computers and arts management

A paper for discussion
prepared by Iwan Williams

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Foreword

Computers and Arts Management deals with the impact of information technology on the management of one small but important sector of creative activity. It is appropriate, therefore, that it appears at the beginning of 1982 which has been designated by the British Government as the year of Information Technology.

This report has been produced by a Working Party established in June 1981 on the recommendation of the Gulbenkian Foundation's Arts Initiative and Money (AIM) Advisory Committee which seeks to assist arts organisations to achieve better management and use of resources. Computers are a resource which, as their price declines and ease of operation increases, are being looked to by arts organisations of all sizes. The AIM Committee, however, was particularly concerned with *small* arts organisations. These might not have the staff and resources to investigate the application of computers, yet the benefits of computers to them might be considerable. This situation inspired the Working Party's brief, which was to investigate the potential use of computers in small arts organisations. Nevertheless its conclusions are relevant to arts organisations of all sizes.

The Working Party concluded that the needs of arts organisations are sufficiently specialised to make software development necessary in order to realise the full potential of computers. This report, therefore, contains an outline description of a system designed to meet these needs, which is presented as a discussion document. The report is to be discussed at a series of conferences around the country where the advantages and disadvantages of computers and the merits of the particular system proposed in the report can be examined. If it is favourably received, the system might be developed incorporating suggestions from the conferences in ways discussed in the final chapter of the report.

The members of the Working Party have worked extremely hard to produce this report within a few months. We are grateful to them and Iwan Williams for their commitment. We, and they, hope that this report of their work will be a valuable source of information and guidance for people in the arts who are considering how they might apply information technology within their organisations.

Peter Brinson
Director
United Kingdom Branch
Calouste Gulbenkian Foundation, Lisbon

Background to the Study

The Gulbenkian Foundation's AIM Committee described the objectives of the study as follows:

> '1 to analyse the management systems common to most small and medium-sized arts organisations and to determine the benefits which might accrue to them from the use of computers;
>
> 2 to estimate the extent to which specific software development is required to realise these benefits and to determine whether this development is likely to be achieved to an acceptable standard by normal commercial processes or whether some special initiative is needed;
>
> 3 to identify and publicise sources of further information for arts organisations seeking to use computers.'

Two end-products were promised from the work:

> '1 A report to the committee containing
>
> – a detailed analysis of the systems requirements of arts organisations
>
> – an assessment of the likelihood of the commercial computer markets meeting these needs
>
> – recommendations for further action
>
> 2 A document to be made available to arts organisations outlining
>
> – what computers can and cannot do
>
> – how to go about evaluating them
>
> – common problems encountered in using computers
>
> – sources of further information.'

As the study progressed, it became clear that a more appropriate way of presenting the material would be to combine it in one report to be published as a consultative document. This is that document.

The working party which was assembled in June 1981 for the study consisted of:

Dr John Bessant	Technology Policy Unit, University of Aston
John Ellis	Belt and Braces Theatre Company
Gavin Henderson	Director, South Hill Park Arts Centre
Barry Jackson	Formerly, Press and Publicity Officer, Greater London Arts Association, now with the Arts Council of Great Britain
Judith Knight	Arts Admin
Len March	Consultant on technology and management to McKinsey and Company
Dave Perry	Technical Manager, Combination at the Albany
Elizabeth Richie	AIM Co-ordinator

Iwan Williams — Senior Lecturer, Department of Business Studies, Brighton Polytechnic

The bulk of the working party's deliberations took place at a four-day retreat held in July 1981; we have also held three full meetings. Messrs Bessant, March and Williams have been in close touch during the writing of the report which has been the responsibility of Iwan Williams.

Our objectives during the retreat were:

- to describe the needs of arts organisations for financial and managerial control
- to describe in broad terms a system which would meet those needs
- to estimate the hardware needed to run the system, the requirement for software development and the costs associated with both
- to attempt a preliminary assessment of the possible market size given these costs
- to identify the options available for getting such a system developed.

At an early stage of the study it was thought that we might extend our work to include computerised box-office systems. However, in view of the discussions going on elsewhere about these systems, we decided to omit them from this report (particularly since the requirements of such a system are largely different from the one we describe here). We have concentrated instead on the other major areas in which computers may be of use to arts organisations: financial and managerial control, mailing lists and word processing.

We invited representatives of a wide range of arts organisations to comment on draft versions of Chapters 1 and 2 which describe the needs of arts organisations and the system we propose to satisfy them. The conclusions in Chapters 3 and 4 are the responsibility of the working party alone. The remaining sections of this introduction summarise our conclusions and recommendations and explain some of the terms which, however much we have tried to avoid jargon, must inevitably be used in a report of this nature.

The body of the report consists of four chapters. Chapter 1 describes those factors which make the financial and managerial needs of arts organisations different from those of other businesses. Chapter 2 describes a system which we believe would handle these functions effectively. Chapter 3 discusses the implications of implementing such a system, and Chapter 4 indicates some issues which have still to be resolved.

Summary of Conclusions

1. We believe that while it is impossible to quantify the overall benefits which will accrue to arts organisations from the introduction of computers, these could be substantial if the system which is used is integrated, that is, if the programs which handle main accounting and control functions interact. Such an integrated system is not currently available and differs significantly from the systems now on offer to small businesses. However, the overall costs and benefits may be sufficiently large to generate a market which would support specialised software development.

2. To secure the longer-term interests of the arts world, it is desirable to retain control of the development of the software in the hands of users. There are a number of ways in which this could be done.

3. Before the development work can be undertaken, it is necessary to inform and discuss with the arts world the benefits and dangers of using computers, and to suggest the criteria which should be used in choosing a system. Only then will it be possible to produce the firm estimates of the size of the market which will justify financing the software. We recommend that the Gulbenkian Foundation should support five regional conferences which would form the basis of this exchange of information.

Explanation of Terms

For those readers unfamiliar with computers this section provides a brief introduction.

A computer system requires *hardware*, which is the physical equipment, and *software*, the instructions which tell it what to do. The 'heart' of the hardware is the *central processing unit* (CPU) which directs the operations of the computer and performs the calculations involved. In early units this would be in a separate box, but in the type of equipment discussed in this report it is most likely to be combined with the *keyboard*, which is used for putting information into the computer.

The keyboard will usually have a normal typewriter configuration with some extra keys, plus, in some cases, a calculator-style keypad next to it for rapid data entry. Information being entered into or coming out of the computer may be displayed on a screen, *visual display unit* (VDU), which may be a separate unit or may be combined with the keyboard. Most small computers will drive an ordinary television, but for professional work a specially designed *monitor* is preferable as the visual display is more stable and of a colour which is easier to read over long periods.

A permanent record is provided by a *printer* of which there are a variety of types. The cheaper *matrix* type will produce the kind of print-out normally associated with computers; if letter quality output is required, as with a word processor, a *daisywheel* printed is required.

Software and other information are stored in the computer's *memory*. The computer has a certain amount of *internal memory* to enable it to carry out its functions and to store the information currently being used. This is divided into *read-only memory* (ROM) which contains the instructions built into the computer by the manufacturer to tell it how to operate and which is never accessed directly by the user, and *random access memory* (RAM) in which the user can store information and his own software.

Internal RAM is cleared when the computer is switched off and is said to be *volatile* (ROM is non-volatile). Anything which needs to be kept when this happens must be stored in *external memory*. The principal types of external memory are *cassettes* and *disks*. Cassettes, which on domestic computers may be ordinary audio cassettes running on a cassette player, are a type of *serial* memory because the information can only be accessed in a particular order by running through the tape.

Disks, which run on *disk drives*, are regarded as another type of random access memory because the *read/write heads* which store and retrieve information can be moved to any part of the disk under the control of the computer. Disks, however, like tapes but unlike the internal memory, retain their information when the computer is switched off. There are two main kinds: *floppy disks*, which look like flexible gramophone records in non-removable sleeves, and *hard disks* which normally come in sealed units. The latter are more expensive but have greater information storage capacity.

Software consists of the *programs* (the American spelling is always used) which are essentially lists of instructions telling the computer what to do. A group of programs which relate to a particular activity is called a *package*. For example, a package designed to run a mailing list will include programs for adding a new name and address, programs for printing out a selected part of the list and so on. A related

series of packages—eg for a whole administration system—is called a *suite.* To operate, the program will probably require *data* which may be input through the keyboard or stored in memory—in the mailing list example a name and address constitute data and are not part of the program.

Complex programs are often written in a *high-level language*; the most commonly used on small computers and the most easily learned by the layman is called *Basic.* A program written in Basic will look like a series of statements written using English words and mathematical expressions. It is translated within the computer into a series of instructions, known as *machine code*, which the computer can actually act on. The programs which do this and which control the computer internally are called the *operating software*; they are not normally accessed directly by the user.

Programs may be stored in high-level language and translated into machine code line by line as they are run. They are then said to be *interpreted.* This can be inefficient, particularly when the programs contain sections which are repeated a number of times—the program lines have to be interpreted on every repetition. Alternatively, the programs can be *compiled*; that is, completely translated into machine code before they are run by a special piece of operating software called a *compiler.* Compiled programs run much faster, but are more difficult to modify.

Computers may be operated in *real time* where the system must be available to complete a transaction whenever it is initiated—a box office system must record transactions as they occur, for example—or in *batch mode* where transactions are grouped for efficient processing, as when all incoming invoices are processed together once a week.

Chapter 1
The Working Environment

All businesses, including arts organisations, have certain requirements which the management and control systems, be they manual or computerised, must fulfil. They must ensure that:

a all money, paid or received, is accounted for honestly

b relationships with customers and suppliers are not damaged by a failure to deliver goods or services promised or to pay for those received

c the physical assets and working capital of the company are managed properly

d all employees are paid promptly and accurately

e management has the information about the present working of the company to plan its future progress

f progress against the current plan can be monitored in sufficient detail to take timely and effective corrective action if necessary

g accurate, well-prepared letters and documents can be produced quickly and at minimum cost

h information on the people with whom the company does business is readily available

In all these tasks computers have been used to advantage by companies of all sizes. In particular, microcomputers have been used increasingly in recent years by small businesses to handle such functions as stock control, payroll, ledgers, mailing lists and word processing. Numerous computer stores have opened, selling a wide range of equipment and a series of 'off-the-shelf' packages which can cope with most normal business functions. If computers can be of benefit to arts management, a visit to the local High Street would seem all that is needed.

The reality is more complex. Within the requirement broadly stated above, there is scope for considerable variation. A manufacturer assembling components will require a completely different kind of stock control package from a retailer. Again the retailer, being in a cash business, will not need an elaborate sales ledger such as the manufacturer will use to deal with his customers. Each business has its own particular requirements which off-the-shelf packages may or may not satisfy, and the cost of those requirements not being satisfied can be high. A businessman seeking to computerise his operations, therefore, needs to analyse in detail his own particular requirements and then—and only then—examine the packages on offer to see if they provide a solution. This point may seem obvious, but in practice it is more honoured in the breach than the observance, and it applies equally to arts organisations. Many organisations already have a package running on their own system, or through a computer bureau which handles their mailing list. Of the organisations we have spoken to, many have indicated that while the systems will perform basic mailing list functions perfectly well, they fail to provide all the functions the organisations feel they need, although this has only become clear when the systems have been running for a time. The reasons usually have to do with the degree of selection which is possible. Organisations want to be able to do

a mailing to all those people on their records who are, for example, female, 30-40 years old, living in North Yorkshire and interested in theatre *or* ballet, but who are not members of their local theatre clubs. Many of the mailing list packages currently available, particularly those which will run on a microcomputer, will not do this. If the organisations in question had analysed their needs clearly at the outset, they would have been able to ensure that they had these facilities. Software marketed as general purpose will often fill 90% of a company's needs; it is the final 10% which has to be fought for.

In writing this report we have tried to start this process, but for a whole industry rather than a single organisation. We have tried to analyse the factors which make arts organisations in general different from commercial companies in their requirements for financial and control systems, and then to describe a system which will meet those general requirements and will also allow individual tailoring of particular installations to meet users' special requirements. In other words we are asserting that, while arts organisations differ widely in form and function, there are sufficient common factors, derived mainly from the environment in which they operate, to make it sensible to think of their using a common system which differs significantly from commercial systems. We discuss why we believe this in the next section. The field we have tried to cover is a large one and includes:

a venues
- theatre
- concert halls
- arts centres
- galleries
- museums
- cinemas and film theatres

b producing managements
- touring companies
- orchestras
- commercial managements in theatres and elsewhere
- exhibition promoters

c service organisations
- management services companies
- agents

There are two important fields which our proposals do not cover. First, we have not considered the special needs of those organisations, such as regional arts associations, which *give* funding to arts companies. Second, we have assumed that companies will run their own separate systems (although there is no reason why a number should not combine to run their programs on shared hardware). This excludes considerations of those organisations, perhaps local authority based, which are part of a larger group with its own data processing set-up. In these cases, however, parts of the system we propose may be of interest.

This chapter will consider the factors which make the commercial environment of arts organisations different from most companies; factors which will determine the functional nature of the systems required. It will then go on to look at the physical environment, and in particular some of the human factors involved, which will determine how those functions will need to be implemented.

The commercial environment

We conclude that arts organisations as a group are significantly different from commercial companies in terms of factors which determine the type of management and control systems they need, and that this difference will severely limit their ability to use software intended for such companies. While this is unlikely to be news to anybody, it is important to note that the differences are not related, as is sometimes asserted in the subsidised sector, to being non-profit making. The major differences are that:

a arts organisations are almost entirely cash businesses, like most retailers

b unlike most retailers, they derive different kinds of income from different sources. These will differ in detail for different organisations, but a reasonable classification might be
   - primary income: earnings from the activities which are the organisation's principal reason for being in existence. For a theatre these would be box-office receipts, for a touring dance company guarantees against a percentage of those receipts
   - secondary income: earnings from all subsidiary activities like bars, restaurants, bookstalls etc. Note that what is secondary for one organisation may be primary for another
   - grants and donations: all unearned income
   - other income: any irregular earned income not so far covered such as hiring out facilities, royalties received etc

c analysis of how, when and where primary income is received is a major piece of marketing research, both in terms of uncovering historic trends and suggesting immediate action

d substantial parts of the grant income will come from public bodies who may
   - commit funds long before they actually hand them over
   - make specific reporting requirements
   - earmark grants for specific projects

e because of, amongst other things, these reporting requirements, the budgeting structure is extremely complex

f in producing organisations, the execution of these budgets requires a complex of cash floats to be operated throughout many organisations

g the calculations necessary to prepare a payroll are unusually complex where performers are involved because
   - entertainment industry contracts tend to include a complicated series of allowances which are treated as part of gross pay
   - many performers occupy a grey area between employment and self-employment which makes the calculation of nett pay more difficult
   - cash advances against salary are very common and often informally arranged
   - elements which might not be regarded as part of salary are frequently included in pay, for example, royalties

h royalty payments are an important item of expenditure and frequently require complex calculation based on income details

i the mailing list is a major marketing tool of many organisations

Any one of these factors may apply to a commercial company and they do not *all* apply to *every* arts organisation. A sales force with a complicated commission structure will require an elaborate payroll whereas an art gallery may not. Nevertheless, the profile suggested here is a quite distinct one. It has significant implications for many parts of the system.

Some parts of it will be reasonably standard:
- nominal ledger
- purchases ledger, except that the degree of analysis required will be very high
- stock control

Some parts will differ considerably from a standard system:
- sales ledger, which will be almost non-existent
- payroll, which will be more complex
- mailing list, which will need to permit highly sophisticated selection of names

Some parts will not exist at all in a standard system:
- income analysis
- royalties paid

Moreover, the complex inter-relation between the various parts of the system and the requirement for highly detailed budgetary reporting right to the top of the organisation, suggest that a computerised system, to be any real use, will have to be integrated. An integrated system is one where the packages devoted to individual activities like payroll are capable of passing information to each other automatically. On a non-integrated system, the Payroll program would print out a summary at the end of a run which would give details of pay, total tax etc. These details would then have to be posted to the ledgers by running the Ledger program and typing them back in. On an integrated system, the information would be transferred automatically, although there could be the option of overriding the transfer if necessary.

The subject of integration will be pursued further in the next chapter when the proposed system is described. The next section looks at the physical and human environment in which a computerised system would have to operate.

The physical and human environment

As well as examining what the system will be required to do, it is necessary to look at
- the physical conditions under which it is likely to operate
- the people who are likely to have to deal with it

In the early days computers required air-conditioned, temperature-controlled rooms. Today's mini- or microcomputer is fortunately more robust but is still sensitive to its surroundings:
- temperature: like all electronic equipment a computer generates heat, sometimes a quite surprising amount, but, again like all electronic equipment, there are limits to the temperature at which it will operate effectively, good ventilation is therefore needed
- atmospheric pollution: disk drives are particularly susceptible to this. The read/write heads operate 20 microns away from the disks in a hard disk drive and 100 microns away in a floppy disk drive (a micron is 1/1000th of a millimetre). Cigarette smoke molecules are 300 microns across; the heads will brush them aside but data may be lost in the process
- humidity: the same applies as for atmospheric pollution
- electrical interference: surges in the supply voltage caused perhaps by the use of large-scale equipment nearby can affect the computer's operation

It is clear that the offices of many arts organisations are likely to provide instances of the kinds of hazards indicated above. They can be overcome with sensible precautions, but robustness will be a key requirement in any equipment chosen.

As far as the human factors are concerned, there are three aspects to be considered:

1 the operator
2 the management
3 the organisation as a whole

These considerations will not affect the type of hardware chosen (other than to ensure that it is ergonomically acceptable) but will affect the software in

a the extent to which the programs themselves instruct the user how to use them
b the type of documentation required
c which information is output
   - regularly
   - on an exception basis
   - on demand

The Operator

As far as the factors which affect the operators are concerned, the system can be designed to maximise the amount of help which the programs give to the operator, at the expense of an increase in cost arising from

- the greater programming time required to incorporate this help
- the greater amount of memory used

There is also some penalty involved in the speed at which the system runs if the program keeps stopping to display information.

Programs can help the operator in two main ways

1 by indicating when data has to be input and what kind of data is required and providing other explicit instructions (prompts)
2 by refusing to accept data which is faulty in some way (checks)

A program which has no prompts simply stops when it requires data, or, at most, prints out a question mark. The operator has to know which piece of data has to be fed in next. If the wrong piece is fed in (annual income instead of age, say) at best ludicrous results will be produced, at worst some operation will be attempted which the computer's own operating software regards as illegal (for example, trying to add up a list of names). In this case the running of the program will be halted and some kind of error message (which may not be very explicit) will be printed out. Retrieving oneself from this situation with data intact will certainly be very time-consuming and may be impossible.

Using prompts can help to avoid the wrong piece of data being input; it cannot guard against errors in actually typing the numbers. The more disastrous effects of this can be headed off if the data is tested on entry by using checks. Possible checks include name vs number, integer vs fraction, positive vs negative and most often a test to ensure that the data input falls within some permitted range. If the data fails the test, the response can be either rejection of it or a request for confirmation. For example, if a theatre occasionally employs children, an input of age on a payroll program might be accepted in the range 16 to 99, be rejected if less than 1 or more than 99, and attract a request for confirmation if between 1 and 15.

If you have an operator who knows the system thoroughly, never goes sick or takes holidays, is certain not to give notice and never makes a mistake, then none of this is necessary. This suggests that the extent to which the system needs to be 'user-friendly' depends on

a the number of potential operators
   - now
   - over the next year

b the operators' level of skill
   - will they be specialists?
   - will management require direct access to the system?

c the opportunity to train potential operators
   - in house (which means tying up the system)
   - outside (which means being able to release them for a time)

d the degree to which data can be pre-checked
   - by the operator
   - by whoever originated it

We have concluded that the most likely situation in an arts organisation is that

- while there may be main operators who have attained a high degree of skill, they are likely to be covered in their absence by a number of people who may not be so expert
- this key operator will need to be trained on the job, without disrupting other duties
- management will require direct access, at least to extract information concerning trends in sales for planning purposes. Moreover, there are some operating functions (for example some journal entries) which should require direct management participation for security reasons
- compared with some non-arts applications, speed of processing is relatively unimportant

This suggests that the system should incorporate a high degree of user-friendliness, with the proviso that the experienced operator should be able to skip the more elaborate prompts.

Management

The reports required for the *management information system* (MIS) are a key component of the output of all parts of the system. A payroll system, for example, must produce not only the payslips, but also a summary of total gross pay, total tax deducted etc to enable management to exercise a control function.

One of the principal decisions management will have to make for each piece of information is whether or not

- it should be reported automatically on a regular basis
- it should be reported on an exception basis, that is, only if it deviates markedly from its expected value
- it should not be reported but should be accessible on demand

Of course, data reported automatically gives management the fullest picture of what is going on. However, experience in other areas suggests that the computer's facility in generating reams of figures causes management to demand ever increasing quantities of reports. They start from the figures they are already getting from the manual system and build on them, eventually disappearing under piles of print out. There is no particular reason for supposing that arts organisations will be immune from this process. The worst of it can be avoided if all information is divided into three categories:

1 information immediately vital to running the business
2 information which will give early warning of significant long-term trends in the business
3 information that would be nice to have but which is not essential

Only the information vital for running the business need be reported on a regular basis. Information which indicates long-term trends need only be reported on an exception basis. This means that a pre-determined range is established for each piece of information and a report is only made if the figure goes outside that range. The figure in question need not be a piece of raw data (the attendance at last night's performance); it could be a measure calculated from current and historical data (the percentage change between the attendance at last night's performance and the performance on the same night last week). The information to be reported in this way should be chosen so as to give a warning as early as possible of a problem rather than to give full information about it; further data can always be obtained on an interactive basis. For example, while everyone in a theatre's management may wish to see the details of attendance at last night's performance on a daily basis, they may not wish to see every day a lot of calculations about trends. If they wish to study, for example, if it is worth continuing to perform on Mondays, the relevant data can be extracted from the computer records in response to specific enquiries. However, raising the question in the first place might depend on examination of the daily figures. It might be more effective to establish some pre-determined cumulative or average measure for each night of the week (which might be quite elaborate and include cost information, secondary sales etc) and report it on an exception basis. Thus the system itself would flag an impending problem. Reporting by exception probably represents an innovation in most arts organisations' MIS; used properly it provides a significantly increased degree of control over the organisation without a correspondingly increased flow of paper.

The implication for the development of the system is that, during the Systems Analysis phase (see Chapter 3), the managements of a variety of organisations will need to be consulted to establish an overall framework in which individual reporting requirements can later be provided. This may involve some radical rethinking of the way reporting is currently carried out.

The total environment

Most of the operations the system will be required to perform need programs which operate in batch mode, that is to say, transactions are processed through the system at a time remote from the physical events which give rise to them (the sale of a ticket, the purchase of some equipment). The efficiency of the system is maximised by processing transactions of the same kind at one time. However, any system, manual or automated, involves both set-up time and processing time. On a purchase ledger, for example, the processing time will be the time required to deal with one invoice and clearly it is likely to be much quicker on a computer. The set-up time on a computer, on the other hand, is likely to be much longer. Whereas on the manual system it may simply be a question of opening a book or finding the correct file, a computer has to be powered up, various system disks have to be loaded, followed by the program and data disks. This makes it an inefficient way of processing a single invoice; for full benefit the transactions must be batched. Achieving this may entail a formalisation of processes which have hitherto been carried out on a fairly casual basis; documentation which forms the input to one particular program must be ready from all departments by a prescribed time, or else none of it will be processed.

Chapter 2
The Proposed System

In Chapter 1 we described some of the characteristics which place special demands on the financial and control systems of arts organisations, and we indicated some of the physical and human factors which would significantly affect any attempt to implement a computer-based system. In this chapter we describe in broad conceptual terms a system to be run on a computer which would meet most of the requirements described. In Chapter 3 we go on to consider the hardware and software needed to implement it in a way suitable for arts organisations.

At this stage the system is only described in outline terms. We present it in this form now since the main needs are to

1 assess its acceptability
2 make a preliminary costing
3 gauge the size of the market

Much important practical detail is not shown here; this is left for later development if the broad outlines prove acceptable.

The overall system consists of

a an integrated financial package, including
   - budgetary control
   - ledgers
   - income analysis
   - cash control
   - payroll
   - royalties paid

b a stock control package
c an admission analysis package
d a mailing list package, which may be optionally linked to
e a word processing package

The Integrated Financial package

This section will discuss

- the overall structure of the package
- the implications of having an integrated system
- the individual programs

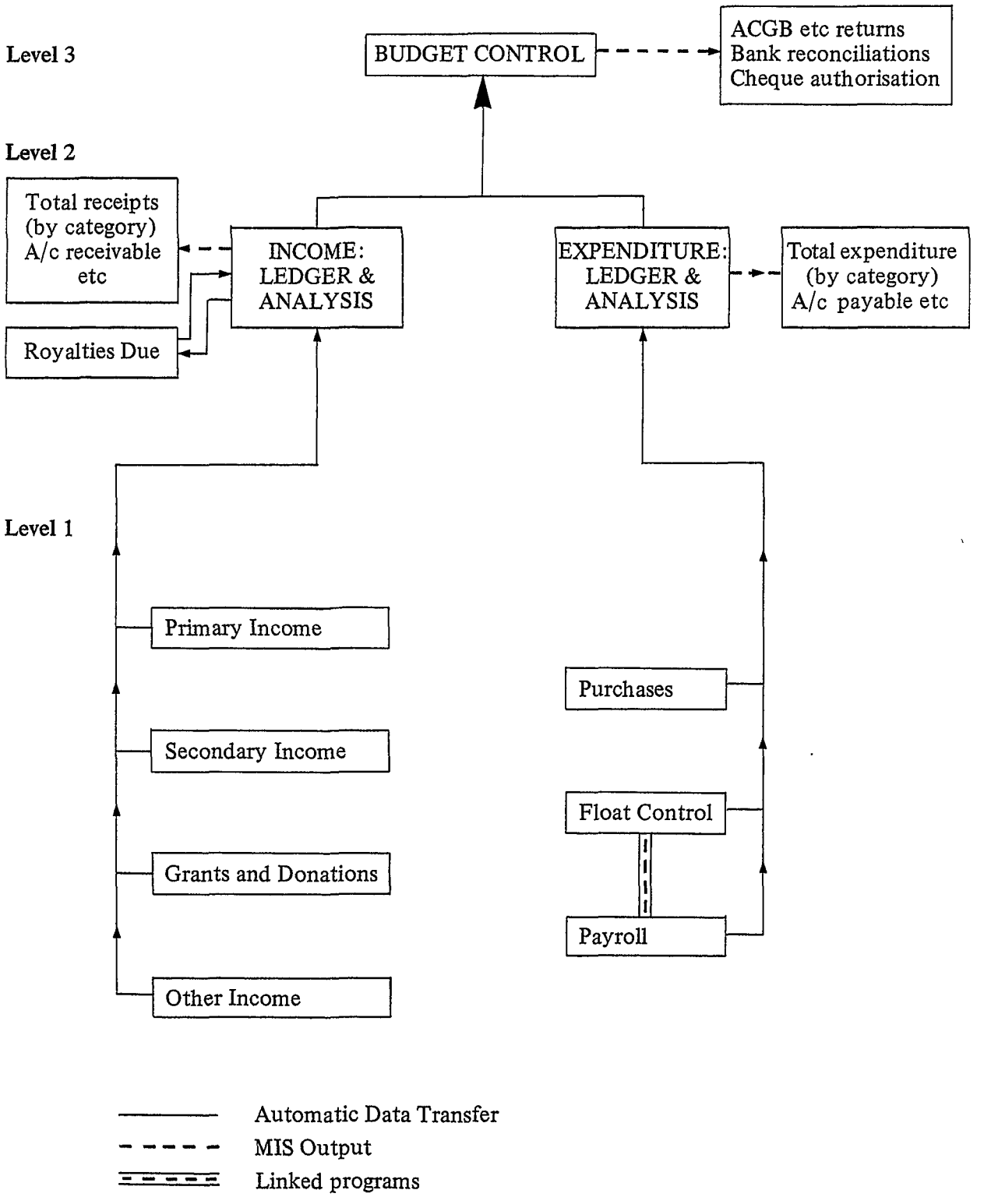
The overall structure

The package has three levels and is shown diagrammatically in Exhibit 1.

Level 1 is the principal level of entry for information relating both to income and expenditure. It contains the main operating programs (which provide their own operating output such as payslips) and MIS, as well as feeding data to higher levels.

Level 2 contains the ledgers, analyses data from Level 1 and permits direct journal entry. A special program uses income data to calculate royalties due.

Level 3 provides budgetary control: the actual data from Level 2 is compared against predetermined target levels.



INTEGRATED FINANCIAL SYSTEM

Exhibit 1

The system is designed so that information is transferred within a level, or from a lower to a higher, but never down from a higher to a lower. This will considerably simplify the implementation. The data may be used by other packages: the same data will be used, for example, by Purchases and Stock Control, and by Primary Income and Admission Analysis, although these packages are not otherwise linked.

The implications of an integrated system

As suggested earlier, it would be prefectly possible to run the payroll as a 'stand-alone' package. It would then have its own data store which would contain information about each employee plus general data such as the tax tables. When data about the hours worked by each employee was fed in each week or each month, the system would calculate gross and nett pay and make out a payslip. When this had been done for all employees, it would print out a report showing totals (and if desired the detail) for gross pay, nett pay, PAYE deductions, National Insurance and so on. These figures would then have to be posted to the appropriate ledger accounts manually, or at any rate retyped into the computer.

Many computerised payroll systems run in this way. Alternatively, stock control and all the other individual packages can be kept entirely separate—even if they are run on the same machine. The primary advantage of this is cost; a stand-alone stock control system can have wide application so the cost to the individual user can be kept low. The major disadvantage is that data has to be continually retyped and, apart from the cost this entails, the opportunity for human error is increased.

We have therefore concluded that the most useful system would be one in which all the component parts can interact with each other. In the case of the payroll, the totals printed out at the end of the run would automatically be transferred to the ledgers. The computer would print out an instruction to the operator to load the disk(s) containing the ledger data and the postings would then be carried out. Similarly, the stock records would be automatically updated in the same operation which updated the purchases ledger.

Though integrated, the proposed system will be modular, that is to say, it will be possible in individual cases to omit programs which are not required and to add special facilities.

The individual programs

A standard format will be used to describe the individual programs in the system (Exhibit 2). Rather than consider the detail of the calculations to be performed (which are likely to be different for each organisation), the description will focus on

- data to be input
- data stored by the individual program
- major outputs
- functions performed

The payroll system used as an example is meant to demonstrate a typical application rather than to be the Payroll program the system should actually contain—this is done later.

NAME OF PROGRAM:

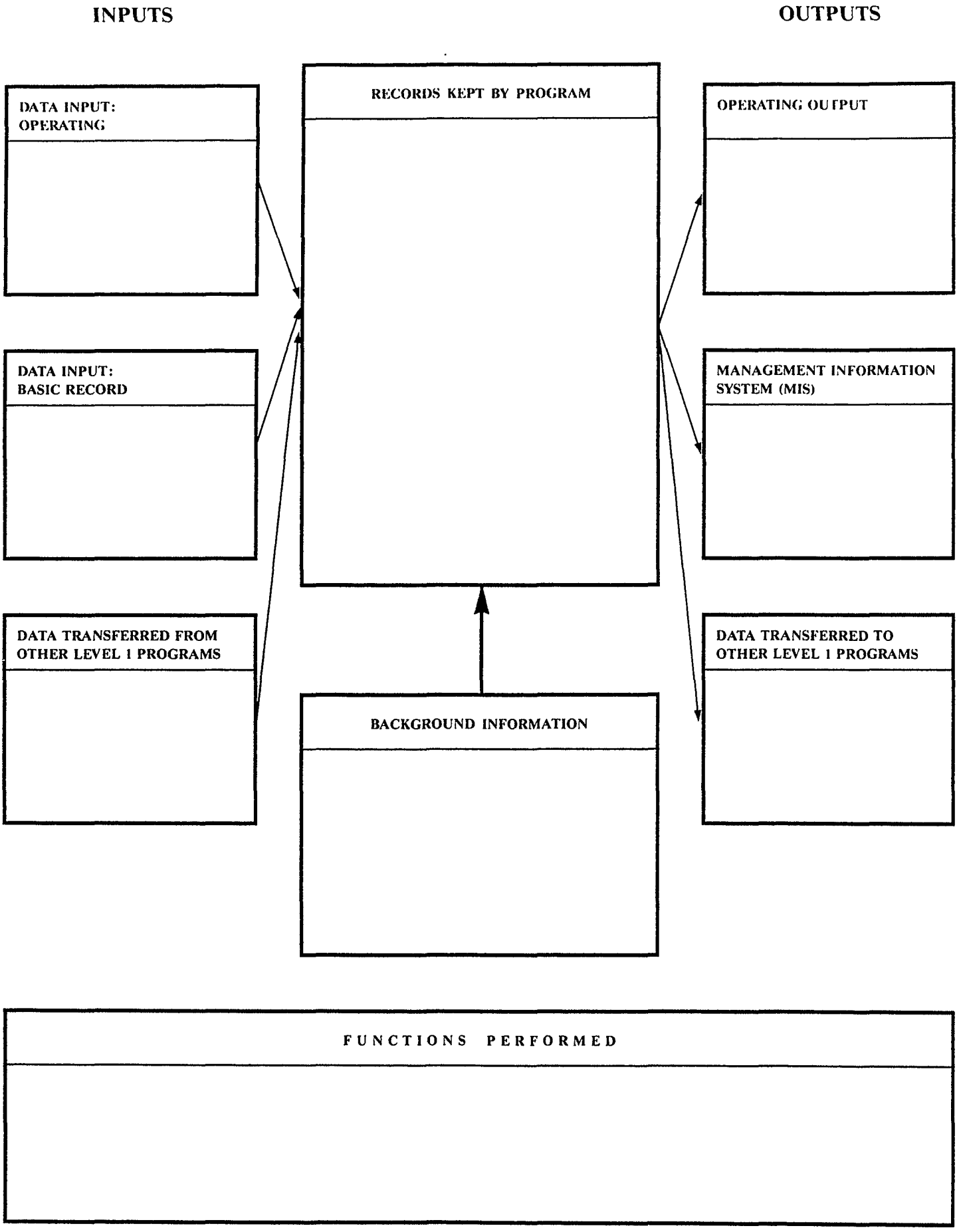


Exhibit 2

The contents of the various boxes are as follows:

- *records kept by program* is the basic information store; in a Payroll program there would be one record for each employee which would contain name, address, tax code, pay to date, tax deducted to date etc
- *background information* is the data which is needed by the program to operate but which does not apply to any particular record; for payroll you would need tax tables etc
- *data input: operating* is the information which needs to be fed in afresh each time the program is run; for example, hours worked
- *data input: basic record* is the data needed to set up the record into which the operating data will be fed; for example, if a new employee joins, a record must be opened containing basic details like name and address—the other information the computer holds, like pay to date, will be derived from the operating data
- *operating output* includes all the things, other than reports, that have to be produced to make the system work; for example payslips
- *management information system (MIS)* consists of the reports and summaries given to managers whether automatically printed out on a regular basis or produced interactively in response to a particular request; for example, total salary paid broken down by department
- *functions performed* summarises the things the program is there to do
- *data transferred to*, and *data transferred from, other Level 1 programs* only arise where two programs on the level transfer data between each other; for example, the Float Control program needs to transfer information about cash advances to staff to the Payroll program and both are on Level 1. In terms of system development, these two areas would probably be treated as parts of the same program; they are treated separately here for simplicity. Similarly, the Mailing List will supply names and addresses to the Word Processor.

1 Primary Income (Exhibit 3)

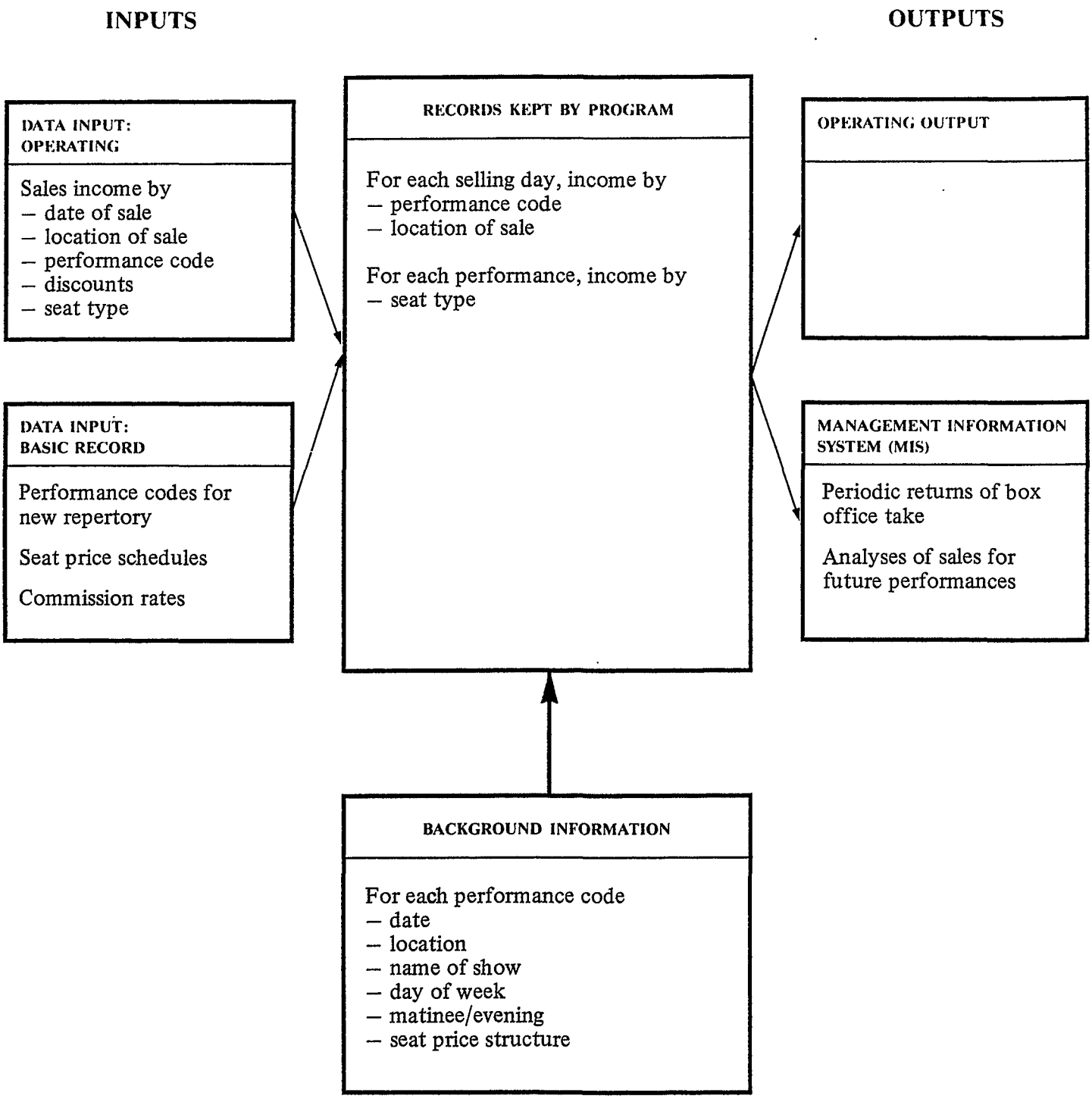
As indicated previously, Primary Income deals with income earned from the organisation's principal activities. It may be linked at the data input stage with the Admission Analysis package

- where data about primary income is linked to information about sales which needs to be stored and analysed in detail for management purposes, the two programs will work from a common database, the information being entered once. For example, in a theatre, the information from the daily box office returns can be entered just once and used for both purposes
- in non-venue operations, financial information may be separate from sales data and will need to be entered at different times

As described, the system requires a manual transfer of data from a box office system, whether the latter system be manual or itself computerised. A direct interface between two computerised systems might be possible, but is something which would need to be discussed at a much later date.

The Primary Income program will produce analyses of sales for all future performances from the current day on. Historical analysis will be carried out by the Admission Analysis package.

NAME OF PROGRAM: PRIMARY INCOME



FUNCTIONS PERFORMED
Store income data Provide prospective sales analysis

Exhibit 3

2 Secondary Income (Exhibit 4)

The Secondary Income program assumes that all sales included are cash sales (any credit sales would be handled through the Other Income program). The program will accept totals classified by time and place of sale and goods type, and can handle multiple VAT rates.

3 Grants and Donations (Exhibit 5)

The Grants and Donations program is designed to handle all unearned income. It will enter data into the ledger accounts opened for the major sources of funds (including, if necessary, one for 'Miscellaneous Donations'), and provide analysis of money committed as well as received. The entries will be coded in such a way as to indicate where funds have been given to specific projects.

4 Other Income

This program will handle the initial storing and analysis and transfer to the ledgers of all other earned income. Examples might include advertising revenue in programmes, hire of premises etc. It is likely to vary considerably (hence no exhibit); special optional programs might be attached at this point for particular needs, for example, if a theatre wanted to operate a full scale costume hire service.

5 Payroll (Exhibit 6)

The Payroll program is intended to handle the complexities of paying performers and is considerably different from normal standard packages. As such, while it will handle the payrolls of organisations which do not pay performers, like art galleries, it may be over complex for this purpose. In this case a simpler, standard alternative could be provided.

The main differences arise because

a the calculation of gross pay is more complex
   - overtime rates and special payments are particularly complex
   - subsistence payments are frequently treated as part of salary
   - a large number of differing contracts may exist within the organisation

b more options are needed for the calculation of nett pay
   - PAYE plus Class 1 NI
   - Schedule D plus Class 1 and Class 4 NI
   - Schedule D plus Class 2 and Class 4 NI

c other transactions are often handled through the payroll
   - repayment of advances
   - payment of royalties to writers/performers

We are proposing a system which is intended for use by any organisation where payment to staff is based on a contract and occurs at regular intervals (all fee payments being handled through the purchases ledger). Within such organisations it will handle the pay of

a people earning a basic salary with no overtime. Here the periodic payments will be automatically computed and there will be no need for any input of data about hours worked (eg administrative staff)

b people who have a basic working week but who are entitled to extra payments if they work overtime. If no overtime is worked, no data need be input and the program will compute the basic salary; otherwise only the overtime data need be input (eg actors)

NAME OF PROGRAM: SECONDARY INCOME

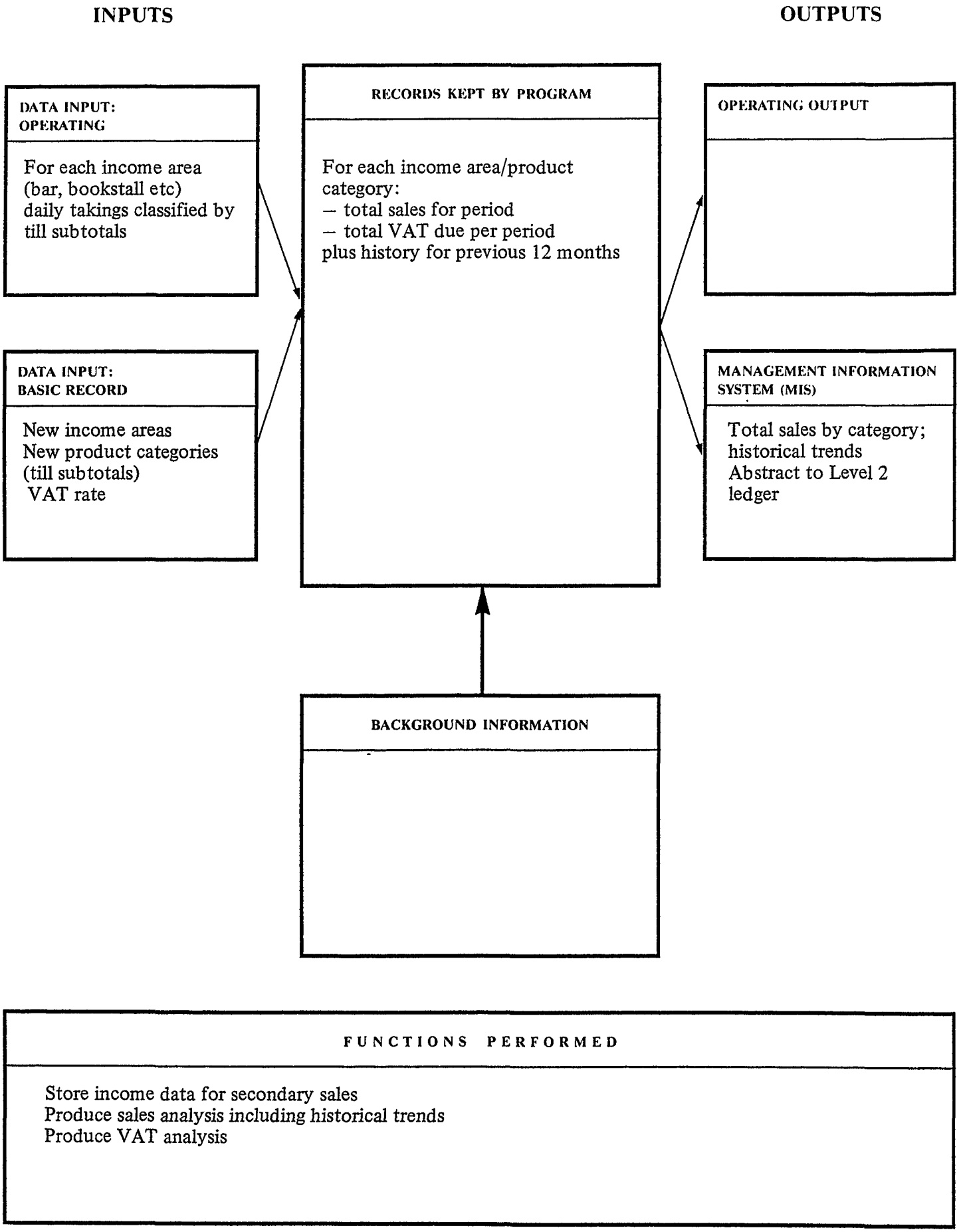


Exhibit 4

NAME OF PROGRAM: GRANTS AND DONATIONS

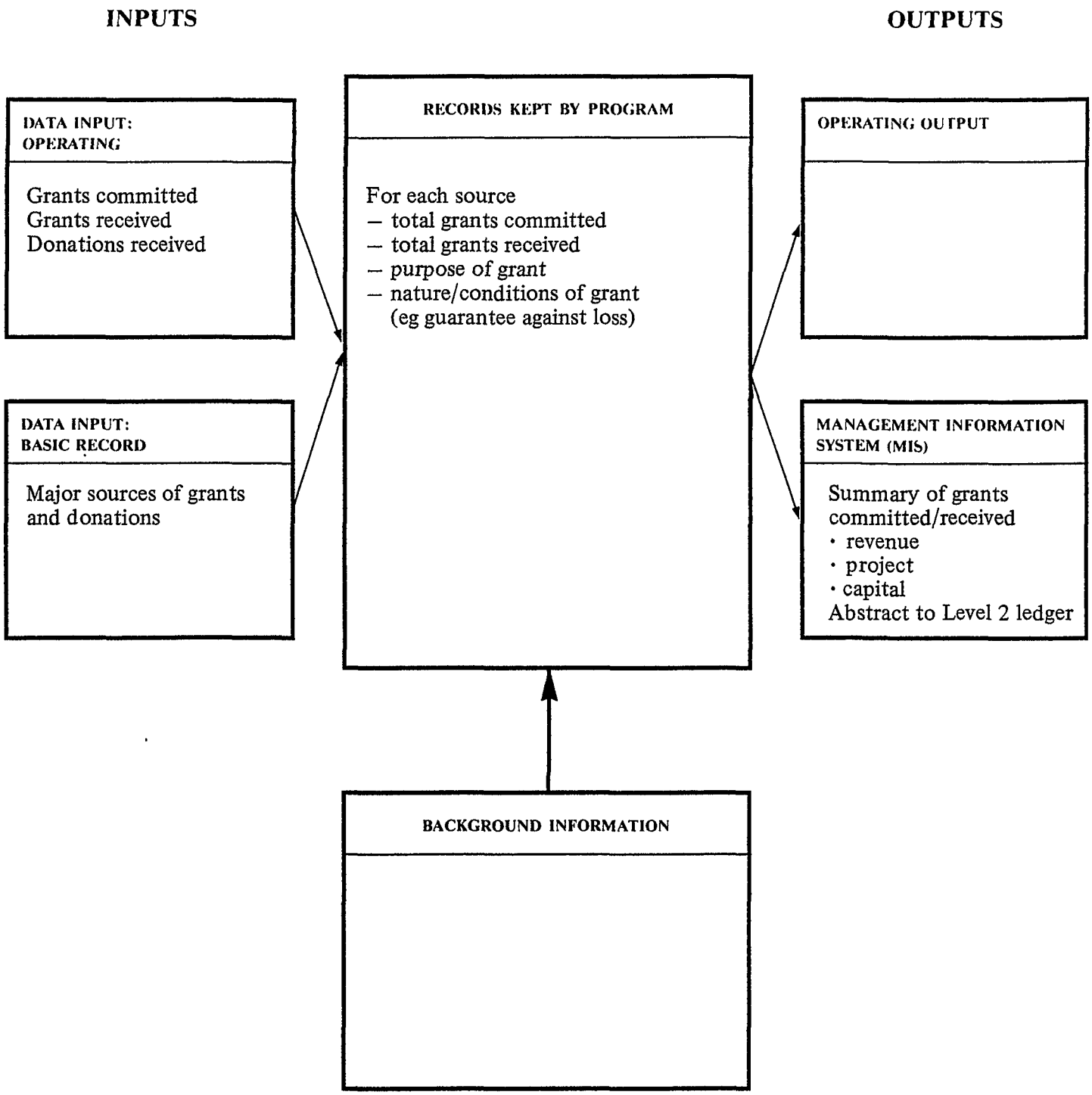
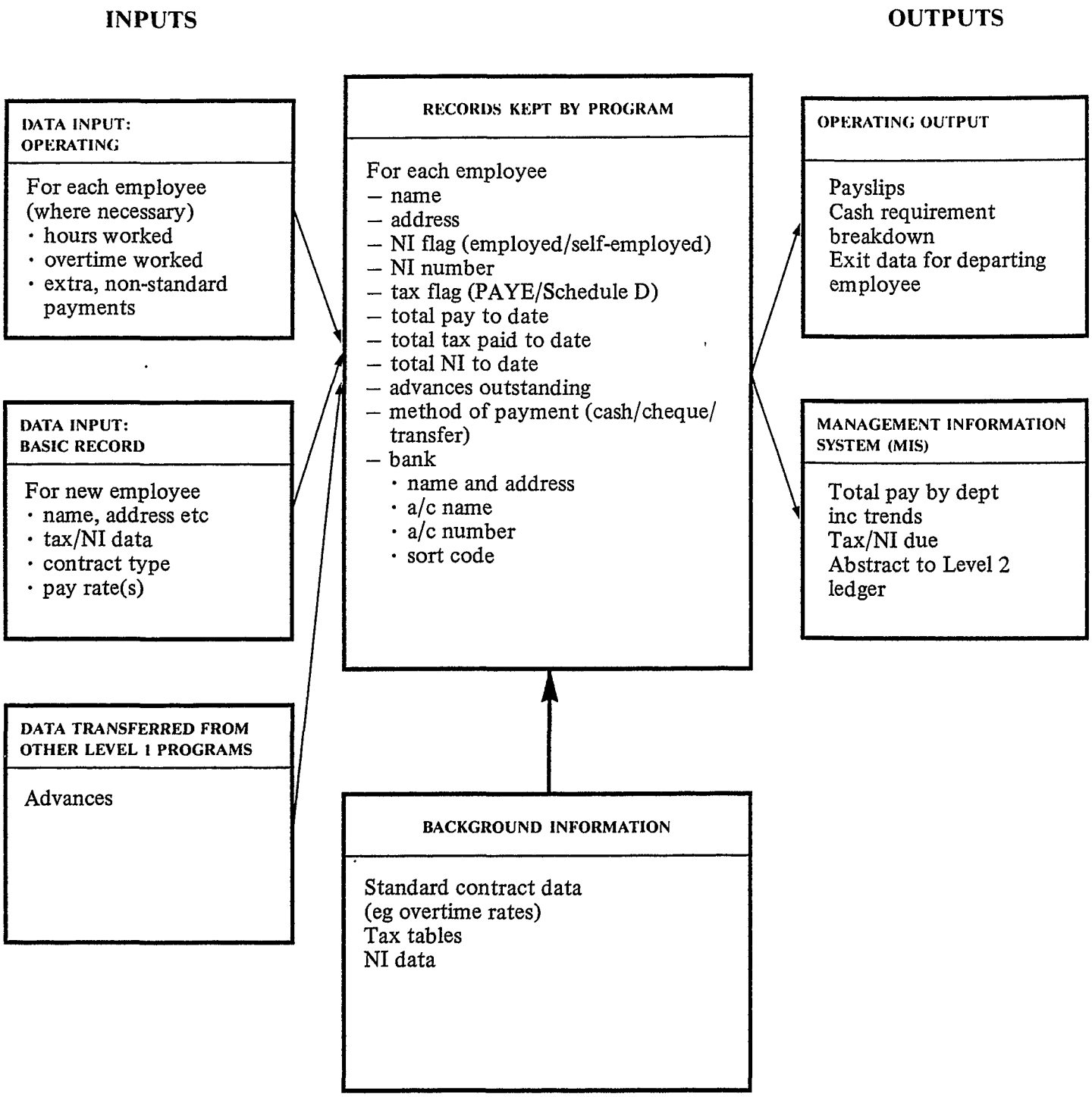


Exhibit 5

NAME OF PROGRAM: PAYROLL



FUNCTIONS PERFORMED

Production of payslips
Cash breakdown analysis
Termination of employees

Exhibit 6

c people who are paid hourly and for whom a time record must always be input (eg technicians)

This formula should cover a wide range of organisations although it may not be adequate to handle the freelance orchestras.

The complexity of paying performers is considerable. Exhibit 7 is a flowchart showing the proposed approach. It should be noted that the boxes which contain such items as 'subsistence' may either be an opportunity to input a cash figure directly or a subroutine (a program within a program) which calculates the figure based on input or stored data. After calculating gross pay the program may print out a listing to permit validation.

6 *Float Control (Exhibit 8)*

The Float Control program is designed to record the status of floats held by various staff, and to control the large number of cash purchases many organisations make. When a float is given, the name of the holder and the amount are recorded. When receipts are presented, they are credited to the float account and debited to the appropriate cost centre. The amount required to top up the float is then calculated and the appropriate documentation printed.

In the case of those floats having specialised authorisation to make cash advances against salary to staff, the relevant information is transferred to the Payroll with options to repay

- on the next pay day
- regularly over a stated number of periods
- in irregular amounts to be input manually as each payroll is run

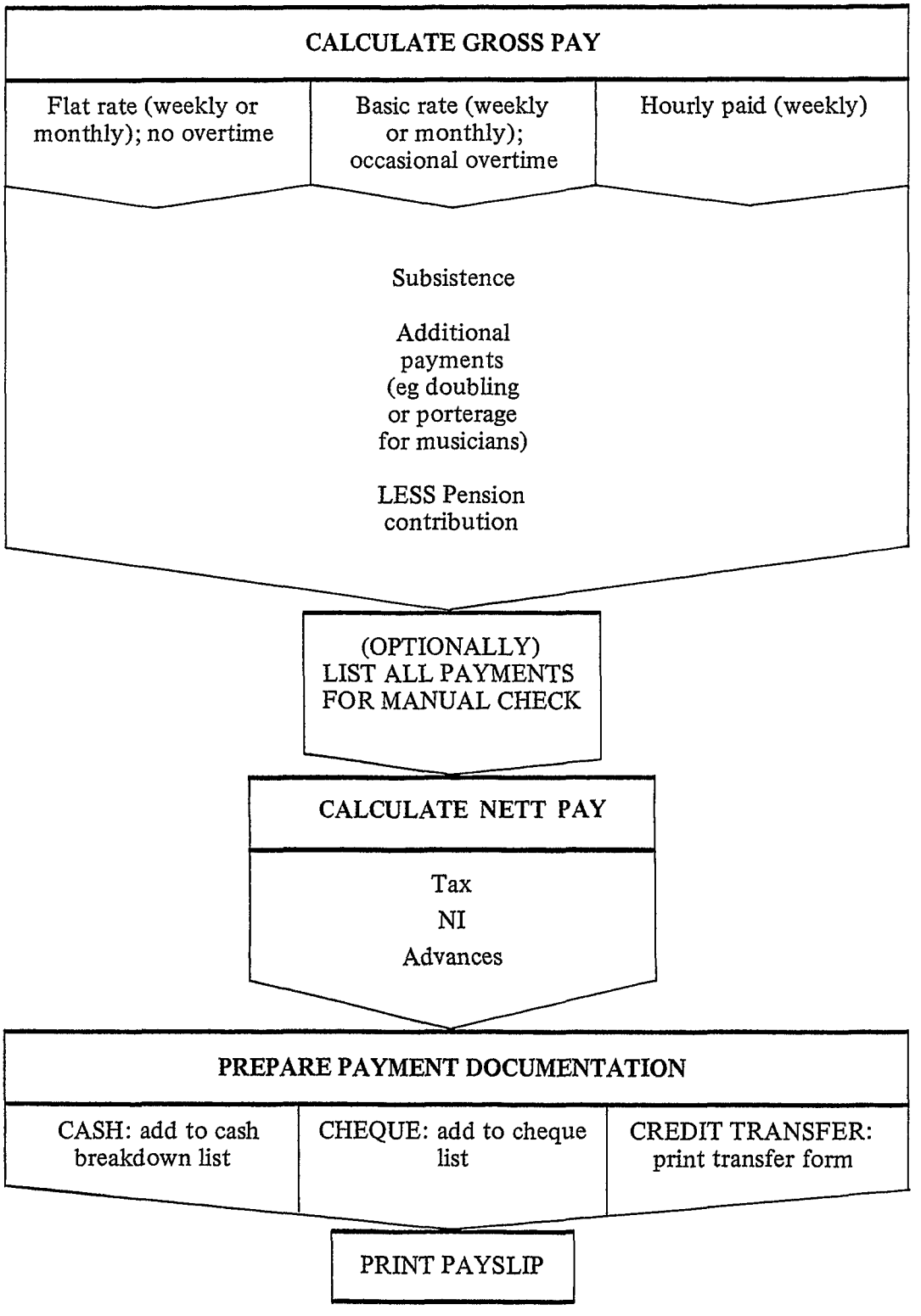
7 *Purchases (Exhibit 9)*

The Purchases program is the point of entry for all data relating to the purchase of goods on credit and thus corresponds to a purchases day book. It assumes that incoming invoices will be numbered sequentially, and the details input with codes relating to the supplier and the cost centre to which the item is to be charged (the structure of the cost centres will be discussed under Level 2). Outstanding items will be held on an open entry basis and when the account is settled details will be entered through another program in the Purchases package which will allow input of the cheque number. Part payment of an invoice will be permitted by retaining the last two digits of the invoice code to denote split payments. The package will produce remittance advice notes.

8 *Level 2—Ledgers and Analysis*

All the programs at Level 1 will include a routine at the end which will transfer details of all the transactions entered during that run to the database at Level 2. The programs at Level 2 will enable this database to be used in a number of ways.

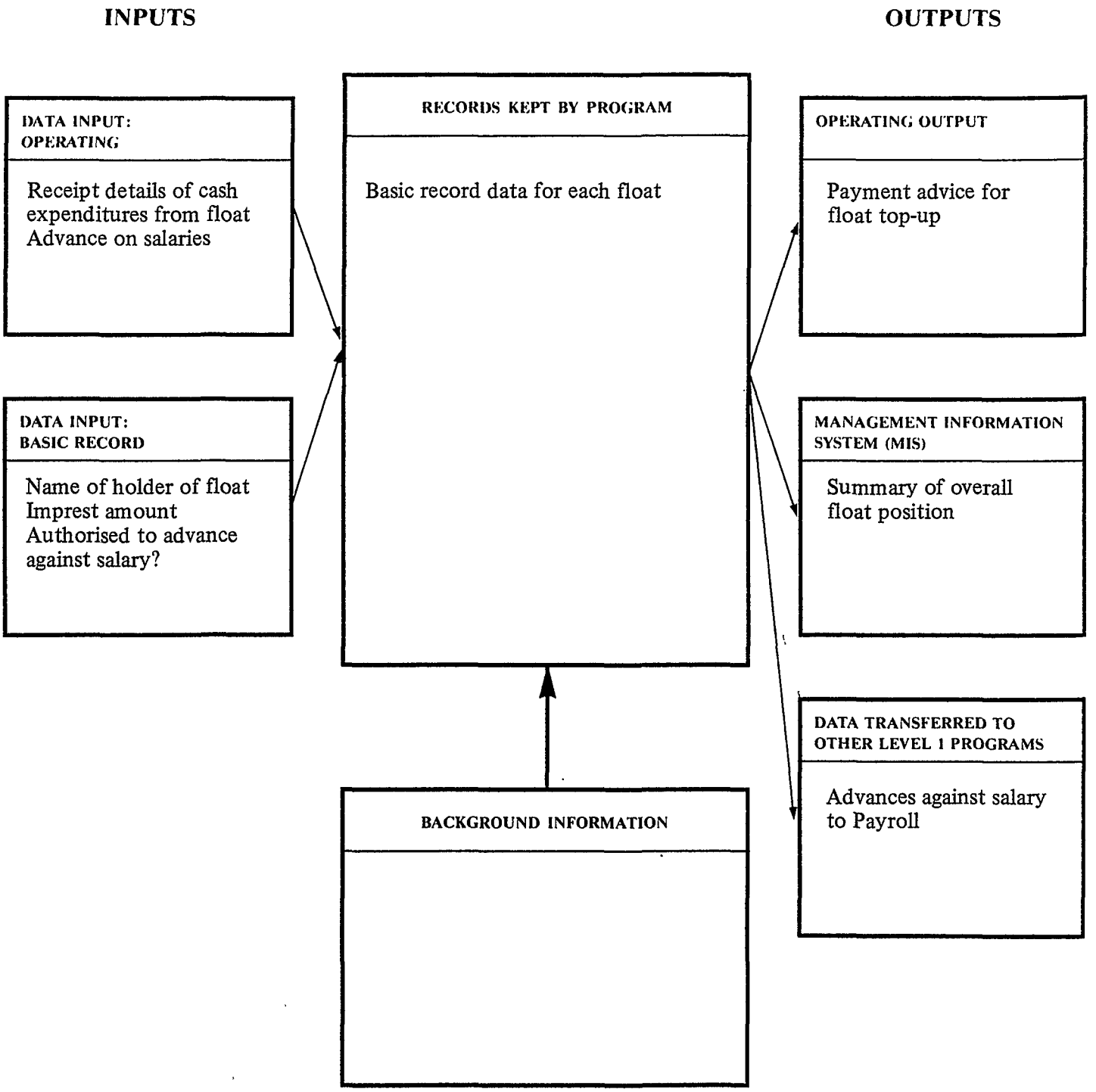
a *Ledgers* The Ledger program will permit the printing out of ledger cards for all accounts on the sales, purchase and nominal ledgers with full details of the account (name and address of suppliers etc) and details of each transaction (date, reference, amount etc).



SCHEME FOR PAYROLL PROGRAM

Exhibit 7

NAME OF PROGRAM: FLOAT CONTROL

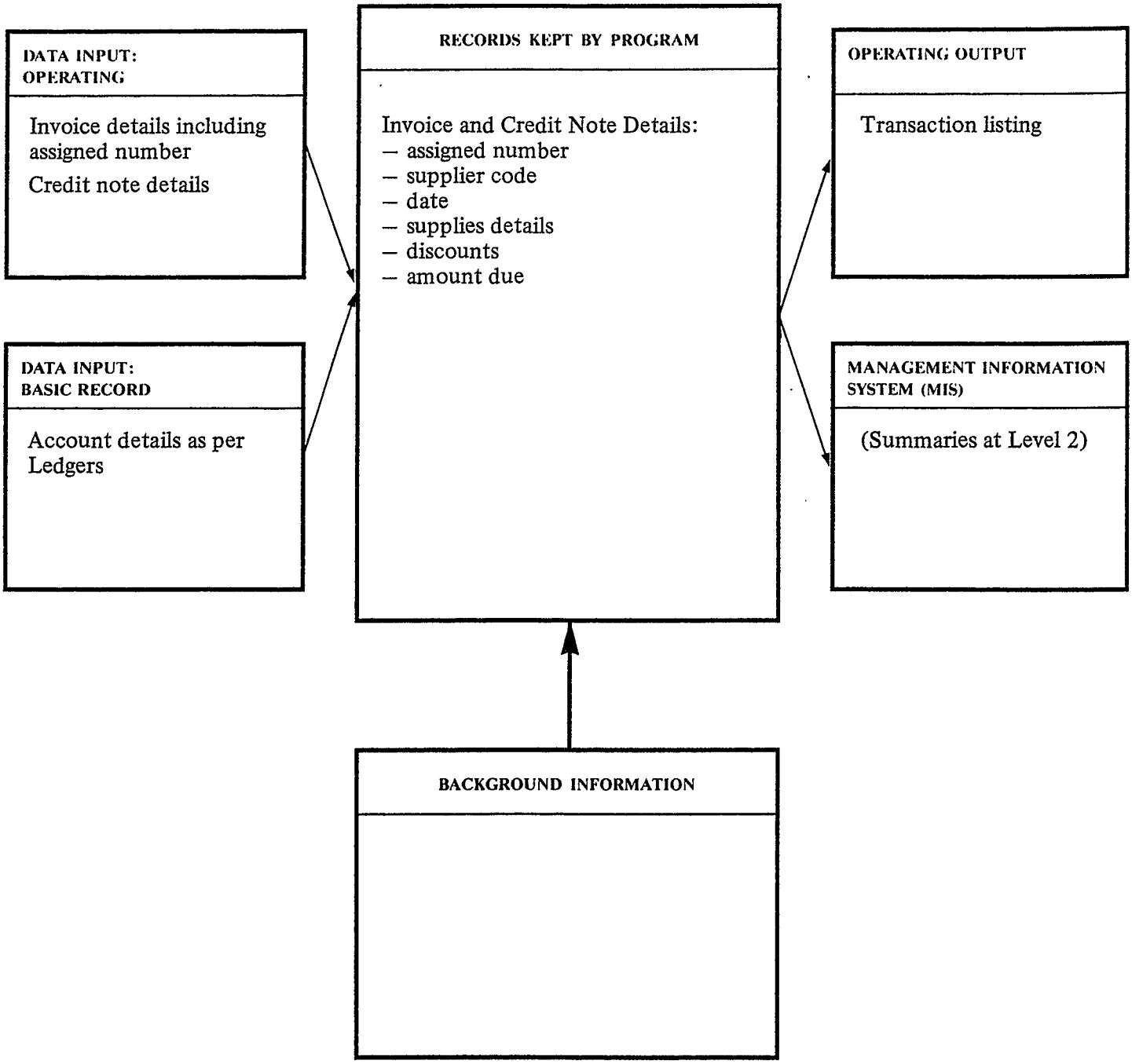


FUNCTIONS PERFORMED
Monitors overall position of floats Records cash advances on salary and transfers to Payroll

Exhibit 8

NAME OF PROGRAM: PURCHASES

INPUTS **OUTPUTS**



FUNCTIONS PERFORMED

Data entry and analysis for credit transactions

Exhibit 9

b *Analysis* The database will permit the detailed analysis of expenditure both by production/exhibition and by spending department. The user will be able to determine the accounts to be debited on both dimensions so that the data may be thought of as being held in a matrix, the rows and columns of which may be assigned as appropriate. In a theatre, for example, part of the matrix might appear as:

	Production A	**Production B**	**Production C**	.....
Set	£	£	£	
Costumes	£	£	£	
Lighting	£	£		
⋮				

Direct access to the ledgers will be possible at Level 2 to provide journal entry facilities.

9 Royalties Paid (Exhibit 10)

Arts organisations frequently have to make payments to writers, composers, artists etc who may not be on the payroll but who receive either a flat fee per sale or performance or some percentage of the money the organisation has received for it.

These payments may be

a to individuals such as
- the author of a play as a percentage of the box office
- members of an orchestra who played on a broadcast recording and are now entitled to residuals as a result of a repeat
- the composer of music specially written for a performance
- the painter of a picture sold in reproduction by a gallery

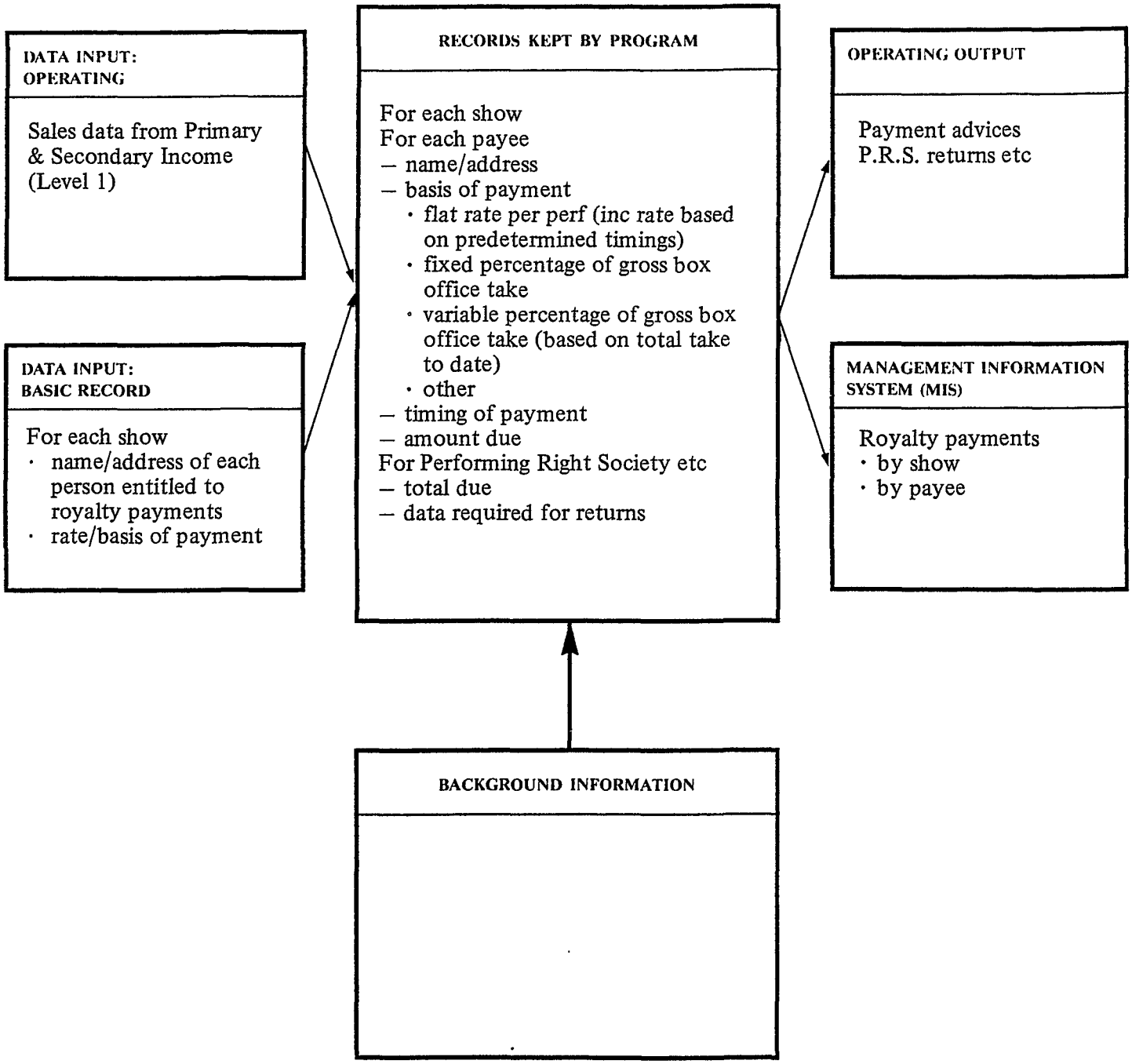
b to collection agencies
- the Performing Right Society
- the Mechanical Copyright Protection Society etc.

When a new production is mounted, a ledger account will be opened for each person to whom royalties must be paid on a continuing basis and the program stores details of the formulae to be used calculating them. Data relating to performance/sales is automatically fed from the Income programs on Level 1 and used as the basis for calculation. When a payment is made or a return is required the program will print out the appropriate details with a remittance advice where necessary. Alternatively, where it is not desired to set up an account for each individual to be paid, the program can print out individual remittance advices and update a control account.

NAME OF PROGRAM: ROYALTIES PAID

INPUTS

OUTPUTS



FUNCTIONS PERFORMED

Automatic preparation of payment advices on regular basis
Management analysis

Exhibit 10

10 Level 3–Budgetary Control

The principal function at Level 3 will be to combine the detailed data contained in the matrices at Level 2 with predetermined budget figures for each item entered directly at Level 3. Thus, the matrix shown on the previous page will contain figures for budget and actual expenditure in each cell which may be summed vertically or horizontally as required. While the actual figures will be constantly modified as the ledgers are updated by the lower level programs, the budget figures will normally remain constant and can only be altered by senior management. A similar process will apply to income.

It will be possible to print out budget vs actual figures for
- any individual item eg costumes for Production A
- any department eg costumes
- any production

In addition, a list can be produced to show those departments/productions where actual expenditure
- exceeds budget
- is within, say, 95% of budget

This sort would be done automatically.

It will also be possible to print out and analyse budget vs actual figures for all overheads/department expenses. Where the need for particular routine reports is identified, the system can be programmed to produce them automatically.

Level 3 will also carry out a number of housekeeping functions such as
- the production of details of returns required by the Arts Council and other funding bodies
- the production of a list of those payments which are due to be made, and which are based on the suppliers' terms of trade stored in the purchases ledger, with invoice numbers for cheque authorisation
- the production of a list of outstanding debts, by age
- bank reconciliation

All the programs outlined above will be written in such a way as to be 'user-friendly', that is to say, the computer will provide step-by-step instructions to guide the operator through each program. Where one part of the system is required to interact with another, for example to update the ledgers, the computers will ask for the appropriate disks to be loaded. It will be possible to override the detailed system of prompts and instructions when the operator has become more experienced.

The Stock Control package (Exhibit 11)

This is a standard package such as would be found in a commercial system. It is designed to handle three types of stock:

1 fixed equipment like office furniture
2 consumable stock like light bulbs
3 resale stock like programmes, catalogues or bar stock

In the case of equipment it is necessary simply to record the nature and value of each item. In the case of consumable and resale stock it is necessary also to provide a re-order mechanism and information about usage rates. The re-order mechanism depends upon a re-order point and re-order quantity being given for each item. The program will then flag those items which need to be re-ordered and, if provided with information about suppliers, can automatically print out the purchase order.

NAME OF PROGRAM: STOCK CONTROL

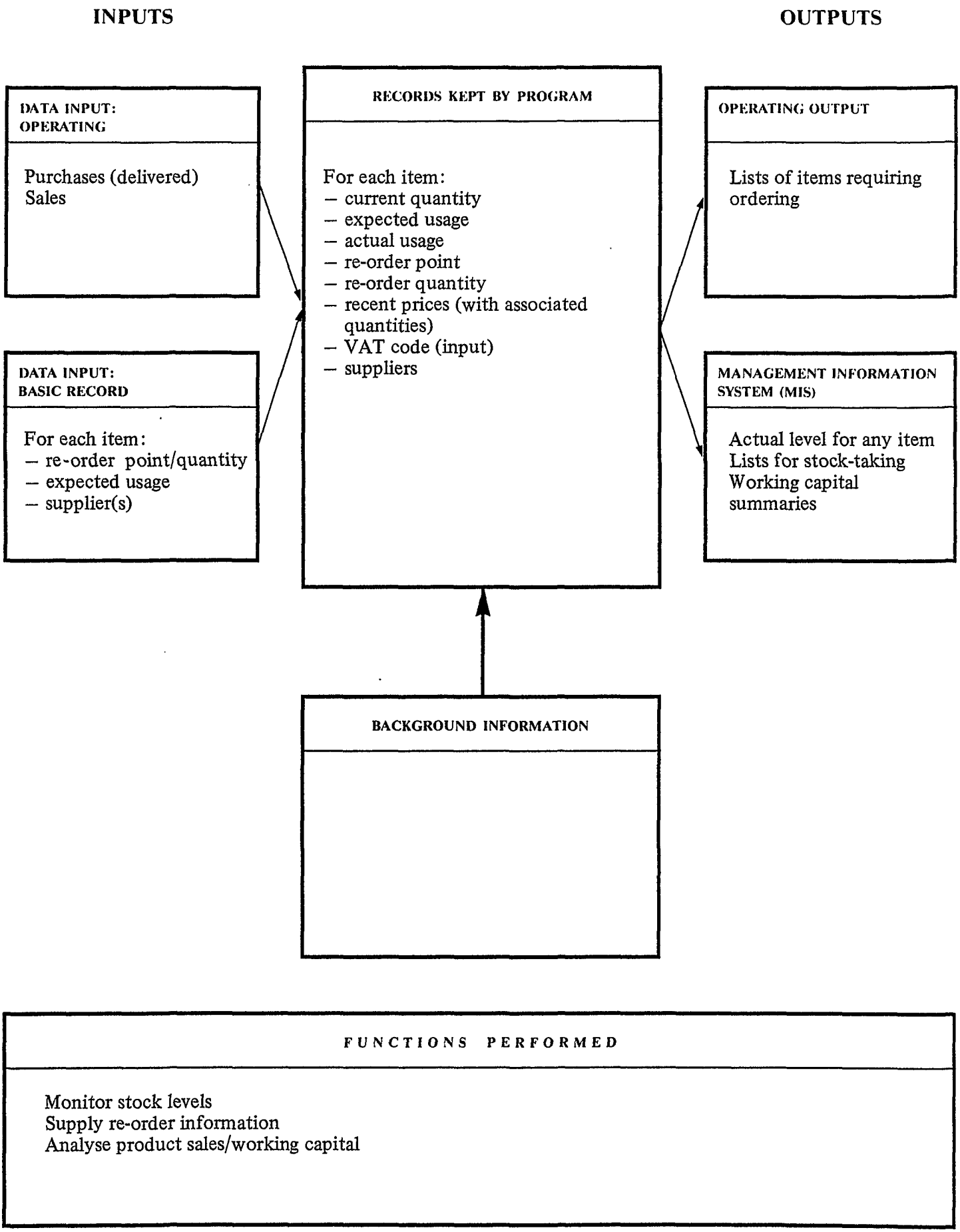


Exhibit 11

The Admission Analysis package (Exhibit 12)

This package is included to meet a widely-felt need to carry out detailed analysis of box office returns in performing organisations. However, it will permit sales analysis for all organisations which sell tickets to admit the public.

Essentially it is an elaborate series of sort routines. This concept, which has been alluded to earlier and will recur in the context of the Mailing List, may require some explanation. Assuming that the Admission Analysis database is linked to the Primary Income program (one of the options discussed earlier), a record for each performance will gradually be built up. After the performance, when the record is complete, it will contain data on:

a performance details
- title of work performed
- location/auditorium
- capacity
- day of week/date
- evening/matinee

b sales details
- number of tickets sold at each price
- value of tickets sold at each price
- special deals/discounts

c other details which can be anything you can be bothered to establish a code for such as
- weather
- who was playing the lead

What the programme will then do is print out the details of all those performances which meet user-specified criteria for one or more of those pieces of information and, if required, total and do other calculations on the numbers involved. For example, it would be possible to print out details of all performances taking place on a Monday, give all (or just some) of the details listed above for each performance, and calculate the average gross takings from such performances. Where the piece of information is a variable, such as the gross takings, it would be possible to establish a range criterion; for example, to print out a list of all performances where the house was below 40%, or between 40% and 60% of capacity. The program will also sort by more than one variable, calculating subtotals as it goes; for example, it would list all performances of a particular show where the house was less than 40%.

There are a number of possible modes such as:

a to output the details as a table

b to output only the totals and other analysis as a table

c to output the data as some form of chart. There are a number of standard chart types which could be used:
- graph
- bar chart
- histogram
- pie chart

NAME OF PROGRAM: ADMISSION ANALYSIS

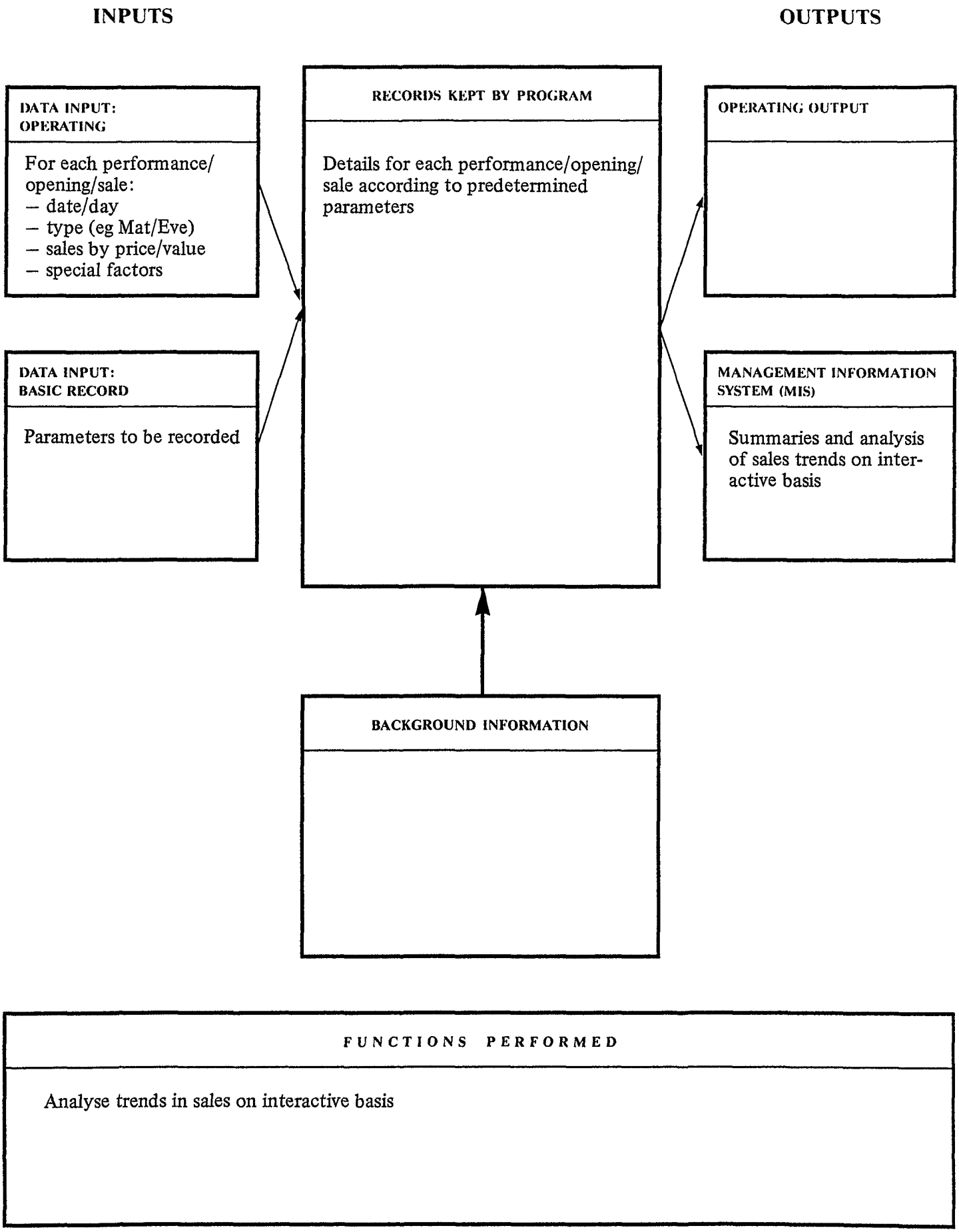


Exhibit 12

The Mailing List package (Exhibit 13)

The mailing list is an essential selling tool for many arts organisations. This is an area which many organisations have already computerised often using an outside computer bureau. As with the Admission Analysis package, the requirement is to be able to conduct elaborate sorts of the records to ensure that material is sent only to the appropriate people. This is important both for cost and for good customer relations. The output from the system will be not only the list of those to be mailed in each category but also typed stick-on labels for the envelopes.

The principal use of the mailing list in arts organisations is to contact

- the customers
- the media

We have not integrated the mailing list with the ledgers so as automatically to produce a supplier's name and address from the central list as this would greatly increase the complexity of the system. However, there is nothing to stop such names and addresses being stored on the list and being called up manually.

The information which needs to be stored for the media is likely to be common to most organisations;that required for customers will vary greatly. For example, a venue's customer list will consist of individuals about whom they will wish to store data on interests, age, location, profession etc. A touring company's customer list, on the other hand, will consist of venues which it will wish to classify by stage size, capacity, type of repertory and so on. This will be handled by a series of options. Exhibits 14 and 15 show options for the two customers' lists described above while Exhibit 16 shows a common media mailing list.

The basic 'sort' mechanism will be the same as in the Admission Analysis package; it will be possible, for example, for a venue to print out a list of people who are

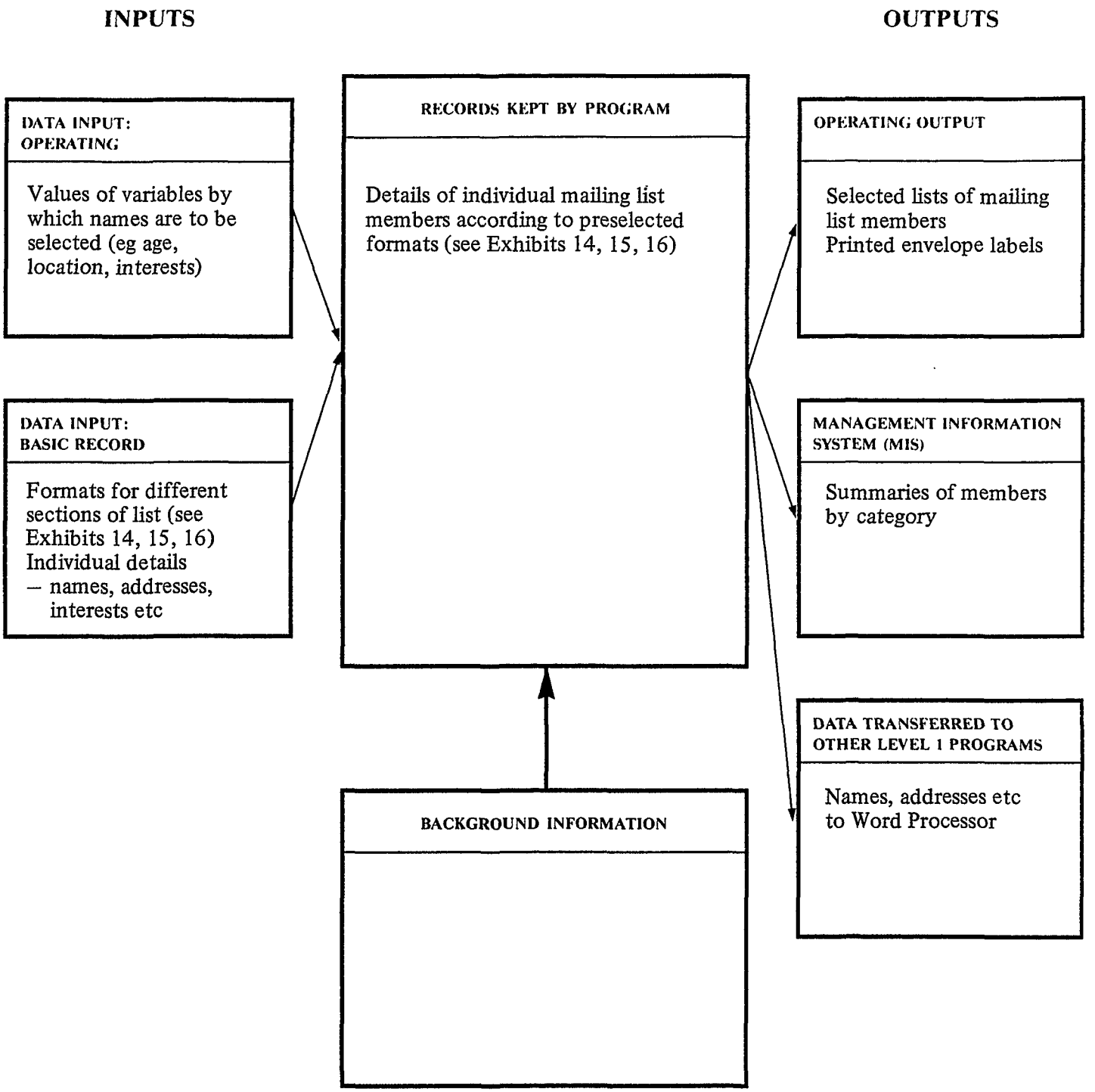
- under 25
- interested in theatre
- living in one particular area

The sort routine will need to be able to combine the various pieces of information in different ways using what are known as logical operators. The three most important are AND, OR and NOT, as in

- list all the people who live in Leeds AND are interested in ballet
- list all the people who either live in Leeds, OR are interested in ballet (or both ie the first list)
- list all the people who live in Leeds and who are NOT interested in ballet (perhaps because we have already mailed the ones who are)

The programs will perform a check for duplication when a new name is entered. This is done by checking certain significant parts of the entry, for example, the program might check the first four letters of the surname, the telephone number and the post-code. If all these items turn out to be identical, the computer will print out a warning to the operator to check for duplication. If there is duplication, one of the entries will be deleted; if the two entries are genuinely different, a synonym code will be established to avoid future warnings. It may be that there is an existing package which can meet these requirements, but it is clear that many of them will not.

NAME OF PROGRAM: MAILING LIST



FUNCTIONS PERFORMED
Production of selected lists of mailing list members Printing of envelope labels Analysis of membership Data supplied to Word Processor

Exhibit 13

MAILING LIST – CUSTOMER Venue Version
Surname First Name(s) Address inc postcode Telephone number – home/work Age Sex Interests Occupation Date of last mailing Batch code *If a membership scheme is in operation:* Membership number Membership type Membership expiry date

Exhibit 14

MAILING LIST – CUSTOMER Touring Company Version
Name of venue Address incl postcode Principal contacts – administrator – artistic director – technical director – publicity director Regional Arts Association Cross reference–multiple auditoriums (venues with more than one auditorium would have a separate entry for each, but this would be flagged to avoid unnecessary multiple mailings) Stage type code Stage size code Capacity Fee range code Batch code Comments/special problems

Exhibit 15

MAILING LIST – MEDIA
Name of correspondent/critic/editor Name of publication/organisation Address of publication incl postcode plus telephone number Name of editor (if not first entry) Personal address plus telephone number (if known) Type of publication/organisation Interest code Date of last mailing

Exhibit 16

The Word Processing package (Exhibit 17)

There are no features peculiar to the arts which are required in the Word Processing package, and it will almost certainly be a commercial program bought off the shelf. However, such programs do differ in the facilities they offer and it will be necessary to choose one that is appropriate for the intended use as well as compatible with the equipment on which it is to be used. The most likely requirements in the arts context are

- to enable two-finger typists to produce perfect letters
- to produce standard contracts and documents with only individual details having to be typed in
- to produce individually typed letters to members of the Mailing List automatically
- to hold scripts-in-progress in memory, enabling a revised version to be produced without complete re-typing

These requirements will necessitate a program such that

- a beginner can use it
- the computer will hold large amounts of text without insisting on it being stored on disk
- the text is displayed on the screen in the format in which it will be printed

Again, not all packages do this.

The Word Processing package will be capable of being run on the same equipment as everything else. However, producing output of letter quality requires a printer of higher quality (and hence cost) than might be used for other purposes.

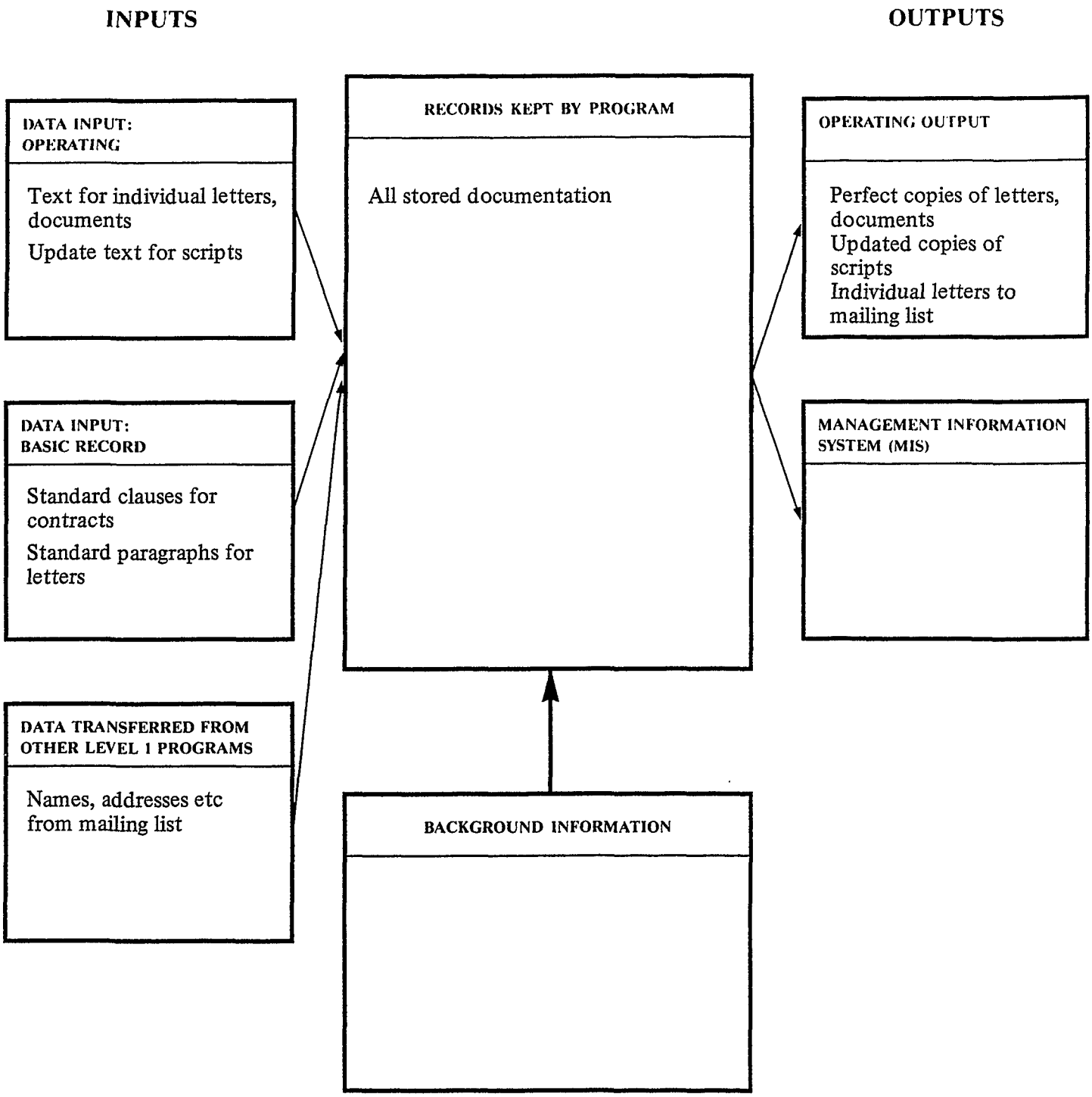
We believe that the programs described in this chapter will be of great use to a wide variety of arts organisations. This is based on the conviction that different kinds of organisations have to perform similar managerial and control functions even if they call them by different names. It should be made clear that within the framework outlined, considerable variation is possible in order to tailor the system to individual needs. For example,

- where major differences of need become apparent, it will be possible to have available alternative versions of some of the programs and to supply the appropriate one in each case—an art gallery for example, might not need as complicated a payroll system as an orchestra. The program disks will not in fact be mass-produced but copied individually from masters for each application, permitting the appropriate selection to be made
- when the system is set up, special programs called initialisation routines will be run which will enable the user to specify the way he wants his particular system to operate. For example, on the Payroll program, the initialisation routine might ask if the sub-routine for subsistence payments was needed in that particular organisation. If not, that section would be skipped when the program was run. If subsistence payments were later introduced, the instruction could be changed

A number of requirements have been identified as important to arts organisations which have not been included in the system because

- they do not need to be integrated with the main system
- we believe that they are adequately met by packages which are widely available

NAME OF PROGRAM: WORD PROCESSOR



FUNCTIONS PERFORMED
Producing perfect copies of letters and documents Producing standard documents (eg contracts) with individual details only input Producing individual letters etc for selected members of the mailing list Producing revised versions of scripts etc with only updates input

Exhibit 17

Of these, the two most important are budgeting and scheduling. Of the budgeting programs available, Visicalc is both flexible and comparatively simple to use. Data is entered into a normal worksheet format and 'what if' calculations, for example on the effects of playing to different capacity audiences, can be made by simply changing one figure, all the other figures changing automatically.

On scheduling, we have concluded that it is probably impractical to develop the program, requested by many, which would calculate the optimal schedule given all the data relating to each performance. However, the computer could be used to store scheduling information and make it more readily accessible. The programs which would be used to do this are called database management systems and a wide range are currently available.

It will be necessary to ensure that versions of these programs are available to run on the equipment selected.

Chapter 3
The Physical and Financial Requirement

Given the environment described in Chapter 1 and the system outlined in Chapter 2, it is possible to assess the hardware and software which will be required to implement the scheme and the costs involved. This chapter will review

- the components of the system
- how much memory is required
- alternative configurations and their costs
- software development

The components of the system

To run the system described in the previous chapter or any similar package useful to arts organisations, four major components are required:

1 the computer (which will include the keyboard)
2 the monitor—a screen on which programs and data can be displayed
3 a mass memory store for data and programs
4 a printer

This section will discuss the criteria which should determine the selection of each of these items but we do not propose at this stage to make recommendations on the actual models which should be used.

The Computer

It is unlikely that there will be many applications of the system which cannot be run on a microcomputer, and equally it is unlikely that many arts organisations will be able to afford anything else. However it should be noted that the recent development of the business market for microcomputers has resulted in business software being developed for machines which were originally designed for personal and domestic use, as well as the development of hardware to meet business requirements. The computer specialists on the working party strongly recommend that domestic computers (by which they have in mind such machines as the Apple II and the Commodore Pet) should not be used in this application because

- their level of reliability, while adequate for domestic use, may not be adequate for business use
- their operating systems limit the response time and degree of integration which can be obtained
- having been designed for domestic use they include features unnecessary for a business application (eg colour graphics, music synthesis)

There are a number of more suitable machines currently available, and more soon to be released, which have the following characteristics:

a reliability

b good dealer support: there needs to be a network of dealers who can
  - carry out repairs
  - replace any part of the equipment at one call

- if necessary run user programs themselves
- provide advice and assistance at all times

c good response time: on the smaller micros the time involved in waiting for the machine to find a particular piece of data or program can be appreciable and can affect the user's view of the machine's usefulness—this is a criterion which also applies to the mass memory

d good keyboard characteristics: a typewriter keyboard plus calculator-style keypad for fast data entry and single keys for common commands

e programs which can be interpreted not compiled

The Visual Display Unit (VDU)

Most microcomputers can drive a normal domestic television but this is not recommended since close use over an extended period of time can cause discomfort and eyestrain. Specially designed monitors are more comfortable to use as

- the colours chosen for the screen are better for long use
- the image is steadier than on a television
- they can be more easily adjusted to a convenient angle

We have identified a number of programs (in particular the Admission Analysis package) where large amounts of information will need to be present on the screen at the same time, since it may be desired to compare data without necessarily printing it out. Monitors differ in the number of columns of letters or figures they can hold—for this application 80 rather than 40 columns would be appropriate.

The Mass Memory

The only practical and reasonably priced method of mass program and data storage for the system is the disk. Cassettes are in fact cheaper than disks, but it can take them seconds rather than microseconds to access a particular piece of information since they may have to wind through the whole length of the tape. In an integrated system where data will have to be called up from a variety of locations for use in one program, the use of cassettes would result in operators spending large parts of their time doing nothing while data is found.

In a disk system, the head that reads the data off the disk can be moved to a specific location under the control of the Disk Operating System (DOS) which is a piece of operating software usually located in the Read Only Memory (ROM) in the disk drives themselves. This gives fast access to any piece of data.

There are two main kinds of disk in use with microcomputers: floppy and hard. Floppy disks, which are flexible plastic disks permanently protected by a cardboard sleeve, come in two sizes, 5¼" and 8". Hard disks are larger and as their name implies non-flexible. Both kinds of disk drive require a comparatively stable environment, free from dust, smoke and excessive humidity, but the hard disk drive is more sensitive.

The main advantage of the floppy disk over the hard disk is cost. A hard disk drive can cost £2,000 against £500 to £900 for a floppy disk drive depending on type. Against this the hard disk has three major advantages:

1 Reliability: although the drive is more sensitive to its environment, once installed in proper conditions it will outperform a floppy drive. Breakdowns occur when data is corrupted in transfer to or from the disk or the disk itself is physically damaged. Floppies, being flimsy, suffer this more often

2 Capacity: one hard disk can hold 40 to 50 times as much information as a floppy. In practical terms, this means that a considerable amount of time operating an integrated system on floppy disks will be spent simply loading and unloading disks. Updating the ledgers on Level 2 from just one of the Level 1 programs, for example, could involve four such operations. On a hard disk system all the programs and all the current data would be available all the time—no such operations would be needed

3 Security: floppy disks are small, insignificant and easy to lose. Being numerous, it is also more difficult to keep track of them. It is much easier to lock away one hard disk than a pile of floppies

The making of back-up copies is more complicated for hard disk systems than for floppy disk. Nevertheless, the balance of operational effectiveness probably favours the hard disk, but it is clear that the cost may put it out of reach of some organisations. Making the system available on both hard and floppy disks represents a significant increase in software development costs since there have to be substantial differences in the programs.

The Printer

A similar though less difficult choice occurs with the printer. The cheaper type is the dot-matrix printer which produces copy of the type normally associated with computer printout. It is normally fed from a continuous sheet of paper which may be a roll or fan-fold for specialised applications like pre-printed forms or stick-on labels for envelopes. The more expensive daisywheel printer produces letter-quality copy similar to that of an electric typewriter. It can be sheet-fed when the Word Processing package is being used to produce letters or other documents. The relative cost is likely to be £1,500 for a daisywheel printer as against £400 for the dot-matrix type. Slight differences in software are required to drive different kinds of printer; this can and should be implemented as an option selected once when the system is first installed.

How much memory is needed?

Exhibit 18 lists the programs specified in Chapter 2 together with preliminary estimates of the number of floppy disks required to store them, and the *current* data required for their operation. It does not show

- historic data archived for use either by the Admission Analysis program or to satisfy the requirements of the Inland Revenue etc
- back-up copies held in case of damage to the original disks

It will be seen from the exhibit that seven floppy disks would be required to store the programs and a similar number to hold current data. All this could be held on one hard disk but for reasons of security (since one disk is normally left in the drive) it would be better to store programs and data on separate disks. An organisation which kept one back-up copy of each disk and had historic data for three years might therefore be storing 49 floppy disks or seven hard ones.

PROGRAM	NUMBER OF FLOPPY DISKS REQUIRED TO STORE	
	PROGRAM	CURRENT DATA
INTEGRATED FINANCIAL PACKAGE		
Level 3 – Budgetary Control *Level 2* – Ledgers	1	1
Level 1 Primary Income Secondary Income Grants and Donations Other Income	1	1
Purchases Cash Control Payroll Royalties Paid	1	1
STOCK CONTROL	1	1
ADMISSION ANALYSIS	1	1
MAILING LIST	1	At least 1
WORD PROCESSOR	1	At least 1
TOTAL	7	7

ESTIMATE OF MEMORY REQUIREMENT

Exhibit 18

Alternative system configurations and their costs

We have defined a system with a standard computer and monitor, and choices for disk drives and printers. Exhibit 19 gives preliminary estimates of the capital costs involved in each of the four resulting options. Since we are not at this stage recommending specific items of equipment, these figures should be taken as broad indications only. Two factors may lead to their being over-estimates:

- the price of computers has fallen in recent years and may continue to do so
- substantial discounts are frequently given for quantity purchases

In addition there will, of course, be running costs for the system. The major items, with estimates of their cost, are listed in Exhibit 20. It may be possible to negotiate a leasing or rental agreement for this equipment so that the costs could be spread over several years and met from annual revenue budgets.

Software development

We believe that the software required for the proposed system will need to be written from scratch. While there are integrated systems for managing businesses on the market, the special requirements of arts organisations are such that the cost of modifying an existing system would be no less than writing a new one, for example,

- the whole of Level 1 represents a complete departure from the sales day book/ledger approach of most standard systems
- Payroll requires sufficient add-on sub-routines as to make it virtually a new package
- royalties paid would not exist on a standard package
- the degree of detail required in the analysis both of costs and income is beyond most packages of comparable size

Moreover, these differences are merely the ones apparent at the very generalised level at which we have been working; it is likely that many others will emerge as the arts environment is studied in greater detail.

We estimate that the development of such a system from the ground up would take about a year and would be divided into three stages:

1 systems analysis
2 program coding
3 testing and 'debugging'

The documenting of the work is carried on throughout the process.

Systems analysis is the process of defining in great detail what the system will be required to do. It will involve extending the process begun with the writing of this report so as to make it

- broader: the needs of a wider variety of arts organisations will have to be considered
- deeper: the needs will have to be defined down to a very detailed level

Program coding, as its name suggests, involves writing the programs which the computers will run.

ITEM OF EQUIPMENT	ESTIMATED COST (£)
Computer Monitor/VDU	6,000
Disk Drives (2): hard disk floppy disk	 2,000 900
Printer: dot-matrix daisywheel	 400 1,500

TOTAL COST OF SYSTEM Computer and VDU (Monitor) PLUS			
HARD DISK		FLOPPY DISK	
DOT-MATRIX PRINTER	DAISYWHEEL PRINTER	DOT-MATRIX PRINTER	DAISYWHEEL PRINTER
£8,400	£9,500	£7,300	£8,400

PRELIMINARY ESTIMATE OF CAPITAL COST OF TOTAL SYSTEM
(full price–does not include discounts which could be as much as 30%)

Exhibit 19

OPERATING COST	£
Hardware maintenance (inc some training)	1,000
Disks	500
Stationery	400
Electricity etc	100
TOTALS	£2,000

PRELIMINARY ESTIMATE OF ANNUAL OPERATING COST

Exhibit 20

Testing and 'debugging' includes running the programs using simulated and real data to iron out all the inevitable mistakes ('bugs') which will be in them. Testing is normally carried out in a location or series of locations which are similar to those in which the system is actually going to be used. This will involve a number of arts organisations who intend to use the system and who are prepared to give practical help in the development effort. This may also present a market for the system.

We estimate that the amount of effort required to carry out the three stages will occupy approximately one year divided as follows:

1 systems analysis: four months
2 program coding: two months
3 testing and debugging: six months

We do not believe that, given the complexities of the problem, the time can be significantly shortened by increasing the resources. At current rates, this represents a cost of £20,000 to £50,000 depending on

a the type of organisation employed

b the level of documentation required

c the availability of test systems

d the acceptable error (military systems have to be much more error free than the average commercial system, for example)

e the degree of 'portability' required (how easily the software can be transferred between systems)

f the degree of modularity required

g the levels of
- error checking
- error correction
- self diagnosis
- prompting
- idiotproofing

Chapter 4
Issues to be Resolved

The description of the system contained in the previous chapters is intended as a basis for discussion by arts organisations both at the consultations which the Gulbenkian Foundation will be organising, and elsewhere. It is the view of the working party that this system represents a viable scheme for handling the management and control of a wide variety of arts organisations, and nothing we have been told by those people we have consulted materially alters this view. However, it is entirely possible that the comment which we hope to receive from those reading this report and attending the consultations will lead to substantial changes in the system.

Apart from seeking information about computers in general from those attending, our objectives at the consultations will be

a to determine if a system of the broad type that we are proposing is felt to be widely needed

b if it is, to refine our description of it to meet the requirements of potential users

c to obtain data which will enable an estimate of the potential market to be made

d to determine, on the basis of the evidence obtained in this way, the next steps which need to be taken

If it is found that the system is likely to be purchased by a sufficient number of organisations to make development viable, a number of courses of action are possible for bringing it about. The purpose of this chapter is to set out some of these options as a basis for discussion, and to outline some of the considerations which will need to be taken into account when making decisions.

Issues which need to be considered immediately relate to

- organisation and funding
- software development

Organisation and funding

It is possible that this report and the results of the consultations which follow from it may persuade a software development company that it is worth undertaking the development of the system on a commercial basis. This would have the advantage that the company would carry the resulting financial burden and risk, although they would, of course, expect the price to the user to reflect this. They would also be responsible for marketing and installation. The disadvantage would be that control over the system and its future developments would be in the hands of the software house who might be able to build themselves a monopoly position, since it is not clear if the market will be large enough to sustain effective competition.

The alternative is for some organisation, based within the arts world, to commission the software. It would then own the copyright and maintain control. There are several ways in which this could be done:

a an organisation such as the Arts Council or the Gulbenkian Foundation, could take the responsibility for setting up a trading offshoot

b a small commercial company could be set up by interested parties from the arts world

c a company could be set up which would be owned by those who have bought the software. Every user organisation when buying the software would also buy one share in this company and would thus be eligible to elect a management committee which would
   - determine the allocation of the main software servicing contracts
   - determine the disposal of any surplus earned on the sale of software (which might be substantial if the software were licensed overseas)
   - agree future developments to the system

   It is likely that such an organisation would eventually need at least one full-time employee plus secretarial back up.

It seems unlikely that either the Arts Council or the Gulbenkian Foundation would be prepared, or indeed are equipped, to take on such a role; in both cases it would demand a radical departure from their normal operations. However the Arts Council is already involved in examining computerisation of its own internal records and might see such a role as an extension of that.

The other two options would require the raising of external finance for the software development. It is doubtful whether such finance could be obtained on a commercial basis since the project would be seen as high risk. If it were, interest rates would be punitive. It is possible, therefore, that the funding will have to be sought privately within the industry.

Software development

Unless the whole project has already been taken over by a software development company, tenders will have to be sought for the work. The main contenders are likely to be

1 software development companies
2 individual programmers
3 the computer departments of academic institutions

The boundary between the first two types is by no means clear–software houses range from two main outfits to large organisations. The latter would probably claim (not necessarily accurately) to produce a higher standard of work, and are rather more likely to be around in a year's time. On the other hand, they will cost more (perhaps more than twice as much) and may not give the same priority to what, to them, will be a very small job. University departments are comparatively low cost and are (barring Government cuts) likely to be around in a year's time, but they have difficulty managing the job in the context of their academic work.

At the same time as this decision is made, the hardware to be used will have to be selected and a system bought for the software developer to work on. The considerations relevant to this choice have been discussed earlier. It need only be emphasised that the results of this decision will be around for a long time. Different computers have different characteristics and although they run in the same languages they usually have different dialects. The system will therefore be specific to the machine it is written on, and transferring it to another will be a major operation.

It is not our purpose here to propose a complete implementation plan for the system but merely to indicate the main organisational options. We hope that the preferred option will emerge during the consultations.