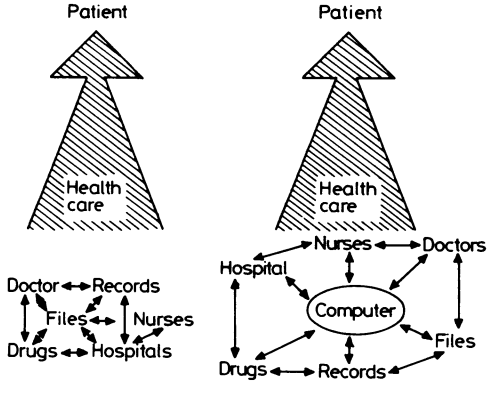
ABC of Computing

A J ASBURY

TO COMPUTERISE OR NOT

Computers are being applied to all sorts of problems (business, accounting, general practice, intensive care), and it is easy to imagine that purchasing a computer will simply solve all the problems. A computer may even not be needed; several calculators bolted to the workbench may solve the problem. This article describes some of the steps in implementing a computer system in a small business with perhaps a dozen employees—about the size of a general practitioner's group practice. The scale of the operation and therefore the time and expense will vary in different circumstances, but the principles are the same. It is important to remember that the computer is not a panacea; it will not produce efficiency where the practices on which it is based are inefficient. Sometimes the improved organisation which the use of a computer imposes produces a greater improvement in efficiency than the computer itself. In even the simplest case where a microcomputer is being considered much thought must be given to matching the computer to the task.

What is the system?

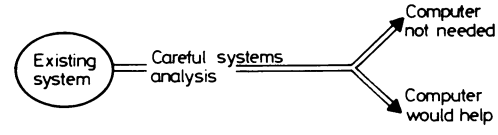


The system is an organised grouping of people, equipment, documents, and methods collected together to perform predefined tasks. The general practitioner's surgery is such a system designed to deliver primary health care and comprises doctors, nurses, receptionists, and hospital laboratory services, thousands of patient records, and the patients themselves. A computer system is simply a system that is based on a computer or a network of computers. For someone considering introducing a computer the first step is to employ a systems analyst to look at the problem.

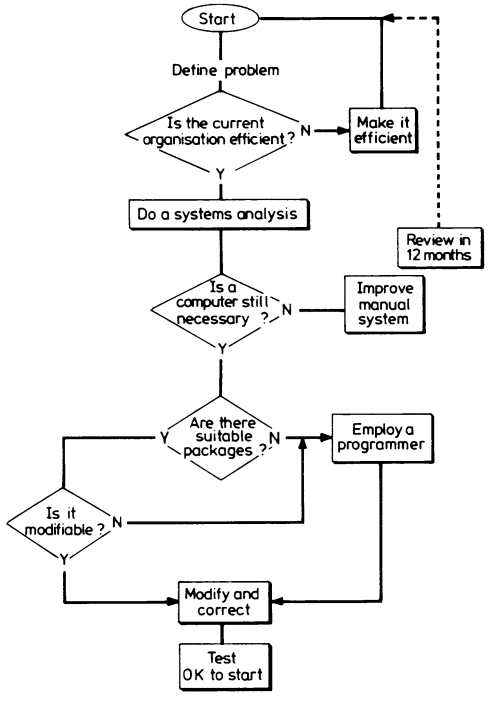
Systems analysis

The analyst will have had extensive experience of computers and will be familiar with the process of applying computer methods in various environments. Ideally the analyst should not be commercially biased towards any particular type of computer and should always be prepared to find the right computer for the task rather than attempt to fit the task to the computer. There is a great temptation for an analyst working for a computer firm to presuppose that a computer is necessary and to bias his analysis towards his firm's equipment and software.

If, as is usual, a system of some sort already exists and conversion to a computer based system is necessary some of the major steps in implementing that decision are as follows.



Defining the task



In an industrial company the task would be defined at management level, but the needs of other staff and interested parties, such as trade unions, should be taken into account if the system is to gain cooperation at all levels.

The defined task would fall into one of several categories: it might be a task already efficiently undertaken by humans, a task that is being done by humans but inefficiently and incompletely, or a task that is beyond the capability of humans. The first type of task may be inappropriate as a computer application, whereas the second type may be very appropriate. The third type of task carries the greatest risk of financial loss as a computer application because it cannot be adequately specified.

Future needs must also be predicted at the outset because the system bought may not have enough capacity for expansion. This inevitably needs a certain amount of guesswork but some guidance may be obtained from careful study of similar microcomputer applications. The final defence against future technological developments is to make the system design as flexible as possible. This may, however, necessitate some wasted computer capacity in the early stages.

A detailed survey of any existing system must be carried out to answer questions such as:

Where is the information generated and by whom?

What happens to the information and how is it stored?

Who needs to retrieve it and how often?

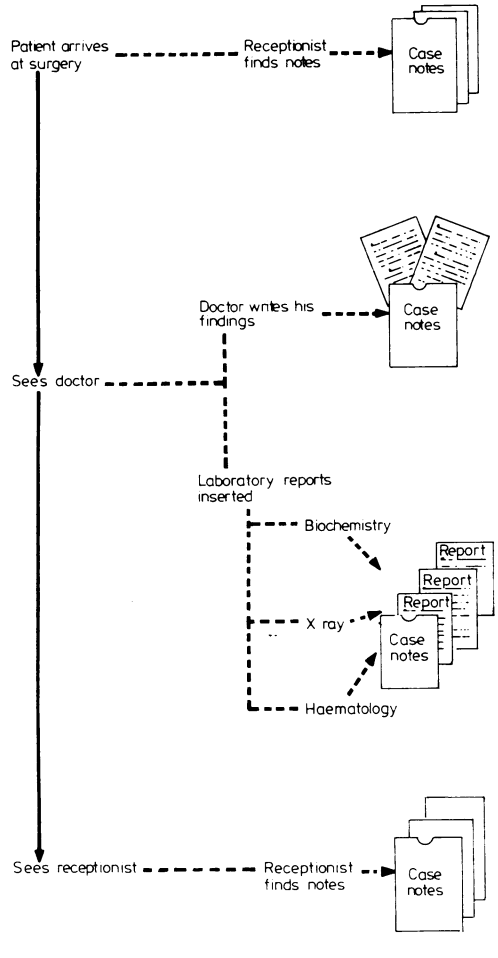
Is information being collected but not used? (This is important because the user must not think that his time is being wasted.)

Who will use the system, and how should any forms be designed?

Is paper necessary anyway?

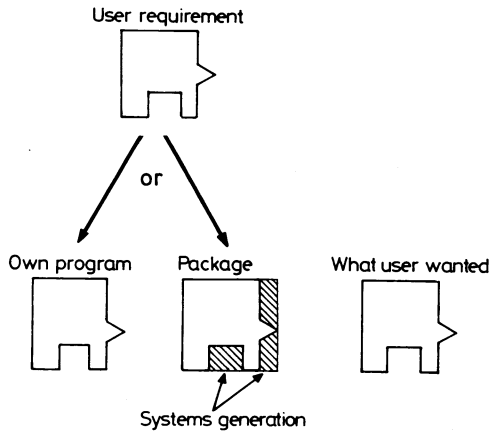
The analyst will then express these ideas in the form of tables and diagrams showing the information flow, and this allows the hardware and software to be specified.

New programs or packages



When the analysis is complete and the specification drawn up ways of tackling the problem can be considered. The system can either be programmed by using an existing commercially available computer package or the whole job can be programmed from scratch. This decision has an important bearing on purchase of the hardware and depends on the extent to which the proposed system can be created within the budget.

A computer package consists of a series of commercially produced and pretested computer programs, often designed for one make of computer. Typical examples are accounting and stock control packages, which are readily available for microcomputers. The advantages of the package are that the programs are readily available, pretested, and usually well written. Most of the large software producers produce programs that can be "personalised" in one step for particular applications. This process is called systems generation. In essence, the package is divided into parts, the programs that do not need personalising and those that do. The parts that need adapting can be altered in one operation by the use of a commercial systems generation program. For example, in a general practitioner's surgery package the systems generation will ensure that the particular style of record format favoured by the doctor is used and that automated letters would automatically have the correct surgery name.

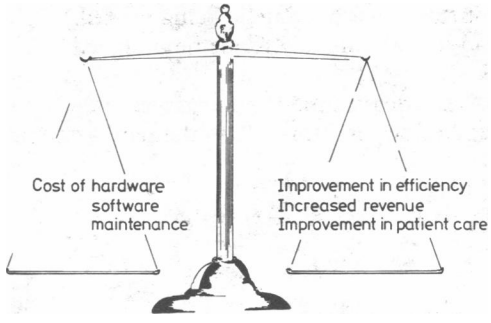


On the other hand, packages, while saving programming time, may not provide exactly what is needed. The use of a package may also tie the user to one type of computer favoured by the software manufacturers, which may not necessarily be the best in the circumstances. The package may also restrict development and maintenance to that which will be done by the software producer's programmers, inevitably at considerable cost. Commercial programs are usually well written and very efficient in their use of computer time and memory, but they tend to be complex, and it is therefore unrealistic for the medical computer enthusiast to imagine that he can modify a commercial package efficiently and cheaply. Most commercial packages are also written so that the program itself cannot be inspected, thereby discouraging tampering. Nevertheless, if the package really meets all the requirements and can be properly maintained then it is probably the best way to do the job.

The use of a package presupposes that the user has certain requirements and that they can be satisfied by small modifications to a larger all embracing package. This might seem to negate the work of the analyst, but in fact the suitability of the package cannot be judged until the specifications have been clarified by the analyst.

The second method is to create the computer system from the start. This will need programmers and computer management staff and is inevitably expensive.

Final decisions



When all the avenues have been explored, the specification, initial costing, and projected maintenance costing will be reviewed. The initial requirements may have been unrealistic and the costs of implementing a computer system might prove to outweigh the benefits. The projected requirements might also have been excessive, and the cost of managing them might have increased the costs out of all proportion to the expected benefits. People are often surprised at the cost of running a computer system; it is easy to imagine that the cost lies mainly in buying the hardware and software, but in fact the additional staff often turn out to be the most expensive component—even if the extra cost is simply a bonus paid to existing staff for working the "new technology." Maintenance contracts for both hardware and software also represent a continuing revenue commitment.

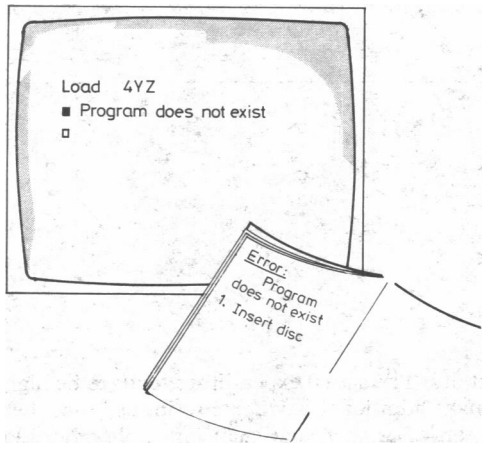
Buying a computer and getting started

Once the specification and costing have been agreed the type of computer can be specified and tenders requested from several manufacturers of suitable equipment. Manufacturers can be very persuasive and the naive may be easily taken in by the appearance of the equipment. It is essential to confirm that the computer actually does all that it is claimed to do and all that is wanted, and the help of an unbiased expert who can really put the computer through its paces is most useful. It is very easy to be misled by glossy brochures and talkative salesmen. Once agreement has been reached the minicomputer can be bought. If a package is to be used the modifications can be passed to the company, and it can do the systems generation. Alternatively, if the programming is to be done de novo a team of programmers must be assembled to write the software to an agreed standard.

Writing software for a large project is a team effort requiring frequent discussions between the potential users, programmers, and managers. Usually each programmer is responsible for writing the programs for one part of the system. In many cases a common core of software—for example, a general practitioner's age-sex register—is developed first followed by the peripheral software, such as programs to print out address labels.

During the programming the potential users should always be consulted to ensure that the displays are most helpful—for example, the general practitioner may prefer to see the patient's name and age at the top of the visual display unit rather than embedded in the text. Such considerations taken into account early on save much frustration later on.

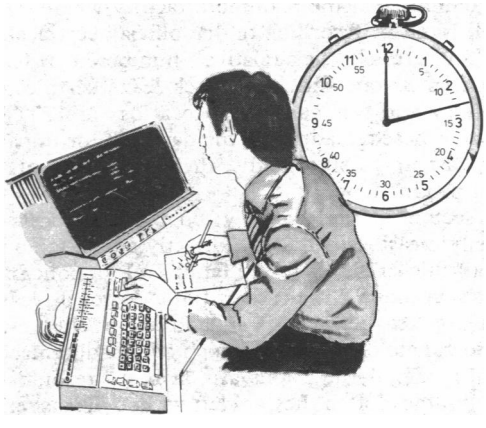
Documentation



As the software is developed it must be fully documented so that the intended reader can follow the program. The documentation is essential because chaos would result if staff in strategic places left their jobs, leaving software that had been implemented but not documented. Under these circumstances fault finding and maintenance would be impossible. Only when the documentation has been done can staff training be done properly; though a secretary or clerk likes to be shown what to do, he or she must also be able to look information up in the user's manual if an unexpected problem arises.

The manufacturers of commercial packages have a great advantage with documentation because the same package may be applied in many different circumstances, and it then becomes economically viable to employ experts to write documents that can be used for training. The better manufacturers run courses on the package software as well as providing on site training. The training program for the staff should be negotiated before the package is accepted.

Testing



Testing must accompany program development, and again this is done at two levels. Firstly, the expert user should test it (this is often one of the firm's computer trained staff), and ideally he should not do unexpected things. Secondly, the least experienced potential user should try the system and he almost certainly will do unexpected things. The system must be designed to cope with the worst possible combination of non-expert users and yet function properly. It should never be assumed that a commercial package will do all that is required of it, and it should be tested against the systems analyst's specification just as rigorously as any new software.

Final testing—When the programming and documentation have reached an agreed stage the buyers must satisfy themselves that the computer does all the specified functions. Ideally this stage should be reached before any money is paid.

Maintenance

Year	1	2	3	4	5
Cost of hardware	3000				
Cost of software	350				
Yearly maintenance contract		650	650	650	650
Consumables	400	400	400	400	400
	3750	1050	1050	1050	1050

Implementing a computer system does not end with paying the bill. The computer and software need to be maintained. Some parts of the computer hardware have a limited life—for example, tapes and discs—and will have to be replaced, while materials such as paper are constantly being consumed.

The expensive hardware components are often regularly maintained under a service agreement with the manufacturers, though this is expensive. If the equipment is a vital part of the working of a surgery or business 24-hour breakdown facilities will have to be available. These can also be expensive since most companies charge their engineer's time from the moment he leaves the home base, so considerable expenses may be incurred while he travels the motorways. The software also needs maintenance as unforeseen developments occur and new facilities become necessary. If software has been created for the specific application then the maintenance can be done by the existing programmers. If a package is used a schedule for software maintenance needs to be agreed and costed from the outset. Big software houses, keen to pursue the latest ideas, can become very reluctant to deal with any residual errors in software already provided, and these gremlins can be exasperating for the purchasers.

Dr A J Asbury, FFARCS, PHD, is lecturer in anaesthetics, University of Sheffield.