

Computers in Less D

The authors discuss the arguments for and against installing computers for some tasks in developing countries and suggest eight questions that should be asked before a decision is taken.

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In the early 1960's a multinational chemical manufacturer was formulating plans to build a plant in Africa to serve the African market. A feasibility study of the manufacturing problems showed that a fully automated plant was technically possible. A manual or semimanual system would have resulted in a much lower cost per unit of output, but would have needed more labor and given rise to more management problems. In spite of the lower costs as well as the entreaties and inducements from the host government arising from their concern for increasing employment as well as developing a trained labor force, the fully automated plant was built.

At the beginning of the 1970's the governments of less developed countries are facing the same kind of decision with respect to computerizing the routine functions associated with the rising level of government services. In contrast to their oft-stated policies regarding employment and training, and often unobtrusively, more and more frequently they have made the decision to use computers.

In order to analyze this problem an illustration is useful. A government department in Latin America is charged with running one of the public utilities. This public utility serves 40,000 customers, about 36,000 of whom are charged at a flat rate. The remaining 4,000 accounts are the large users who are charged

on the basis of a rate schedule. These large users account for about 70 per cent of the \$1 million in annual revenues. In the past the utility has been managed by an engineer who paid little attention to the business aspects of the operations. Principally as a result of poor billing and collection procedures, arrears have increased to almost \$500,000 and government subsidies have had to be increased correspondingly. In an effort to improve the situation, the government has appointed a new manager; one of his principal tasks is to improve the accounting and billing procedures.

At present the accounting and billing procedures are dealt with manually by about 20 people with total costs running at \$4,000 a month; most of their time is spent on accounting and billing for the large customers. There is currently a procedure which partially automates the billing of the 36,000 customers who are charged on the flat rate basis; it involves a machine to reproduce the bills and a manual addressing machine for duplicating the mailing addresses.

The new manager has three main alternatives: (1) improve the present manual system; (2) introduce a semimanual system incorporating the billing functions; and (3) computerize the operation.

In the actual case outlined above, although the costs were substantially higher, the new manager's decision was to computerize. The reason for this decision was

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“greater efficiency.” By “greater efficiency” the manager meant fewer management and personnel problems as well as substantially fewer errors.

In an over-all consideration of the country’s welfare this decision was probably wrong. The country has high unemployment with a poorly trained labor force. In this situation manual or labor-intensive methods generally will yield the highest welfare for the country as a whole since they will result in increased employment and income (and it is hoped will increase the trained labor force). In addition, labor-intensive methods will reduce the drain on scarce capital resources, especially foreign exchange resources. In a free market economy this situation will be reflected in the relative costs. It will cost

less for business as well as governments to use manual methods rather than invest capital in computer equipment. In the case described, the better solution is to use either a manual or a semimanual system from the point of view of over-all welfare as well as cost.

The new manager’s decision to use a computer was made not on a basis of relative costs but on the criteria of fewer personnel problems and fewer errors. The decision in favor of computers for such purposes is more often than not made in conjunction with foreign experts from developed countries. Many of these experts have worked only with computer systems and are not familiar with manual or semimanual systems. Further, they can offer a software package requiring little



In the Philippines, former tenant farmers separate the rice from the chaff. The Philippine Bureau of Lands uses a computer to process land survey data and to prepare land titles; these farmers have gained ownership of the land under the country’s land reform program.

adaptation that they are confident will solve the problem as well as provide efficiency over the long run. This is especially true for software packages for the second generation computers. Efficiency here may mean little more than conforming to the work habits of foreign experts. The concept clearly calls for examination.

Of course, there are many computers in developing countries being used to excellent purpose. In India, the Life Insurance Corporation is using a computer for data processing purposes. The Tata Fundamental Research Institute in Bombay is using the same computer for research in the physical sciences, and a computer is being very helpful in economic research at the Delhi School of Economics. In Iran, computers are being used for inventory control, payroll, accounting, and research.

System Effectiveness

Quite often the use of computers is advocated on the ground that they will cure the current problems of a system beset with human errors. It is recognized that human beings are more fallible than computers. Nevertheless, the computer cannot be expected to locate all errors in input data and to correct them. If the current system is riddled with human errors, isn't it logical to expect at least the same proportion of errors in computer input data? Possibly the error rate will be higher. Human beings can contextualize; computers cannot. A person would recognize a transposition such as—"He sat on the *chari*" to be "He sat on the *chair*." Computers would not be able to recognize and correct such errors. There is a fairly well-known computer phrase to illustrate this problem—GIGO—Garbage In, Garbage Out. The output of a computer will be no better than the quality of the input.

The computer has proved to be no panacea in the highly developed countries. Computer use brings special problems, many of them technical in nature. One must find systems analysts, programmers, computer operators, and people to maintain the computer. Once possible technical personnel are located, how is the selection to be made? If it is decided to train local talent, how does one select those who have the potential to fill a technical position associated with computers? How and where should they be trained? What should be done to get clerks who are making many errors in the old system submit error-free work in the new system? If a general program to complete a routine application such as payroll or inventory control is made available, who will adapt the system to the specific application? Furthermore, since changes are almost inevitable, who will maintain these general programs, and take account of the changes? On top of personnel problems, there are serious questions concerning quality and stability

of electrical power and the need for maintenance and backup provisions for the computer. Before ordering a computer to correct deficiencies in the system, one should be sure that he is not creating more significant problems.

Data Processing Personnel

Quite often the failure of a computer installation is attributed to problems associated with people—both managerial and technical. The requirements for a data processing manager are demanding. He needs both managerial skills and technical experience. Furthermore, he must be able to take a company-wide or country-wide view of what he is trying to accomplish, while recognizing and forestalling many minor snags, any one of which can result in failure of the system.

The recruitment and training of technical personnel is another major problem. If they are not available in a country, transportation costs and other fringe benefits, as well as comparatively high salaries, will be needed to attract them from abroad. The fact that foreign personnel tend to leave after a relatively short time is still another difficulty.

And there is the problem of language. Most of the valuable literature in the computer field is in English, although a considerable amount is in French, Russian, German, and Spanish. It is possible to write computer programs without knowledge of any of these languages. In order to become a good programmer, however, it is necessary to read and understand computer literature. It enables programmers to broaden their background and to understand new and improved techniques. The inability of technical personnel to read such literature normally results in mediocre performances.

Electricity

The power requirements of computers are quite stringent. Voltage variations will cause malfunctions if they exceed allowable limits. If there is any possibility of the voltage exceeding these limits, voltage regulators will be needed. These regulators will take care of short surges or drops in power. Drops could result in serious computer malfunctions and/or damage. Since computers run on electricity it is clear that anything that stops the supply of power also will halt completely computer production. If the supply is as variable or spasmodic as it is in many less developed countries, power problems could be significant.

Computer Maintenance and Backup

Computers need regular preventive maintenance and intermittent emergency service if they are to operate for an acceptable part of each day. If the computer is the only one of its kind in the country, a complete stock

of parts must be kept in the country. Furthermore, a well-qualified maintenance man must be there. If a single man attempts to service the computers in more than one country, protracted delays in repairing the computer can be expected. Even assuming that no two computers malfunction simultaneously, there will be considerable time lost if a computer in one country fails while he is in the other. Furthermore, if a complete stock of spare parts is not available, days can be lost waiting for a needed part to be flown into the country.

If the computer is out of service for a long period of time it may not be possible to revert to the former manual system, since all records may be on computer tape or disk. It may not be possible to get to these records if the computer is out of service. Also, the knowledge of how a manual system operates tends to disappear after the work is transferred to a computer. This results in complete dependency on the computer. If the computer fails nothing gets done.

In order to forestall problems inherent in computer failure, backup provisions are needed even if degraded performance results; there must be another computer where the work from the computer that failed can be completed. Furthermore, this backup computer must

perfectly on one machine to fail ludicrously on another. It is necessary to run the same program on both systems before assuming that there is backup.

Justification for Computers

A computer is an expensive piece of equipment. Not only is it expensive to purchase or rent, but its upkeep costs are high. If a second generation computer is bought or rented instead of a third generation one, the initial costs may be lower. Monthly maintenance costs, however, will be higher. Furthermore, costs for systems analysts, programmers, and computer operators easily can exceed the equipment costs. On top of these, one must consider air conditioning and other costs associated with a computer installation.

In the United States, with its relatively high labor costs, very few computer installations have resulted in net savings. Thousands of such installations anticipated such savings, but few achieved them. In less developed countries, where labor rates are low, there is much less chance of any real savings. Furthermore, transportation costs for the computer and import taxes (if any) lower the possibility of justifying a computer on the basis of savings.



have the capabilities required by programs and also must be able to run such programs with little or no change. It is rash to assume that a program that runs on one computer will run on another computer, even though it may come from the same manufacturer, have the same model number, the same size memory, and identical peripheral units. Variations of the module of the operating system in use or different characteristics of particular units can cause a program which runs

If a computer cannot be justified on the basis of savings, possibly it can result in increased income, which more than offsets added costs. This would be true if the added expenditures associated with the computer were less than the selling price of the products of the computer. Here one must be sure that all costs are considered and that there is a relatively certain market for the products at the prices used in the justification.

Aside from monetary factors, it is possible to justify

a computer if the equipment will perform functions which could not be done without a computer. The questions to be asked here are:

- Is it necessary to do them?
- What is their value?

Too often a computer is ordered for various nonquantifiable reasons, when the real purpose is to get a status symbol. It is a very expensive way of achieving status. An official who cannot justify a computer through quantifiable facts probably should not get a computer.

Guidelines

Officials in developing countries faced with the question of whether to go over to a computer in a particular field might well ask themselves eight questions—not too many in view of the costs involved. All but the last examine the question of efficiency while the last question considers over-all costs. Unless the officials can answer with an unequivocal “yes” to all of these questions it is very probable that the computer should not be used. With the difficulty in answering “yes” in many of the less developed countries, it is probable that the installation of a computer will cause more problems and cost substantially more than a manual or semi-automated system. The country will fare better with an improvement in the manual system and/or the use of some of the more simple types of automated equipment.

1. Is the decision to get a computer based on quantifiable facts?
2. Is a data processing manager with sufficient background in computers available?
3. Is there a ready source of people with experience

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in the technical areas of computers available within the country?

4. Are the power sources reliable and relatively stable?
5. Will the manufacturer or some other reliable source maintain the computer?
6. Will the guaranteed response time for maintenance calls be sufficiently rapid?
7. Is there another computer available and suitable for effective backup for the computer?
8. Considering *all* cost elements, will the computer-based system be cheaper than the manual or semimanual system?

In view of the likely conclusion that the acquisition of a computer is not the rational decision, officials in less developed countries might be well advised to develop goals and rewards that will reject such a decision. There is no doubt that the computer is currently a cogent status symbol throughout the less developed world, and its desirability on this ground needs to be offset. While it was the status symbol in the more developed countries, bitter experience has proved it to be an extremely costly one. This disillusionment has occurred despite the fact that higher wage rates in the more developed countries tend to make computers an attractive and economic alternative. In the less developed countries, however, lower costs of human effort and lack of computer background make the use of computers less tenable. The less developed countries cannot afford to make the same mistake. There should be no higher status symbol than the achievement of an efficient operation incorporating a high level of employment and continuing employee development.

