripherals. Rs.

11. (a) Date of Installation—

(i) Unit Record Equipment ..
 (ii) Computer system ..

(b) If already in production please give the date of first production run.

12. (a) How far the EDP facilities of your Organisation are utilised currently (please give monthly percentage utilisation) in relation to established goals of the organisation, at present.

(b) Out of the monthly computer utilisation, please give the percentage utilisation in the table given below :—

Serial No.	Category	Monthly percentage utilisation
1	Your own Organisation job	
2	Outside Organisation job	
		100

12. (c) When do you expect to achieve full or near full utilisation as per the present plans ?

(d) Give indication of your current and envisaged applications by classifying items into *major* and *minor* as per usage of Computer time in the table below :—

Serial No.	Types of job (Job description)*	Job on Computer at present		You would like to take up additional application						Remarks, if any.	
				1970		1971-72		1973-74			
		Major	Minor	Major	Minor	Major	Minor	Major	Minor		
1	2	3	4	5	6	7	8	9	10	11	
1	Pay Roll ..										
2	Financial Accounting.										
3	Share Accounting ..										
4	Production Statistics (Sales Analysis)										
5	Market Statistics ..										
6	Invoicing and Billing										
7	Purchase Bills ..										
8	Budgeting ..										
9	Management Accounting.										
10	Production Control										
11	Inventory Control ..										
12	Forecasting Credit Control.										
13	Pert/CPM ..										
14	Linear Programme ..										
15											

*These are only representative categories of application.

12. (e) Give indication of your current and envisaged applications by classifying items into *major* and *minor* as per importance to the company by way of benefits in the table below :

Serial No.	Types of Job (Job description)*	Job on computer at present		You would like to take up additional application						Remarks, if any.	
				1970		1971-72		1973-74			
		Major	Minor	Major	Minor	Major	Minor	Major	Minor		
1	2	3	4	5	6	7	8	9	10	11	
1	Pay Roll ..										
2	Financial Accounting										
3	Share Accounting ..										
4	Production Statistics (Sales Analysis)										
5	Market Statistics ..										
6	Invoicing and Billing										
7	Purchase Bills ..										
8	Budgeting ..										
9	Management Account- ing.										
10	Production Control										
11	Inventory Control ..										
12	Forecasting Credit Control.										
13	Pert/CPM ..										
14	Linear Progamme ..										
15											

*These are only representative categories of application.

13. (a) What types of applications are purely on Unit Record Equipment ? ('tick' whichever is being used) :

Serial No. 1	Type of Job (Job description) 2	Remarks, if any 3
1		
2		
3		
4		
5		
6		
7		
8		
9		

14. Persons employed in EDP Department.

Serial No. 1	Designation 2	Total No. 3	Trained from within 4	Recruited from outside 5	Remarks, if any 6
1	Key Punchers				
2	Punch Supervisors ..				
3	Unit Record Machine Operators.				
4	Unit Record Section Supervisor.				
5	Computer Programmers ..				
6	System Analysts				
7	Checkers				
8	Coders				
9	Others				
10	Person-in-charge				
11	Computer Operators ..				
	Total—No. of Employees				

III. The following questions (15-18) are to be Answered only if EDP facilities of another Organisation are used on Hire Time Basis

15. (a) The system is used—

Daily	Weekly	Fortnightly	monthly	Sporadically
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

(b) Number of hours used per month : (i) Clock..... Hours.
 (ii) Meters..... Hours

16. (a) Do you use your own Stationery ?

Yes	<input type="text"/>	No.	<input type="text"/>
-----	----------------------	-----	----------------------

(b) Do you use pre-printed Stationery ?

Yes	<input type="text"/>	No.	<input type="text"/>
-----	----------------------	-----	----------------------

17. (a) Are programmes written by your staff ?

Yes	<input type="text"/>	No.	<input type="text"/>
-----	----------------------	-----	----------------------

(b) If yes,
 (i) What is your Department known as ?
 (ii) Person in-charge

Name :
 Designation :
 Telephone :

(iii) Personnel in the Department.

Serial No.	Designation	Total No.	Trained from within	Recruited from Outside	Remarks if any
1	2	3	4	5	6
1	System Analyst				
2	Programmer				
3					
4					
5	Person in-charge . ..				
	Total No. of Persons ..				

18. If the data is punched on our punches give the following information:

(a) (i) No. of punches (b) (i) No. of verifiers
 (ii) No. of persons on punches. (ii) No. of persons on verifiers.

19. Each installation has its own unique features. Kindly give information which would be useful to qualify the data given above.

GOVERNMENT OF MAHARASHTRA
WORKS STUDY TEAM ON AUTOMATION IN MAHARASHTRA STATE

QUESTIONNAIRE ' B '

for

The Survey of the Current Status

of

Electronic Data Processing Equipment (E. D. P.) in Maharashtra.

- Note.*—(1) This Questionnaire is for all Organisations/Offices using EDP Equipment of their own or on hire time basis.
- (2) It should be filled in by the top management.
 - (3) The details, filled in, should be as on January 1, 1969.
 - (4) Tick (✓) whichever is relevant in case blocks are given to answers in this Questionnaire.
 - (5) Use separate sheet of Paper to answer questions where the space provided is not sufficient.
 - (6) Please attach this Questionnaire with Questionnaire ' A ' along with statistical Tables attached to this Questionnaire.

1. Name of the Organisation :
2. Person filling in this Questionnaire :
 - (a) Name :
 - (b) Designation :
 - (c) Date :
3. When was the decision to use the computer made ?
4. Major objectives and reasons for going in for computer such as :
 - (a) Volume of data is too large for manual processing.
 - (b) Computation required could only be done by computer.
 - (c) To reduce time lags in receipts and processing of data.
 - (d) To decrease cost.
 - (e) To introduce modern management control system.
5. Did you examine feasibility before going in for computerisation ? If possible, kindly indicate how you went about it.
6. Comments, if any, on how the model and its configuration was selected.
7. Comments, if any, how job priorities were initially designed.
8. Comments, if any, on factors taken into consideration while deciding the priority.

9. Indicate briefly the nature of difficulties encountered by your organisation in installing a computer due to (if possible, give an explanatory note):

Sr. No.		Yes	No	Comments
a.	Capital Investment			
b.	Space			
c.	Trained Personnel			
d.	Labour/Trade Union			
e.	Foreign Exchange			
f.	Other Items			

10. Have you come to any understanding with Labour Union/Workers' Group before the computer was acquired/installed ?

Yes

No

(a) If yes, please supply a copy of the agreement.

(b) If No, please give reasons.

11. Please give a brief account of the problems encountered by your organisation concerning recruitment, training etc. after the installation of the computer.

12. Was there any Labour unrest (strikes, go-slow, work to rule, demonstration etc.) on account of the introduction of the computer ? If yes, please give a brief explanatory note.

13. (a) If there has been any displacement of staff on account of introduction of the computer (job redundancy) please give the total No. of redundant job-personnel.

- (b) How was the problem of displacement of staff on account of the introduction of the computer was dealt with? Please fill in the following table.

Sr. No.	The Method of Adjustment	No. of Persons	Percentage	Remarks, if any
i	Absorbed in expansion.			
ii	Provided Alternate jobs.			
iii	Retrained and put on the computer section.			
iv	Transferred to new jobs.			
v	Retrenched.			
			100	

- (c) If you have increased the staff (please give details if possible).

14. Do you think that the computer will decrease recruitment over the next 3 to 5 years? Please give a brief note.

15. How were the staff recruited for your computer installation.

Sr. No.	Category	From the existing staff members	Recruited from outside	Remarks, if any
1.	Key Punch Operator.			
2.	Punch Supervisor.			
3.	Unit Record Machine Operator.			
4.	Unit Record Supervisor.			
5.	Computer Programmer.			
6.	System Analyst.			
7.	Checker.			
8.	Coder.			

16. Give in brief the nature of the consequences due to EDP installation in respect of the following:—

- (a) Improvement in information
- (b) Reduction in cost
- (c) Staff economics

17. Did computerisation result in coupling of different processes of the old system.

Yes No

- (a) If yes, please give details ..
- (b) If no, please indicate reasons ..

18. What was the experience of your organisation regarding.

- (a) Labour Discontent
- (b) Employees supervision and training.
- (c) Efficiency of office record maintenance.

19. (1) What other special advantages flow from computerisation to your organisation.

- (a) Employees
- (b) Management

(2) What other disadvantages flow from computerisation to your Organisation.

- (a) Employees
- (b) Management

20. Any other comments/remarks which you think would be useful to the work of the Study Team.

TABLE I
Survey of Office Employment

Please give number of full time, part time and temporary employees on the payroll of this organisation (including all branches and company agency offices) during the pay period mentioned under :—

All office employees Total for the entire company	As at 1st January						Comments
	1961		1965		1969		
	Male	Female	Male	Female	Male	Female	
Full time ..							
Part time ..							
Temporary ..							
Total ..							

Total Number of clerical employees in the organisation	As at 1st January						Comments
	1961		1965		1969		
	Male	Female	Male	Female	Male	Female	
Full time ..							
Part Time ..							
Temporary ..							
Total ..							

Total Number of employees performing work directly essential with the	As at 1st January						Comments
	1961		1965		1969		
	Male	Female	Male	Female	Male	Female	
Unit Record ..							
E.D.P. Section ..							
Total ..							

TABLE II
Computer Personnel

Category	Total	Male		Female		General Education required (Graduate etc.)	No. of trained persons		No. of persons trained abroad	Comments
		Total	Salary range (monthly)	Total	Salary range (monthly)		At our installation	Outside agency		
(a) Administrators or Supervisors.										
(b) Project Planners, Systems Designers, Systems Analysts.										
(c) Programmers ..										
(d) Console Operators ..										
(e) Peripherals & Equipment Operators.										
(f) Tape Librarians ..										
(g) Keypunch verifiers, data typing, communication and related machine operators.										
(h) Receptionists, secretaries, stenographers, typists, messengers, etc.										
(i) Miscellaneous ..										
Total ..										

TABLE III
OFFICE AUTOMATION

1. Employment Effects of Electronic Computerisation (EDP) on 1st January 1969

Category of employment	Name and Identification of job category	Total employment before introduction of EDP	Total employment after introduction of EDP (at the present level)	Retained in old jobs	Re-deployed or absorbed elsewhere in organisation	New entrants in new jobs in the organisation	Absorption in new occupations created by introduction of EDP	Retrenchment	Comments
1	2	3							
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
I	Administrative/Managerial Personnel.								
II	Supervisory Personnel								
III	Clerical staff including typists, stenographers etc.								
IV	Technical Staff (other than EDP Personnel).								
V	Computer Programmers and Systems Analysts.								
VI	Punch Operators, Machine and Computer Operators.								
VII	Miscellaneous (Please describe).								
VIII									
	Total								

1. This column could be used also for the charged occupational structure after use of EDP.

2. The same pro forma can be used for perspective picture after 5 years.

3. If retrenchment compensation is paid, please give the amount.

If it is not feasible to give figures as per categories given above kindly give a running descriptive account of the actual changes that have occurred before and after installation of computer under different categories of personnel together with figures available.

TABLE IV
Impact of Electronic Computerisation (EDP)
 (Before and After Automation)
 As at 1st January, 1969

Serial No.	Nature of job (Classification)	Occupational Structure		Working Conditions					Conditions of Service			
		Nature of work (Simpler)	Nature of functions (supervisory)	Skill requirements (higher efficiency)	Hours of work (more leisure)	Shift work (facilitated)	Safety conditions (safer work)	Physical environment at work (pleasant)	Remuneration and living standards			
									Higher Wages	Better Incentives	Fringe Benefits	Employees services
i	ii	iii	iv	v	vi	vii	viii	ix	x	xi	xii	xiii
I	Executive Personnel ..											
II	Administrative Personnel											
III	Clerical Staff including typists, stenographers, etc.											
IV	Technical staff (other than EDP personnel)											
V	Computer Programmers, Systems Analysts.											
VI	Punch Operators, Machine and Computer Operators											
VII	Miscellaneous (Please describe).											

Note.—(i) Answer questions marked * by YES/SAME.
 (ii) Answer questions marked † by IMPROVED/SAME/DETERIORATED.

TABLE V

Impact of Electronic Computerisation (EDP)

(Before and after Automation)

As at 1st January 1969

Category	Description of Job Category	Decision Making (Speed, quality, economy)			Comments
		Communi- cation	Planning	Organi- sation	
1	2	3	4	5	6
I	Administrative/Managerial Personnel . .				
II	Supervisory Personnel				
III	Clerical staff including Typists, Steno- graphers, etc.				
IV	Technical staff (other than EDP personnel).				
V	Computer Programmers and Systems Analysts.				
VI	Punch Operators, Machine and Computer Operators.				
VII	Miscellaneous (Please describe)				

TABLE VI

TABLE
Impact of Electronic Computerisation
PERSONNEL
 (Changes before and
 As at 1st January

Description of the job category 1	Age Composition 2	Physical requirements 3	Mental make- up 4
Executive Personnel ..			
Administrative personnel ..			
Clerical staff including typists, stenographers, etc. ..			
Technical staff (other than EDP personnel) ..			
Computer programmers and systems analysts ..			
Punch operators, machine and computer operators ..			
Miscellaneous (please describe)			

Note.—Answer these questions by YES or NO.

GOVERNMENT OF MAHARASHTRA

WORKS STUDY TEAM ON AUTOMATION IN MAHARASHTRA STATE

QUESTIONNAIRE 'C'

for

The Survey of the Current Status

of

Electronic Data Processing Equipment (E.D.P.) in Maharashtra

- Note.*—(1) This Questionnaire is for all Organisations/Offices hiring EDP timings.
(2) It should be filled in by the top management.
(3) The details, filled in, should be as on January 1, 1969.
(4) Tick (✓) whichever is relevant in case blocks are given to answers in this Questionnaire.
(5) Use separate sheet of paper to answer questions where the space provided is not sufficient.

I. Details of the Organisation

1. Name ..
2. Nature of business ..
3. Legal status of the Organisation .. (a) Proprietorship.
- (b) Partnership.
- (c) Private Limited Co.
- (d) Public Limited Co.
- (e) Statutory Corporation.
4. Registered Office Address : Telephone :
Telegram :
5. Total No. of Office Employees—

Serial No.	Category	Within Maharashtra				Outside Maharashtra			
		Male		Female		Male		Female	
		Perma- nent	Tempo- rary	Perma- nent	Tempo- rary	Perma- nent	Tempo- rary	Perma- nent	Tempo- rary
A	Technical								
B	Clerical								
C	Supervi- sory.								
	Total ..								
D	Subordi- nate								
E	Others								
	Total ..								
	Grand Total								

N.B.—Clerical employees include those engaged in Book-keeping and Accounting, computing and statistical compilation, posting, checking and maintaining records, sorting, routing filing, typing and routine-correspondence, secretarial assistance etc.

6. Since when you have been hiring the EDP facilities.

7. Types of job for which EDP timings are hired. Please fill in the following table:—

Serial No.	Type of job (Job description)	At present	In future			Remarks
			1970	1971-72	1973-74	
1	Pay Roll					
2.	Financial Accounting.. ..					
3	Share Accounting					
4	Production Statistics					
5	Market Statistics					
6	Invoicing and Billing					
7	Purchase Bills					
8	Budgeting					
9	Management Accounting					
10	Production Control					
11	Inventory Control					
12	Pert/CPM					
13	Linear Programme					

8. (a) The system is used—

Daily	Weekly	Fortnightly	Monthly	Sporadically
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(b) No. of hours used (i) Clock Hours.

(ii) Meters Hours.

9. (a) Do you use your own stationery

Yes

No

(b) Do you use pre-printed stationery

Yes

No

10. (a) Are programmes written by your staff?

Yes

No

(b) If yes,

(i) What is your Department known as

(ii) Person-in-charge Name

Designation

Telephone

(iii) Personnel in the Department—

Serial No.	Designation	No. of persons	Remarks, if any
1	System Analyst ..		
2	Programmer ..		
3	..		
4	..		
5	Person-in-charge ..		
	Total No. of Persons ..		

11. Major objectives and reasons for hiring the EDP facilities on time basis. (1)

(2)

(3)

(4)

(5)

12. Have you come to any understanding with labour union/Workers' Groups before hiring EDP facilities? Please give a note/copy of the agreement, if any.

13. (a) Has there been any displacement of staff solved?

(b)

Serial No.	The method of adjustment	No. of Persons	Percentage of the total redundant persons i.e. of 13 (a)	Remarks, if any
(i)	Alternate job ..			
(ii)	Transfer ..			
(iii)	Retrenchment ..			
(iv)				
(v)				
	Total ..		100	

14. Do you think that hiring of EDP facilities will decrease recruitment in your organisation over the next 3 to 5 years? Please give a brief note.

15. Please give in brief the nature of the consequences due to hiring of EDP facilities in respect of the following :

- (a) Improvement in information ..
- (b) Reduction in cost ..
- (c) Staff Economies ..

16. Please give details in Table No. 3 (attached) wherever relevant.

17. Any other comments/remarks ..

TABLE III

TABLE III
OFFICE AUTOMATION

1. Employment Effects of Electronic Computerisation (EDP)

On 1st January 1969

Category of employment	Name and Identification of job category	Total employment before introduction of EDP	Total employment after introduction of EDP (at the present level)	Retained in old jobs	Redeployed or absorbed elsewhere in organisation	New entrants in new jobs in the organization	Absorption in new occupations created by introduction of EDP	Retrenchment	Comments
<i>a</i>	<i>1</i> <i>b</i>	<i>c</i>	<i>2</i> <i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>3</i> <i>i</i>	<i>j</i>
I	Administrative/Managerial Personnel.								
II	Supervisory Personnel								
III	Clerical staff including typists, stenographers etc.								

IV	Technical Staff (other than EDP Personnel).							
V	Computer Programmers and Systems Analysts.							
VI	Punch Operators, Machine and Computer Operators.							
VII	Miscellaneous .. (Please describe)							
VIII								
	Total ..							

1. This column could be used also for the changed occupational structure after us of EDP.
2. The same proforma can be used for perspective picture after 5 years.
3. If retrenchment compensation is paid, please give the amount.
 If it is not feasible to give figures as per categories given above kindly give a running descriptive account of the actual changes that have occurred before and after installation of computer under different categories of personnel together with figures available.

GOVERNMENT OF MAHARASHTRA
WORKS STUDY TEAM ON AUTOMATION IN MAHARASHTRA STATE

QUESTIONNAIRE ' D '
for
The Survey of the Current Status
of
Electronic Data Processing Equipment (E.D.P.) in Maharashtra

- Note.**—(1) This Questionnaire is for those trade Unions who are directly connected with the Establishments which have installed computer/EDP Equipment.
- (2) The details, filled in, should be as on January 1, 1969.
- (3) Tick (✓) whichever is relevant in case blocks are given to answers in this Questionnaire.
- (4) Use separate sheet of paper to answer questions where the space provided is not sufficient.

I. Details regarding the Trade Union Organisation

1. Name of the Trade Union

2. (a) Legal status (as on 1st January 1969)—

(i) Registration No.

(ii) Date of Registration

(b) Whether representative union under B. I. R. Act, 1946 ?

Yes

No

(c) Other status (as on 1st January 1969)—

(i) Whether recognised under (Code of Discipline/by Agreement).

Yes

No

3. Registered Office Address

Telephone :

Telegram :

4. No. of branches where union deals with the EDP Establishment in Maharashtra State.

5. (a) Whether affiliated to any recognised Central Organisation of Workers.

Yes

No

If yes, please give the name and address of the Central Organisation.

Name :

Address :

Telephone :

Telegram :

5. (b) Status structure of your Trade Union.—

- (i) Name of the President ..
- (ii) Name of the General Secretary ..
- (iii) Name of the Joint Secretary (if any)

6. Membership of your Union (on the latest date). (a) Claimed :
- (b) Verified :

7. Total membership of your Union amongst the office employees of the Establishment using EDP Equipment.—

Serial No.	Category	Male		Female	
		Permanent	Temporary	Permanent	Temporary
A	Technical ..				
B	Clerical* ..				
C	Supervisory ..				
	Total ..				
D	Subordinate ..				
E	Others ..				
	Total ..				
	Grand Total ..				

* Clerical employees include those engaged in Book-keeping and Accounting, Computing and Statistical Compilation, Posting, Checking and Maintaining Records, Sorting, Routing, Filing, Typing and Routine Correspondence, Secretarial Assistance, etc.

8. (a) Date of installation if known (a) Unit Record Equipment :
- (b) Computer System :
- (b) If already in production please give date of first production, if known.

9. From the list of job descriptions given below please give indication of the job being *major* or *minor* items, as per usage of computer time in the EDP Establishments—

Serial No.	Type of Job (job description)*	Jobs on computer at present	Remarks, if any
		Major or Minor	
1	Pay Roll		
2	Financial Accounting		
3	Share Accounting.		
4	Production Statistics (Sales Analysis).		
5	Market Statistics		
6	Invoicing and Billing		
7	Purchase Bills		
8	Budgeting		
9	Management Accounting ..		
10	Production Control		
11	Inventory Control		
12	Forecasting Credit Control ..		
13	Pert/CPM		
14	Linear Programme		
15			

*These are only representative categories of application.

10. What types of applications are purely on Unit Record Equipment of the Establishment (tick whichever is being used).

Serial No.	Types of job (job description)	Remarks, if any
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

11. What according to you should be the major objectives and reasons for going in for a computer ?

12. What according to you should be the appropriate agency to examine the feasibility of EDP installation ? Please give reasons.

(a) Has your Trade Union formally/informally discussed about Office Automation in the Union Meetings ?

in (i) Executive Committee :

Yes

No

(ii) General Body Meeting :

Yes

No

Please give comments :

(b) Has your Trade Union taken any definite stand with regard to office Automation ?

Yes

No

(i) If no, please state reasons.

(ii) If yes,

Is it unequivocal or conditional ?

(A) If conditional. what have been the qualifying clauses.

13. Was there any friction between, management and your union, while installing the computer? If yes, what were the major issues involved in the friction, such as:

(a) Unemployment.

(b) Reduction in Potential Employment

(c) Retrenchment

(d) Transfer

(e) Training

(f) Miscellaneous

N.B.—Please give a brief note .

14. Has there been any understanding between the management/employer and your union before/after the computer was acquired/installed?

Yes

No

(a) If yes, please supply a copy of the agreement.

(b) If no, please indicate reasons.

15. Was there any labour unrest or agitation in the form of strike/demonstrations etc. on account of installation of the computer?

Yes

No

(a) If yes, please give in brief the views of your union regarding the nature of the main issues involved and the views of your Union thereon.

16. If according to you, there has been any displacement of staff on account of introduction of the computer i.e. job redundancy. Please give the total No. of redundant-personnel. (please supply a detailed note separately, if possible)

16. (a) How was the general problem of job redundancy resolved? Please fill in the following table from the basis of your knowledge.

Serial No.	The Method of Adjustment	No. of Persons	Percentage	Remarks, if any
(i)	Absorbed in expansion			
(ii)	Provided Alternate jobs			
(iii)	Retrained and put on the computer section			
(iv)	Transfer to new jobs			
(v)	Retrenched			
			100	

(b) If there has been any increase in the staff? Please give a brief note.

17. Give your studied opinion as to whether computer will decrease recruitment in the EDP Establishment concerned over the next 3 to 5 years.

N.B.—Please quantify your estimates as far as possible.

18. Give in brief your studied views of the nature of the consequences of the EDP installation in respect of the following:

(a) Improvement in information	Yes	<input type="text"/>	No	<input type="text"/>
(b) Reduction in costs	Yes	<input type="text"/>	No	<input type="text"/>
(c) Staff Economies	Yes	<input type="text"/>	No	<input type="text"/>

19. (1) What according to you are other special advantages flowing from computerisation to—

(a) Employees

(b) Management

(c) Community

(2) What according to you are the disadvantages flowing from computerisation to—

(a) Employees

(b) Management

(c) Community

N.B.—Please give significant illustrations wherever possible from your experience in the establishments with which you are concerned.

20. How would you gauge the overall economic, human and social effects of EDP Programme on the work people, community as well as the economy in general (Please narrate from your experience if possible).

21. How do you visualise interstate effects of office automation having particular bearing on socio-economic aspects of life?

22. Please give general comments on table No. 3 enclosed.

23. Please give information required in Table No. III.

TABLE III
OFFICE AUTOMATION

1. *Employment Effects of Electronic Computerisation (EDP) on 1st January 1969*

Category of employment	Name and Identification of job category	Total employment before introduction of EDP.	Total employment after introduction of EDP (at the present level)	Retained in old jobs	Redeployed or absorbed elsewhere in organisation	New entrants in new jobs in the organisation	Absorption in new occupations created by introduction of EDP.	Retrenchment	Comments
	1				2			3	
a	b	c	d	e	f	g	h	i	j
I	Administrative/Managerial Personnel.								
II	Supervisory Personnel ..								
III	Clerical staff including typists stenographers etc.								
IV	Technical Staff (other than EDP Personnel).								
V	Computer Programmers & Systems Analysts.								
VI	Punch Operators, Machine & Computer Operators.								
VII	Miscellaneous (Please describe).								
VIII	..								
	Total ..								

263

1. This column could be used also for the changed occupational structure after use of EDP.
 2. The same *proforma* can be used for perspective picture after 5 years.
 3. If retrenchment compensation is paid, please give the amount.
 If it is not feasible to give figures as per categories given above, kindly give a running descriptive account of the actual changes that have occurred before and after installation of computer under different categories of personnel together with figures available.

GOVERNMENT OF MAHARASHTRA
WORKS STUDY TEAM ON AUTOMATION IN MAHARASHTRA STATE

QUESTIONNAIRE 'E'

for

The Survey of the Current Status

for

Electronic Data Processing Equipment (E.D.P.) in Maharashtra

- Note.*—(1) This Questionnaire is for Employers' Organisation/Central Organisations of Workers.
- (2) Tick (✓) whichever is relevant in case blocks are given to answers in this Questionnaire.
- (3) Use separate sheet of paper to answer questions where space provided is not sufficient.

1. Name of the Organisation
2. Address
3. Total Membership
4. Does your organisation support/oppose office automation/electronic computerisation in India ? Please give reasons.
 - 1.
 - 2.
 - 3.
 - 4.
 - 5.
 - 6.
5. If automation is to be selective, how would your organisation comment on the following factors—
 - (a) Total incapacity or inability of human being to perform the job.
 - (b) Incapacity/human inability to perform the job because of its magnitude.
 - (c) When jobs cannot be done within reasonable time, reasonable efficiency and cost.
 - (d) Human use of human beings (i.e. to reduce human drudgery).
 - (e) To enable export oriented industries to compete adequately in international market.
6. If computerisation is to be introduced—

What according to your Organisation should be the major consideration for the introduction of office automation/electronic computerisation ?
7. What according to your Organisation is the appropriate agency to examine the feasibility of EDP installation ?

8. What should be the principles governing the scheme of job priorities if office automation is to be introduced ? Such as—

Serial No.	Type of Job (Job description)	Indicate priority by A. B. C.	Remarks
1	2	3	4
1	Pay Roll .. .. .	..	..
2	Financial Accounting .. .. .	..	..
3	Share Accounting .. .. .	..	..
4	Production Statistics (Sales Analysis) .. .. .	..	..
5	Market Statistics .. .. .	..	..
6	Invoicing and Billing .. .. .	..	..
7	Purchase Bills .. .. .	..	..
8	Budgeting .. .. .	..	..
9	Management Accounting .. .. .	..	..
10	Production Control .. .. .	..	..
11	Inventory Control .. .. .	..	..
12	Forecasting Credit Control .. .. .	..	..
13	Pert/CPM .. .. .	..	..
14	Linear Programme .. .. .	..	..

9. Does your organisation have any special reasons for a particular make/model of computer ?
10. (a) If your organisation supports office automation, would you advocate the idea of manufacturing EDP Equipment by the Indian Industry ? (Please give a brief note).
- (b) What steps does your organisation contemplate to ensure that the computer personnel safe-guards the national interest ?

11. Comment in brief on the following factors which condition the speed and penetration of automation.
- | | | |
|------------------------|----|----|
| (a) Capital Investment | .. | .. |
| (b) Space | .. | .. |
| (c) Trained Personnel | .. | .. |
| (d) Labour/Trade Union | .. | .. |
| (e) Foreign Exchange | .. | .. |
| (f) Other items | .. | .. |
12. What according to your organisation would be the consideration which should figure in the settlement/agreement while coming to an understanding with labour union/employer/employers' organisations ; if office automation/electronic computerisation is to be introduced ? (If agreement has been reached please supply a copy).
13. Please indicate the line of thinking of your organisation in dealing with the problems arising out of office automation/electronic computerisation with special reference to—
- | | | |
|-------------------------------|----|----|
| (a) Job Redundancy | .. | .. |
| (b) (i) Training for EDP work | .. | .. |
| (ii) Training for other work | .. | .. |
| (c) Transfer | .. | .. |
| (d) Displacement of employees | .. | .. |
| (e) Retrenchment | .. | .. |
| (f) Potential employment | .. | .. |
| (g) Unemployment | .. | .. |
| (h) New Recruitment | .. | .. |
14. What should be the criteria, such as qualifications, experience etc. while recruiting staff in the computer section proper ? such as—
- | | | |
|------------------------|----|----|
| (1) Key Punch Operator | .. | .. |
| (2) Punch Supervisor | .. | .. |
| (3) System Analyst | .. | .. |

15. On the basis of study/survey/factual knowledge of your organisation regarding automation in India, Comment on the following.
- (a) Improvement in information
- (b) Reduction in cost
- (c) Staff Economics
16. Give the studied opinion of your organisation as to whether computer will decrease recruitment/potential employment/over the next 3 to 5 years.
- 17 (1) Please state in brief the advantages which your organisation think that flow from computerisation to—
- (a) Employees
- (b) Management
- (c) Community
- (2) Please state in brief the disadvantages which your organisation thinks that flow from computerisation to—
- (a) Employees
- (b) Management
- (c) Community
18. How would your organisation gauge the overall economic, human and social effects of EDP programme on the work—people, community as well as economy in general ?
19. How does your organisation visualise interstate effects of office automation having particular bearing on socio-economic aspects of life ?
20. (a) According to your Organisation should there be national/state or integrated policy with regard to office Automation ?
- (b) Suggest the ways and means as to how it could be best implemented ?
- (c) Having bearing on the Policy regarding Office Automation, Please comment with reference to :—
- (i) To automate or not to automate
- (ii) Types of job to be automated.
- (iii) Redeployment of Labour ..
- (iv) Resolving Industrial disputes arising out of Office Automation.
- (v) Manufacture of equipment.

GOVERNMENT OF MAHARASHTRA

WORKS STUDY TEAM ON AUTOMATION IN MAHARASHTRA STATE

QUESTIONNAIRE 'F'

for

The Survey of the Current Status

of

Electronic Data Processing Equipment (E.D.P.) in Maharashtra

Note.—(1) This Questionnaire is for Experts/Institutions.

- (2) Tick (✓) whichever is relevant in case blocks are given to answers, in this Questionnaire.
- (3) Use separate sheet of paper to answer questions where the space provided is not sufficient.

1. (a) Name
- (b) Designation
- (c) Status
- (d) Profession/Occupation
- (e) Standing (in the field) (in years)

2. Address

3. Do you support/oppose office automation/
electronic computerisation in India ? (1)
Please give reasons. (2)
(3)
(4)
(5)
(6)

4. If automation is to be selective, how would
you comment on the following
factors ?
 - (a) Total incapacity or inability of
human being to perform the job.
 - (b) Incapacity/human inability to per-
form the job because of its magnitude
 - (c) When jobs cannot be done : within
reasonable time, efficiency and reason-
able cost ?
 - (d) Human use of human beings :
(i.e., to reduce human drudgery).
 - (e) To enable export oriented indu-
stries to compete adequately in inter-
national market.

5. If computerisation is to be introduced—
 - (a) What according to you, should be
the major consideration for the
introduction of Office Automation/
Electronic Computerisation ?

6. What according to you is the appropriate
agency to examine the feasibility of
EDP installation ?

7. What should be the principles governing the scheme of job priorities if Office Automation is to be introduced such as—

Serial No.	Type of job (job description)	Indicate priority by A. B. C.	Remarks
1	Pay Roll		
2	Financial Accounting		
3	Share Accounting		
4	Production Statistics (Sales Analysis)		
5	Market Statistics		
6	Invoicing and Billing		
7	Purchase Bills		
8	Budgeting		
9	Management Accounting		
10	Production Control		
11	Inventory Control		
12	Forecasting Credit Control		
13	Pert/CPM		
14	Linear Programme		

8. Do you have any special reasons for a particular make/model of computer ?
9. (a) If you support office automation, would you advocate the idea of manufacturing EDP Equipment by the Indian Industry ? (Please give a brief note).
- (b) What steps do you contemplate to ensure that the computer personnel safeguards the national interest ?

10. Comment in brief on the following factors which condition the speed and penetration of automation :—
- | | | |
|-------------------------|----|----|
| (a) Capital Investment | .. | .. |
| (b) Space | .. | .. |
| (c) Trained Personnel | .. | .. |
| (d) Labour/Trade Union. | .. | .. |
| (e) Foreign Exchange | .. | .. |
| (f) Other items | .. | .. |
11. What according to you would be the consideration which should figure in the settlement/agreement while coming to an understanding with Labour Union/Employer/Employers' Organisation, if office automation/electronic computerisation is to be introduced ? (If agreement has been reached, please supply a copy).
12. Please indicate your line of thinking in dealing with the problems arising out of Office Automation/electronic computerisation with special reference to—
- | | | |
|-------------------------------|----|----|
| (a) Job Redundancy | .. | .. |
| (b) (i) Training for EDP work | .. | .. |
| (ii) Training for other work | .. | .. |
| (c) Transfer | .. | .. |
| (d) Displacement of employees | .. | .. |
| (e) Retrenchment | .. | .. |
| (f) Potential employment | .. | .. |
| (g) Unemployment | .. | .. |
| (h) New Recruitment | .. | .. |
13. What should be the criteria such as qualification, experience etc. while recruiting staff in the computer section proper ? such as—
- | | | |
|------------------------|----|----|
| (1) Key Punch Operator | .. | .. |
| (2) Punch Supervisor | .. | .. |
| (3) System Analyst | .. | .. |

14. On the basis of your Study/Survey/Factual knowledge regarding automation in India, comment on the following.
- (a) Improvement in information
 - (b) Reduction in cost
 - (c) Staff Economies
15. Give your studied opinion as to whether computer will decrease recruitment/potential employment over the next 3 to 5 years.
16. (1) Please state in brief the advantages, which you think that flow from computerisation to—
- (a) Employees
 - (b) Management
 - (c) Community
- (2) Please state in brief the disadvantages which you think that flow from computerisation to—
- (a) Employees
 - (b) Management
 - (c) Community
17. How would you gauge the overall economic, human and social effects of EDP Programme on the work people, community as well as economy in general.
18. How do you visualise interstate effects of office automation having particular bearing on socio-economic aspects of life ?
19. (a) According to you should there be national/state or integrated policy with regard to Office Automation ?
- (b) Suggest the ways and means as to how it could be best implemented ?
 - (c) Having bearing on the policy regarding Office Automation Please comment with reference to.—
 - (i) To automate or not to automate. .
 - (ii) Types of job to be automated. ..
 - (iii) Redeployment of Labour ..
 - (iv) Resolving Industrial disputes arising out of office automation.
 - (v) Manufacture of equipment. ..

GOVERNMENT OF MAHARASHTRA
WORKS STUDY TEAM ON AUTOMATION IN MAHARASHTRA STATE
QUESTIONNAIRE ' G '
for
The Survey of the Current Status
of
Data Processing Equipment in Maharashtra

- Note.*—(1) This Questionnaire is for all Organisations/Offices using Data Processing Equipment of their own or hire-time basis.
- (2) The details, filled in, should be as on January 1, 1969.
- (3) Tick (✓) whichever is relevant in case blocks are given to answers in this Questionnaire.
- (4) Use separate sheet of paper to answer questions where the space provided is not sufficient.

1. Details regarding the Organisation

1. Name of the Organisation ..

2. (a) Nature of Business (give synopsis) ..

(b) Total Volume in appropriate units i.e. total sales in Rs., number of policies etc.

3. Legal status of the Organisation ..

(a) Proprietorship

(b) Partnership

(c) Private Limited Co.

(d) Public Limited Co.

(e) Statutory Corporation

4. Registered Office Address

Telephone No. :

Telegram :

5. (a) Number of Branches

	Total No. 1	Within Maharashtra 2	Outside Maharashtra 3
(a)			
(b)			

(b) No. of branches using Data Processing Equipment facilities, as output.

6. (a) Data Processing Equipment Installation at.

Registered Office.

Branch

Factory

(b) Address of Data Processing Equipment Installation.

Telephone No. :

Telegram :

7. (a) Person-in-charge of the Data Processing Equipment Installation. Name :

Designation :

Telephone No. :

(b) To whom does the person-in-charge of the Data Processing Equipment installation report to— Name :

Designation :

Telephone No. :

8. Total Number of Office Employees (please fill in the following table) :—

Serial No.	Category	Within Maharashtra				Outside Maharashtra			
		Male		Female		Male		Female	
		Perma- nent	Tempo- rary	Perma- nent	Tempo- rary	Perma- nent	Tempo- rary	Perma- nent	Tempo- rary
A	Technical ..								
B	Clerical* ..								
C	Supervisory								
	Total ..								
D	Subordinate								
E	Others ..								
	Total ..								
	Grand Total								

If information by categories asked for is not available, totals may be given.

*Clerical employees include those engaged in Book-keeping and Accounting, Computing and Statistical Compilation, Posting, Checking and Maintaining Records, Sorting, Routing, Filing, Typing and Routine Correspondence, Secretarial Assistance etc.

Description of the Data Processing Equipment

9. (a) Description of the Data Processing Equipment.

Serial No.	Equipment	Manufacture	Model No.	No. of Units	Remarks if any
1	Interpreting Card Punch ..				
2	Card Punch				
3	Card Varifier				
4	Interpreter				
5	Sorter				
6	Collator				
7	Reproducing Punch ..				
8	Calculating Punch ..				
9	Accounting Machine ..				
10	Other (describe)				
11					
12					
13					

(b) Approximate No. of Cards ..

10. (a) Is the equipment purchased or hired ?

(i) Purchased :

(ii) Hired :

(iii) Both (Please explain)

(b) If purchased

(i) Total cost of Data Processing Rs.
Equipment (including importation
Charges).(ii) Average monthly cost of main- Rs.
tenance.

(c) If Hired

(i) One time charge paid Rs.

(ii) Average monthly hire (including maintenance) charges of Data Processing Equipment. Rs.

11. (a) Date of Installation of Data Processing Equipment.

(b) If already in production please give the date of first production run.

12. (a) How far the Data Processing Equipment facilities of your Organisation are utilised currently (Please give monthly percentage Utilisation) in relation to established goals of the Organisation at present.

(b) Out of the monthly Data Processing Equipment utilisation, please give the percentage Utilisation in the table given below :—

Serial No.	Category	Monthly Percentage Utilisation
1	Your own organisation job ..	
2	Outside organisation job (if any)	
		100

(c) When do you expect to achieve full or near full utilisation as per the present plan ?

(d) Give indication of your current and envisaged applications by classifying items into *major* and *minor* as per usage of accounting machine time in the table below :—

Serial No.	Type of Job (job description)*	Jobs on Data Processing Equipment at present		Future Projection						Remarks, if any	
				1970		1971—72		1973—74			
		Major	Minor	Major	Minor	Major	Minor	Major	Minor		
1	Pay Roll										
2	Financial Accounting										
3	Share Accounting										
4	Production Statistics (Sales Analysis) ..										
5	Market Statistics										
6	Invoicing and Billing										
7	Purchase Bills										
8	Budgeting										
9	Management Accounting										
10	Production Control										
11	Inventory Control										
12	Forecasting Credit Control.. ..										
13	Pert/CPM										
14	Linear Programme										
15											

*These are only representative categories of application.

12. (e) Give indication of your current and envisaged application by classifying items into major and minor as per importance to the company by way of benefits in the table below :—

MO-B R 4219-18 (2,525-8-70)

Serial No.	Types of job (job description)*	Job on Data Processing Equipment at present		Future Projection						Remarks, if any
				1970		1971—72		1973—74		
		Major 3	Minor 4	Major 5	Minor 6	Major 7	Minor 8	Major 9	Minor 10	
1	2									11
1	Pay Roll									
2	Financial Accounting									
3	Share Accounting									
4	Production Statistics (Sales Analysis) ..									
5	Market Statistics									
6	Invoicing and Billing									
7	Purchase Bills									
8	Budgeting									
9	Management Accounting									
10	Production Control									
11	Inventory Control									
12	Forecasting Credit Control									
13	Pert/CPM									
14	Linear Programme									
15										

*These are only representative categories of application.

13. Persons employed in Data Processing Department—

Serial No.	Designation	Total No.	Trained from within	Recruited from outside	Remarks, if any
1	2	3	4	5	6
1	Key Punchers				
2	Punch Supervisors				
3	Unit Record Machine Operators				
4	Unit Record Section Supervisors				
5	Checkers				
6	Coders				
7	Others				
8	Person-in-charge				
	Total No. of Employees ..				

GOVERNMENT OF MAHARASHTRA
WORKS STUDY TEAM ON AUTOMATION
IN
MAHARASHTRA STATE
QUESTIONNAIRE ' H '
for
The Survey of the Current Status
of
Data Processing Equipment in Maharashtra

Note.—(1) This Questionnaire is for all Organisations/Offices using Data Processing Equipment of their own or on hire time basis.

(2) It should be filled in by the top management.

(3) The details, filled in, should be as on January 1, 1969.

(4) Tick (✓) whichever is relevant in case blocks are given to answers in this Questionnaire.

(5) Use separate sheet of paper to answer questions where the space provided is not sufficient.

(6) Please attach this Questionnaire with Questionnaire ' G ' along with Statistical Tables attached to this Questionnaire.

9. Indicate briefly the nature of difficulties encountered by your organisation in installing Data Processing Equipments due to (if possible, given an explanatory note).

Serial No.		Yes	No	Comments
a	Capital Investment ..			
b	Space ..			
c	Trained Personnel ..			
d	Labour/Trade Union ..			
e	Foreign Exchange ..			
f	Other items ..			

10. Have you come to any understanding with Labour Union/Workers' Group before the Data Processing equipment was acquired/installed?

Yes

No

10. (a) If yes, please supply a copy of the agreement.

(b) If no, please give reasons.

11. Please give a brief account of the problems encountered.

12. Was there any labour unrest (strikes, go-slow, work to rule, demonstration etc.) on account of the Entroduction of the Data Processing Equipment? If yes, please give a brief explanatory note.

13. (a) If there has been any displacement of staff on account of introduction of the Data Processing Equipment (job redundancy) please give the total number of redundant job personnel.

(b) How was the problem of displacement of staff on account of the introduction of the Data Processing Equipment was dealt with? Please fill in the following table.

Serial No.	The Method of Adjustment	No. of Persons	Percentage	Remarks, if any
(i)	Absorbed in expansion			
(ii)	Provided alternate Jobs			
(iii)	Retrained and put on the Data Processing Equipment Section			
(iv)	Transferred to new jobs			
(v)	Retrenched.			
			100	

(c) If you have increased the staff (Please give details, if possible).

14. Do you think that the Data Processing Equipment will decrease recruitment over the next 3 to 5 years ? Please give a brief note.
15. How were the staff recruited for your Data Processing installation.

Serial No.	Category	From the existing staff members.	Recruited from outside	Remarks, if any
1	Key Punch Operator.			
2	Punch Supervisor.			
3	Unit Record Machine Operator.			
4	Unit Record Supervisor.			
5	Checker			
6	Coder			

16 Give in brief the nature of the consequences due to Data Processing installation in respect of the following :—

- (a) Improvement in information
- (b) Reduction in cost
- (c) Staff Economies

17 Did the introduction of Data Processing result coupling of different processes of the old system ?

Yes. No.

- (a) If yes—please give details.
- (b) If no—please indicate reasons.

18 What was the experience of your organisation regarding—

- (a) Labour Discontent.
- (b) Employees supervision and training.
- (c) Efficiency of office record maintenance.

19 (1) What other special advantages flow from the use of Data Processing Equipment to your organisation :—

- (a) Employees
- (b) Management

(2) What other disadvantages flow from the use of Data Processing Equipment to your Organisation :—

- (a) Employees
- (b) Management

(c) Any other comments/remarks which on you think, would be useful to the work of the Study team.

TABLE I
Survey of Office Employment

Please give number of full-time ; part-time and temporary employees on the payroll of this organisation (including all branches and company agency offices) during the pay period mentioned under:—

All Office Employees Total for the entire company 1	As at 1st January						Comments 8
	1961		1965		1969		
	Male 2	female 3	Male 4	Female 5	Male 6	Female 7	
Full time ..							
Part time ..							
Temporary ..							
Total ..							

Total Number of clerical employees in the organisation 1	As at 1st January						Comments 8
	1961		1965		1969		
	Male 2	Female 3	Ma 4	Female 5	Male 6	Female 7	
Full time ..							
Part time ..							
Temporary ..							
Total ..							

Total number of employees performing work directly essential with the 1	As at 1st January						Comments 8
	1961		1965		1969		
	Male 2	Female 3	Male 4	Female 5	Male 6	Female 7	
Unit Record Section							
EDP Section ..							
Total ..							

TABLE II
Data Processing Personnel

	Category	Total	Male		Female		General education required (Graduate Etc.)	No of trained persons.		No. of persons trained abroad	Comments.
			Total	Salary range (monthly)	Total	Salary range (monthly)		at our installation	out side agency		
(a)	Administrators or Supervisers.										
(b)	Project planners, systems designers, systems analysts.										
(c)	Unit Record Machine operator and Central board Wirers.										
(d)	Key punch, verifier, data typing, communications and related machine operators.										
(e)	Receptionists, secretaries, stenographers, typists, messengers, etc.										
(f)	Miscellaneous ..										
	Total ..										

TABLE III
OFFICE AUTOMATION

1. Employment effect of Data Processing

Category of employment	Name and Identification of job category	Total employment before introduction of Data Processing Equipment	Total employment after introduction of Data Processing Equipment (at the present level)	Retained in old jobs	Rede played or absorbed elsewhere in organisation	New entrants in new jobs in the organisation	Absorption in new occupations created by introduction of Data Processing Equipment.	Retrenchment	Comments
	1		2					3	
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>d</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
I	Administrative/Managerial Personnel.								
II	Supervisory Personnel								
III	Clerical staff including typists, Stenographers etc.								
IV	Technical staff (other than Data Processing Equipment Personnel.)								

V	Punch Operators Machine Operators.	and							
VI	Miscellaneous .. (Please describe).	..							
VII									
	Total ..	..						

- (1) This column could be used also for the changed occupational structure after use of EDP.
- (2) The same proforma can be used for perspective picture after 5 years.
- (3) If retrenchment compensation is paid, please give the amount.

If it is not feasible to give figures as per categories given above kindly give a running descriptive account of the actual changes that have occurred before and after installation of computer under different categories of personnel together with figures available.

TABLE IV
IMPACT OF DATA PROCESSING EQUIPMENT
(Before and after Automation)

As at 1st January, 1969.

Serial No.	Nature of Job (Classification)	Occupational Structure			Working conditions				Conditions of service			
		Nature of work (Simpler).	Nature of functions. (Supervisory).	Skill requirements (Higher efficiency).	Hours of work (More leisure).	Shift work. (Facilitated).	Safety conditions (Safer work).	Physical environment. At work (pleasant).	Higher Wages.	Better Incentives.	Fringe Benefits.	Employees Services.
(i)	(ii)	*	†	*	*	*	*	*	*	†	†	
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)	(xi)	(xii)	(xiii)
1	Executive Personnel ..											
2	Administrative Personnel ..											
3	Clerical Staff including Typist Stenographer, etc.											
4	Technical Staff (other than DP Personnel).											
5	Punch Operators and Machine Operators.											
6	Miscellaneous (please describe).											

Note.—(1) Answer questions marked * by YES/SAME.

(2) Answer questions marked † by IMPROVED/SAME/DETERIORATED.

TABLE V
 IMPACT OF DATA PROCESSING
 (Before and After Automation)

As at 1st January 1969.

Category	Description of Job Category	Decision Making (Speed, Quality, economy)			Comment
		Communica- tion	Planning	Organisation	
1	2	3	4	5	6
I	Administrative/Managerial Personnel.				
II	Supervisory Personnel				
III	Clerical staff including Typists Stenographers, etc.				
IV	Technical Staff (other than Data Processing Personnel)				
V	Punch Operators, Machine Operators.				
VI	Miscellaneous (Please describe)				

TABLE
 IMPACT OF DATA
Personnel
 (Before and after Data
 (Changes before and after
 As at 1st

Serial No.	Description of the job category	Age composition	Physical requirement	Mental make up
1	2	3	4	5
1	Executive Personnel			
2	Administrative Personnel			
3	Clerical Staff including typists, stenographers, etc.			
4	Technical Staff (other than DATA Processing Personnel.			
5	Punch operators and machine operators ..			
6	Miscellaneous (Please describe) ..			

Note.—Answer these questions by YES or NO.

VI

PROCESSING

Criteria

Processing Equipment).

Data Processing use)

January, 1969.

Character personality 6	Educa- tional back- ground 7	Training needs 8	Experience preference 9	Respon- sibility assump- tion 10	Promotion chances. 11	Transfer possibili- ties 12	Replace- ment of new functiona- ries 13