

9. INFORMATION TECHNOLOGY

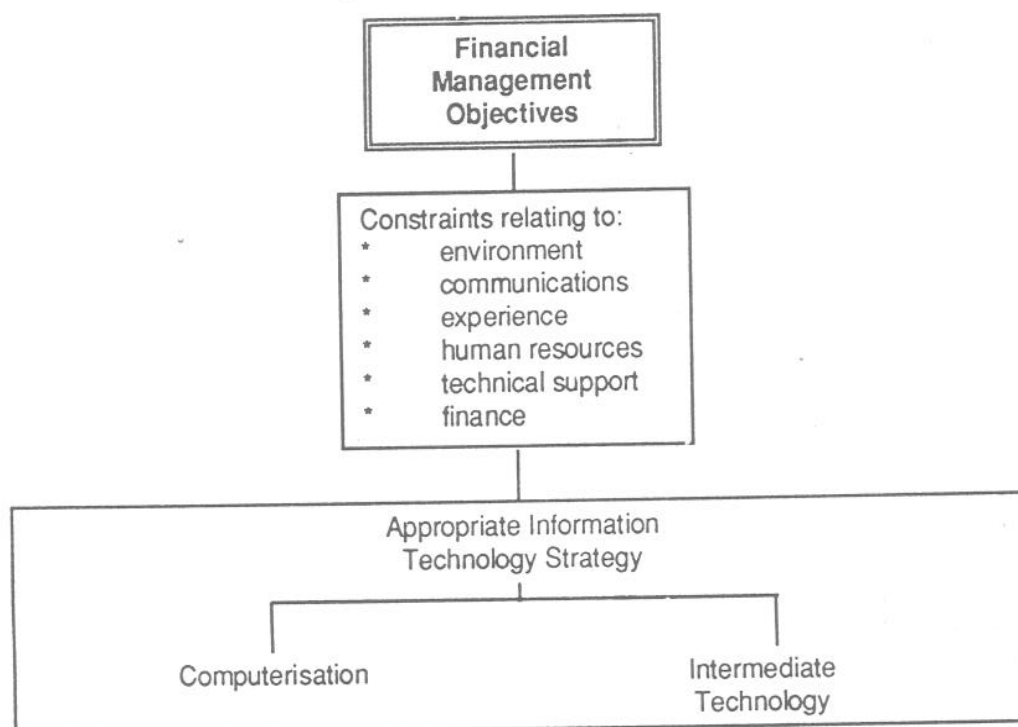
9.1. The role of information technology

9.1.1. Existing computer systems and strategies are examined in more detail in Technical Paper No. 5 "Computerisation and Management Information Systems".

9.1.2. Information technology is not an end in itself, but a tool which can enhance the achievement of financial management objectives. Information technology is commonly regarded as synonymous with computers, but in fact also embraces intermediate information technology, e.g. calculators, card index accounting systems. This wider concept of information technology is particularly apposite in the context of Bangladesh, where intermediate technology needs to be considered both generally as an alternative to computerisation, and specifically in locations where computerisation is presently infeasible.

9.1.3. The task is to identify an information technology strategy that is appropriate to the needs of Bangladesh, in that it will effectively promote the achievement of the goals of financial management. Such a strategy must be realistic, taking account of constraints relating to limited experience of accounting applications, the physical and communication environment, and the human resources to operate the system. These factors are represented diagrammatically in the model below.

Figure 20: Technology strategy



9.2. Present information technology strategy

9.2.1. Bangladesh is fortunate in that has by-passed the era of large and cumbersome mainframe computers. There are no major applications in either accounting or budgeting using such machines. There are, however, a number of specific applications within both budgeting and accounting which have been computerised on mini-computers or micro-computers⁶. For example, the Planning Commission use a computer planning model, and IMED have computerised project monitoring; Economic Relations Division has a spreadsheet model of the Three Year Budget; within Finance Division, the Autonomous Bodies monitoring system (known by the acronym SABRE) is computerised. In addition, many projects and some offices have introduced micro-computers, some of which are used for accounting related functions. These various systems use different software, and none are able to exchange information. A number of the larger systems are operating on hardware which is at the end of its economic life.

9.2.2. The accounting and expenditure control systems are entirely manual, using hand written paper records. Very little use is made even of simple intermediate technology, in terms of calculators and add-listing machines. However, the systems, procedures and documentation, despite their age, are remarkably well structured and form a sound basis for any information technology strategy.

9.2.3. The Comptroller and Auditor General's office has initiated an important programme to computerise payroll, and also the Defence accounts. Though we are unclear as to why this is taking place within the office of Comptroller and Auditor General, rather than the Controller General of Accounts, we support this initiative. The technology platform⁷ adopted also meets our criterion below. We do not consider the systems development approach is sufficiently vigorous, but regard this of less importance than the valuable experience in computerisation that will be gained.

9.2.4. There is no group within any of Comptroller and Auditor General's, Controller General of Accounts, Finance Division or the Planning Ministry which has responsibility for co-ordinating and developing technology strategies. Nor is there any mechanism for co-ordinating the information strategies of these various organisations, so as to ensure compatibility and where appropriate, the capability to exchange information. No computer standards have been developed for use by these organisations. We regard the development of such a co-ordinating mechanism and standards as being of the greatest importance, and have included it within our strategies.

9.2.5. The Bangladesh Computer Council is a statutory body set up to promote the use of computers by formulation of policy and provision of advice on information technology matters throughout Government, to provide advice to the Private Sector, and to provide training facilities. However the role of Bangladesh Computer Council is ill defined. It suffers from a shortage of skilled resources, both in manpower and equipment, and is unable to carry out its mandate effectively. Despite these limitations the Council has made recommendations on a common development environment for Government, which fall within the parameters we indicate below.

⁶ This section attempts to minimise the use of technical jargon, or where it used to explain the terms by way of footnote. In this section, "mainframes" refers to large computers which typically handle central processing of very large volumes of data; "minicomputers" are progressively taking over most of the applications previously handled by mainframes, because of the increasing power of small machines (often referred to as "downsizing", for obvious reasons). Microcomputers refers to small PCs, typified by the ubiquitous IBM PC.

⁷ By technology platform is meant the combination of hardware (equipment), operating systems, and software (in total the "platform") on which the system operates.

9.2.6. The UNDP is funding a project to upgrade the Computer Council, which we support. We believe the focus of this project should be on developing computer standards and common policies for use throughout government, and also the development of training and consultancy support for government computerisation. This should lead ultimately to a broad strategy for government computerisation, and in so far as this exists before the implementation of Phase II of this project, it should be observed.

Recommendation

63 The UNDP Project with the Bangladesh Computer Council should focus on developing standards and common policies, and those should be observed by the Phase II project.

9.2.7. At present no consideration has been given to implementing or changing intermediate technology in the budget or accounting systems. Indeed, the level of intermediate technology is degrading, as many offices suffer a severe shortage of accounting forms and books, and are having to revert to plain sheets of paper. Many offices lack calculating or add-listing machines.

9.3. Appropriate Technology

9.3.1. The need to identify and implement appropriate technology has already been identified. Computerisation has substantial advantages, which are set out below. However, it also has certain requirements: (i) reliable and constant voltage electrical supply; (ii) dust and humidity free environment; (iii) physical security; (iv) personnel capable of operating the equipment and dealing with minor problems; (v) prompt access to maintenance. Furthermore, the capital, maintenance and training costs of the equipment and software have to be set against the volume of transactions and expected benefits.

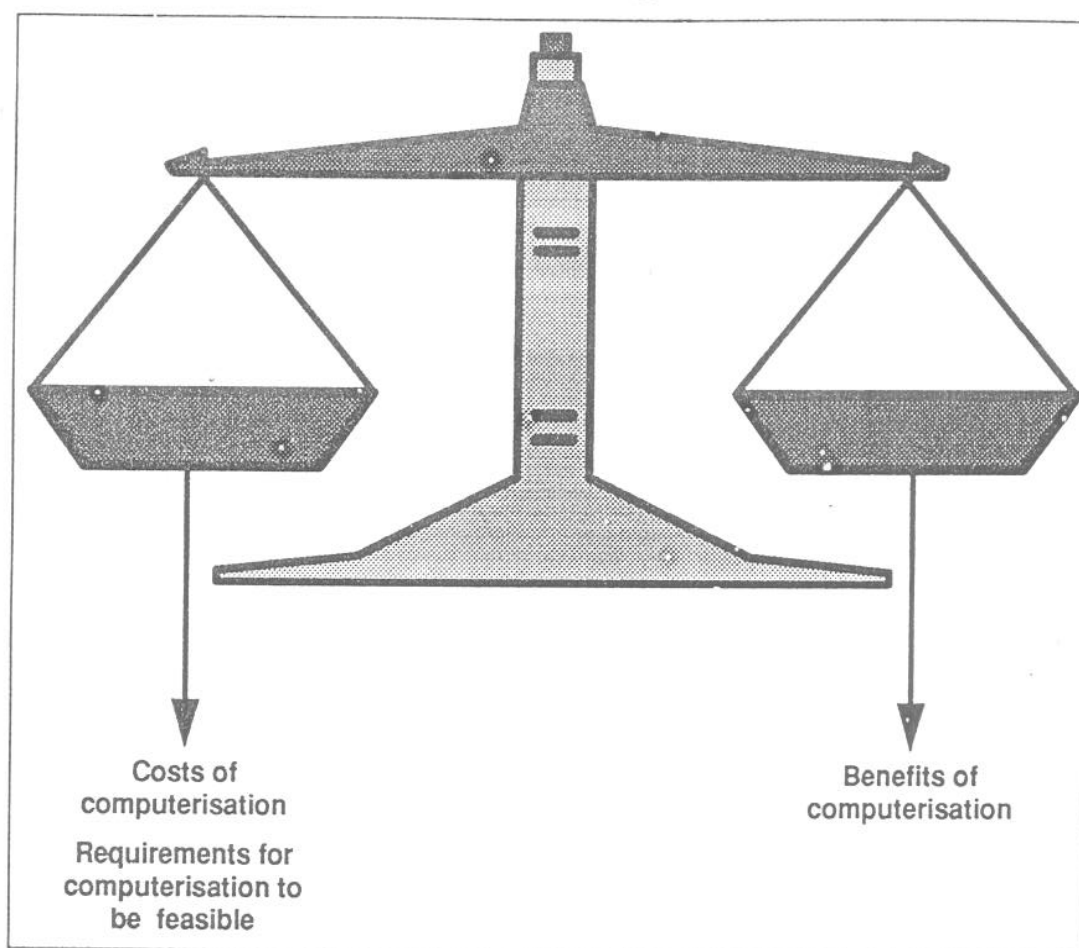
9.3.2. However, the benefits of computerisation are substantial. They may be summarised as follows:

- the ability to handle and process large volumes of data quickly and accurately;
- the ability to store and retrieve quickly and easily data, and to be able to analyse that data flexibly according to varying requirements;
- the controls and checks that can be built into the system;
- output and report formats that can meet high presentation standards so as to make complex information more readily understood.

9.3.3. Against these benefits must be set the very real and substantial costs identified above. Furthermore it must be recognised that a computer system will not in itself solve data processing problems - if input data is unreliable or inaccurate, no computer can resolve these inadequacies. Furthermore, the "invisibility" of the processing makes it more difficult to identify errors, or frauds, and therefore makes a system of checks and controls of vital importance. Finally, dependence is on a computer system which is always liable to mechanical failure, and therefore the system must be properly planned to cope with such disasters.

9.3.4. Thus the choice of information technology today in Bangladesh is essentially a matter of balancing the benefits of computerisation against the costs and problems identified above.

Figure 21: the technology balance



9.3.5. The choice that emerges from this balance is likely to vary between individual locations, and may change over time. For example, in many Thanas and Districts, computerisation is unlikely to be feasible for some considerable time. However, this will change as both technology and electricity supplies improve in these areas, and the level of human resource skills improve.

9.3.6. Therefore it is concluded that for significant parts of the budgeting, accounting and expenditure control system, computerisation is either inappropriate or infeasible. Such parts of the system will have to continue to use some form of intermediate technology, which will need to be able to communicate effectively with computer applications as they are introduced. The question arises as to what extent the present manual systems and technology should be upgraded by the use of intermediate technology pending full computerisation.

9.3.7. It is our judgement that the present manual systems are conceptually sound, and the gains from moving, for example, to a card index system, would be outweighed by the costs and disruption that would result. However, significant gains could be made from ensuring that the existing systems operate as intended by ensuring adequate stationery supplies, and new forms are designed and made available to cope with the new classification system when it is introduced. Also the provision of add-listing machines to all offices would at a small cost bring considerable gains.

9.3.8. By continuing to operate existing manual systems pending full computerisation, efforts would not be dissipated in re-designing such existing systems, and training staff in their use. Instead the focus can be on maintenance of existing systems, and the design and introduction of computer systems as and when appropriate (see below).

Recommendation

64 Intermediate technology should be used and developed for the major part of the system where computerisation is presently infeasible, and resources should be invested with this objective.

9.4. Target applications for computerisation

9.4.1. Having accepted that the existing manual systems will be maintained substantially unchanged until computerisation, it is necessary to identify those areas which will be the priority for computerisation, and where the benefits outweigh the costs. Three major target applications have been identified for computerisation:

- (i) preparation, presentation and monitoring of Revenue and Development Budgets;
- (ii) accounting, reporting and expenditure control system in the Controller General of Account's Office, as a core system to be able to provide management reports, information to Finance Division and other Ministries, statutory accounts, and other reports to constitute a Financial Management Information System;
- (iii) a payroll and pensions system for all as a bureau service for all CAOs in relation to their central salary payments (but not Thanas and Districts within Phase II).

9.4.2. In addition we propose in Phase II two pilot applications, an interim system, and the development of a general policy in relation to office automation tools:

- (iv) pilot computerisation of two District Accounting Offices;
- (v) an interim system of expenditure control and monitoring for all CAOs, based on providing each CAO with a small network of microcomputers and systems to enable them to consolidate data directly from Districts and prepare their own reports for management;
- (vi) progressive introduction of office automation tools (word-processing, spreadsheet, database) wherever they are appropriate. In each case the software package should be standardised, rather than allowing users to select their own software.

9.4.3. The detail of these applications, and the reason for their selection is further discussed below. It is our view that this level of automation is both appropriate and feasible, and in all of these applications the benefits substantially outweigh the costs. Before considering these applications individually, some general principles on the computerisation strategy are set out below.

9.5. Computerisation strategy

9.5.1. Computerisation involves a series of decisions. It is not appropriate that all of them should be made at this stage, because many must depend on evaluations of tenders from vendors, and detailed design in Phase II. However, it is appropriate to identify the area of decisions, and to indicate those which do need to be made at this stage. In summary they are:

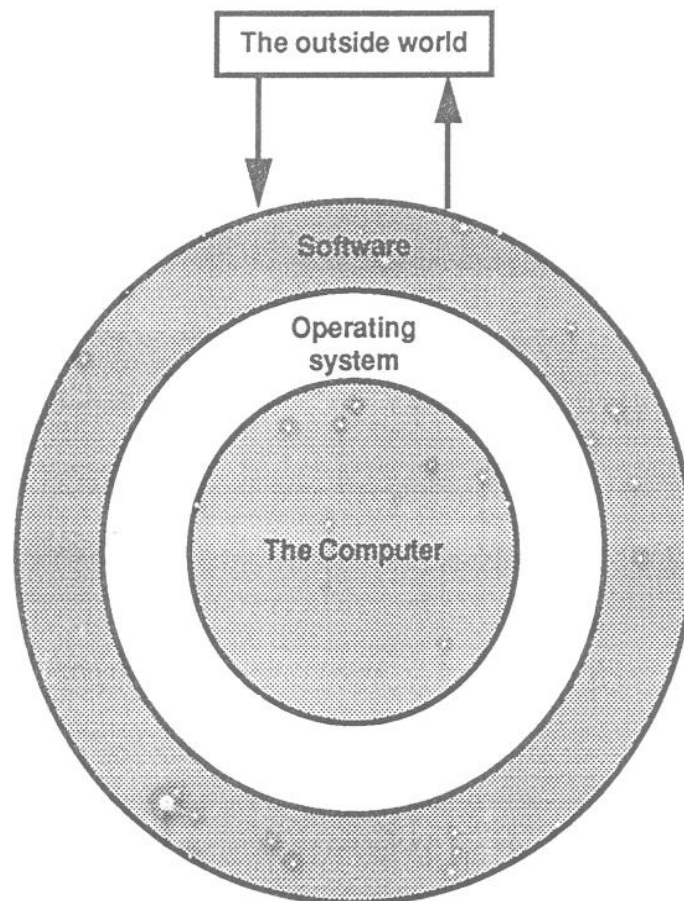
- the technology platform, and particularly the choice of "open" systems;
- the approach to selecting and developing software;
- the approach to dealing with the need for Bangla output;
- physical organisation of data processing and communications;
- vendor selection strategy;
- approach to system development.

9.5.2. In total these define the systems architecture. They are further discussed below.

9.6. Technology platform

9.6.1. The heart of any computer system is the machine itself, and the operating system which enables the machinery to link to software. These two comprise the technology platform, and can be seen as part of a multi-layered cake.

Figure 22: the concept of technology platform



9.6.2. Software (e.g. an accounting system, database, word processor) is the visible part of the computer system to the user. This software communicates with the computer via an operating system, which converts software instructions into coded electronic instructions. Until recently operating systems were specific to individual machines, and as a result software had to be written afresh for every different machine. More recently, standard operating systems have been developed which can be used by a variety of different machines. The concept of "open systems" is essentially linked to the use of these "machine independent" standard operating systems. The two main examples of such general operating systems are DOS and UNIX.

9.6.3. However, open systems concepts have wider implications than the operating systems, and these are of fundamental importance in selecting the technology platform for the target applications. Where a number of machines operate under open systems the following characteristics apply:

portability	the ability to move software applications between different makes and models of computers
scalability	the ability to change the overall size of an application, so that can be used for locations with very different volumes of activity

interoperability	the ability to connect the different makes and models of computers so that they can exchange information
compatibility	the capability to use applications and systems over time with new versions of the equipment and other systems components

9.6.4. These are clearly desirable characteristics of any system, and therefore in principle such systems should be adopted. Unfortunately no systems at present totally comply with the above requirements. The nearest examples are provided by DOS and UNIX. The Bangladesh Computer Council has recommended UNIX as the system to be adopted for all applications where DOS is not adequate, and we endorse this recommendation⁸. The choice between mini and micro computers is dealt with under physical system organisation, below.

Recommendation

65 Any minicomputer systems implemented under the Project should comply with open system standards and use UNIX operating systems.

9.7. Software selection and development

9.7.1. The selection and development of software will be critical to the success of the applications, and there are essentially three choices:

Packaged software	Software developed and maintained by third party vendors. Typically such software is used for most office automation tools, and also for commercial accounting. The advantages relate to reliability and sophistication; however, such packaged software can be very expensive if licenses are required for every machine.
Custom software	Software specially developed and written for a specific application. The advantages are that it is tailored to meet the exact user requirements, and once developed can be used at different sites without further cost. However, development is very expensive, systems need to be maintained, and it is very difficult to develop a sophisticated system which works without any problems.
Custom development on a Relational Data Base Management System (RDBMS)⁹	The RDBMS package is used for the development of a custom solution, but with many of the general tools (e.g. reporting facilities, security, screen format design) already built into the package. Most such packages use the so-called "4GL" languages which make development much quicker and easier.

9.7.2. A decision has to be made at an early stage between these alternatives for each of the target applications. The risks must be recognised, and are dramatically exemplified by the recent UK decision to decommission the custom developed share dealing system for the London Stock Exchange (TAURUS), because it has simply failed to work after four years of development and a very large investment. This is also why the tendency has been to move to the use of packaged software for commercial accounting applications.

⁸ Strictly we should refer to compliance with the POSIX (Portable Operating System Interface) standards, but as Unix has become a proprietary operating system, UNIX is likely to be the de facto POSIX standard by the time Phase 2 implementation takes place

⁹ An RDBMS is a sophisticated software package which allows the creation of a series of data bases which can be linked together, in which the format and relationship of data can be specified, and from which a variety of reports can be generated. Such software is ideal for developing financial applications, where the accounting and budget transactions comprise the data.

9.7.3. On the other hand, it must be recognised that worldwide there is very little government budget and accounting software, and as a result commercial accounting software often has to be adapted to the special needs of government. No suitable accounting or budget packages have any vendor support in Bangladesh. Furthermore, lower labour costs in Bangladesh make custom development more financially feasible. Experience in and vendor support for some RDBMS is available within the country. Also, sustainability needs to be considered; packaged software would take the control for development and maintenance outside the country, and there would be substantial and ongoing costs. This applies to some extent to RDBMS, but it may be possible to negotiate an agreement at a national level for such widespread applications.

9.7.4. Finally it should be noted that the Computer Council has recommended the adoption of Oracle as an RDBMS. Oracle is a proprietary software package, is widely used internationally, and is supported within Bangladesh. It runs under both DOS and UNIX. This RDBMS is the system on which the payroll application in the Comptroller and Auditor General's office is being developed. Inevitably this recommendation has been opposed by other RDBMS vendors. We would not become embroiled in a dispute between alternative proprietary packages, but consider that a clear choice should be made and adhered to, and the RDBMS should meet the above criteria. In so far as Oracle is presently the recommended system, then this standard should be adhered to in Phase II.

9.7.5. Our conclusion is that the major target applications on the budget, core accounting and payroll should be custom developed on a UNIX-based RDBMS approved by the Bangladesh Computer Council. The interim system for CAOs should use a commercial accounting package, adapted for the specific needs of Bangladesh (this would also provide a backup should custom development of the core accounting system run into problems). The pilot system in the Districts could experiment with both custom developed and pilot software, as part of the development exercise. All office automation should be based on standardised package software.

Recommendation

66 The target applications for budget, the central accounting system, and the payroll system should be custom developed on a UNIX based RDBMS recommended by the Bangladesh Computer Council.

67 The office automation tools and interim CAO System should use packaged software which should be standardised. Pilot applications should be developed on both packaged software and the RDBMS.

9.8. Language

9.8.1. It is regarded as essential that any application has the capability of producing output in both Bangla and English. It is also desirable that input can be made in Bangla, because of the limited English language capabilities of the likely operators. However, at present there are no minicomputer applications in Bangla, and only word processors in Bangla on DOS based PCs. The only system with extensive Bangla capabilities is the Macintosh microcomputer system, where the ability to select Bangla fonts can be used in any software. However, Macintosh computers use a proprietary operating system which does not comply with the open system standards set out above.

9.8.2. To develop an RDBMS in Bangla would require a very substantial investment, and also an ongoing maintenance cost. This would be broad policy decision, and not one to be made within the context of a specific project. Therefore the proposals made below are based on software that currently exists or may feasibly be developed.

9.8.3. It is therefore regarded as inevitable that data entry will have to be via conventional keyboards onto a screen using English characters. The problems of the limited English of operators may be overcome by developing manuals in Bangla, which show screen displays in English and then provide a translation in Bangla. Over time operators with only basic English will be able to cope with English screen instructions because they see them every day.

9.8.4. To achieve output in Bangla or English, two approaches are possible. One is to have the reports set up in a Bangla word processor as a series of template documents, into which the figures are manually typed. This approach would be cumbersome and prone to error. The preferred alternative is to set up the templates as spreadsheets, into which the figures are automatically transferred from the minicomputer system¹⁰. At present this would only be achievable using Macintosh computers as terminals to the minicomputer, but there is no reason in principle why a similar capability should not be developed for DOS based microcomputers.

Recommendation

68. Tender requirements for applications should specify the capability to produce report output automatically in either English or Bangla

9.9. Physical organisation of data processing and communications

9.9.1. Traditionally computer systems have been highly centralised. However, the economics of modern computers make smaller decentralised systems more cost effective. In Bangladesh this means moving computer systems out to Chief Accounts Officers, District Offices, and even Thanas. In the longer run, such distributed computer systems are undoubtedly appropriate. However, at present such a distributed approach presents a number of problems:

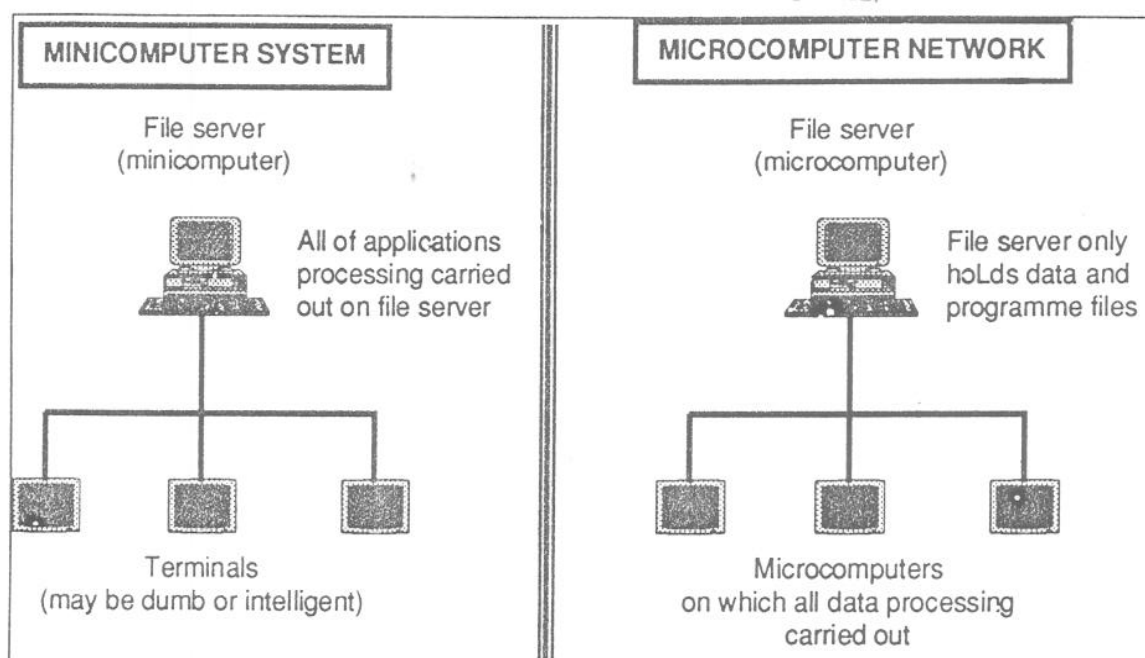
- the lack of maintenance or support facilities outside Dhaka;
- the inadequate communications (see below);
- the lack of expertise or experience of computer systems in Government, and the difficulty of managing a number of different implementation sites.

9.9.2. For these reasons the priority applications relating to budget, accounting and payroll are all located centrally, with only pilot systems in two DAOs. Nevertheless, we consider that the objective in Phase III should be to distribute the data processing as far feasible.

9.9.3. A choice must also be made between minicomputer systems, and networks of microcomputers. The difference is represented diagrammatically below.

¹⁰ Minicomputers can use either simply screens and keyboards as terminals (dumb terminals), or alternatively can use microcomputers as terminals (intelligent terminals). If the latter approach is used, data can be transferred from the minicomputer to the microcomputer terminal, and the latter can then carry out further processing on the data as indicated above.

Figure 23: minicomputer compared to network installations



9.9.4. Thus the major difference is that under a minicomputer system, the "file server" not only holds files but also processes the data. Terminals may be "dumb" (i.e. have no data processing capability of their own), or intelligent (i.e. microcomputers capable of processing data in their own right). However, intelligent terminals do not use their own data processing capability for the main application processing, but for other purposes, such as word-processing, i.e. they become dual purpose machines. Under a network, on the other hand, the file server is itself simply a microcomputer, and only holds files; the actual data processing is done on the microcomputer workstations. Note that physically minicomputers are no larger than microcomputers, and indeed the same machine may serve in either role depending on the software.

9.9.5. Minicomputer systems (as defined above) are advantageous where large volumes of data relating to a single application need to be processed, e.g. accounting and payroll applications with many transactions. Networks are more suitable where the volume of data relating to individual applications is smaller, but more sophisticated data analysis is required. Minicomputer systems generally have better file security procedures, and larger data storage capacity. Combining microcomputer terminals with a minicomputer file server obtains the advantages of both systems, but is more expensive.

9.9.6. Standalone microcomputers (i.e. not connected to a network) provide the lowest cost computing, and are appropriate for many office automation tasks. However, experience shows that where in an office a number of users are using such machines, considerable benefits are gained from networking, in terms of ability to share files and transmit information.

9.9.7. There is no doubt that the three major target applications - budget, core accounting system, and payroll - are better suited to development on a minicomputer system, but using at least some intelligent terminals for further data processing, and particularly for conversion of data into English and Bangla reports (see above). For office automation tasks microcomputers (standalone in smaller locations, networked in larger offices) are appropriate. The interim system in the CAOs and the pilot applications in DAOs should be based on networked microcomputers.

Recommendation

69 The major pilot applications are initially set up as centralised data processing functions using minicomputers with at least some intelligent terminals. Office automation, pilot CAO and the interim CAO system on microcomputers.

9.9.8. The actual hardware purchased should be in line with both local and world hardware trends, i.e. nothing less than an Intel, or similar compatible, 80386 chip processor computer should be acquired. This provides a logical growth path for the future, as the 80486 chip is now available, and, in turn, its successor is imminent. An alternative hardware is the Macintosh 68x0 chip architecture, referred to above. Exact specifications of hard disk size, memory size, and so on, can only be realistically determined once individual site volumes, and software requirements become clearer. Similarly there will be other hardware requirements dependent on final specifications, including network cards, printers and uninterruptible power supply systems.

9.9.9. It is essential that data can be transferred between the various applications. Specifically data from the budget needs to be incorporated in the core accounting system for expenditure control, payroll data needs to be incorporated into the core accounting system, data needs to be transferred from the core accounting system to CAOs, and so on. Also it is very desirable that data from the Planning Commission on Projects can be transferred into the budget system. The most important requirement is that the various systems are designed to ensure the possibility of such data transfer.

9.9.10. Physically the data can be transferred either by telephone links, by special cable links, or by the physical movement of disks. At present the telephone links are of too low a quality to be used reliably for data transmission. Cable links may work within a building, but are infeasible for longer distances, and may conflict with statutory monopolies. For communication between DAOs and Dhaka, it may be feasible to use the fibre optic cable network between most railway stations. However, this is an issue for Phase III when the computerisation is extended to DAOs. For the present, the simplest and most reliable method of transmitting data will be by moving floppy disks.

9.9.11. The feasibility of the introduction of alternative methods of data transmission should be kept under frequent review. In the meantime, all equipment purchased should be compatible with international communications standards, and industry protocols, to facilitate a smooth migration path to alternative transmission methods in the future.

9.10. Target Applications

(i) Preparation, Presentation and Monitoring of Revenue and Development Budgets

9.10.1. The Revenue and Development Budget Application will provide an integrated model into which all budget estimates can be entered as they are received from departments. It will interface with the core accounting system so as to be able directly import files of previous years' actual data. The system will generate all the budget documentation, in both English and Bangla, both as ongoing documents for review during the budget preparation phase, and as camera ready documents for printing once the budget is finalised. This will substantially reduce the need for detailed proofing, and remove delays in the printing process other than associated with the printers themselves. The system will also be able to retain and generate detailed budget documents required by the departments. The system will be located in the Finance Division.

9.10.2. It is very desirable that this system uses compatible file formats and project reference numbers to those used by Planning Commission in the new computer system to be developed for them with assistance from UNDP. The present numbering system used for Projects in the budget is not suitable for computerisation, and is in fact not used by IMED for their computer monitoring. For the latter they use a six-digit number generated within IMED and not used outside. We would recommend a single project number, which need only be four digits, used consistently throughout government and by the projects themselves.

Recommendation

70 The Phase II Project and the UNDP Project in the Planning Commission co-ordinate their activities to ensure that data can easily be transferred between the systems, and a standard referencing system be developed for all projects.

(ii) Core Accounting, Reporting and Expenditure Control System

9.10.3. The core accounting, expenditure control and reporting system will provide an integrated government accounting function for the central consolidation of data, reconciliation with CAOs, preparation of statutory accounts, and the generation of reports for a Financial Management Information System. It will hold details of budgets and compare these with budgets for expenditure monitoring and control. Both budget and payroll data will be transferred into the system from the separate computer applications. It will generate its output reports in both Bangla and English.

9.10.4. Once the system is developed and operational, tools can be developed to extend the financial analysis of data, to provide cash forecasting and monitoring information, and to upgrade the quality and relevance of the financial reports to meet the needs of users as they are identified, and as users become accustomed to a flow of financial information.

(iii) Payroll and Pensions System

9.10.5. Payroll is a very high priority area in view of the large volume of transactions occurring each month, and the considerable time and effort expended by employees in achieving payment of government officers and staff. At this stage the system will be operated in CGA's office as a bureau for CAOs, and the CGA and C&AG themselves. Later, the system can be decentralised to CAOs and also to Districts.

9.10.6. For these personnel, the payroll and pension system will perform these functions automatically, providing pay cheques for encashment by drawing and disbursing officers together with pay-lists, and cheques and payslips directly for self drawing officers. Pension cheques will be generated for pensioners within the Dhaka area, or those outside who choose to use the system. The system will hold the employees service history in sufficient detail for calculation of pay, allowances and pensions.

9.10.7. An important requirement in the design of this system will be the need to interface with manual systems, so that employees can be transferred from manual to computer system, or vice versa, if they are posted to different locations. Later the same interface will be required between the distributed payroll systems.

9.10.8. A payroll computerisation project is currently being developed by C&AG department, with the assistance of a consultant from a local computer company. There is currently, however, no intention to process monthly payments to pensioners. Subject to the necessary approvals within C&AG department, it is hoped to commence implementation of the Civil Service Payroll in July 1993 with a pilot scheme to cover C&AG Class I and II Officers in Dhaka. This scheme should be treated as a pilot for the payroll application.

(iv) Pilot computerisation of two Districts

9.10.9. This pilot application will both process the transactions within the District, and also accept and consolidate manual summary records of transactions within Thanas. It will be linked to a Thana payroll application, modelled on the central system. It will be able to receive budget data, and to transfer data to either the CGA central accounting system, or later the accounting system with CAOs.

(v) Interim system of expenditure control and monitoring for CAOs

9.10.10. The core accounting system in CGA's office is large, and will take some time to become fully effective. Meanwhile there is an urgent need to improve expenditure control and financial monitoring, and the CAOs are anxious to commence this task. Some have already begun using ad hoc systems. It would be better to harness this enthusiasm to provide an effective solution, which can later provide a basis for a distributed system based on CAOs.

9.10.11. Therefore each CAOs office should be provided with a small microcomputer network of three machines and a high quality printer. They would also be provided with an accounting package in which the coding and reporting formats would have been tailored to meet their specific needs. This setup would be used for consolidating the summarised data from Districts with their own transaction information and producing monthly reports. Implementation would be a pilot in one or two CAOs, which would develop the formats, followed by a training programme for all CAOs and at least one officer from each CAO who would be responsible for the system. The MIS Directorate would provide ongoing support to the CAOs.

(vii) Office automation tools

9.10.12. Office automation tools cover all of word-processing, spreadsheets, database, and such other software as may be used to automate routine office functions. We make no specific recommendations on the rate of introduction of such systems, which will happen as a matter of course. However, it is important that the software is standardised, so as to facilitate training and interchange of data. Also the government should ensure that proper licenses are obtained for all sites, and no unauthorised software is introduced by staff, to minimise the risk of computer "viruses".

9.11. Organisational Implications of computerisation

9.11.1. At present there is a lack of expertise and experience in the CGA's office and the Finance Division of computerisation. It is essential that an adequate organisation structure is established to co-ordinate and manage the development of the applications identified above. The requirement is for a Management Information Systems Directorate, which would have overall responsibility. This should be located in the Finance Division, and be headed by an officer of the level of Joint Secretary.

9.11.2. To provide the required technical support for the computerisation, expertise must either be developed or recruited directly to the directorate. Because of the time-lags involved in training, some staff will be needed quickly, and these could be recruited on contract. Officers assigned to the department should undergo in-country training, making use as far as feasible of resources and skills available within the country. Some short overseas study tours to gain experience of regional computerisation programmes are also recommended.

9.11.3. The directorate would carry out the following functions in relation to computerisation:

- adherence to the overall technology strategy
- standards for system development, from initial analysis of requirements, through design, development, programming, testing, and installation

- control of maintenance and enhancement requests
- backup, security and recovery procedures
- change control
- apportionment of costs of running FMIS
- co-ordination with vendors

9.11.4. The Management Information Systems Directorate will liaise with the Bangladesh Computer Council. Whereas the Directorate will form a substantial undertaking by itself, the strategy employed should not conflict with any government-wide strategy that Bangladesh Computer Council may introduce in the future.

Recommendation

71 An MIS Directorate is established in the Finance Division to be responsible for the programme of computerisation. It would need both to train its own personnel, and also to recruit outside expertise.

9.12. Training in computers

9.12.1. Knowledge of computers within government is currently limited. Current training facilities provided to staff are uncoordinated and inadequate. The introduction of computers on a large scale must be accompanied by substantial additional training provisions. Computer training is likely to make staff more marketable and attractive to the private sector. Retention of skilled personnel in government can be helped by enhancement of pay and allowances for staff, and by bonding skilled staff for a specified period. Nevertheless it must be recognised that there is likely to be a substantial loss of skilled personnel.

9.12.1. Specific job-related training with detailed instruction on the daily routines of the FMIS operations will be needed for junior staff. Senior staff will need more detailed technical training to be able to manage the day to day operations of the system. It is anticipated that this training will be undertaken by the Audit and Accounts Training Academy as part of their expanded programme of activities. However, in the short term ad hoc courses will need to be organised using other training resources, e.g. Bangladesh Computer Council. Different forms of computer training are of relevance to different sections of staff. A summary of requirements follows:-

Table 16: computer training programme

Course	Participants
1 Basic computer appreciation	All officers involved in finance
2 Managing computer systems	Officers involved in computerisation, plus all senior officers
3 CAO interim system	All CAOs plus one selected officer from each
4 Word-processing, spreadsheets, databases.	As required
5 Strategic considerations systems management *	Officers of MIS Directorate
6 Systems design, development, and maintenance *	Officers of MIS Directorate

9.13. Developing systems

9.13.1. Procurement of both hardware and software should be seen as an integrated exercise, whereby one vendor is required to supply both these component areas. This avoids the situation that can arise where these components are supplied separately, in that the source of problems are frequently disputed by the different vendors, and remedial action is consequently delayed.

9.13.2. The approach recommended is the "turnkey" approach. Under this approach the supplier will be provided with an extremely detailed systems specification, identifying inputs, processing requirements, outputs, controls and technology platform. The vendor will tender for a complete hardware and software solution to meet these requirements, and will be responsible for handing over the system in finished and working order.

9.13.3. The GOB will need to identify milestones and target dates for the vendor, so that the progress of the contract can be monitored at an intermediate stage, rather than just at the end. Also the specification must state precisely the requirements the finished system must meet, and include test data which must be processed correctly.

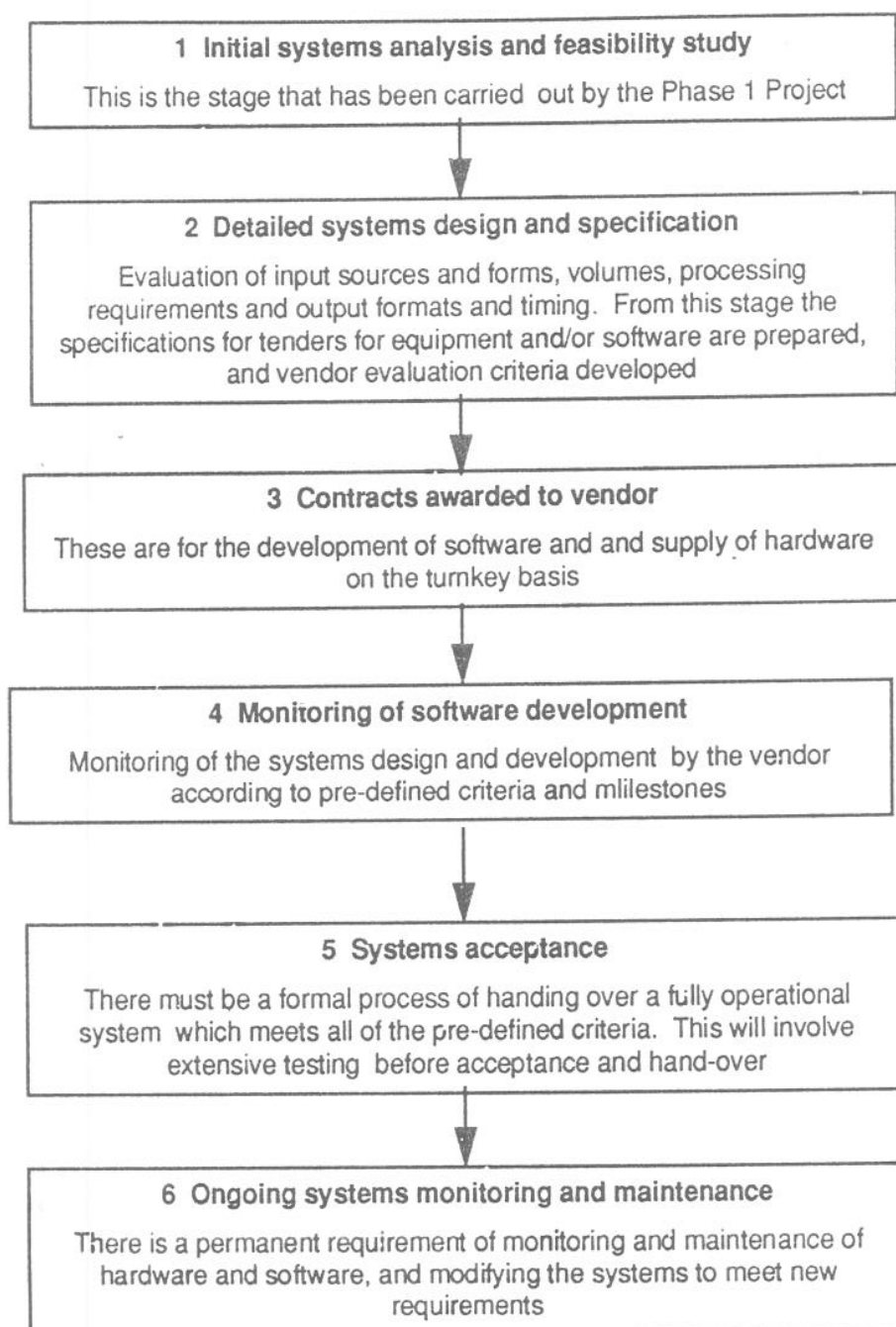
9.13.4. To a degree, this approach can be used to pass substantial responsibility to the vendor for ensuring that, not only does the hardware supplied at individual sites have adequate capacity to handle the required data volumes, for example, but also that the transfer of data between sites takes place in a controlled manner. This is particularly important in the context of the proposed decentralised processing methodology proposed for Government of Bangladesh.

9.13.5. In order to select the most appropriate vendor, it is necessary for a clear set of evaluation criteria to be drawn up, covering technical and financial considerations. It is imperative that the basis of the evaluation criteria are made known to prospective vendors, in order to avoid the submission of inappropriate tenders.

9.13.6. The operation and management of this "turnkey" approach requires considerable technical expertise and experience within GOB. The specification preparation may be expected to take three man-months for each application, and there is also the need for ongoing monitoring of the development against the pre-defined milestones, and evaluation and testing of the finished system before acceptance. This will certainly require substantial external support, since these skills are not generally available within GOB. However, the opportunity should be taken to train selected officers.

9.13.7. It is essential that the development of the computer systems for the target applications is properly organised and controlled. There are various structured approaches to systems development¹¹, but these can be simplified to a seven stage process. This does not correspond exactly to any of the established structured approaches, but we consider it more appropriate in the context of the target applications.

¹¹ For example Systems Development Life Cycle (SDLC), or the UK public sector approach of Structured Systems Analysis and Design Method (SSADM).

Figure 24: computer systems development

9.13.8. The tendency of the systems development we have reviewed has been to pass the responsibility for Stage 2 to the vendor, who both carries out the system design and specification, and develops the software. This reflects both a lack of technical expertise on the part of the user, and also a failure to allocate sufficient time for the task. It is a very dangerous approach, because the vendor is unlikely to have adequate knowledge of the systems and requirements of the user, and as a result systems designed using this approach rarely achieve all that is required of them.

9.13.9. Therefore a very important function of the MIS Directorate will be to develop systems specifications, tender documentation, tender evaluation criteria, and to monitor the development of the systems and to fully test them before acceptance.

9.13.10. We are aware of the argument that in Bangladesh the computer industry is at too early a stage of development to be able to handle such turnkey contracts, in which as far as we are aware there is no prior experience. However, our review has indicated that there is a remarkably active private sector computer industry, capable of producing high quality software. Whilst any approach involves risk, we consider that the approach indicated minimises such risks, and also will encourage the development of the private sector computer industry.

Recommendation

72. The systems should be implemented using the "turnkey" approach against very detailed and tightly drawn systems specifications developed by the MIS Directorate.

9.14. Strategies

No.	Strategy	Comment
26	Improve use of intermediate technology pending full computerisation by availability of existing and redesigned forms, and add-listing machines in all offices	Since full computerisation is some considerable time away, the existing manual systems must be made to work effectively. Whilst no general re-design of the manual system is recommended, considerable gains can be made by ensuring an adequate supply of standard forms, which need in some cases to be re-designed to take account of other changes, and to ensure that all offices have add-listing machines.
27	Initial target computer applications: (i) budget system; (ii) accounting, expenditure control and reporting in CGA's office; (iii) interim expenditure control and reporting system in CAOs; (iv) pilot computerisation in two District offices; (v) interim Financial Reporting System	Those have been selected as a feasible group of applications for computerisation in Phase II. The budget system is required urgently as being fundamental to the improved budget presentation and its more effective use as a resource allocation system. The system in the CGA's office is intended to be the core source of central financial information for expenditure control and reporting to Government. The interim systems in the CAOs is to focus control at the point closest to operational responsibility. The pilot projects at DAOs are intended to lead the way to a distributed data processing approach in Phase III.
28	Establishment of an MIS Directorate in the Finance Division, Ministry of Finance	This organisational change is essential if the computerisation programme is to be effective. It will develop a core of MIS and computer expertise which will be used for all systems development.
29	Training programme to enhance computer skills as required	The computerisation will not be sustainable unless expertise is developed amongst users. Training is therefore fundamental to the programme. It is recognised that there will be leakage of trained personnel, and the volume of training must take account of that factor.