

This item was submitted to Loughborough University as a PhD thesis by the author and is made available in the Institutional Repository (<https://dspace.lboro.ac.uk/>) under the following Creative Commons Licence conditions.



For the full text of this licence, please go to:
<http://creativecommons.org/licenses/by-nc-nd/2.5/>

D 42314/82

LOUGHBOROUGH
UNIVERSITY OF TECHNOLOGY
LIBRARY

AUTHOR/FILING TITLE

BENTLEY, J J

ACCESSION/COPY NO.

190914/02

VOL. NO

CLASS MARK

17 MAY 1997
20 JAN 2001

FOR REFERENCE ONLY

UNLESS RECALLED

019 0914 02



D 42314/82

LOUGHBOROUGH
UNIVERSITY OF TECHNOLOGY
LIBRARY

AUTHOR/FILING TITLE

BENTLEY, J J

LOAN 1 MTH + 2 UNLESS RECALLED <i>date due:-</i> 21 OCT 1982 LOAN 1 MTH + 2 UNLESS RECALLED	1 MAR 1984 LOAN 1 MTH + 2 UNLESS RECALLED HERIOT-WAT <i>date due:-</i> 05 JUL <i>date due:-</i> 23 AUG 1984 LOAN 1 MTH + 2 UNLESS RECALLED	28 07 <i>date due:-</i> 8 NOV 1986 LOAN 1 MTH + 2 UNLESS RECALLED 18. 11. 7 7
---	--	---

019 0914 02



Defining Management's Decision Making Information Needs

by

TREVOR JOHN BENTLEY FCMA FMS

**A Doctoral Thesis submitted for the Award
of Doctor of Philosophy of the Loughborough
University of Technology.**

**Supervisor: Dr. Peter Stratfold
Lecturer in Management Studies
Department of Management Studies**

© by Trevor John Bentley

Loughborough University of Technology Library	
Due	Dec 81
Class	
Acc no	190914/02

<u>Contents</u>	<u>Page No.</u>
<u>Chapter 1</u> <u>The Need for Research</u>	4
1.1 Statement of the Problem	5
1.2 Reasons why the Problem has not been Solved	15
1.3 Manifestations of the Problem	17
1.4 The Relationship of Information to Decision Making	22
1.5 The Impact of the Problem on Decision Quality	27
1.6 The Objectives of the Research	30
1.7 The Approach to the Research	34
✓ 1.8 Relationship of Research to Tilcon	38
<u>Chapter 2</u> <u>The Company</u>	39
2.1 Tilling Construction Services Ltd. (Tilcon)	40
2.2 The Organisation Structure	42
2.3 Political Nuances	48
2.4 The Researcher's Position	52
2.5 The Need for Research	54
✓ 2.6 The Decision to Carry out Research	59
<u>Chapter 3</u> <u>Research Techniques</u>	60
3.1 Information and Decisions	61
3.2 The Decision Grid	62
3.3 Decision Information Analysis	64
3.4 Information Analysis	67
3.5 The Approval of Management	71
3.6 The Seminars	73
3.7 The Interviews	77
3.8 Data Analysis	81

<u>Chapter 4</u>	<u>Application of Techniques in Tilcon</u>	86
4.1	Identifying the Managers to Interview	87
4.2	Human Relationship Problems	88
4.3	Political Problems	90
4.4	Intrusion of Other Company Problems	91
4.5	Effect of Researcher's Internal Status	92
4.6	Educational Benefits of the Survey	93
(4.7)	Impact of Management Philosophy	95
4.8	Management Co-operation	97
<u>Chapter 5</u>	<u>Tilcon Results</u>	98
5.1	Tangible Results	100
5.2	Intangible Results	108
5.3	Areas for Action	112
5.4	Management Action	113
<u>Chapter 6</u>	<u>General Results</u>	117
6.1	Management's Information Needs	118
6.2	Decision Responsibilities	122
6.3	Information Analysis, a Method	125
✓ 6.4	A Blueprint for Systems Design	127
<u>Chapter 7</u>	<u>Analysis of Research Data</u>	131
7.1	Analysis of Research Data	132
7.2	Directional Bias	135
7.3	Attitudes Towards Complexity and Impact	138
7.4	The Predictability and Realism of Management Attitudes	139
(7.5)	The Implication of Style and Level of Management on Attitudes	141

Contents (continued)Page No.

<u>Chapter 8</u>	<u>A Method for Defining Management Information Needs</u>	146
8.1	A Method for Defining Management Information Needs	147
8.2	Information & Decisions	150
8.3	Information Analysis	152
8.4	Management's Information Needs	156
8.5	Conclusion	158
<u>Chapter 9</u>	<u>General Conclusions and Suggestions for Further Work</u>	159
9.1	Information Needs can be Defined	160
9.2	Consequences of Information Analysis	164
9.3	The Value of the Research to the Systems Designer	168
✓ 9.4	Suggestions for Further Work	169

<u>References</u>	179
-------------------	-----

<u>Bibliography</u>	181
---------------------	-----

Volume IIAppendices

A	Information for Decision Making	225
B	Decision Definitions	259
C	Decision Lists	310
D	Information Flows	331
E	Action Report - 7.7.77	369
F	Plant Maintenance Initial Report - 28.4.78	397
G	Management Information Systems - Accounts - 3.10.78	411

Chapter One

The Need for Research

The Need for Research

1.1 Statement of the Problem

Managers need information.

In this managerial world of increasing remoteness, scale, complexity and change, information becomes the key to management effectiveness. Not surprisingly the study of management information has blossomed. But it is new; until very recently information, though obviously vital, was not considered overtly. It is not a subject for study in the earlier classical works on management. Like sunlight for the Victorian naturalists it was recognized as vital, but either it was available or it was not. Today the manager faces a confusion of potential sources of information. He has to determine what information he needs. This is a new and crucial management function. In earlier centuries the scholar alone had to decide what information he needed. The rest of society could respond intuitively to the information that was available. Subsequently the scientist faced this task. Now it is a fundamental part of management. It is also a very difficult process. (1)

The development of sophisticated data processing facilities has exacerbated the problem. More detailed information can and is offered to management often at a higher cost. The design and development of modern information systems has been carried out mainly by the computer specialists with little if any direct management involvement.

James D. Gallagher sets the following goal.

The ultimate goal of an effective management information system is to keep all levels of management completely informed on all developments in the business which affect them. To do this, the data-processing personnel and those entering information into the system should know exactly what data to collect and which to tabulate, and management on its part has the obligation to be able to write down its actual requirements for internal information. (2)

If Gallagher's goal is accepted then it is necessary to "know exactly what data to collect and which to tabulate". This is the problem to which this research addresses itself. Information is the raw material of the decision taking process which is the fundamental role of managers.

The manager needs information to assist him to select courses of action i.e. take decisions, to control the implementation of action and to record the success or failure of the action taken. It is necessary, therefore, to define the decision making areas of each manager's job in order to provide information which will be of help. (3)

To enable the problem of defining management's information needs to be examined in a dynamic environment, where decisions are being taken with or without the information needed, it is desirable to formulate some definition of decision levels.

Charles Stein propounded what he referred to as a "spectrum of decision".

I have heard many people say that there are really two parts to a management system: (1) the routine tasks which do not involve any decision making, and (2) the decisions involved in planning and controlling operations. For our ... purposes, however, it is more useful to regard the entire process as a "spectrum of decision." At the lower end of the spectrum are the simple, routine decisions, such as determining whom to bill, how much to bill him for, and whether or not a discount is applicable. Towards the middle of the spectrum are the more complex but still fundamentally "mechanical" decisions, such as determining when to order, how much to order, when to ship, how to ship, and what size production run is most economical. At the upper end of the spectrum are the extremely complex managerial decisions on such questions as whether to diversify the product line, where to locate a new plant, and how much to invest in an undertaking. At the bottom of the decision spectrum, practically no judgment is needed: Certain basic facts produce certain specific answers. As we move up the spectrum more and more human judgment is injected into the decisions. (4)

Using Charles Stein's "Spectrum of decision" as a basis it is possible to isolate three levels of decision. These levels overlap to some extent, but they do form a basis for analysis.

The three levels are:-

Mechanical:	taken regularly; highly structured with easy access to the data required, e.g. raising a credit note for a pricing error.
Routine:	taken less frequently, but still structured with known data requirement but of less easy access e.g. producing a production schedule.
Complex:	taken infrequently, unstructured, depending largely on current circumstances. Unknown information requirement, i.e. cannot be pre-determined.

These three levels can be depicted as overlapping circles, the outlines of which become increasingly indistinct as information needs become less easily definable.

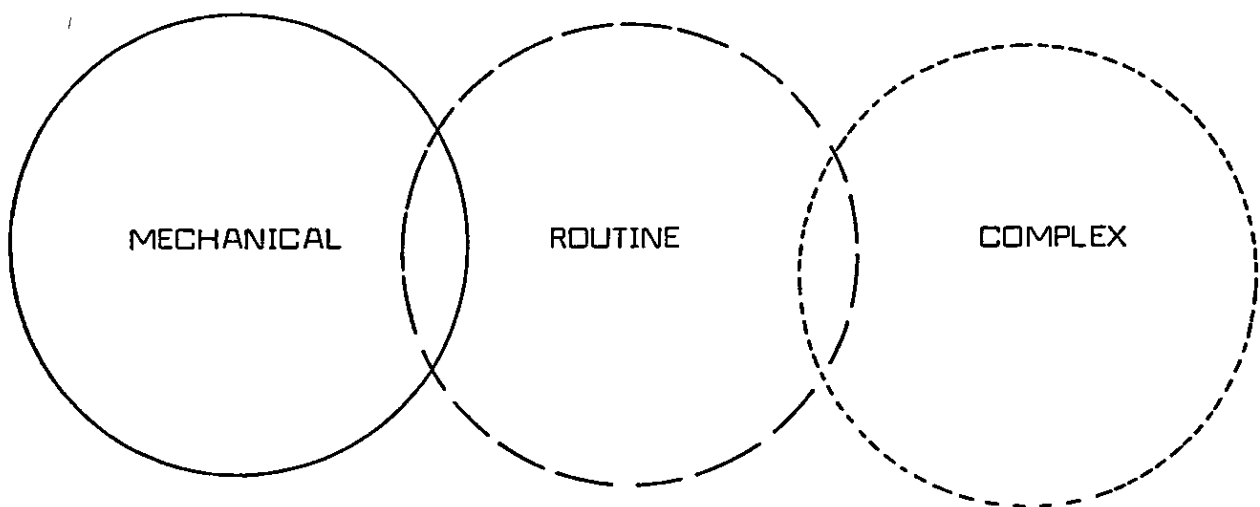


Fig. 1 Decision Types

If we add to these three definitions of decision type a measure of the decision's impact we have created a decision matrix, Fig. 2, which covers a wide sphere of effort, and which we will call the "Decision Grid".

It is important to consider the impact of the decision if attention is to be given to providing information for the more important "key" decisions of the business.

The three levels of impact would be selected by the managers concerned relating the decision to the effect it had on the performance of the activities for which he is responsible.

Impact Spectrum	MINOR	IMPORTANT	VITAL
COMPLEX			
ROUTINE			
MECHANICAL			

Fig. 2 Decision Grid

The decisions made by management can be classified according to the matrix which will enable the information system to be designed with a well balanced concentration of effort where the impact demands.

This relationship of information to decisions is fundamental to the research and is clearly a vital consideration in the development of the right approach to the problem.

Research carried out by R. Beresford Dew and Kenneth P. Gee (5) on "The Use of Control Information by Middle Management in Manufacturing Companies" was aimed at answering two questions.

- Firstly "How is it possible that systems of budgetary control should in fact be so largely ignored by the managers for whose benefit they have been designed?"
- and Secondly "Is it possible that management control information as such, i.e. the wide range of formally presented information produced in many companies for purposes of management, and not simply the accountant's information on output and costs, tends similarly, in practice, to be ignored by the managers, and if so why?"

Kenneth Gee (6) identified five main reasons why the control information was not used.

The Defects of Items of Control Information which were not used.

<u>Reasons for Non-Use</u>	<u>No. of Items not used for this Reason</u>	
		<u>%</u>
Subject covered outside manager's control	85	33.9
Arrives too late for effective action	80	31.9
Insufficient detail provided	31	12.3
Thought to be inaccurate	25	9.9
Not provided in a form that can be understood	10	4.0
Other reasons	20	8.0
	<u>251</u>	<u>100.00</u>

It has been pointed out that it is impossible to state accurately the information requirements of a job until that job's responsibilities have been thoroughly defined, and the most critical responsibilities highlighted. However, there is more to it than simply drawing up job descriptions. A complete specification of management's responsibilities (and consequently of the control information required) demands examination both of the place of management in society and of the style of management appropriate to modern conditions.

Such an examination is outside the scope of this paper, but the correct specification of management responsibilities and control information requirements is all the time becoming of increasing importance.

(Percentages in the above reference were added by the author for clarification.)

The manager must then receive information related to his job, his responsibility and the decisions which he takes.

Such information can be broadly categorised as follows.

The manager needs several kinds of information:

The objectives which he is to attempt to achieve;

Technical information about specific jobs, for which he is responsible;

Control information based on feed back of the results of decisions so that corrective action can be taken;

Background information about activities related to those for which he is responsible and of the company and the environment in which he is operating. (7)

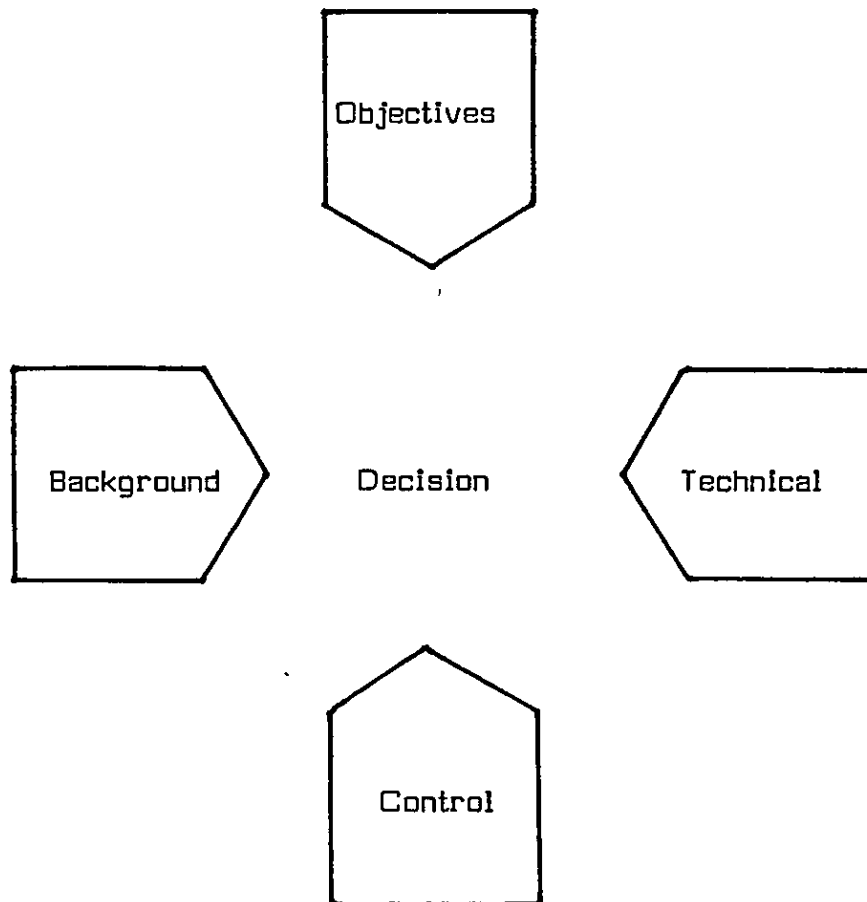


Fig. 3 - Information Flows

These four principal information flows can be examined in further detail.

- Objectives:** Where clear objectives are established, and there are organisations where this is not done, they will be part of a budgeting procedure. This may or may not be part of a planning process which is linked to the organisation's strategy for the future. Whatever the system it is important that the manager knows his overall objectives. He must also be aware of how each decision leads towards the achievement of the objective. When taking a decision the manager must know the answer to the question "What am I trying to achieve?"
- Control:** Control information systems are mainly accounting systems. This is a historical situation rather than a planned one. The introduction of computers has led to the development of control systems which are based on non-financial information. In addition most managers operate small personal control systems which are outside the formal framework. One such system was encountered during the research.
- The system operates in a quarry. As each tonne of material travels along the conveyor it passes over a belt weigher. The weight is recorded and registers in the manager's office on a meter. The meter has been adjusted to make an audible click for each tonne. The speed of the clicks i.e. the rhythm changes as production rises and falls. Changes in the rhythm cause a varying response from the manager, ranging from interest to annoyance if the sound should stop.

He can act immediately if desirable. Because his men know that he can "hear" what is happening they are always quick to diagnose and correct any problems. Control information systems have always received attention, unfortunately the standards against which many activities are measured leave a lot to be desired.

Technical: Every manager should have access to the technical information that he needs to do his job. For the accountant this will be both internal and external dealing with the way systems work and with accounting standards and legislation. In most companies technical information has to be obtained from whatever sources the manager has access to. Few companies provide a technical service or even operate a library.

Background: Background information covers a very wide area including the company, the market, the industry and the economy. This is another area where few companies set out to provide their managers with sound information. Managers are left to their own devices to read the press and listen on the grapevine to "keep in touch" with events. A company with a well organised general communications system will reap the benefits through having well informed managers.

Some of this information will be available, some will not. It is obtained from both internal and external sources. Managers already have sources of information which they use for making decisions and the research must start from the present position and seek to discover answers to the following questions.

1. How can key decisions be isolated?
2. Can a decision structure be devised?
3. How can the information requirements of the decisions be assessed?
4. Can the availability of the information be determined?
5. How can the degree of risk be related to the availability of information?
6. Can an information system be designed to satisfy management's needs?

Information is a peculiar thing which varies depending upon when it is received, how it is received and who receives it. The same piece of information may be interpreted differently by different managers depending upon their attitudes and approach to the decision concerned.

Like management itself, management information has vital human implications ... To demonstrate a point, then, let's consider the implications to various people of a train whistle penetrating the evening dusk.

To the saboteur crouching in a culvert it might signify the failure of his mission because the whistle indicates that the train has already passed over his detonating charge without causing an explosion. To the playboy it might presage the imminent arrival of the transgressed husband. To the fireman in the cab of the locomotive it indicates a drop in steam pressure and the need for restoking the furnace. To the lonely wife it means the return of her travelling husband. To the man with his foot caught in the switch down the track it preshadows doom ... For another (preparing to retire) it signifies a time for prayer... In brief, the nature and significance of any information are fundamentally and primarily functions of the attitudes, situations, and relevant responsibilities with respect thereto of the people involved with it ...

... Information is management information only to the extent to which the manager needs or wants it; and it is significant to him only in terms of its relation to his accumulation of relevant knowledge and plans and to his personal responsibility. (8)

The problem being faced is therefore a complex and difficult one. There is unlikely to be a specific solution, but if a way can be defined to analyse and categorise information needs then the aim will have been achieved.

...There is a frighteningly common desire today to prove that incredible amounts of information can be developed with electronic devices by preparing business reports that are incredibly long, incredibly dull, and, all in all, just plain incredible.

Information alone is not enough. Try visualising, for example, one of our big daily newspapers if it was presented straight off the wire in continuous columns, with no headlines, no attempt to avoid duplication, and no simple means of judging the relative importance of the various news stories or putting them in proper perspective. Would you even attempt to read such a paper? I think not. Yet management is frequently forced to hunt through a haystack of irrelevant information in its reports in order to find for itself the needle of pertinent fact. What is needed, obviously, is a planned system of business intelligence - or, as the author of this report prefers to call it - a "management information system" which selects, rejects, edits, and headlines business information - in short, which turns it into business intelligence. (9)

1.2 Reasons why the problem has not been solved.

There are a number of reasons why the problem of meeting management's information needs has not been solved. These reasons are concentrated in three main areas.

- a) the time available to examine the problem;
- b) an understanding of management's information needs;
- c) a method of tackling the problem.

Few, if any, of the groups of people responsible for providing management with information have had the time to examine management's needs. This is not surprising for they have been fully involved in ensuring that the existing procedures continued to perform successfully, that is to say, that they continued to produce the information managers are used to receiving.

These same information providers have been trained either as accountants or systems designers and have not come face to face with the manager's problems. The manager is primarily concerned with dealing with problems as they occur and ensuring that his group of employees performs effectively. To do this he keeps his eyes and ears open and constantly discusses what is going on with his supervisors and foremen. This could be considered as the informal information system. In addition he peruses the routine reports that he receives looking for information pertinent to his activities.

The final reason why the manager's information needs have been largely neglected is the difficulty met by those who try to determine managers' needs. Numerous approaches have been tried but these have all floundered on the basic problem of how needs can be effectively defined. Three main ways have been tried by the information providers, none of which have worked successfully.

- a) Asking the manager what he wants.
- b) Suggesting what he might need.
- c) Telling him what he is going to get.

In the first case the manager does not know, in the second he accepts what is offered and in the third he has no choice. These approaches do not represent a realistic attempt to establish the manager's needs.

1.3 Manifestations of the problem.

There must be a point at which someone recognises there is a problem.

This rarely occurs by the sudden flash of insight which leads immediately to both the recognition and resolution of the problem.

More often than not there is a build up of events which leads to the recognition that a problem exists.

Such a series of events can be likened to a manifestation of a problem rather than sudden realisation. The problem of defining management's information needs was a manifestation from a number of basic criteria.

It was noticed that no matter what information was offered to the manager, it did not seem to meet his needs. This anomaly became apparent in two distinct ways.

a) The accountant's view

The first of these could be called the accountant's view, because it is the way accountants see the problem. The accountant's role is to provide management with information which indicates the financial result of the manager's action. Whether such results are compared with previous plans or not, the manager quite rightly, sees such information as being concerned with the past rather than the present or the future.

Accounting information is also seen as a form of measurement, and managers react to being measured by accountants, who they believe could not perform as managers. There is, therefore, a dichotomy between the people being measured and the measurement system, which tends to lead managers towards an attitude which questions accounting information rather than using it as part of the management process.

b) The systems designer's view

The systems designer sees the problem from a different angle.

This can be summed up by a statement made by a Programming Manager who said to a colleague,

"You're like a user, you tell us what you want, and when we do it, it isn't".

This attitude is prevalent in most organisations that use computers. The systems man wants the user's requirements "frozen" so that the system can be designed. And though they talk about flexibility, they are not prepared to offer it as the managers believe would be helpful. Flexibility is crucial and this lack of flexibility causes even good information systems to become out of date.

Edward T. Elbourne recognised this in 1914 when he wrote:

It is quite possible for the Management to collect more information than it can use to advantage, or which is more costly, or hinders production more, than the information is worth. This is a real danger that has to be guarded against continuously, for routine that serves a valuable purpose when initiated may cease to be useful by some later change in conditions. (10)

The information system should be flexible in respect to three areas which are all likely to demand changes.

1. The user will almost certainly want to change the format, content and possibly timing of the information he receives. This should be possible without any difficulties and should be a service that can be provided quickly and simply. Users will change and the new user's needs will almost certainly vary.

2. The organisation will change via acquisitions, re-organisations, product changes, diversification, etc. The system must recognise this and be able to adapt within reason to cope with these changes.
3. The environment will affect the system, particularly in respect to external factors. Recent examples are VAT changes, price controls, etc. The need to provide ways of catering for such factors should be accepted and even if the initial design is extended, this should be done. Many firms have been caught out on VAT rate changes, although this was a certainty and should have been catered for.

Flexibility is a key to efficient information systems. Without flexibility systems have to be amended and have additions grafted on in such a way that when looked at as a whole the system has become un-wieldy, inefficient and wasteful of time and effort.

This is depicted in Fig. 4 as showing management's needs and the information available. It is likely that needs will be shown to be less in volume than the information available, but because of the problems of defining needs there will be a mismatch between the two, shown in Fig. 4 as an overlap.

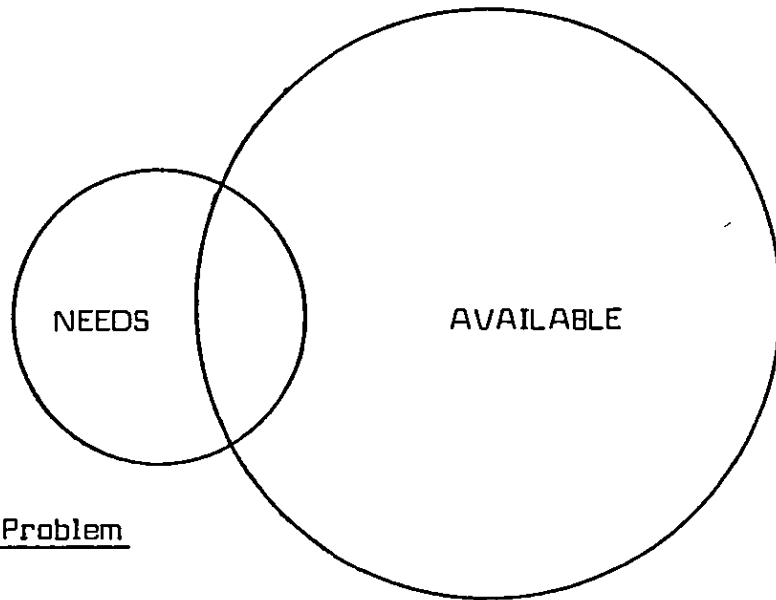


Fig. 4 The Problem

The nature of the problem is such, that although it manifests itself in management's negative attitude to information, especially that provided by the accountant and systems man, it cannot be easily quantified or resolved with the formal information systems.

Perhaps the principal reason for this is the dynamic nature of the decision making process which is perhaps why Gee (11) discovered that managers believe-

1. Information comes too long after the period to which it relates for effective action to be taken on it.
2. The subjects covered in the information are outside the control of managers.
3. The control information provided is insufficiently detailed to help.
4. The information provided is thought to be inaccurate.
5. The information is not presented in a form that could be understood.

Gee suggested that perhaps the reason for these problems stemmed primarily from a misunderstanding of the manager's role and individual responsibilities.

To this view can be added a number of other reasons :-

1. There has been an overconcentration on accounting systems.
2. There has been and still is a lack of understanding of what constitutes control information.
3. Information has been provided as the spin off from administrative procedures.
4. Information providers and management have not fully understood the use of information in the decision making process.

1.4 The Relationship of Information to Decision Making

The problem of identifying management's information needs cannot be solved unless we can identify and define the decisions managers take. The relationship between information and decisions is fundamental to this research. It was stated earlier (page 5) information is the raw material of the decision taking process. If this hypothesis is true then it follows that the lack of the appropriate information will affect the decision making abilities of management.

This research is based on the view that information needs can only be identified by examining the decision making process and defining the information needed for each decision. This implies that once the decision structure of the individual manager's job has been established, it would be possible to relate his information needs to the decisions he takes.

This presents two distinct problems for the researcher.

1. What constitutes an information need?
2. What is the relationship between the need and the decision?

A need is defined in the Oxford Dictionary as:-

"Something that cannot be done without".

This definition is considered to be too strict because it is apparent that managers are not prevented from taking decisions because their information needs are not met. Most decisions have to be taken regardless of whether or not the appropriate information is available.

The manager will never be able to get all the facts he should have. Most decisions have to be based on incomplete knowledge - either because the information is not available or it would cost too much in time and money to get it. To make a sound decision, it is not necessary to have all the facts; but it is necessary to know what information is lacking in order to judge how much of a risk the decision involves, as well as the degree of precision and rigidity that the proposed course of action can afford. For there is nothing more treacherous - or alas, more common - than the attempt to make precise decisions on the basis of coarse and incomplete information. (12)

It is apparent therefore that the degree of need for information will vary in regard to the decision, the manager and the timescale. Some information will be essential and affect the quality of the decision and other information, though of some slight value, would probably not change the decision.

Perhaps the most crucial aspect to be examined is the relationship of the degree of need with the decision. To examine this idea it is necessary to have some insight into what constitutes a decision.

We do not yet understand how to describe a human decision. The descriptions usually offered reflect the psychological traits of the describers. A thinking type believes that the mathematical theories of games and of optimization will provide all the concepts necessary to define a decision clearly, as well as a correct decision. He is arrogant enough to label his efforts "decision theory", without any uneasy pang of conscience. The feeling type asserts that a decision is essentially a unique expression of human values and that the meaning of a decision cannot be captured by generalized mathematical expressions. An intuitive type believes that decisions are insights, quick flashes of understanding how to solve a problem. They frequently assert that the manager leaps to his conclusion without benefit of, or even the need for, analysis. Finally, there are those who assume that the whole business of decision-making is contained in available information: what decision is made depends solely on what facts are known. (13)

Everyone would agree however with Drucker's definition of a decision.

A decision is a judgement. It is a choice between alternatives. It is rarely a choice between right and wrong. It is at best a choice between "almost right" and "probably wrong" - but much more often a choice between two courses of action, neither of which is probably more nearly right than the other. (14)

Drucker quite rightly introduces the idea of uncertainty into his definition of a decision, and this is where information plays a major role in helping to remove or reduce uncertainty.

Whatever contributes to the diminution of ignorance or of uncertainty surrounding an impending decision merits the label of information. Information, therefore, ranges in value from a position in which it eliminates completely all ignorance and uncertainty surrounding a decision to a position in which it contributes absolutely nothing to the diminution of existing ignorance and uncertainty. (15)

There are, of course, varying levels of uncertainty in any decision making process. March & Simon (16) considered that there are three definitions which help us to appreciate problems of uncertainty.

Certainty - a definite known outcome;

Uncertainty - an unknown outcome;

Risk - a measurable probability.

It has been suggested that the greater the degree of uncertainty surrounding a decision, the greater the need for information to reduce the uncertainty.

The amount of information necessary for a particular individual in a decision-making situation will therefore be proportional to the amount of uncertainty initially surrounding the problem. The greater the uncertainty, the greater will be the amount of information necessary to reduce it. (17)

This relationship between information and decisions becomes a vital factor in the decision to spend money gathering more information, and it almost certainly affects the manager's need for information. This view of the value of information has been expressed before.

Information has many of the characteristics of material resources. It can be produced, stored, and distributed; it is perishable to the extent that it has no utility beyond the time it is needed; yet it is not consumable in the sense that it can be used up. As for its worth, the less a decision maker knows about a problem and its possible solutions, the higher the cost he must pay for potentially useful information. The greater the potential value of information, the larger the investment management must be willing to make for its acquisition. (18)

Yet this makes the assumption that the manager making the decisions is aware of the degree of uncertainty or his own lack of knowledge, and is therefore able to place a realistic value on the need for information. It also assumes that managers take a similar approach to decisions, balancing the need to act with the need for further information. Managers do not however behave in such a rational way, they are affected by emotions and personality which create varying attitudes towards decisions and information needs.

Let us not forget, though, that the amount and nature of the information desired by business managers vary with their personalities. Some are impatient with elaborate detail study and preparation and like to make quick decisions based on the information at hand as they begin their deliberations. These men get their best results when historical or environmental data are not the major influencing elements in the decision, for example, with a decision involving the introduction of a new product. Other managers delay decisions too long waiting for information that may be helpful but actually is not vital. Between the two extremes fall the vast majority of business managers, who generally achieve the right balance between waiting for more information and making quick decisions, but wish that more pertinent and timely information could somehow be made available on an economically feasible basis. (19)

The supply of information to the decision maker depends to a large extent on where decisions are made within the organisation structure of the business. The decision hierarchy plays an important part in the problem of meeting management's information needs. The further the decision point is from the source of the information, the more likely it is that the information will be delayed and corrupted in the communication channels through which it flows. Decision making responsibility is therefore an important pre-requisite for defining who needs what information.

Decision-making responsibility is assigned at the lowest point in the organization where the needed skills and competence, on the one hand, and the needed information, on the other hand, can reasonably be brought together. A great improvement is believed to result in any firm when the creative talents of responsible individuals are encouraged to develop in a climate of individual responsibility, authority, and dignity - a climate that is made possible by the decentralization of decision making. (20)

Whether or not decentralisation of decision making in itself brings about better decisions is debatable. What is important is the bringing together of the decision maker and the information needed by him at the earliest possible point in the information system. This vital link between the decision and the information needed to make an effective decision is fundamental to this research.

1.5 The Impact of the Problem on Decision Quality

The problem being examined by this research is the defining of management's information needs. If this problem can be resolved and if the manager's information needs are met, will it lead to better decisions? This is a question which has not been satisfactorily answered. Writers on this subject nearly always relate the value added by information to be based on the taking of better decisions. McDonough states five ways in which information adds value.

Here are some of the places where information value accounting can pay off:

1. Value added by information as administrators are given time to match the scope of the problems for which they are responsible.
2. Value added by information as decisions are made that otherwise would not be made.
3. Value added by information as decisions by analysis prove better than decisions by insight.
4. Value added by information as the scarce commodity of insight is freed from lower-level decisions and can be applied to higher-level problems.
5. Value added by information as decisions are made sooner because of the increased confidence of the manager.

It has been said that "knowledge is power". Likewise, with complete information available, the decision may already have been made. Another way to say this is that "facts may speak for themselves" and require only a formal acceptance and stamp of authority rather than a decision. (21)

Of these five ways three are concerned with making more decisions and better decisions more quickly. The implication of this is that where the decision maker lacks information he is avoiding decisions, taking them more slowly or making poor decisions. If this is true then the meeting of management's information needs is indeed a crucial activity.

However, we must ask the question -

"What makes a decision a good decision?"

Is it the way the decision is made, the way information is collected and analysed, the way people are involved, or is it the result? Does a bad result mean the decision was bad or does it mean that the predicted result was wrong? The decision to act or not to act is usually judged on the result that occurs. Yet the result may have much more to do with the way the decision has been implemented than with the decision itself.

At the time a decision is taken the manager considers that in the light of what he knows his decision will produce the best result. He can only make such a judgment if he has been able to predict the likely outcome of each alternative and select the best one.

If the outcome of each available alternative were known to the manager in a strategic-decision situation, the function of management would be rather simple. In the decision involving advertising expenditures, for example, if the manager knew that one expenditure level would produce a profit of \$100,000 and another would produce a profit of \$110,000, he could very simply determine that the second expenditure level was the better choice. If no other alternatives were available to him and profit were his sole motivation, his decision problem would not be at all vexing. Even if a larger number of alternative expenditure levels were available, he would just have to choose the one that results in the greatest profit. If the number of alternatives were very large, he could use a computer to perform the search for him. In either case, the intellectual exercise required to make the decision would be minimal. (22)

The management decision process is difficult precisely because the outcome of decisions is uncertain. The role of information in improving the manager's choice of alternative is to provide increased knowledge of the problem and the likely outcome of each alternative.

The effective decision maker will satisfy himself that he should or should not act, based on his knowledge, experience and belief. The information he needs is that which will help him make up his mind to select a course of action or inaction in preference to the others.

...the effective decision-maker compares effort and risk of action to risk of inaction. There is no formula for the right decision here. But the guidelines are so clear that decision in the concrete case is rarely difficult. They are

- act if on balance the benefits greatly outweigh the cost and risk; and
- act or do not act; but do not hedge or compromise.

The surgeon who takes out only half the tonsils or half the appendix risks as much infection and shock as if he did the whole job. And he has not cured the condition, has indeed made it worse. He either operates or he doesn't.

Similarly, the effective decision-maker either acts or he doesn't act. He does not take half-action. This is the one thing that is always wrong. (23)

It can be said that the quality of a decision depends upon whether the alternative chosen was the best in the circumstances, and not on whether the outcome was what was originally predicted. Information on the results of previous decisions does not necessarily lead to a change in the decision maker's approach but it may well alter his prediction of the likely outcomes of future decisions.

Information can be said to aid the manager's decision making activities if it is relevant to the decisions he has to take, adds to his store of knowledge, assists him in arriving at a better understanding of the problem and helps him to select the alternative which appears most likely to meet the objectives of the decision.

1.6 The Objectives of the Research

This research has three principal objectives.

1. To develop a methodology for defining management's information needs.
2. To test the practicality of such a methodology in an existing company which offered a wide range of management style and attitude.
3. To formulate a method of building the management's information needs into the information system.

A Methodology

Devising a way of defining management's information needs is a principal objective of the research, for if a method can be devised it will be possible for other people to use the method and improve the ability of those concerned with meeting management's information needs, to do just that.

Such a method must be based on an understanding of the use of information for decision making and must involve the managers concerned to a great extent.

The recognition of the importance of studying management's information needs throughout the organisation is being amplified as computer systems analysis pushes upward into the decision hierarchy. Questions about the data to report routinely to management, or in an approved format on demand, or in a special format when requested, are naive unless made in the context of the particular organisation.

As information system studies broaden their boundaries, pushing outwards and upwards from the operational data base towards the information needs of managers, there is a need to understand the idiosyncratic and personal nature of information, and to appreciate the different information needs at different decision levels. (24)

The method used must be based on a considerable amount of field work, it cannot be done sitting at a desk and making assumptions of the information needed by management. The information provider and the manager must work together to define their needs and the method produced by this research should enable them to do this.

The method should provide for the following:

- a) the definition of decisions,
- b) the determination of a decision structure,
- c) the gathering of information needs related to decisions,
- d) the subsequent comparison and analysis of information needs,
- e) the production of information flows to and from decision points.

The method must be simple to operate and yet provide comprehensive records of information needs that can be used in the design of information systems.

Testing the Method

No methodology is of real value unless it has been tried and tested in a dynamic environment which provides a wide range of problems. Only if the method is stringently tested and proven can it be considered of practical use.

The proving of the methodology is a fundamental objective of the research. The principal measures of success will be:-

- a) Management's acceptance of the findings;
- b) That the method can cope with all circumstances;
- c) That the method can be described and applied in a wide variety of organisations;
- d) That it defines management's information needs.

Meeting the Information Needs Defined

Having defined management's information needs it is important that they are related to the basic systems which will be used to meet the needs. Unless the method used provides the basic data for this to be done it will have stopped short of being a really valuable management tool.

The researcher must consider the way the information needed can be analysed into its primary sources so that the required systems framework can be specified.

Secondary Objectives

There are a number of secondary objectives which are concerned with the managers themselves, their attitudes and approaches to the question of decision responsibility and their use of information for decision making.

There are four secondary objectives:-

- 1. To determine whether managers are aware of their decision responsibilities.
- 2. To establish if decision responsibility is given to or acquired by managers.
- 3. To determine the relative level of decisions responsibility vis a vis the availability of information.

4. To establish the way managers use the formal and informal information systems, and to relate this to their position, experience and general knowledge.

1.7 The Approach to the Research

The research was approached in a number of steps.

- 1) Discuss the need for and the basis of the research with the University.
- 2) Discuss the need for the research with the Company and obtain general approval.
- 3) Decide on the method to be used.
- 4) Design the basic documentation.
- 5) Discuss the approach with Divisional Management and obtain approval.
- 6) Test basic method with "friendly" managers.
- 7) Explain basis of research.
- 8) Carry out research.
- 9) Analyse results.
- 10) Report to management.
- 11) Write up results.

Discussions

The early discussions, both at the University and Company, were beneficial in gauging different attitudes to the question of information for decision making. The University felt that this was an important area for research that could produce valuable results which could be used quite widely. The Company accepted the need for a survey of decision making and information flows, but were dubious of the practicality of actually producing concrete results.

In June 1974 both the University and the Company agreed that the research should proceed.

The Method to be Used

Three methods of carrying out the research were considered, these were:-

- a) Use of a questionnaire;
- b) A questionnaire and interview;
- c) Open-ended interview.

The first two, both involving the use of a questionnaire, were discarded because of the problems of definition and interpretation that it was considered would arise. This decision was arrived at after discussions on the problems of questionnaire design with Keith Blois at Loughborough University.

The choice of the open-ended interview also presented a number of problems, but it was felt that these could be overcome with care, they were:-

- i) Interviewer bias,
- ii) bias in recording responses,
- iii) faulty interpretation of responses.

To help overcome these problems a "questioning sequence" was prepared which helped the interviewer to keep to the point and to cover the same ground with each manager. The managers would also be asked to agree the record of their answers and this, it was hoped, would overcome problems of faulty interpretation.

Design of Documentation

It was believed that the basic documents used to record management's answers and for subsequent analysis would prove crucial to the success of the research.

In fact the basic document design formed part of the research in that it would be a substantial element of the methodology for defining management's information needs.

The documents had to provide a basis for doing three distinct jobs,

- a) record managers' decisions,
- b) record information needs for each decision,
- c) bring together decisions and information.

The form of the documents is explained in Section Three of this thesis.

Discussions with Divisional Management

The form of the research was discussed with each of the Divisional Boards of Management to obtain their approval to the research and the methods and to agree which group of managers would be included in the research. Approval was obtained in October 1975.

Test Basic Method

The basic interview approach and documents completion was carried out with three managers who were willing to act as "guinea pigs" for the research. During this trial run it was established that the managers to be interviewed were unlikely to be able to discuss decision making and information needs unless they had had some prior information on what the research was about and how they could help. It was decided to hold a seminar for each Divisional group of managers to overcome this problem.

Explain Basis of Research

A booklet entitled "Information for Decision Making" was written (APPENDIX A) for the managers and was handed out at the seminars. This, together with the seminar, formed the basis for explaining what the research was about, and how they could help.

Carry Out Research

The actual research, starting after the seminars, was carried out over a period of eighteen months. During this time all the managers concerned were interviewed and full records prepared. This phase was the most difficult phase of the whole research project. It required considerable travelling and a very high level of concentration during the interviews. Many problems had to be overcome, particularly concerning personality and attitudes of the managers.

Analyse Results

This phase of the research was almost totally concerned with sorting the information collected, though further visits had to be made to clarify the responses given by managers in the initial interviews.

Report to Management

It was an important test of the research to obtain management's approval to the results of the project and so a comprehensive report was prepared for the management, indicating the principal areas of need for information as identified by the research.

Write Up Results

This final phase of the research provides the basis upon which the success of the research can be measured and provides the description of the way in which the research achieved its objectives. This thesis is the result of this final phase of the research.

1.8 Relationship of Research to Tilcon

The research was particularly relevant to Tilling Construction Services Ltd. (Tilcon) because of a number of factors which had created an environment in which management's needs for information were quite evidently not being met by the systems.

The factors which had created this situation were:-

- a) the recent formation of the company from a number of subsidiary companies of Thomas Tilling;
- b) the lack of any formal systems development strategy;
- c) the geographic spread of activities;
- d) the variety of management styles in operation;
- e) the independency which geographic remoteness tends to promote;
- f) a weak communications system suffering from geographic spread and fragmented management.

These factors rolled together provided an environment in which the research project was not only needed but one in which there was sufficient scope for the research method to be fully tried and tested.

Chapter Two

The Company

The Company

2.1 Tilling Construction Services Ltd. (Tilcon)

Tilling Construction Services Ltd. (Tilcon) is a large private company, being a wholly owned subsidiary of the Thomas Tilling Group. Its activities are concentrated in the areas concerned with providing basic materials and services to the construction industry.

The company is organised into a series of operating divisions each concentrating in a particular product area and each autonomous. The general structure of the company is one of vertical integration, from extraction of raw materials to the production of finished products.

The company has developed over fifty years from individual quarrying, readymixed concrete and mortar plants and transport companies, by a process of merger, acquisition and organic growth.

In 1970 three major groups of companies, all subsidiaries of Thomas Tilling were amalgamated to form Tilcon. The groups involved were:-

- a) Lime Sand Mortar Ltd.
- b) Slaters Quarries
- c) Alexandra Building Services Ltd.

All these groups operated as a collection of small independent companies so that when the amalgamation took place in 1970 the number of individual companies involved was in excess of 50. This growth and development explains to a large extent the present philosophy of the company, to operate reasonable sized local businesses with profit accountability, autonomy and thus considerable flexibility in operation.

This philosophy has tended to provide an ideal environment for entrepreneurial managers operating on their own initiative with the only real control being the allocation of funds and the measurement of performance, namely profits earned. This control is exercised by accounting and budgetary control systems which provide details monthly of the operations and profit of every individual unit.

2.2 The Organisation Structure

The organisation of the main elements of the business reflects the philosophy of profit accountability fostered by the parent company Thomas Tilling.

The company is divided into four main divisions,

Headquarters,

Quarries,

Concrete,

Mortar.

The breakdown is shown on the following chart. (Fig. 5)

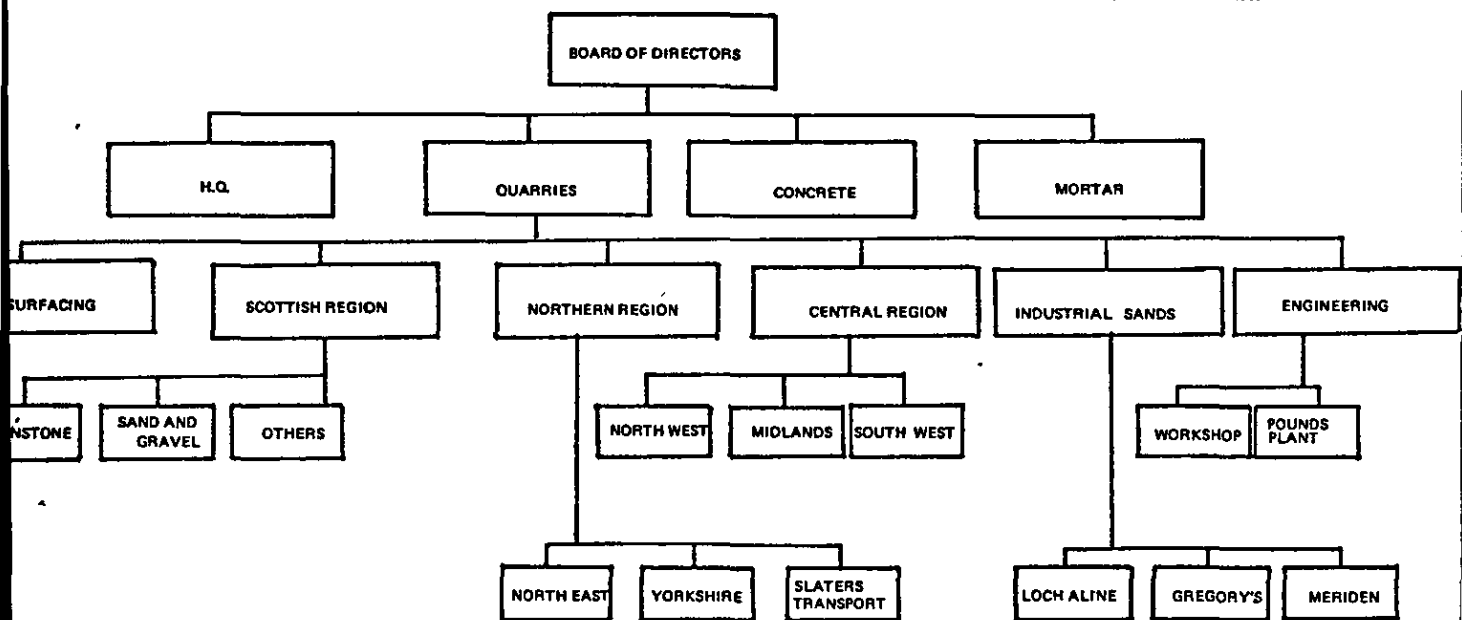


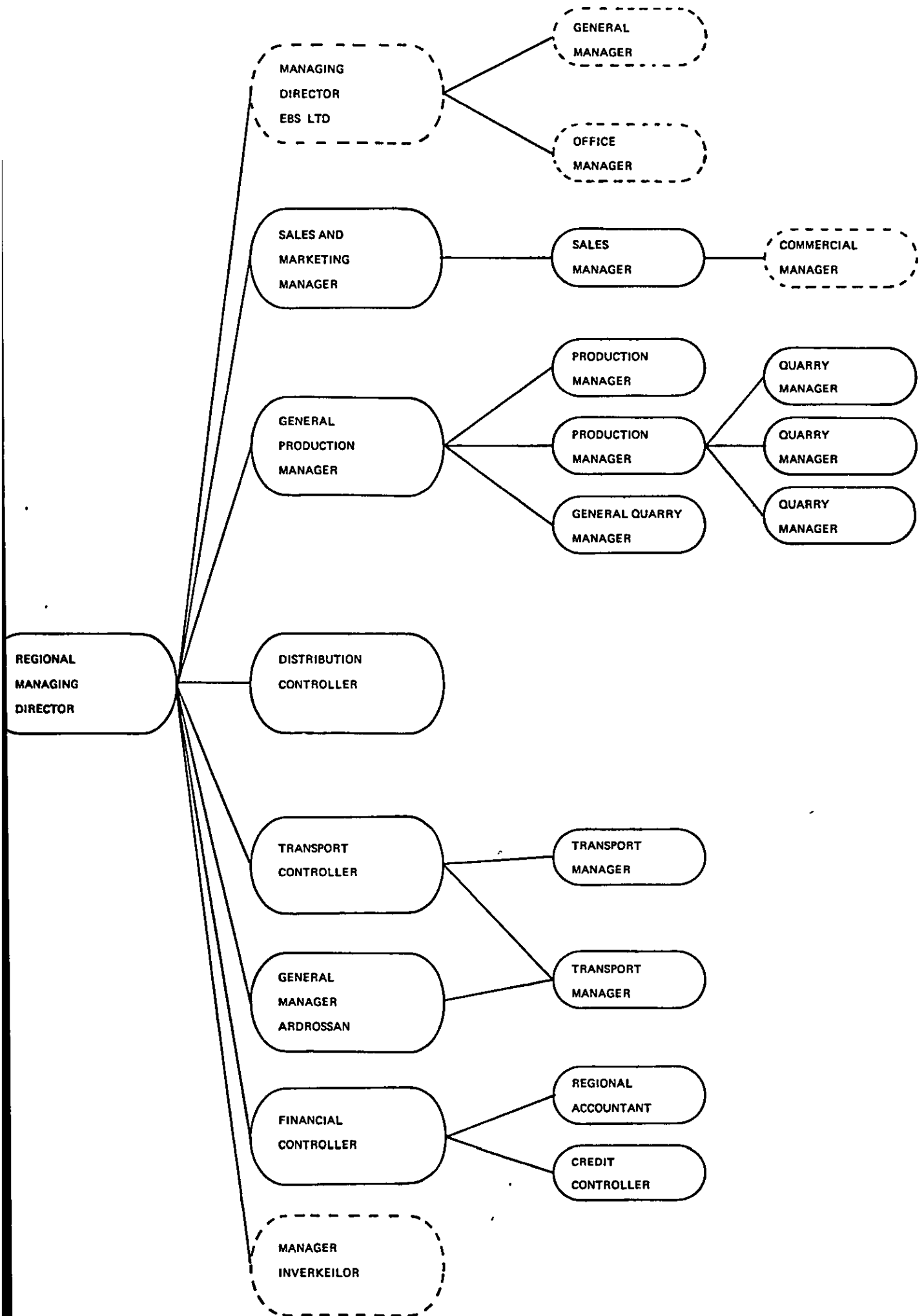
FIG. 5

It was decided by the Main Board of Directors that the research would be confined to the Quarries Division which at that time had a sales income of £50M.

The Quarries Division was sub-divided into three main Regions, Scotland, Northern and Central. Each of these Regions was operated independently. The individual Regional Managing Directors are able to decide the management structure they wish to adopt. Because of this flexibility each structure is different and positions and titles are not therefore directly comparable, this can and does lead to confusion.

The organisation structures of the individual regions of the Quarries Division are as follows.

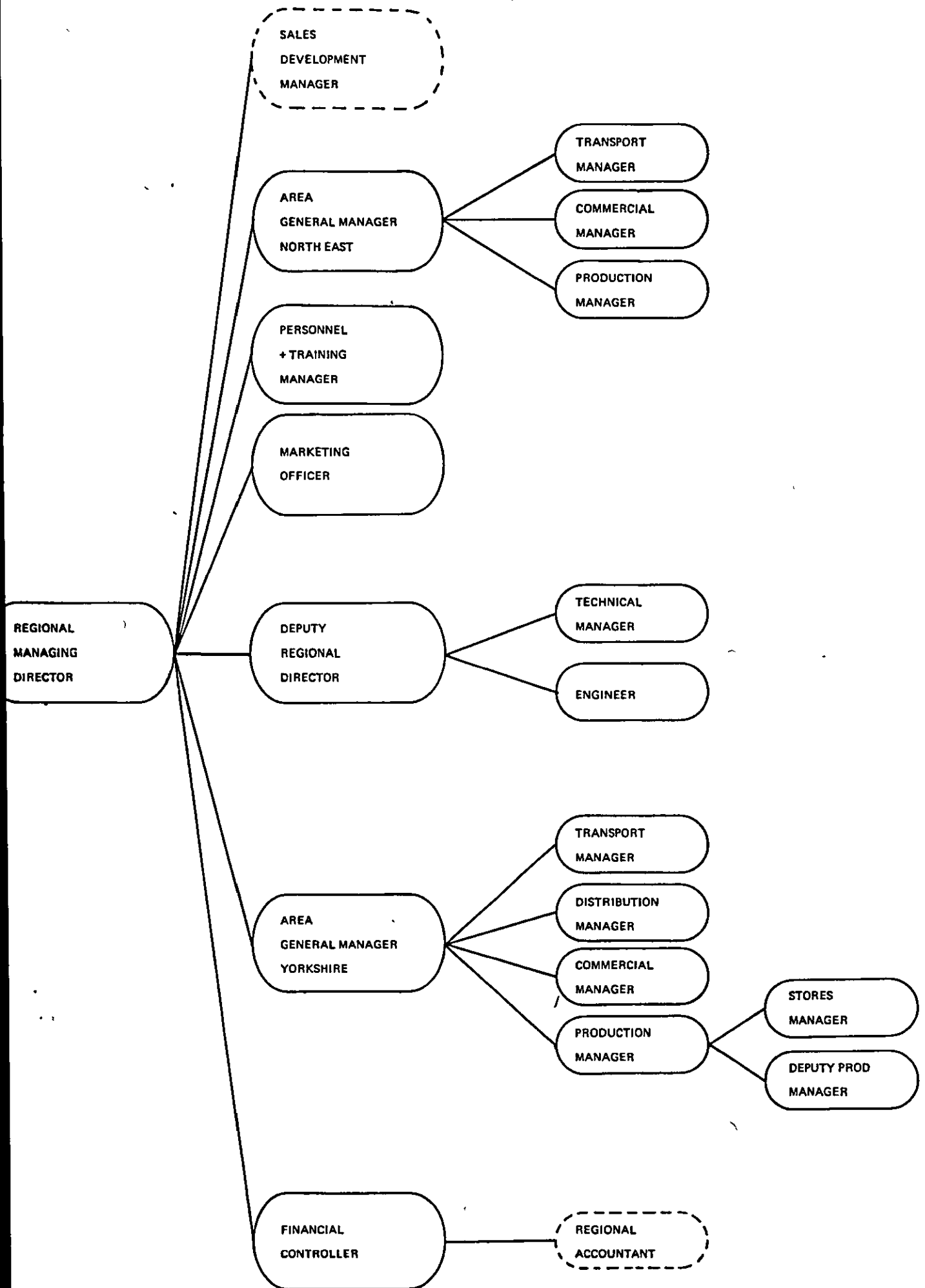
QUARRIES & CONTRACTING DIVISION - SCOTTISH REGION

LOCATION

REGIONAL HEADQUARTERS - GLASGOW
EBS LTD. - ELGIN - NR PERTH

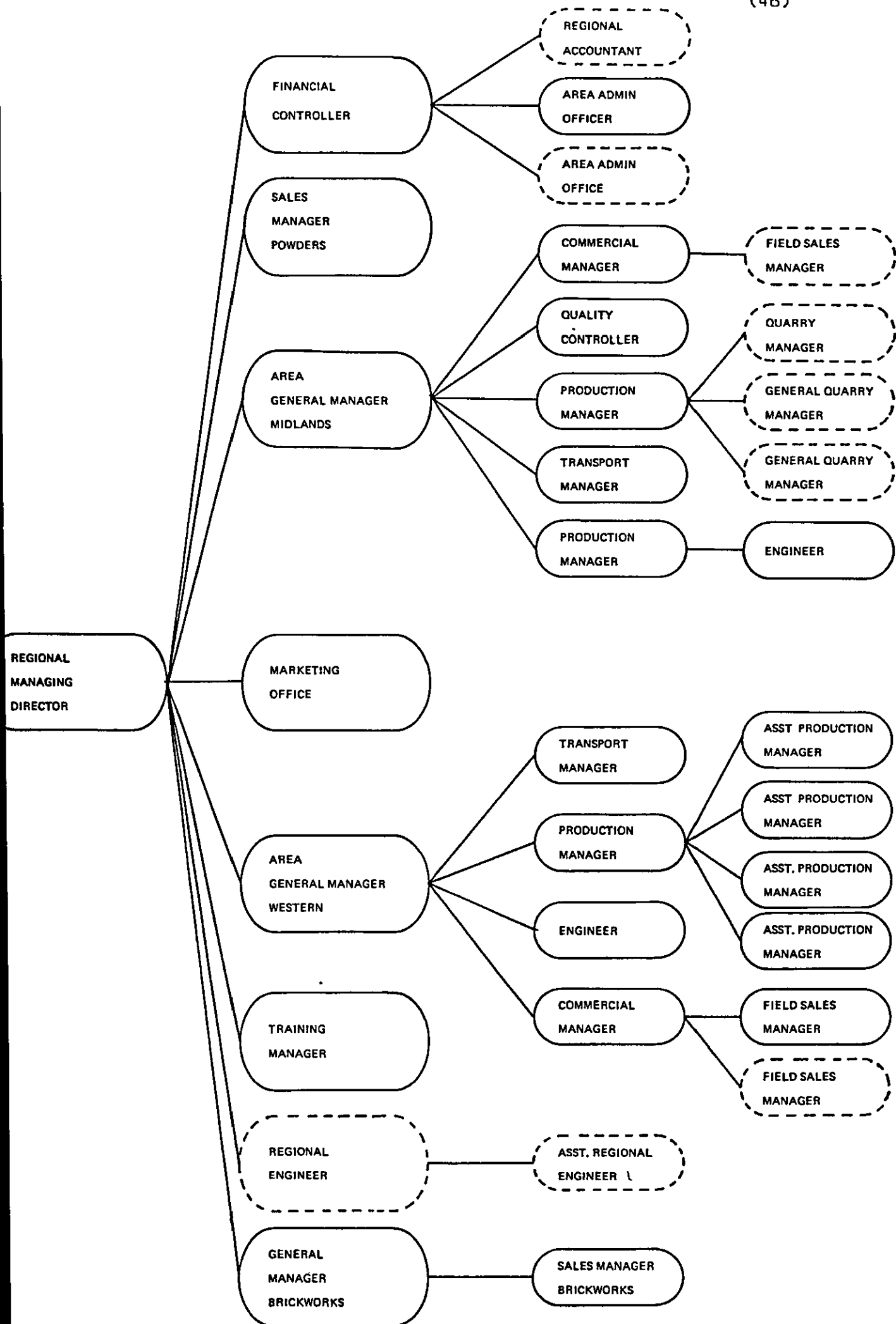
FIG. 6

QUARRIES & CONTRACTING DIVISION – NORTHERN REGION

LOCATION

REGIONAL HEADQUARTERS — THORNTON-LE-DALE NR PICKERING
 NORTH EAST AREA OFFICE — SHERBURN HILL — DURHAM
 YORKSHIRE AREA OFFICE — SKIPTON — YORKSHIRE

FIG. 7



LOCATION

REGIONAL HEADQUARTERS - HARROGATE - YORKSHIRE
 MIDLANDS AREA OFFICE - BALLIDON NR ASHBORN - DERBYSHIRE
 WESTERN AREA OFFICE - CHELTENHAM - GLOUCESTERSHIRE

FIG. 8

The geographical spread of activities is shown on the following map. The Regional Head Offices are shown in a circle with the initial letter, e.g.

⑤ Scotland. The area offices are shown by a square with the abbreviated area name e.g. ■ NE North East Area. Operating activities are shown by a dot ● .

The geographical spread has some influence on attitudes as there are a number of parochial historical factors which have led to the present form of management.



FIG. 9

2.3 Political Nuances

No organisation is free from politics, and Tilcon is no exception. The struggle for power and authority is continuous at all levels of the organisation, but it is particularly noticeable at Divisional and Regional levels.

Divisional Politics

At the Divisional level the struggle is between the three Regional Managing Directors and the Divisional staff. This is very much akin to Machiavelli's (25) courtiers and baron situation, with the Prince, the Divisional Managing Director, keeping his Barons, Regional Managing Directors, in their place with the help of his courtiers, i.e. the Divisional staff.

Each Regional Managing Director is judged on the profit performance of his Region in terms of the return on capital related to the original budget. The Regions are, however, quite different in size, number of units, employees, products, etc., and this makes comparison very difficult. The three Regional Directors have to battle for financial resources based on performance and individual project reports. There are always more demands for resources than can be met.

Project playbacks are carried out, but as these are usually done by the Regional staff, the results tend to always show that the project has paid off.

The Divisional staff are concerned to see that they are fully informed of Regional Activities, but this is not easy as the formal information systems are based at Regional level and in the words of a Divisional executive -

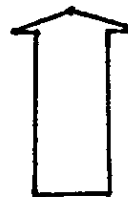
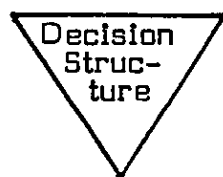
"Show just what the Regional people want them to."

Regional Politics

These vary region by region depending upon the management philosophy in vogue at any one time. At the time of the research the general philosophy in each region was quite different.

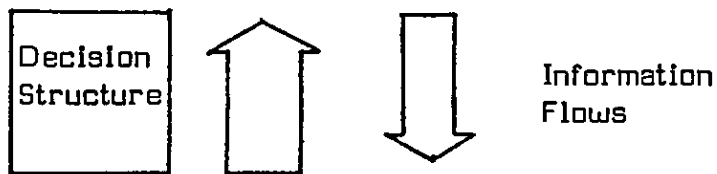
In the Scottish Region the philosophy could be described as Autocratic.

The Regional Managing Director had all the functional managers reporting directly to him, thus he had a wide span of control. Decisions tended to move up the hierarchy placing a strain on the information system with many demands for information being placed on middle management. This situation can be depicted as below.



Information
Flow

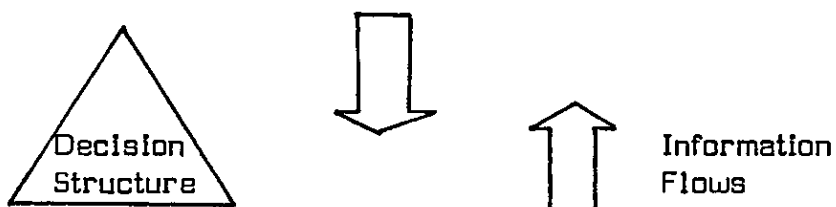
In the Northern Region the Regional Managing Director acted as a Benevolent Autocrat. He had two Area General Managers and several function managers reporting to him. Decisions spread fairly evenly although the Regional MD was involved in quite a number of apparently low level decisions. Situation can be depicted as below.



In the Central Region the philosophy was Democratic.

In this Region the Regional Managing Director worked through his two Area General Managers who had considerable autonomy. Decisions were passed down and information flows were appropriate to the decision structure.

This situation can be depicted as below.



It was noticeable that attitudes in all three regions were affected by the decision structure and the information flows. If the manager had grown up in an autocratic environment he was not keen to take decisions and relied on receiving instructions. This was less noticeable under the other styles of management.

Moving from one style to the other did not seem to work and very little movement of staff took place between the regions. The manager moving from the autocratic environment found it more difficult to cope, the manager moving from the democratic environment found it more frustrating.

The impact of management style was noticed mainly in terms of management attitudes and in the way information flowed through the system. The specific effects of this were noticeable throughout the research and will be commented on further.

2.4 The Researcher's Position

At the start of the research the researcher held the position of Organisation and Methods Manager, reporting to the Financial Director at the Group Head Office, and as such was outside the Divisional and Regional management structure. This was not only convenient, it was essential for the research to be unfettered in scope.

During the research the researcher was promoted to Management Services Manager and given responsibility for all systems developments, including computer systems analysis and programming. This provided an excellent opportunity to see that the results of the research were built into the company's systems development strategy.

When the research started the researcher had been with the company four years, and through a variety of projects had a good insight into the company structure and the existing information systems. Though in many ways an advantage this background information was also seen as a possible disadvantage in the researcher's ability to be unbiased and objective. This was recognised at the very beginning so was manageable and did not affect the research.

Many of the managers to be interviewed were known to the researcher and this was a help in making contacts. Though not being a part of the Regional Management, the researcher did nevertheless have a certain status in the company which would be considered as roughly equivalent to an Area General Manager. This certainly helped in some situations but on occasions was found to be a distinct disadvantage.

On the whole the researcher's position in the company was found to be an advantage in understanding and communicating with the managers involved in the research. The research was also accepted as an ordinary project like any other carried out by management services staff, which was in itself a distinct benefit.

2.5 The Need for Research

The need for research became apparent when the researcher was given the responsibility for designing and installing a computer based management information system. The first step was to establish the basic system requirements and to determine whether a computer was necessary, and if so, what type and size of machine should be obtained.

A small ICL 1901A was in operation handling the purchase and sales systems.

Several papers were prepared which indicated the need for a systematic approach to establishing the information needs of the managers concerned. The first decision made was to concentrate administration in the local offices, providing a means of access to the central computer. The decision was made in order to ensure that local data collection was handled efficiently, accurately and speedily.

The following abstracts indicate the basis for the decision to localise administration.

Developments of Tilcon Systems

1. Tilcon is organised in a number of independently administered operating units (be they Division/Region or Area). The work handled at these points covers all the basic administrative activities including dealing with customers and suppliers. In order to ensure that data is processed effectively, these administrative points have to be in control of the data which is input to the basic systems. This control is desirable for both the collection, handling and input of data, and should extend to a logic point, where further processing is desirable, using the facilities of the mainframe computer.
2. Local clerical activities need to be designed to suit the circumstances and yet allow for data to be input into the overall systems pattern applicable.

3. The handling of data at the administrative units should be minimised so that no additional work is carried out in keeping basic records and in the control of data being input into the basic system.
4. The development of systems in Tilcon should be to -
 - a) Strengthen the local control of data handling.
 - b) Minimise clerical activity locally.
 - c) Provide all the basic records for successful local administration.
 - d) Ensure effective services to customers and suppliers when dealing with queries.
 - e) To be flexible and allow local administrative points to approach local problems in different ways.
 - f) To ensure local management receive data and information speedily and at the correct level of accuracy.
5. Eventually it must be our aim to provide local management with a means of inputting data direct to the computer and of interrogating the master files held in the mainframe computer. This will require the following:-
 - a) An understanding of the use of computers via terminals.
 - b) The knowledge of local requirements ie what questions should be asked.
 - c) A desire to use this form of information facility.
 - d) The support of local management in the successful development of local resources.
6. To achieve these objectives requires:-
 - a) Sound local administrative offices.
 - b) Good local clerical procedures.
 - c) Efficient data handling machines or methods.
 - d) Effective overall systems.
 - e) Well managed carefully designed mainframe configuration.

The objectives for the system to be introduced were agreed as follows:-

- a) The main objective must be to have the most effective system. By this it is meant that the work at administrative centres (be they divisional, regional or area offices) should be minimised while control is enhanced. Careful consideration is needed as to where that control could most effectively be operated within the desired divisional structure.

- b) Particular consideration should be given to management requirements for information particularly that of immediate significance which may not be available at present but which could be automatic output of any future system. In this non-financial as well as financial information should be considered.
- c) There will be one co-ordinated group system but the proposals should allow for a reasonable level of flexibility across the Divisions/Regions and even between areas in the Divisions where logical reasons exist.
- d) Customers and suppliers requirements should be fully considered with particular emphasis on settling queries quickly.
- e) The control over debtors, creditors, stock and work-in-progress to be enhanced with the cashflow improved.
- f) Likely growth of Tilcon to be considered not just in relation to the forecasts but also allowing for an equal growth through acquisition.
- g) Consideration should be given to the speed with which future development in processing may take place so that the eventual system will be in a position to process data most efficiently for many years to come.
- h) A very high priority to be given to the reliability of the equipment.
- i) The system to produce accurate information and minimise the possibility of making errors.
- j) Equipment putting high priority on the skill of the operator other than at the centre to be avoided.

(8.1.73)

The above objectives were all considered to be valid and achievable if care and attention were given to the formulation of the requirements as stated, the following paper was then presented to the Board of Directors.

Development of Group Systems

A review of the present group systems including accounting based on the computer at Harrogate House has been initiated in order to establish the direction of these systems. This review has become necessary for the following reasons:

1. With the growth of Tilcon which has been forecast to take place over the next few years and bearing in mind the likely level of acquisitions, the present computer configuration would be incapable of coping. In October 1972 when turnover reached a new peak, a considerable amount of overtime and weekend work was necessary and it is likely that this effect will be seen in 1973 at peak times and it will also become difficult to incorporate new programs.
2. Since Tilcon was formed, the systems surrounding the computer have been gradually developed and this is one reason why the total costs of the computer at Harrogate House have been reduced. It is possible to see other ways of improving the systems and reducing costs but certain key decisions would have to be made which would establish a pattern for the computer for the future. It is therefore important that these decisions should be right ones and only a detailed review can establish this.
3. The present computer configuration is inflexible in that it cannot be consulted or interrogated during processing and can only deal with one program at a time. This prevents many useful systems from being considered and it makes the present system slower and possibly more expensive than it need be. In addition, the initial maintenance agreement with ICL is due to terminate in 1974 and thereafter the cost of maintenance will become more expensive.
4. The idea that the computer can be a considerable aid to management is gradually becoming accepted in certain parts of the group. The original computer was designed to satisfy an accounting problem and one of the objectives of this review would be to design a system which would allow management to make far greater use of the computer.

With these factors in mind, Mr. Trevor Bentley has been asked to carry out a review and he has been consulting Financial Controllers and members of the Data Processing Committee. Very shortly, he will be producing a report for discussion within the Group and it is suggested that each of the Divisional and Regional Boards might like to set aside some time on the agenda of their next meetings to discuss this report with Trevor Bentley and Ian Morris present. The report will be given the maximum exposure. It will be discussed at the next Financial Controllers' Meeting and the Data Processing Meeting and if a Managing Director or Regional Director feels that he or any one of his staff would like to discuss the report with Trevor Bentley, then this can be arranged.

As well as these internal discussions, the advice of the major manufacturers and Tillings Data Processing Adviser will be sought. When this report has been fully discussed, it will be revised and designed as a paper for the Tilcon Board requesting permission to go ahead and implement the systems which Group discussions have indicated are necessary. This would include a review of the financial implications.

(29.1.73)

This paper was followed by the report of "Development of Group Systems" which was prepared for the Board on 21.2.73.

This report was discussed widely with management and the most obvious and frequent conclusion drawn from such discussions was that the managers did not know what information they needed, nor were they clear as to the decisions they took; the following is an extract from the minutes of one meeting with management.

"The sales and production information needs were discussed and it was felt necessary for the systems specialists to say what was available and practical, rather than asking the managers what they wanted."

The Group Systems Project continued and on 17.5.73 a report was prepared for the Board of Directors setting out the basis for the future development of systems.

The pro's and cons were presented verbally to the Board by the researcher who at that time commented on the need for management to assess their needs and consider the key decision areas in the business and the need to provide information to meet the needs of these key decisions.

On 29.6.73 the project was set in motion and the new computer ordered. It was very clear at this stage that though it had been possible to design an approach which would meet the majority of the objectives listed previously, it was going to be impossible in the prevailing climate to meet management's information requirements, when they were not aware of their needs or the key decisions taken at each level of management.

2.6 The Decision to Carry Out Research

Following the decision to proceed with the purchase of a new computer and terminal network, the researcher suggested that it would be a sensible idea to examine management's information needs. This was to be done alongside the development of basic data collection procedures.

The idea was initially considered impractical by the Board of Directors. The researcher, believing the research to be important, approached Loughborough University, Department of Management Studies, with the suggestion that the definition of management's information needs would form the basis for a research degree.

Loughborough University accepted the proposal and the researcher then approached the company for approval to carry out the research. This time the company agreed and initial work started in the summer of 1974. As far as the company was concerned, the research was seen as a pragmatic exercise as part of the overall development of systems within the Group, and it was clearly stated that they expected the results to be directly applicable to the design of information systems for the company and that this should be seen as a principal objective.

Chapter Three

Research Techniques

Research Techniques

3.1 Information and Decisions

It was clear that the first task in defining management's information needs was to define the decisions taken by a group of managers, and then by a process of examination and discussion, to define the information needed to take each of the decisions.

In defining decisions it was considered important to attempt to segregate decisions according to type and importance. This separation would enable emphasis to be placed on defining the information needs of the key decisions within the business as a first priority.

It was necessary as a first step to determine whether the decisions taken by managers had been previously analysed and built into the manager's job description. It was established that this had never been done in the company before and that where job descriptions had been issued they did not include an analysis of the decisions that had to be taken by the manager.

The first stage of the research was concerned with analysing the decisions taken by management and devising a means of recording this data so that decisions could be separated by type and importance.

3.2 The Decision Grid

The researcher decided to produce a Decision Grid, Fig. 10, which would be completed during an interview with each manager.

MANAGER				
IMPACT SPECTRUM		MINOR	IMPORTANT	VITAL
	COMPLEX			
	ROUTINE			
	MECHANICAL			

FIG. 10


The decision on the type of decision and its impact would be made by the manager who would assess these two factors in relation to his job and the achievement of his objectives, where he was able to state what they were.

This approach pre-supposed that the manager had some knowledge of his own job and what constituted a decision. It was found in initial discussions with a "friendly" group of managers that such knowledge could not be pre-supposed and it was decided that before the decision analysis took place it would be necessary to educate the managers concerned.

The evaluation of what constitutes a Key Decision was based on the Decision Grid. It was anticipated that the grid would produce a range of decisions as indicated in Fig. 11.

MANAGER				
IMPACT SPECTRUM		MINOR	IMPORTANT	VITAL
	COMPLEX	FEW IF ANY		
	ROUTINE			
	MECHANICAL			FEW IF ANY

FIG. 11

It was decided that all decisions falling in the sections marked  would be considered Key Decisions and that this approach to define key decisions would not be done until the results of the interviews were assembled and combined.

The next step would be to assess the information needs for each of the decisions the manager said he took.

3.3 Decision Information Analysis

The aim of this form was to record the manager's information needs for each decision appearing on the Decision Grid. The information needed was recorded under one of four main headings. (See Fig. 12)

Objectives,

Technical,

Control,

Background.

The information was classified, where known, according to three factors:-

- a) available and used,
- b) available and not used,
- c) not available.

This information was not always known at the time of the interview and had to be completed during the data analysis stage of the research. The source of the data was also entered at either the interview stage or the subsequent analysis.

At the same time as the manager was interviewed about his information needs for each decision, data on what information was currently being received was collected. In most cases this was done by obtaining copies of routine and non-routine reports.

As it was anticipated that the data to be collected would be somewhat voluminous a procedure for coding and filing documents was devised.

MANAGER		DECISION INFORMATION ANALYSIS	
DECISION			
TYPE	INFORMATION REQUIRED	class	source
OBJECTIVE			
TECHNICAL			
CONTROL			
BACKGROUND			

Class: A available and used
B available not used
C not available

FIG. 12

The Decision Grids, interview notes and Decision Information Analysis sheets were filed in a Regional file and indexed by manager's name, using colour coding for function as follows.

Red	: Production, Engineering and Technical
Green	: Sales and Marketing
Yellow	: General
Blue	: Transport
White	: Administration
Dark Red	: Distribution

With this form of detail record and indexing it was possible to build up a complete picture of a very complex survey and provide sufficient detail to make the subsequent analysis comprehensive and meaningful.

3.4 Information Analysis

The analysis of the information gathered was going to present quite a problem. For every manager interviewed the researcher was going to have -

- a) Decision Grid
- b) Information Analysis sheet for each decision
- c) Interview notes
- d) Documents and Reports

It was decided to analyse these data in two ways under the headings of information needs and information available, which should provide an indication of the extent of the problems discussed earlier. (Page 20.)

To analyse information needs it was decided to use a Decision Definition Sheet (Fig. 13) which would bring together the information needs for each common decision. This was the build up of the combined information needs for the decision as expressed by a number of managers taking that decision. This was important in subsequent analysis and systems design in making sure the system could meet the needs of the decision maker, whoever he happened to be.

The Decision Definition sheet was fundamental to the analysis procedure. It contains three main sections:-

Definition of the decision.

Importance of the decision.

Who makes the decision.

The section on who makes the decision was to be simply a list of the managers, by name, who claimed to make the decision during the interview.

The reverse of the Decision Definition formed the Decision Information Analysis for that decision. In this way all the information concerning that decision could be contained on one sheet of paper.

The three documents detailed above formed the basis of the data collection procedure used in the research. The relationship of the forms is indicated by the following flowchart, Fig. 14.

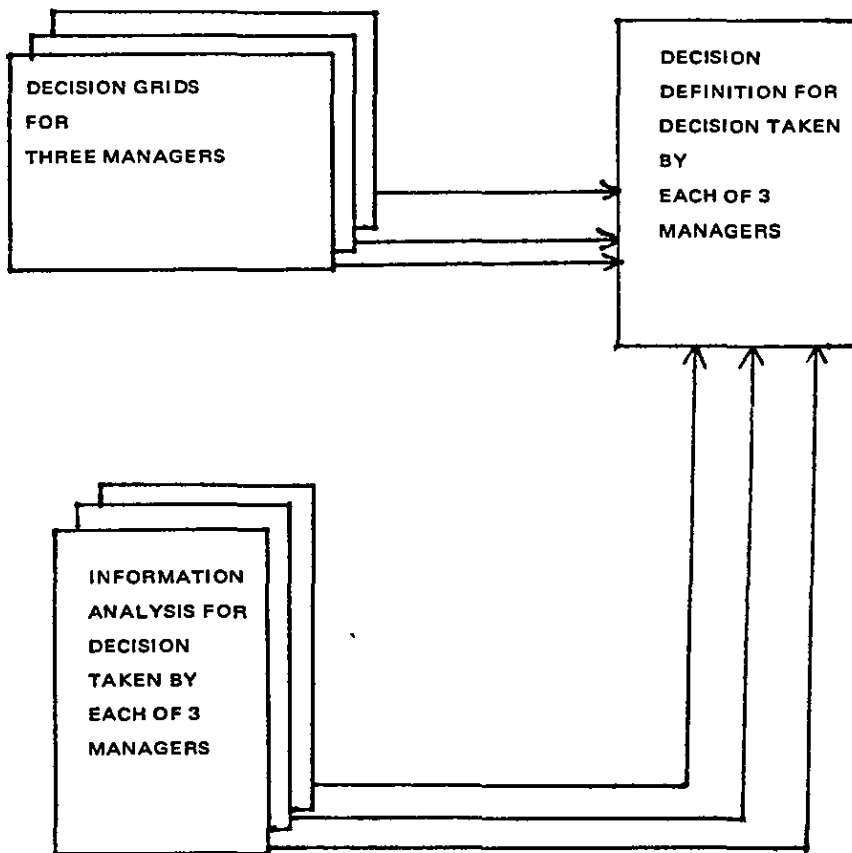


FIG. 14

With this analysis completed it was considered that it would be possible to produce schedules of the decisions taken and information needed by individual managers and by functional groupings of managers, thus achieving the objectives of the research. It was recognised that this process could only be successful if management gave their full co-operation to the research.

3.5 The Approval of Management

The basic problem being researched and the objectives have been set out in preceeding sections. The main aim of the research was to produce a detailed analysis of management's information needs. This will then form the basis for the re-design of the company's decision structure and related information system. The results, if they are to be accepted by management, have to be based on a practical approach, not only understood by management but fully accepted by them. Their involvement in the research is fundamental. The need for such a practical approach had to be conveyed to the senior managers and they had to be persuaded that the sacrifice in time was worthwhile.

Senior Management Discussions

These discussions were held at three levels:-

The Main Board of Directors

The Quarries Division Board

The Quarry Regional Boards

The main board meeting discussed the subject in September, 1975 and gave approval, providing that each succeeding level of management accepted the need for the research. They were not prepared to issue a directive. This placed additional strain on the researcher, but ensured the required degree of management involvement.

The Managing Director of the Quarries Division then discussed the subject in a little more detail and gave the research his support, though once again he insisted that the Regional Directors approved any proposals.

The Regional Directors and their senior executives were met personally at three meetings held during December 1975 and January 1976. At these meetings their support was obtained to the principle of the research and particularly to the holding of a series of management seminars.

This initial phase has been quite decisive in ensuring the very high level of support and commitment that was forthcoming from all levels of management.

3.6 The Seminars

It was decided to hold a series of seminars for the managers who would be taking part in the project. The objectives of the seminars were:-

1. To explain what the research was about and how the company hoped to benefit.
2. To explain their role in the research.
3. To explain some of the principles of information for decision making.
4. To create an atmosphere of understanding.
5. To obtain co-operation.

The seminars were held on the following dates.

- 19th. February 1976 (Evening)
- 26th. February 1976 (One Day)
- 10th. March 1976 (One Day)

The programme was as follows (Table 1) and included an additional section on "Financial Considerations". This was presented by the appropriate Financial Controller and was included for two reasons -

- a) The managers were together, and
- b) To stress the importance of finance in decision making.

The three seminars were held at slightly different times, but were of the same duration. The introduction was made by the Regional Director and the presentation involved the use of overhead projector screens and audience participation, with a time for the participants to ask questions, air doubts, etc.

<u>Programme</u>	<u>Leader</u>	<u>Time</u>
<u>Introduction</u>	REGIONAL DIRECTOR	4.15 pm
<u>Why is a review necessary?</u>	TJB	4.30 pm
<p>The next stage of the development of Group Systems. A gradual evolution to weed out the unnecessary and bring in information required. The computer is only part of the answer. A systematic detailed analysis co-ordinated through- out Tilcon is the best way of building the right foundations.</p>		
<u>Information and Decisions</u>	TJB	5.20 pm
<p>The relationship of information with decisions and the importance of having the information at the right time. Establishing what information is needed and how it is important to know where information can be obtained. How the information being entered into Tilcon's system is filed and how it can be retrieved. Put the use of the computer in perspective.</p>		
<u>The Review</u>	TJB	6.20 pm
<p>The detailed recording and analysis. Who will do it and his objectives: Right Data, Right Time, Right Place. How will it be done? What is the manager's role? Discuss the benefits to be obtained by the company from this review.</p>		
<u>Development of Tilcon's Information System</u>	TJB	7.10 pm
<p>The concepts. The wider approach. The new facilities: Management by exception, Access to data. Timing and individual division's approach.</p>		
<u>Financial Considerations</u>	BJH	8.00
<p>The importance of cashflow and how managers can assist in improving cashflow. The effects of inflation on the replacement of plant.</p>		
<u>Review of Seminar</u>	REGIONAL DIRECTOR	8.40 pm
<u>Close</u>		9.00 pm

TABLE 1

In each case the seminars proved of value in at least three ways.

- 1) An improved understanding of the problem in the eyes of the managers.
- 2) An improvement in the planned approach to the survey by incorporating management suggestions.
- 3) A considerable aid in obtaining a 100% co-operation and involvement of the managers who attended.

These values were fully realised when I interviewed managers who through ill health, holidays or business commitments did not attend the seminars. Of all the managers interviewed only four had not attended seminars. In each case the interview took longer, was more difficult, and was less informative. The need and benefits had not been accepted by these managers and so their attitude was mildly hostile.

It was realised that the seminars would not provide all the detailed information needed by the managers if they were to make an important contribution. It was decided to publish an explanatory booklet which would be handed out at the seminars.

The booklet (APPENDIX A) set out to discuss the subject with particular emphasis on the company's needs. It was essential for the written material to be as practical as possible. The approach taken in the booklet, entitled "Information for Decision Making" was as follows.

- 1) Introduction (written by the Financial Director)
which set the scene for the research.

- 2) The need for a review: in which the case for the review was set out with the emphasis on the growing need for better, more relevant information.
- 3) Information and decisions: the relationship between information and decisions was brought out in this section, with attention being paid to information types and decisions that the managers could relate to.
- 4) The review itself: the detailed step by step procedure which it was intended should be followed.
- 5) Developing Tilcon's Information System: the final section discussed how the company might use the results of the research to build better systems for management.

The aim quite simply was to look at the research in a practical way and find answers to why, how and what for. The booklets were used in three ways.

- a) To stimulate interest.
- b) As a record of the seminars.
- c) For reference during the interview stage.

In all these areas it proved of significant benefit and was extremely well received by the majority of the managers involved.

And as one manager commented,

"The interviews would have been a complete waste of time without the seminar and the booklet".

3.7 The Interviews

Following the seminars the detailed interviewing and data collection started.

It was obvious from comments made by managers during the seminars that few, if any, of them had ever attempted to relate the basic principles of decision analysis to their own jobs.

One of the main areas of general comment was the need for information to make effective decisions. In most cases the managers concerned had not previously examined their decision making in this light and though some found, to their obvious delight, that they had been taking the right approach, others found, to their dismay, that they had overlooked, and in some instances, misused, the vital resource of information.

Detailed Individual Interviews

The following numbers and categories of managers were interviewed.

- 3 Regional Directors
- 1 Deputy Regional Director
- 4 Area General Managers
- 4 General Managers
- 10 Production Managers
- 6 Sales Managers
- 5 Commercial Managers
- 2 Technical Managers
- 3 Engineers
- 3 Financial Controllers
- 5 Administration Managers
- 7 Transport Managers
- 6 Quarry Managers
- 2 Distribution Managers

The relative positions of these managers can be seen on the organisation charts on pages 44 - 46.

The interviews were not carried out in any specific order, being dealt with as time and geographical location permitted.

The interviews, which all followed a certain pattern (see Table 2), were not structured and no pre-prepared questionnaire was used. The aim was quite simply to complete the Decision Grid and the Information Analysis for each manager and to obtain sufficient data on the information used for subsequent analysis.

Interview Pattern

The Job

Brief definition of the job and the principal objectives as seen by the manager.

Area of Responsibility

Organisation below the manager reporting directly to the manager.

Decision Areas

A breakdown of the job into the main decision areas.

Principal Decisions Within Each Area

For each decision, record on the Information sheet the information required to take the decision in the four main aspects, objectives, control, technical and background. Highlight areas of need.

Existing Reports Received

Collect copies of all existing reports, relating them to the above analysis.

Check the Decisions and Information

Confirm with the manager that all his decisions have been covered. In addition check attitudes and views associated with information received and the information needs previously highlighted.

NOTE: During the interviews record opinion, attitude and comment concerning the analysis and its value.

TABLE 2

In practice this pattern was followed and found to be adequate for three main reasons.

- a) It was possible to gain a clear understanding of the manager's role and position in the organisation as he saw it, and as his subordinates and superiors saw it.
- b) The pattern enabled the researcher to exercise a control on the discussion.
- c) The manager had time to relax talking about his job generally before meeting the more difficult area of his decisions.

It was found that the Decision Grid could be filled with very little difficulty. Most managers had little doubt as to where the decision should be placed in the grid. Those that did have any problem were invariably those who had not attended the seminar and had not read the introductory booklet.

Following each interview approximately two hours was spent analysing the notes taken during the discussion. In several cases it was necessary to visit the manager a second time to confirm that the analysis of the interview was accurate. This extra visit was usually associated with the longer interviews.

The interviews were spread over a period of five months. This was due to the difficulty of arranging suitable appointments during the holiday period. All managers were advised at least four weeks in advance of the appointment which was confirmed again in the preceeding week. In this way the managers were able to consider the subject for some time prior to the actual interview.

The co-operation and response of the managers in the interviews was excellent and has contributed significantly to the value of the research. It was interesting to note that many managers found the discussions of benefit in three ways:

- a) It forced them to consider their job from a different viewpoint.
- b) They learned a great deal about the principles of information systems.
- c) Several areas where information needs existed were highlighted, though previously the manager had been unaware of this lack of information.

The length of the interviews varied from $1\frac{1}{2}$ hours to 6 hours, the pattern of time was not wholly related to management position and the degree of decisions. The wider the area of responsibility the longer the discussion was expected to take. However, this was not the case, though span of responsibility was a key factor, there were several other factors.

- a) The manager's personality, confidence and ability to converse.
- b) Attendance at the seminar.
- c) Reading of the booklet.
- d) Time in the job.
- e) General level of management training.
- f) The form of management philosophy.

The impact of management style and philosophy on the research is dealt with later.

3.8 Data Analysis

The detailed analysis of the information recorded during the interviews presented several problems.

1. A good deal of the information given by the managers was subjective.
2. Though the interviews followed a pattern they were not structured and so quantitative analysis was difficult.
3. The manager's description and interpretation of decisions varied considerably.
4. The description of the information used varied by area and region, through different reporting structures.
5. Content and frequency of information flows varied by area and region.
6. Managers' titles varied for the same responsibility in different regions.
7. Responsibilities of managers with the same titles differed in different regions.
8. Decision making levels were quite different in the different areas and regions.

With these problems it was essential to find a common denominator which would serve as the basis for analysis. The common denominators seen were the decisions themselves. In order to produce such a basis the first task was to analyse the information to produce a list of decisions. This was followed by relating this list to each manager's decision grid and then producing a set of Decision Definition Sheets. (APPENDIX B).

The list of decisions was examined and all decisions numbered (APPENDIX C).

It was possible to use the list as an index for subsequent analysis of the decision definitions into functional groups. This was achieved by firstly preparing a functional decision list. (See Fig.15)

NO	DECISION TITLE	BRIEF DESCRIPTION	Key	FUNCTION									
				P	D	S	G	T	Te	FE	Tr		
1	CAPACITY VARIATIONS	Changing levels of capacity by adjusting hours worked on plant.	✓	✓			✓						
2	REPLACEMENT OF PLANT	What should be replaced and when.	✓	✓			✓						
3	OPERATING METHODS	Original decision and changes thereto.	✓	✓			✓	✓	✓	✓			
6	STAFF APPOINTMENT (SENIOR)	Appointment of staff above Quarry Manager.	✓	✓			✓	✓			✓	✓	
7	EXPENDITURE CONTROL	Authority to spend.		✓			✓	✓	✓	✓	✓		
9	PAY LEVELS	For all staff.		✓			✓	✓	✓	✓	✓		
18	MONITORING PERFORMANCE	Action on results.		✓			✓	✓	✓	✓			
19	TECHNICAL CONTROL	Maintain quality of products.	✓	✓			✓		✓				
24	STAFF APPOINTMENT (MIDDLE)	Below quarry manager.	✓	✓			✓	✓	✓	✓	✓	✓	
25	CUSTOMER COMPLAINTS	Deciding upon the action to be taken to resolve the query.	✓	✓			✓	✓	✓	✓			
29	PRODUCTION ---- BUDGET APPROVAL		✓	✓									
30	IMPROVING OPERATIONS	Deciding to make improvements in the operating environment.	✓	✓									
31	MAINTAINING OPERATIONS	Decision on action to maintain plant in working order.	✓	✓							✓		
37	ORDERING VEHICLES	Decision to order vehicles from outside hauliers.		✓					✓				
39	ORDERING SUPPLIES	Deciding what to buy from whom.		✓					✓	✓	✓		
40	STORES LEVELS	Which items to hold in stock, and the levels.		✓				✓	✓		✓		
50	INSPECTION OF PLANT			✓							✓		
51	STOCK LEVELS			✓									
52	CAPITAL EXPENDITURE	Decision on which items will be included in budget.	✓	✓				✓			✓	✓	
53	ENVIRONMENTAL	Decision on matters affecting the environment, pollution, dust, etc.	✓	✓				✓			✓		
64	ALLOCATION OF RESOURCES	Allocating people and money to specific activities.	✓	✓				✓	✓	✓	✓		
66	PREVENTATIVE MAINTENANCE	Establishing and maintaining a preventative maintenance system.	✓	✓							✓		
78	WHAT TO SUPPLY	How demand is met at the operating unit.		✓									
79	SAFETY	Ensuring all safety requirements are met.	✓	✓									
80	HANDLING MEN		✓	✓									
82	INDUSTRIAL RELATIONS	Dealing with all aspects of the working situation.	✓	✓									✓
83	APPOINTMENT OF OPERATIVES	Selecting operatives.	✓	✓									

FIG. 15

This showed:-

Decision ref. number

Decision title

Brief description

Key (ticked if a key decision)

Functions: P = production

D = distribution

S = sales

G = general

T = transport

Te = technical

F = finance

E = engineering

Tr = training

The information requirements of each functional group were then summarised by re-sorting the Decision Definitions and analysing the information flows.

(APPENDIX D)

Information Flows

These were developed from a process of sorting and data extraction using the decision definitions. The process was as follows:-

- a) Sort decision definition into function groups.
- b) Prepare a sheet for all the information required by that functional group. (Extract from the decision information analysis on the back of the definition sheet.)
- c) This schedule of information was listed by the source from which it came.

This analysis produced the information INFLOWS.

By re-arranging the information on the inflow sheets by making the receiving function on the INFLOWS into DESTINATION and the source on the INFLOWS into FUNCTION it was possible to produce the functional OUTFLOWS. This process is depicted in Fig. 16.

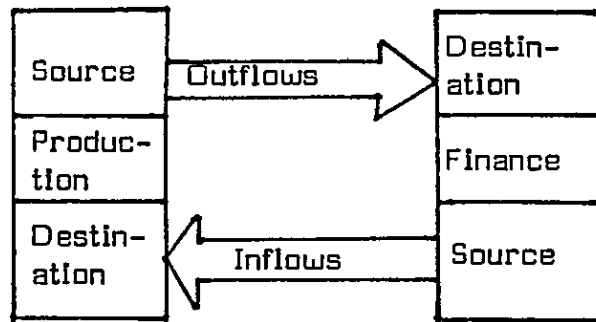


FIG. 16

The detailed step by step approach of the research can be seen in diagrammatic form on the following flowchart. (See Fig 17).

From the data analysed in this way, it was possible to produce an Action Report. (APPENDIX E)

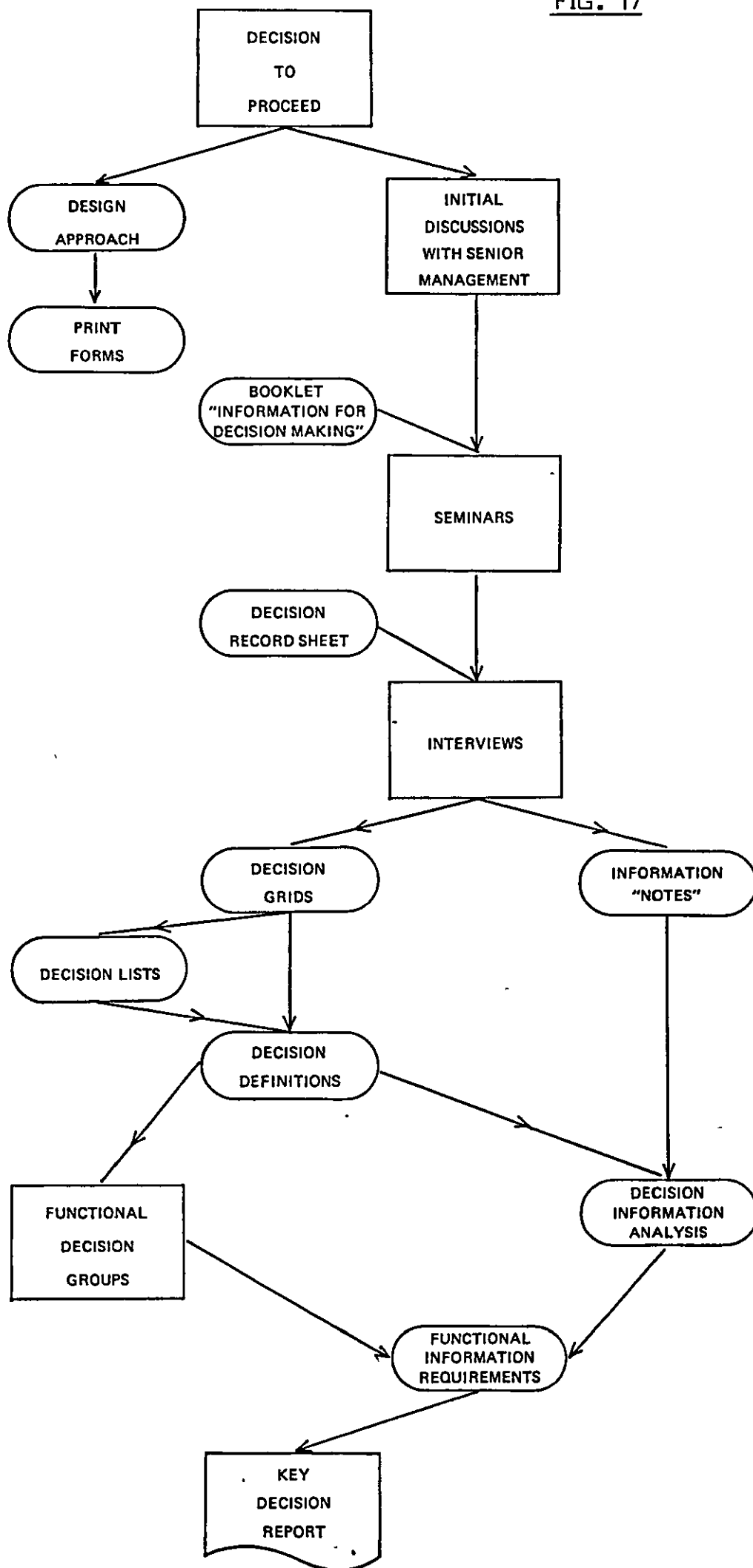
This report now forms the basis of Tilcon's systems development programme leading to the design and installation of the company-wide decision based information system.

The report contains the following information.

- a) The Present Systems.
- b) Synopsis of the way the information has been assembled.
- c) The North East Area organisation structure.
- d) The information flows.
- e) Recommendations.

The report forms the basis for further work to implement the recommendations stemming from the research and the results of the data collection and analysis procedures.

FIG. 17



Chapter Four

Application of Techniques in Tllcon

Application of Techniques in Tilcon

4.1 Identifying the Managers to Interview

The decision on which managers should be included in the research was made by the appropriate Regional Director, and was largely dependent on which managers would be interested and available. As with any selection process of this kind it was more a question of who to leave out rather than who to include.

The selection was made before the managers were invited to the seminars and each region invited all their senior managers and made a selection of middle and junior managers. The researcher was able to influence the selection that was made so that the managers included represented a cross section according to age, experience and performance.

It was also important to make sure that all the functional activities were covered by more than one manager. The numbers of managers are listed by title on page 77 . It was considered vital that the managers selected to partake in the research should be involved from the very beginning. There were one or two instances where managers left during the course of the research. In those instances they were replaced by existing managers who were aware of the project but who had not attended the seminar.

4.2 Human Relationship Problems

In any piece of research of this kind it is obvious that there would be problems caused by the relationship between the interviewer and the interviewee. Several problems did arise and these were concerned with,

- a) the interviewee's suspicion of the project;
- b) the approach of the interviewer;
- c) time and place of the interview.

In the Division that was managed autocratically several of the managers interviewed were suspicious of the real intent of management in asking such searching questions about the work they did. In one instance this was evident by the point blank refusal of one manager to be interviewed. The interview with this individual was left until the end of the interviewing stage, by which time he was able to discuss the project with colleagues who had already been interviewed. This seemed to resolve his suspicion. It appeared that the suspicion was generated in an environment where the managers had not previously been involved, and thus suspected management's motivation for inviting their involvement in this project.

In a number of cases the managers were affected by the interviewer's over-enthusiastic approach. These managers went out of their way to express their views about the pointlessness of the research and how "nothing would come of it". The researcher quickly learned to adapt his approach to the manager he was dealing with so that he got the best response. After ten or twelve interviews the interviewer's approach settled down and very few problems were encountered.

Perhaps the most difficult factor affecting the relationship between interviewer and interviewee was the time and place of the interview. Wherever possible the interview was held on the manager's home ground, sometimes due to office facilities and local day to day problems the interviewing session became disjointed and frustrating. Wherever possible such meetings were adjourned to a more suitable location. Several managers insisted on fitting the interview into their normal working day and the interviewer's tact and diplomacy were almost totally exhausted.

Wherever the researcher felt that these problems had affected the quality and relevance of the information collected, a further meeting was arranged for "checking over some of the points raised" in the previous meeting.

4.3 Political Problems

A number of problems were encountered that can only be described as political, in that they had more to do with the way the organisation was governed than what was actually happening. The managers being interviewed were aware that other managers both junior and senior were also being interviewed. In some cases their concern with what had been said in these interviews could only be described as paranoiac.

Several managers were much more interested in what other people had said than in their own contribution. This also tied in with the problem of suspicion mentioned earlier. It became necessary for the researcher to separate consciously the relevant responses from the managers and in some cases deciding what was and was not relevant became rather difficult.

For some managers the interview presented an opportunity for expressing pent up emotions about the company, the way it was managed, and the way that they had been mistreated and overlooked. Other managers took the opportunity to try to prove how effective they were.

4.4 Intrusion of other Company Problems

On a number of occasions local personnel or systems problems were highlighted by the managers being interviewed. These local problems were sometimes imagined and sometimes real. In one instance a transport manager complained bitterly that though he was responsible for allocating vehicles to operating units, he was not informed of the daily orders. On investigation it transpired that the distribution manager who was responsible for the order office would not provide the information as he believed the allocation of vehicles was his responsibility, not the transport manager's.

In another instance a commercial manager was analysing individual delivery tickets to produce statistics on sales to individual customers. This involved a good deal of additional work. A report containing exactly the information he needed was produced by the computer for the accounts department. As it was an accounting report it was not available for other managers.

Where such problems were discovered they were brought to the attention of the managers concerned so that they could be resolved. This had to be done very diplomatically to avoid annoying the people involved.

There was one problem which occurred on a number of occasions. This was to do with the content and layout of computer reports. Few managers liked the format of computer output and were always quick to point out what they considered to be deficiencies.

As the researcher was responsible for systems design it became necessary to keep a separate record of the comments made with the promise that action would be taken.

4.5 Effect of Researcher's Internal Status

The status of the researcher as the Management Services Manager had a number of effects on the research. These can be separated into favourable and adverse effects.

Favourable effects

The researcher already had a reputation for doing worthwhile work so that the research was taken seriously by the managers involved.

Managers were willing to talk freely about their views because they realised there was a chance that the researcher would act upon their suggestions.

The managers were aware of the researcher's ability to implement the results of the research and so gave their support and co-operation.

Adverse effects

The researcher found it difficult to disassociate his research activities from his normal duties especially with respect to the suggestions made for improvements in systems.

Some managers were suspicious of the use that might be made of the comments they made. This suspicion was worsened by the fact that the researcher also had a management appointment.

There were some managers who were suspicious of the researcher's motives, wanting to know "what are you going to get out of it?"

Those effects, both favourable and adverse, were particularly noticeable at the beginning of the research. As the project progressed the adverse effects became less noticeable, and were completely outweighed by the favourable effects.

4.6 Educational Benefits of the Survey

There were a number of educational benefits apart from the improvement in the researcher's knowledge of management practice and the use of information. These benefits can be separated into three distinct types.

- a) Knowledge of the process of providing information;
- b) The relationship of information to decision making;
- c) The value of considering decision making activities.

Process of providing information:

During the research the managers involved were constantly asking questions about the problems of collecting, processing and presenting useful information. They were often surprised to discover the problems associated with what they thought was a straightforward activity.

Perhaps the most important lesson learned by everyone involved with the research was the desirability of selecting the information needed rather than processing the vast amount of data available in the hope that it would be of value. All the managers recognised the need to search for the needle of relevant fact in the haystack of superfluous data.

Relationship of information to decision making:

At the start of the research the relationship of information to decision making was not fully accepted by the managers involved in the research.

The question most frequently asked at the seminars was:-

"Why is it necessary to establish the decisions managers make before you can provide the information they need?"

The question was understandable as such analysis had not been done before, and yet information was made available. However, as the research progressed the managers came to understand why decisions were such a crucial part of information analysis.

Analysing decision making activities:

Apart from using decision analysis to identify management's information needs, there were several other benefits that were quickly learned by the managers involved. The first of these was the value of knowing the decisions that managers thought they took and in sorting out apparent contradictions.

The second of these benefits was establishing the level at which decisions were being taken. It was apparent in a number of instances that managers who were close to the action were not taking the decisions either because they were unable to because of a lack of information, or because they had been instructed not to. This did, of course, depend on the particular style of management.

It is perhaps too ambitious to believe that these lessons had an impact on the way managers behaved, but it certainly had an impact on the way managers approached the researcher in his position of Management Services Manager when they wanted additional information.

4.7 Impact of Management Philosophy

As mentioned earlier management philosophy is an important factor in the creation of decision structures, and the systems which feed the decision makers with information. The significance of the impact became clear during the research.

In the democratically managed decision managers were more open, more willing to question what was going on and more prepared to benefit from developments which they saw as being an improvement on the present circumstances.

In the division managed by the benevolent autocrat the managers were very willing to partake in the research but they had some difficulty in sorting out what decision they made. There was a good deal of overlap in the decision structure and much of the formal information was of an historic nature and used for examining what had happened rather than for decision making. The managers were co-operative provided the researcher was not questioning established procedures.

In the autocratic division there was considerable suspicion of the research and a distinct resistance to examining the status quo. It was difficult to get managers to talk freely about their jobs and the decisions they took. It was as if they were conscious of the futility of pursuing an objective that they considered unobtainable.

These different management attitudes provided the researcher with considerable variation in the interviews and in management reaction. They also provided a practical and comprehensive test of the methods used by the researcher, which in spite of the difficulties explained here, were nevertheless fully effective.

4.8 Management Co-operation

The research techniques are obviously a very important part of every research project. In this case they formed a substantial element of the research itself and as such were a great help in obtaining the correct response from managers. However, without the co-operation of the managers, research of this kind would be impossible. Co-operation is only given if managers believe there is some value in what they are doing and have a desire to help the researcher. Ensuring that managers take this attitude is not easy and was a very important part of the initial stages of the research. The researcher's position in the company helped more than it hindered, but the large measure of co-operation received indicated that the researcher's efforts to stimulate a good response were rewarded.

Chapter Five
Tilcon Results

Tilcon Results

The results of the research for Tilcon fall into several categories.

Each of these categories relates to the nature of the result. The categories are:

- a) Tangible results that can be seen and used by management;
- b) Intangible results, which though producing a positive benefit, cannot be seen in physical terms;
- c) Results identifying future areas for action.

Before discussing each of these result areas in detail it is worth pausing to examine the original aims of the research as set out on Page 30 .

At the beginning of the research management considered the aims to be too ambitious and in some quarters, particularly front-line managers, thought them to be an unreachable ideal.

In the event the research has met these aims and has produced a number of additional benefits.

5.1 Tangible Results

The tangible results stemmed principally from the analysis of data collected and the documentation and records produced during the research.

These result areas are -

- 1) The preparation of detailed decision lists. (APPENDIX C)
- 2) The identification of key decisions. (APPENDIX B)
- 3) Functional decision analysis. (APPENDIX C)
- 4) Information required for each decision. (APPENDIX B)
- 5) Information required for each function. (APPENDIX D)
- 6) Detailed information flows. (APPENDIX D)

Decision Lists (APPENDIX C)

The preparation of a list of the decisions taken by the management was the first step in the research.

"The only way to isolate the specific information requirements of individual managers is to isolate the nature, frequency and interrelationship of the major decisions made in the company." (28)

The lists produced for the purpose of defining information have created a number of additional benefits.

These are concerned with the degree of overlap and conflict apparent from each manager's view of the decisions which he considered were his. Some of these decisions were found to be group decisions which required the involvement of several managers, others were clearly seen to be overlapping or conflicting decision areas.

Whilst this problem of overlapping and conflicting decision areas did not affect the analysis of information needs, so far as these were related to the decision, it did affect the subsequent system design in terms of who should receive what information. This has led directly to the review of such conflicting areas to determine the most appropriate point for the decision to be made.

This review, though separate from the original research, is proceeding at the present time and a number of changes in the decision structure have already taken place.

Identification of Key Decisions (APPENDIX B)

At the commencement of the research it was considered important to identify those areas where action would create an improvement in management performance. Whether or not information provided to meet specific information needs would contribute to an improvement in performance, it was decided that the selection of key decisions would facilitate a more direct approach than trying to consider all decisions.

In the event, the selection of key decisions had several direct benefits:

- a) Managers were forced to place a value (albeit a subjective one) on the decisions they took. This alone had an impact on many managers' views of their own role and its effect on other related activities.
- b) Several decision areas selected as being key decisions have been subjected to further analysis to determine more precisely how these decisions are arrived at, their frequency and place in the decision structure.

- c) When considering the completed list of key decisions some managers have re-appraised their own assessment in the light of other managers' attitudes, i.e. where a manager did not consider the decision important but others did and vice versa.
- d) The detailed information analysis based on key decisions, led to the identification of several important discrepancies in information needs, some of which were satisfied almost immediately and others which are being examined at the present time.

The key decision schedule, being based as it was on a fairly simple subjective evaluation, generated a significant level of agreement amongst the managers concerned in the research survey.

Functional Decision Analysis (APPENDIX C)

The separation of the decisions into the sections appropriate to each functional grouping (by analysis of the Decision Definitions into the functional group for each manager) has provided a ready reference to the decisions with which that group is concerned.

This has led directly to consideration of incorporating such data into management development programmes and job descriptions currently being assessed in the company. There were also a number of areas where there was overlap and conflict between function groups (see above "Decision Lists").

Job descriptions presently in use deal with such areas as responsibilities, reporting relationships, inter-departmental relationships and specific annual tasks. Nowhere was consideration given to the managers' decisions nor their information resources.

Functional decision lists enable the individual manager's decision responsibilities to be analysed and included on his job description. This, it is hoped, will eliminate some of the conflict apparent at the present time.

The additional details of information resources are provided by the results of the information analysis carried out.

Information per Decision (APPENDIX B)

The first result of the information analysis was the information required for each decision (shown on the back of the Decision Definition sheet).

This analysis shows:-

- a) The information needed,
- b) The source of the information.

The information needed stems directly from the individual interviews and the information collected. The source of the information stems from the analysis of the information system structure and the production of a systems framework. (FIGURE 18).

By using the systems framework and inserting individual sub-systems (FIGURE 19) it is possible to record, using the alpha numeric code, the precise source of the information needed for each decision.

SYSTEM GROUPS

Function System	Production	Distribution	Marketing	Administation
Operating	PO	DO	MO	AO
Reporting	PR	DR	MR	AR
Accounting	PA	DA	MA	AA
Planning	PP	DP	MP	AP

FIGURE 18

SUB-SYSTEMS

FUNCTION SYSTEM	PRODUCTION		DISTRIBUTION		MARKETING		ADMINISTRATION	
OPERATING	PO1 PO2 PO3 PO4	MATERIAL CONTROL STOCK CONTROL PLANT MAINTENANCE PRODUCTION CONTROL	DO1 DO2 DO3 DO4	ORDER OFFICE PROCEDURES LOADPLAN VEHICLE MAINTENANCE STORES PROCEDURES	MO1 MO2 MO3 MO4 MO5	MARKET RESEARCH SELLING PRICING SALES DATA COLLECTION SALES PROMOTION	AO1 AO2 AO3 AO4	CASH CONTROL SALARIES PURCHASE INVOICE CODING CREDIT CONTROL
REPORTING	PR1 PR2	DAILY & WEEKLY REPORTS MONTHLY CONTROL REPORTS	DR1 DR2	VEHICLE PERFORMANCE REP- ORTS VEHICLE UTILISATION REP- ORTS	MR1 MR2 MR3	S.A.M.V. REPRESENTATIVE REPORTS MONTHLY S.M. REPORTS	AR1 AR2	MONTHLY ACCOUNTS AD HOC REPORTS
ACCOUNTING	PA1 PA2	MONTHLY ACCOUNTING STATEMENTS WAGES & CASH	DA1 DA2 DA3	VEHICLE COSTS VEHICLE EARNINGS WAGES & CASH	MA1 MA2 MA3	SALES INVOICING SALES LEDGER EXPENSES	AA1 AA2 AA3 AA4	PURCHASE LEDGER COSTING NOMINAL LEDGER ASSET LEDGER
PLANNING	PP1 PP2 PP3	ANNUAL BUDGETS CAPITAL EXPENDITURE 3 YEAR FORECASTS	DP1 DP2 DP3	ANNUAL BUDGETS CAPITAL EXPENDITURE 3 YEAR FORECASTS	MP1 MP2	ANNUAL BUDGETS 3 YEAR FORECASTS	AP1 AP2 AP3	ANNUAL BUDGETS 3 YEAR FORECASTS CAPITAL EXPENDITURE

By bringing together the decisions in each function (using the functional decision list) it has been possible to produce a functional information schedule.

Functional Information Schedule (APPENDIX D)

The functional information schedule provides a means of assessing each manager's information needs, the sources of the information and the sub-system which should provide the information.

It is intended to publish such a schedule for each manager, (depending upon his decision responsibilities) so that he is aware of the sources of the information and the full range available. This will not restrict each manager from requesting additional information which will be added to the decision definition, and amendments made to the Information Schedule.

Information Flows (APPENDIX D)

Bringing together all the information schedules and analysing the information sources, it has been possible to produce the detailed information flows in two specific ways.

- a) Information inputs and outputs per function (and from this, per job).
- b) Information required from each sub-system.

The first of these has added an additional feature to management job descriptions, namely the managers' responsibilities for supplying information as input to other higher and lower decision areas. This clearly shows responsibility for providing information in both directions.

The analysis of information output from each sub-system has led to the review of certain systems to make the information available. These have been concerned with:-

Sales and Marketing

Distribution

Production Control

Maintenance Costing and Control

Accounting Systems

All these systems are in different stages of review at the present time. Other systems considered to be of lower priority have been scheduled for review in the future.

The analysis of decisions and information flows has produced a basis for information systems development over the next two to three years. This includes appraising management's needs for improved facilities for access to information held in central computer files.

5.2 Intangible Results

The intangible results stemming from the research were created during the process of the research itself and some were acted upon immediately, others remain to be acted upon in the future. These intangible results were as follows.

1. Improved management awareness of the limitations of formal information systems.
2. The improved understanding on behalf of the researcher of management's needs.
3. Some breaking down of the communications barrier between systems personnel and management.
4. A greater understanding on the part of the managers involved of the role of information vis a vis decision making.

Management Awareness

It was quite apparent that many managers were unaware of the limitations of formal information systems. They were aware of problems with the existing systems, but blamed this on administrative inefficiency. During the discussions on information needs they became aware of problems of rigidity, timeliness and accuracy which limit formal information systems from meeting day to day information needs.

The role of informal sources of information was then seen in a different light, as a necessary means of overcoming formal system limitations rather than a misuse of formal information.

There is an important place for the informal information systems which should be recognised in the overview of the methods for meeting management's information needs.

Management's Needs

It is impossible for research of this kind to be carried out without affecting the researcher's attitudes and opinions. In this case a number of pre-conceived ideas about management's information needs were washed away and replaced by a deeper understanding of the way information is used in the decision making process.

Rightly or wrongly a great deal of formal information is given little regard. Managers are more aware of the inaccuracies contained in such information than those who process the data.

In one example local managers assessed the importance of spending money on maintenance in relation to the effect on production and not in relation to the formal budgeting system. In another example local management "played a game" spreading costs over several accounting periods in order to avoid a "high cost" month. It is hardly surprising, therefore, that they then view information with some suspicion.

Communications Barrier

At the commencement of the research it was thought that a communications barrier existed between the people seeking to design information systems and the managers. This belief was proved correct, and during the interviewing process everything possible was done to break down the barrier.

Information for Decision Making

It is widely believed that ~~decisions~~ decisions are made after full examination of all the relevant information and the prevailing circumstances. In reality many decisions are taken with whatever information happens to be available at the time. This is particularly true of mechanical and routine decisions. The more complex decisions can normally wait until sufficient information is available.

To ensure the information system meets management's needs, information must be available when a decision is being made. This stresses the importance of timeliness of information flows. This was perhaps the most important single comment made by the managers interviewed and as a consequence the timing of a number of reports is under scrutiny.

The individual manager's needs for information vary considerably. The most important factor is experience. The more experience a manager has in a particular job then the more he relies on his accumulated knowledge. This is contrary to the general view that the more experience a manager has the more he will value his information sources.

The younger less experienced managers request more information than their more experienced colleagues. Rightly or wrongly, the more experienced managers confirm their decisions after the event.

Very often the combination of experience and information achieves the required result whether it consists of more experience and less information or vice versa.

Throughout the research there was a two way result,

- a) The researcher was made aware of the important, if unquantifiable, part that accumulated knowledge (experience) plays in decision making; and
- b) The managers concerned were made aware of the potential value of information in their decision making process, if it was timely and relevant.

These intangible results were a form of spin-off from the process of the research itself, some managers were more ready to accept them than others. Nevertheless, these results, together with the more tangible results, have led to a number of areas for action.

5.3 Areas for Action

A number of areas of action resulted from the research. These areas for action are related to the specific tangible and intangible results, and are as follows.

1. The relationship of the decisions taken by a manager, his sources of information, his job description and his development programme.
2. An analysis of decisions to show clearly where there were overlaps or where decisions were group decisions.
3. An analysis of information availability leading to re-design of present systems.
4. The re-design of the existing communication system to see that information currently available gets to the point where it is required.

These four areas for action are now in one of two stages of development:

- a) In the process of being implemented as part of the Group's systems development programme (2,3,4 above).
- b) Under critical appraisal with a view to forming part of the Group's management development programme (1 above).

5.4 Management Action

Getting management to act to implement the results of research depends upon convincing them of the validity of the findings. The majority of managers resist change unless they see obvious benefits, not only to the company but to themselves. In Tilcon a certain situation had arisen by accident or deliberately, where managers were in receipt of varying amounts of information and responsible for different decisions. This situation was created over many years and was due to three factors:-

- a) Status
- b) Job Definitions
- c) Decision Grouping

Status

The control of information flows is fundamental to the control of the decision making process. By restricting information to a few senior managers the system forces these managers to take the decisions stemming from the information. In this way information or knowledge is seen as power. Furthermore, in such an environment, the possession of information becomes a closely protected status symbol.

Where information is not restricted, then it has less power and is rarely considered as a status symbol. In the research carried out it was clear that some restriction took place even in the democratically managed Region, and that this restriction on the information flows had contributed to the existing methods used for decision making.

Job Definitions

In Tilcon there has been an attempt to provide a detailed job description for every manager. During the research only twenty seven of the sixty one managers interviewed had a job description that he could produce.

Of these, eighteen were working in the democratically managed division, and the remainder in the autocratic division. In the former it was seen as a guide and in the latter as a set of rules to be followed. This seems to support the famous saying that -

"Rules are for the guidance of wise men

and the obedience of fools."

(Attributed to Douglas Bader)

All the job descriptions available to the researcher contained the following sections.

Title

Reporting to

Responsible for (people)

Involved with

Duties/Responsibilities

Authority (financial limits)

Tasks/Objectives

The three areas of the manager's job not in evidence were:-

The decisions the manager has to make;

The information he will receive and its source;

The information he is expected to produce and its destination.

Without these three important pieces of information it is not really possible for the manager to know what his job is and so the job tends to be formulated over a period of time.

Decision Grouping

A manager's job is really a group of decisions which he is expected to deal with, within a prescribed area of activity. It is noticeable how the manager's title is only a broad guide to his actual job.

In most cases the manager constructs his own decision group by the following process.

1. Take over the job.
2. Get the feel of the job.
3. Take the decisions that seem appropriate.
4. Is told that certain decisions are not his to make.

These are taken at a higher level.

5. Continues to take over decisions, often those which are referred to him by subordinates.
6. Depending on management style, delegates decisions to subordinates, relinquishes decisions to superiors.
7. Formulation of group virtually complete.

The final grouping is dependent more on:-

- a) Management style;
- b) The individual manager's experience and ability;
- c) The existing situation;

than the requirements of the job.

In Tilcon this was clearly shown in the way the job of Transport Manager evolved in different parts of the company. The following examples show how two different managers produced almost totally different jobs.

In the first case the manager was originally a driver who had graduated through foreman driver to manager. His attitude was 90% concerned with the problems of drivers and the efficient utilisation of vehicles to avoid wasting time and other delays. In the second case the manager had been a mechanic and had risen through foreman mechanic to manager. He was 90% concerned with the efficient maintenance of a vehicle and was almost paranoid about keeping the trucks clean.

The two managers had the same duties, but because of their background and experience they had concentrated their decision making in the areas they knew best. In the first case maintenance of the vehicles was neglected so that availability was lower, but when the vehicles were available they were fully utilised. In the second example the availability was high but utilisation was low.

These examples serve to show how managers formulate their own decision group and then resist change which makes them feel vulnerable. Getting such managers to change their emphasis and to accept that certain decisions have been overlooked is not easy and it will take some time before the results of the research can be fully effective.

Chapter Six
General Results

General Results

6.1 Management's Information Needs

One of the primary objectives of this research was to establish that management's information needs could be identified. This objective has been achieved and in the process a number of interesting results occurred.

The first of these is that managers do not know their information needs. If asked outright what their information needs are they simply do not know where to start and in nearly every case where this question was asked the manager reverted to the information he already received and attempted to find reasons why he needed it.

This lack of knowledge appears to stem from the fact that managers have not consciously thought about their information needs. Not one manager interviewed in the research had ever consciously examined the decisions he took with a view to defining the information he needed. This is not only confirmed by the research, but also by a similar response to the question from delegates attending the author's lectures on the subject of defining management's information needs.

Yet managers do make demands on the information providers for more information and it must be interpreted from this that they have a need. During the research a number of specific requests for information were examined to see how the need for the information had been generated. In every case the request was generated by the manager's need to be more informed before making a decision.

It was found that in each case it was the first time that the specific decision had been made by that manager. An attempt was made to assess whether the information would be needed on a continuous basis or only when requested. In most cases the managers insisted that the new information was provided regularly and was added to their general store of information for when and if it was needed again.

The extent of the manager's store of information depended upon his experience, education and training, and background as well as upon his decisions and responsibilities. It was quite clear from the research that older more experienced managers made less demands on the formal information system and instead relied to a large extent on their own informal sources. When questioned why this should be so there was always the same initial response.

- 1) The information was not available when and where it was needed, and
- 2) It was not reliable.

These responses are, it would seem, the manager's favourite reply as confirmed by Gee's work (5,6). As the research proceeded these responses were examined more carefully and it became apparent that in most instances they were excuses rather than reasons. Two examples were found where managers deliberately delayed sending basic information to the accounting department so that the accounts would be late.

The reliance on informal sources of information was not only related to factors of experience and education, but also to the manager's location. If he was near to the activities for which he was responsible he used his eyes and ears much more than any formal system. A quarry manager did not need to see the day's production figures to know whether it was a good or bad day, he had been watching the stone on the belts. He didn't need to see the day's sales figures, he had already seen the vehicles entering and leaving the quarry.

The area production manager with wider responsibilities and being more remote needed to see the information on paper as part of a routine system. His eyes and ears were no longer adequate for gauging each unit's performance. The more remote the manager becomes the more he relies upon the formal information system. This is particularly true if the decisions are also taken remotely. One manager working in the auto-critically managed division described how this felt as follows.

"It's like driving a car without being able to turn the wheel or touch the accelerator until a message is received on the radio from the remote controller, and then to blame the driver if he crashes. It's even more stupid", he went on, "when you think that the driver has to send all the information on what's happening to the controller before he receives the message on what to do."

This problem of separation of the decisions from the information was a constant feature of the research and it was apparent that the information flows had developed to serve the decision structure. This in some instances meant that information had to travel considerable distances both geographically and through the system, before arriving at the point where the decision was made. The more remote this was, the more information was needed to try to overcome the lack of ability to see and hear what was happening.

There were very few instances where the problem of collecting and processing the data had virtually forced management to take the decision at the point where the information was available via the informal system. It became quite clear during the research that if management's information needs were to be met, then either the information flows would have to be created to feed the decision structure, or the decision structure would have to change to meet the reality of providing timely and accurate information.

When this suggestion was put forward it was not welcomed by management. In the first case it was found that restrictions had been placed on the flow of information. Only certain people were allowed certain information. Possession of information became a status symbol which had to be protected. This meant that though information was available in the system it was not available to the people who needed it. In one example a quarry manager was only supplied a monthly cost sheet showing a comparison of actual costs with budget. He was not shown the sales and profits for the quarry. Because of the large fixed cost element in quarrying, if the manager was overspent it usually meant he had made more profit. Finally the manager, who already had the sales tonnages, built up his own information for sales and profits. Even though this information was crude, he found it helpful, eventually he would argue with the accountants on the accuracy of his information compared to the official accounts.

These problems of status and availability were defined during the research and it was suggested that in future developments the needs for information should be closely related to the manager's decision responsibilities and that these should form part of his job description.

6.2 Decision Responsibilities



There were several secondary objectives for the research which related to the managers themselves and their attitudes and approaches to the question of decision responsibility and their use of information for decision making. These were:-

1. To determine whether managers are aware of their decision responsibilities.
2. To establish if decision responsibility is given to or acquired by managers.
3. To determine the relative level of decisions responsibility vis a vis the availability of information.

In the interviewing phase of the research managers were asked to produce the copy of their job descriptions, as mentioned earlier only twenty seven were able to do this. In these instances the job descriptions did not contain any guidance on the manager's decision responsibility. There was an indication of general responsibilities, levels of authority for expenditure and even tasks they had to carry out within the next twelve months.

The managers, whether with or without job descriptions, had to assume responsibility for the decisions they considered necessary to do their job. They did this on an ad hoc basis without consciously examining their decisions as part of a wider decision structure. Because this process was so ad hoc the managers were not aware of the extent of their decision responsibilities until this research highlighted the relationship between information and decisions.

When initially asked what decisions they took the usual response was, "I don't really know, I've never thought about it before". When asked what decisions they had been asked to take or that had been clearly allocated to them, they generally answered that they couldn't remember or none.

As the research progressed it became apparent that the managers present decision responsibilities had been acquired over a period of time.

The managers were all asked if they had been given a clear brief as to their decision responsibilities when they first took the job. In every case the answer was no. They all said they were told what the job was and had their own ideas as to how it should be done, and that they had gone on from there. This was undoubtedly one of the reasons why decision areas were seen to overlap and conflict, which has consequently led to some confusion in the information flows.

This was exacerbated by a tendency of managers who were promoted to take certain decisions with them when they moved. This apparent problem of relinquishing responsibility was highlighted in the autocratically managed division.

In many cases managers complained bitterly of the demands made upon them for information by senior management. In many cases they felt that they had already taken the relevant decisions and that the information required further up the line was not necessary to the senior managers' needs.

This is one of the areas which has given rise to considerable discussion in the organisation. A major question has arisen as to whether information, having reached its decision point, and having been used in the decision-making process, should flow onwards to a higher level in the same amount of detail.

In many instances, by looking at the information needs of decisions at the higher levels, it can be clearly seen that the information needed is a more highly summarised version of that needed lower down. However, as managers move up the hierarchy they tend to request the detailed information they are used to receiving.

Apart from those instances where information was restricted, it had been made available to managers as they requested it. A number of examples have come out of the analysis which clearly showed that often management needing information did not have it, whereas other managers who did not need or want that information had it available. Such discrepancies in the information flows are almost certain to occur in the ad hoc way in which systems have developed and have been designed to meet individual manager's needs. Without a complete framework which analyses information flows and matches them to decision needs, it would be impossible to avoid discrepancies and overlapping in the flows that took place.

Information needs do, of course, change, particularly when managers change jobs. A report which was considered vital by the previous manager may be considered useless by the new one. In two instances where management changes took place during the research, the managers concerned were interviewed or re-interviewed and in each case the decision grid looked quite different from that of the predecessor. This suggested that different managers saw the decision responsibilities of the same job quite differently and that this was a contributory factor in their changing information demands. This tended to confirm the validity of relating information to decisions in such a way that the information needs of any grouping of decisions could be clearly established.

6.3 Information Analysis, a Method

One of the primary objectives of the research was to produce a method for the definition and analysis of management information needs. It is believed that the methods used for collecting data and subsequent analysis have proved effective, and could be applied in any organisation.

The critical phases of the research namely:-

- a) the dialogue with management,
- b) the data recording documents, and
- c) the method of analysis of information flows,

could be used by any trained analyst, who had a good understanding of the system.

The use of questionnaires linked to computer-based analysis was considered and rejected for the following reasons.

- a) the highly subjective nature of the research;
- b) the difficulty of explaining the subject to management;
- c) the lack of involvement with each manager in identifying his needs;
- d) the problems of consistency in interpretation and analysis.

With these problems in mind a method had to be designed which coped with the considerable volume of detailed data that would be produced.

The very complexity of the task of defining management's information needs demanded an approach which was highly structured and which allowed each stage of analysis to be linked to the next, more detailed and more complicated stage. This research programme has provided such a method of analysing information needs. .

The step by step analysis, starting with the management dialogue and moving through a number of stages of detailed recording has led, finally, to the specification of information needs, both in terms of the recipient and also in terms of the provider. It has tied these needs closely to the systems framework which will be used to meet the needs of both. Such a result has provided a tool for the information analyst that up to the present time has not been available. The step by step approach used in this research programme can be adapted to any situation that requires a similar analysis to be carried out. The industry or the environment would not preclude this precise analytical procedure from being followed.

Interest has been expressed by a number of companies requesting information on the research and at least one major company, The Chase Manhattan Bank of New York, is carrying out information analysis projects based on the methods outlined in the author's paper presented to the NCC in New York.

This step by step analysis has now been prepared in the form of a detailed working guide which can be applied in any organisation where there is a requirement to define management's information needs. This guide is set out in Chapter 8.

6.4 A Blueprint for Systems Design

There would be limited value in defining management's information needs if information systems could not be designed to meet them. This was in fact one of the main reasons for Tilcon sponsoring the research. It would in fact seem obvious for needs to be clearly defined before systems are developed and yet it was clear from the research that the systems had been designed on an "overkill" basis of providing as much data as possible in the hope that management would find a use for it.

Developing effective information systems from the analysis of needs is done in three stages.

1. The design of a detailed systems framework.
2. The development of individual sub-systems within the framework.
3. The matching of identified information needs with the framework.

Systems Framework

A systems framework is more than simply a list of systems, it is a more detailed and involved three-dimensional framework (FIG. 20) which provides the linking mechanism between different systems. This linking mechanism travelling in several directions is information. It is essential, therefore, for any company to develop such a systems framework, to be able to understand the way the information flows between the different decision points within the framework. Without such information it would be very difficult for any company to develop a coherent systems framework which meets the needs of its management.

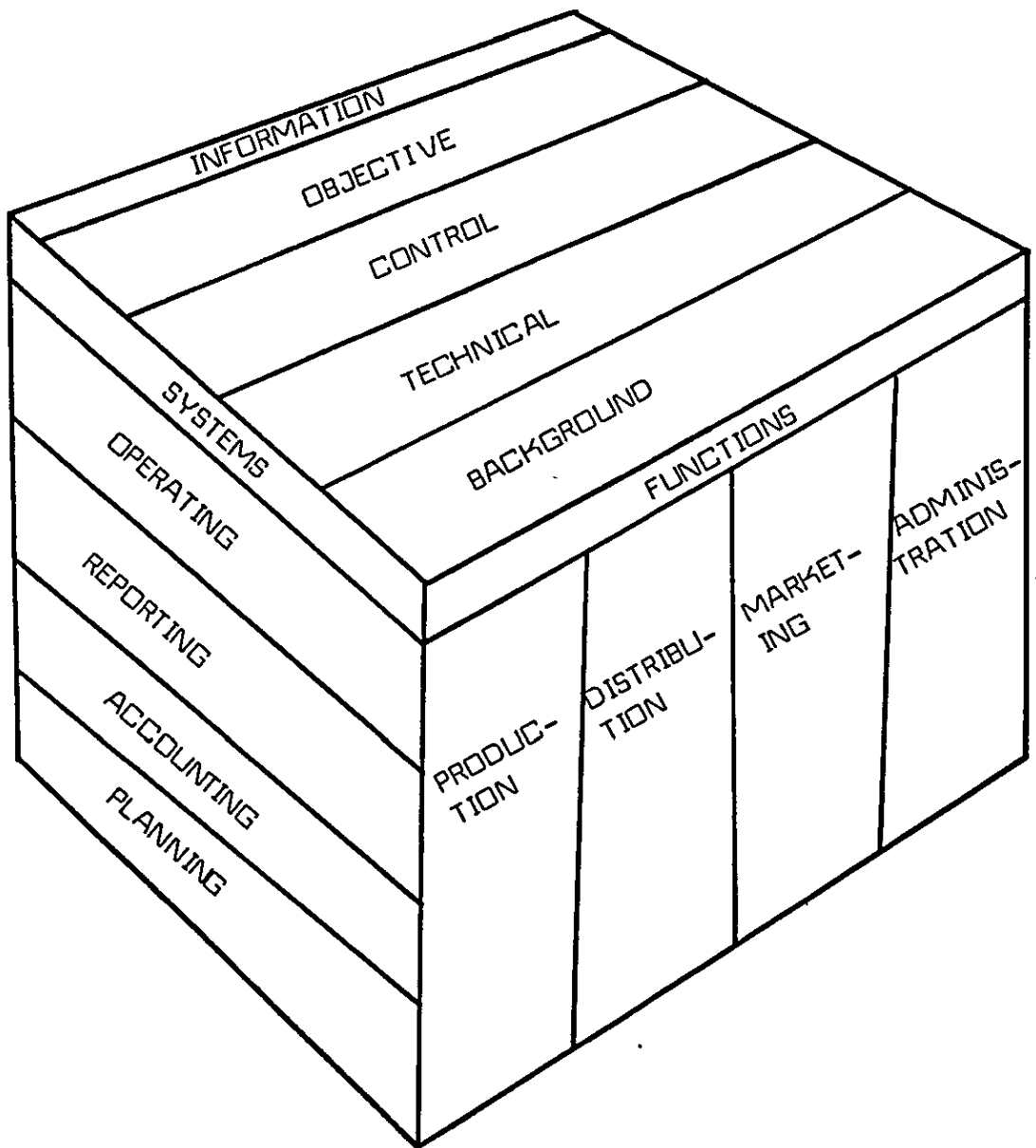


FIGURE 20

Three Dimensional Systems Framework

Sub-Systems

This basic framework can now be used as a basis for the development of systems. This is not only in terms of those systems which require development, but also in assessing the priority, by looking at the need currently not being satisfied in important decision areas. The research has also clearly shown that the total systems framework is made up of a large number of sub-systems, each one complete in itself, but feeding data into other sub-systems and receiving its own inputs from related systems. These sub-systems often have been developed for a purpose not related to the information flows, but related more to administrative and control requirements. The information content on many documents is consequently lost to the company by the lack of understanding of its need in other systems.

Where this need has been identified very often the information is being gathered from sources other than those from which it originally stemmed. This means considerable duplication in requests for information from managers, and departments not concerned with the specific sub-system involved. Development of each sub-system can now take place with two distinct objectives;

- a) the specific purpose of the system,
- b) the role of the sub-system within the information network.

Information Needs and the Framework

The systems framework should be seen as skeleton onto which the real flesh of the information system is hung. Such a skeleton should enable management to understand the relationship between separate sub-systems, and the decision points within the framework which are linked by information.

Having identified information needs and related them to individual decisions, it is possible to show the relationship by linking the decisions to the inflows and outflows. From this analysis the decision relationships can be derived and this enables decision grouping within functions and individual manager's responsibilities.

The framework and the linking mechanisms of the information system must provide for the dynamic state of the organisation where change is a constant companion and where speedy reaction to change is often the crucial measure of the efficiency of the systems, which pump the life blood of information through the organisation's veins.

Chapter 7

Analysis of Research Data

7.1 Analysis of Research Data

The objectives and methods

The data collected during the research was used primarily to establish the managers' information needs, culminating in the production of functional information flows. It was realised, however, that the data collected might provide an insight to managers' attitudes towards the decisions they made, with particular emphasis on evaluating complexity and impact.

In order to make such an analysis worthwhile additional data concerning the managers was collected as indicated below.

Age

Years in Company

Years in job

- Education
- None
 - ONC
 - Above ONC
 - Graduate

- Style
- 1. Benevolent Autocrat
 - 2. Democratic
 - 3. Autocratic

Function

- Level
- 1. General Manager
 - 2. Senior "
 - 3. Middle "
 - 4. Line Manager

With this additional information it would be possible to test the significance of the variable factors on the managers' attitude towards the selection of the appropriate value in the Key Decision Grid.

The analysis set out to examine the following factors:-

1. The degree of difference between different managers.
2. The degree of consistency of the managers' attitudes towards the decisions.
3. To establish the significance of the variables listed above on managers' attitudes towards the decisions.

The analysis is based upon the responses from 58 managers taking a range of 61 decisions, producing a total of 555 decision points on the key decision grid matrix.

For the purpose of the analysis the key decision grid was converted into a matrix as indicated below:-

	Y				
Complex	3				
Routine	2				
Mechanical	1				
		1	2	3	X
		Minor	Important	Vital	

The X axis indicates the impact of the decision -

1. - Minor
2. - Important
3. - Vital

The Y axis indicates the spectrum complexity of the decision -

1. - Mechanical
2. - Routine
3. - Complex

The analysis was carried out in three stages.

1. Tabulation of data and the calculation of X^2 measure of significance.
2. Correction of data by calculation of the error from the mean, correcting for -
 - a) Decisions
 - b) Decisions and Managers.
3. Multiple regression analysis to establish the significance of the variables listed on page 133.

The results of this analysis are discussed in four main sections.

The directional bias in the selection of values for impact and complexity.

The ability of managers to make judgements on the impact and complexity of decisions.

The predictability and realism of management attitudes.

The implications of style and level of management on decision judgements.

7.2 Directional Bias

The analysis of the data shows that there is a directional bias on the matrix towards the selection of more complex and more important decisions. This is shown below.

					Sub-Total
Y					
Complex	3	Ø (7)	104 (8)	99 (9)	203
Routine	2	20 (4)	260 (5)	44 (6)	324
Mechanical	1	18 (1)	10 (2)	Ø (3)	28
Sub-total		38	374	143	555
		1	2	3	X
		Minor	Important	Vital	

By using the X^2 test of significance it was shown that there was a very high degree of significance in the selection of the appropriate decision value and that the selection was extremely unlikely to be random.

This would seem to imply that managers sought to show how valuable their decision making role is by indicating that their decisions were more complex and more important, or even vital. It is interesting that no managers felt that any of the decisions they took were complex but of minor impact, or mechanical and of vital impact.

It is also interesting to note that nearly half the choices landed in the centre of the matrix which might be due to two possibilities:-

1. That a large proportion of decisions are routine and important;
2. That the managers felt it safest to select the middle value.

There is no doubt, however, that the managers interviewed clearly judged the decisions they took to be of significant importance to the company and their activities.

The distribution curve of responses is highly skewed in the direction of the complex decision of high importance. (FIG. 21)

It is appreciated of course that with only nine discrete points in the matrix the curve is somewhat artificial, but the X^2 test shows it to be highly significant.

The interviewing process was designed so that each manager had to select the values for the decisions he took without any knowledge of the values placed on similar decisions by other managers. He was making his judgement solely by comparison between the decisions he took and his own attitude to decisions.

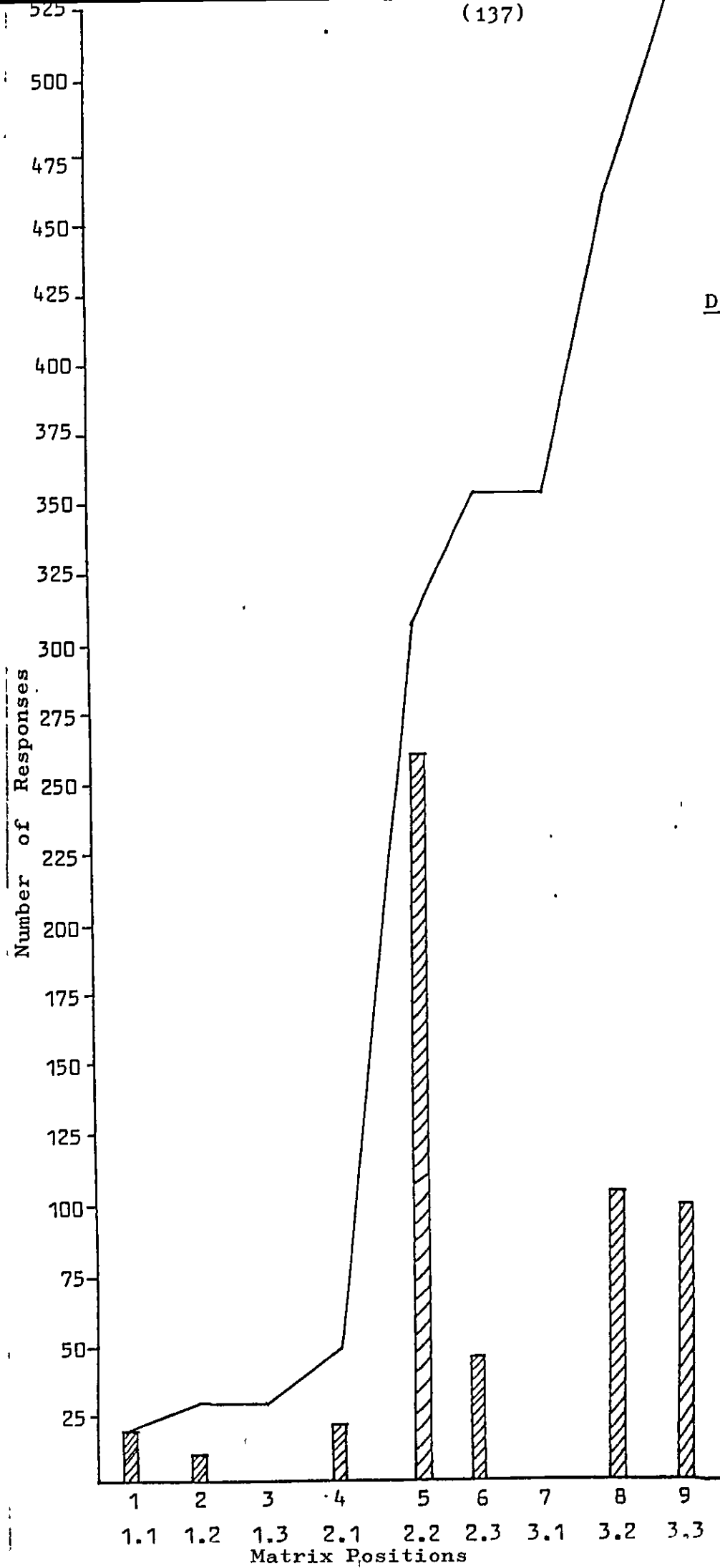


FIGURE 21
Distribution Curve
of Responses

7.3 Attitudes towards Complexity and Impact

The analysis showed that the deviation from the \bar{X} was less than the deviation from the \bar{Y} thus indicating that the managers were more consistent in the selection of the importance of the decision than the type of decision.

It may also imply that they felt unable to push up the "Importance" of the decision excessively but felt that they could say that a decision was "complex" without any contradiction.

Number of decisions stated to be vital = 143

Number of decisions stated to be complex = 209

This leads to the supposition that though managers are aware of the importance of the decisions they take they are less aware of the type of decision they are taking.

This effect was noticed during the interviewing when on several occasions managers found difficulty in deciding whether a decision was mechanical or routine, or whether it was routine or complex.

As the type of decision affects the frequency, timing and type of information to be supplied to the decision point, it would seem that this lack of understanding of the type of decision could be a cause of the inadequacy of many information systems.

7.4 The Predictability and Realism of Management Attitudes

The multiple regression analysis of the variables listed on page 129 indicated that the effect of style and level of management was highly significant, on the data corrected for managers' deviation.

When the data was corrected for both managers' and decision deviation the effect of level and function became the highly significant variables.

This analysis would seem to indicate that senior managers with "nothing to prove" were more realistic in their attitudes towards the selection of complexity and impact. In addition the analysis placed significant emphasis on the effect of style and level and this has been analysed further. (See next section.)

The significance of the factors varied between the X and Y axis and for the fully corrected data the significance of level was more noticeable for the X axis, and function was more significant for the Y axis.

This suggests that the choice of the importance of decisions was more affected by the level of the managers and the choice of type of decision more affected by function.

This seems a perfectly acceptable suggestion as one would anticipate that the importance of decisions would be more appreciated by more senior managers and that each manager would be more aware of the types of decision taken within their function.

Perhaps one of the most interesting points to emerge from the multiple regression analysis was the lack of significance of such factors as age, experience and education on the attitudes towards decisions.

However, this lack of apparent significance may partly be explained by the auto-correlations between factors. For example, senior managers tend to have had long company service and to be older than their junior colleagues. Since educational pattern is highly correlated with age, educational pattern is also correlated with managerial seniority in the company. This association between management level and other factors tends to mask the apparent effects of age, education, etc.

Undoubtedly the most important factor to emerge is the high significance of style and level of management involved in the decision making hierarchy.

7.5 The Implication of Style and Level of Management on Attitudes

In Chapter Four (page 94) It was stated as follows:-

"It was apparent in a number of instances that managers who were close to the action were not taking the decisions, either because they were unable to because of lack of information, or because they had been instructed not to. This did, of course, depend upon the particular style of management".

Further on in Chapter Four (page 95) comments were made on the impact of management philosophy on managers' attitudes and these can be summarised as:-

Democratic - more open, willing to talk.

Benevolent autocrat - difficulty sorting out decisions.

Autocratic - were suspicious and assumed a degree of futility.

In Chapter Two (page 49) and Chapter 6 (page 123) it was further stated that -

"Managers tend to take decisions with them as they move up the hierarchy."

These general views and comments ought to be supported by the analysis of style and level on attitudes and as the multiple regression analysis indicated there was a high significance, it was decided to analyse the data further.

The first question asked was -

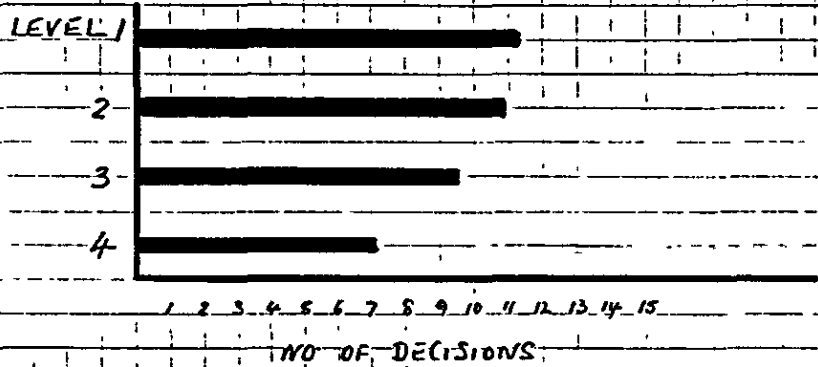
As seniority increases do managers take more or less decisions?

The data was analysed as indicated over and the trend was shown to be significant by using the X^2 test.

The answer to the question is yes. Managers do tend to take more decisions at higher levels.

SIGNIFICANCE OF LEVEL - ALL SALES

LEVEL	1	2	3	4	TOTAL
Nº OF DECISIONS	34	186	258	77	555
Nº OF MANAGERS	3	17	27	11	58
AVERAGE Nº OF DECISIONS	11.3	10.9	9.5	7	9.6



- LEVEL 1 - MANAGING DIRECTOR
- 2 - SENIOR MANAGER
- 3 - MIDDLE MANAGER
- 4 - LINE MANAGER

FIGURE 22

The second question asked was -

"Does style of management have any implication on this general trend?"

A similar analysis to that shown in FIG. 22 was carried out for each style of management, i.e. Benevolent Autocrat, Democrat and Autocrat.

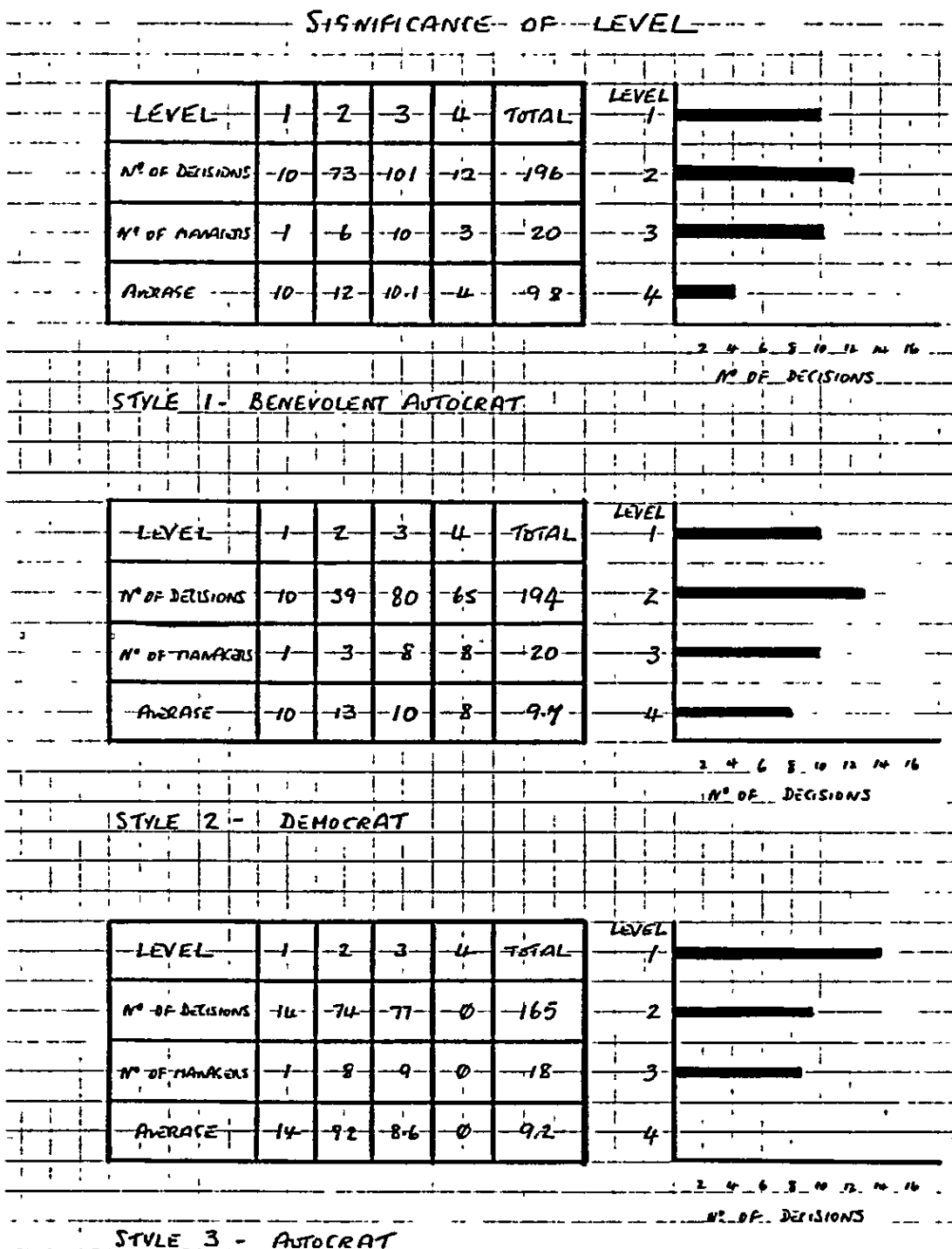


FIGURE 23

The results shown in FIG. 23 indicated that:-

- a) In the division managed by the benevolent autocrat decisions were fairly evenly spread over the top three levels of management, but with line managers taking fewer decisions.
- b) The democratic manager had a much wider delegation of decisions to all levels but with senior managers taking the biggest load.
- c) In the autocratically managed divisions the Managing Director took the bulk of the decisions delegating fewer decisions to lower levels of management with line managers taking no key decisions.

These trends were tested using the X^2 test and all were shown to be significant, which would indicate that style has a substantial effect on the spread of decision taking. It can also be seen that if we remove the data collected in the autocratic division, then the answer to our first question on seniority would change to indicate that the bulk of key decisions are taken by senior management and not the managing director, which is a perfectly acceptable suggestion where democracy and consensus is the order of the day.

Conclusion

The mathematical analysis of the research data has provided several important indications of the implication of style and level of management on decision making attitudes.

It has provided sufficient evidence of consistency of management attitudes to indicate the importance of analysing the decision structure before attempting to analyse information needs.

It has further shown that the approach followed by the researcher was free from bias, other than that introduced by the managers themselves, and that the data collected can be used to formulate the framework for an effective information system.

Chapter 8

A Method for Defining Management Information Needs

8.1 A Method for Defining Management Information Needs

This chapter describes the way in which the research has been distilled into a straightforward procedure for Defining Management Information Needs. Such a procedure can be used by any analyst who understands the role of information systems in an organisation. It is a valuable tool for analysis and synthesis of a most difficult area for the systems designer.

The procedure as set out in this chapter has been published by the Institute of Cost and Management Accountants as an audio visual training programme including tape cassette and colour slides. (29)

Introduction

Most if not all businesses have some form of information system.

The system might be a bad one because it does not meet management's needs, even though there is a great deal of information available.

Or it might be a very good system because it meets all management's information needs, though there may well be information available which is not necessary.

It is more likely, however, that the system will fall somewhere in between these two extremes, with some of the information meeting some of the needs.

The job of the information provider is to see that as far as possible the missing information is found, the useful information is retained and the superfluous information is eliminated. This task is not as simple as it may seem.

The first stage in the search for a solution is to obtain answers to a number of questions.

1. What information is required?
2. When is it required?
3. Why is it required then?
4. What is it for?
5. How can it be obtained?
6. How accurate should it be?
7. What will it cost?

These questions can only be answered if the provider of the information, be it the accountant or systems designer, sits down with the manager and establishes the manager's needs.

It is no good just asking the manager what he wants because he will not know.

Suggesting the information he might need is also doomed to failure for if the manager does not completely reject the suggestions he will still not use the information he receives. Because of these reactions many information systems have been designed to provide what the designer thinks is appropriate.

There is no wonder that information needs are only being partly met. If a reasonably satisfactory answer is to be found it is sensible to try to tackle the problem in a logical and organised way. Whoever designs the system will need a framework in which to work.

We all know that the manager needs information to help him select courses of action, to monitor what happens and to control results. In other words to take decisions.

The relationship of information to decisions is a fundamental and vital consideration in the development of the right approach to the problem. The manager must receive information related to his job, his responsibilities and the decisions which he takes.

8.2 Information & Decisions

There are many separate sources of information open to the manager.

These can be grouped into four main categories.

1. The objectives he has to achieve.
2. Control information.
3. Technical information.
4. Background information.

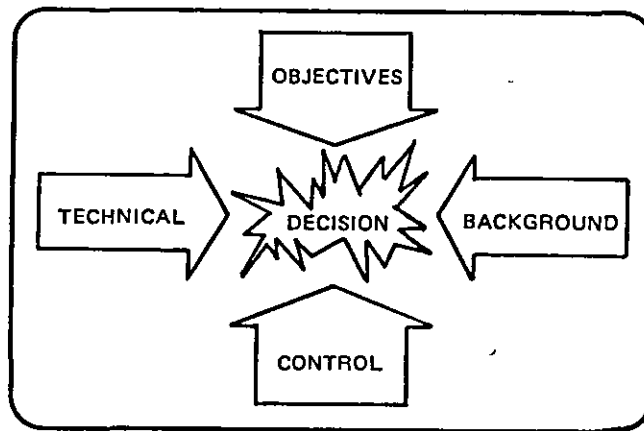


Figure 24
Information Flows

Providing information for decision making requires an understanding of the manager's job and the decisions that he takes. It is only possible to establish information needs when we know the decisions for which the information is needed. This is best done by meeting the manager on his own ground.

During the discussion a Decision Grid is completed. This is designed as a method of recording the decisions taken by each manager, in a way that enables each decision to be categorised. Looking down the left hand column of Fig. 25, the categories are -

Complex: taken frequently, unstructured, depending largely on current circumstances. Unknown information requirement, that is to say cannot be pre-determined.

Routine: taken less frequently dependent on circumstances, but still structured with known data requirements, for example producing a production schedule.

(continued)

Mechanical: taken regularly; highly structured with easy access to the data required, for example authorising the weekly bonus payments.

In addition looking across the grid the manager is asked to say whether he feels the decision is a minor, important or vital decision in the job he does. This evaluation, though subjective, at least enables the subsequent analysis of key decisions to be done.

MANAGER		KEY DECISION GRID		
D HALLSWORTH				
IMPACT SPECTRUM	Minor	Important	Vital	
COMPLEX		2 PLANT IMPROVEMENT 17 MARKETING APPROACH 12 PRICE LEVELS	3 METHODS OF OPERATION	
ROUTINE		18 MONITORING PERFORMANCE 7 EXPENDITURE CONTROL 20 DISTRIBUTION PATTERN 19 TECHNICAL CONTROL (MONITORING) 51 STOCK LEVELS 31 PLANT MAINTENANCE 7 CAPACITY VARIATIONS 10 DEPARTMENTAL INTERACTION	8 APPROVAL OF BUDGETS 29 PROD. BUDGET PREPARATION 57 VEHICLE DISPOSAL/REPLACEMENT 6 STAFF APPOINTMENT 52 CAPITAL EXPENDITURE	
MECHANICAL		9 PAY LEVELS		

Fig. 25 Key Decision Grid

8.3 Information Analysis

When the Decision Grid has been completed the information needs of each decision are analysed on the Decision Information Analysis. (Fig. 26)

The information is entered for each of the four main information flows.

Objectives

Control

Technical

Background

Where possible the source of the information is entered. This is not always known at the time of the interview and has to be completed during the later stage of data analysis.

MANAGER	DECISION INFORMATION ANALYSIS		
DECISION	CAPACITY VARIATIONS		
TYPE	INFORMATION REQUIRED	class	source
Objectives	Budget. Stock limits. Longterm use of resources. Optimum operating level. Quarry breakeven level. Agreed working levels. Maximum permitted hours. Tonnes per hour.		
Technical	Discussion with manager. Current working conditions of face. Number of men needed. Plant capacity i.e. production per hour of each material. Variability of the plant. Ability to move materials. Safety levels. Blasting and drilling programme.		
Control	Stock levels. Demands for additional output : ships etc. Future demand. Stock values. Excess material production. (ie What is not wanted but has to be produced to get what you do want.) The effects on costs, output and profit of various production combinations. Daily report on production. Shortfall on orders in other units. Number of men working. Effects of breakdown on production. Output per man shift. Tonnes per hour.		
Background	General economic situation.		

Class A available and used
B available not used

Fig. 26 Decision Information Analysis

The detailed analysis of the information recorded during the interview presents several problems:

1. A good deal of the information given by the manager is subjective.
2. Though the interviews follow a pattern they are not structured and so cannot be analysed on a statistical basis.
3. Different managers' description and interpretation of similar decisions vary considerably.
4. The description of the information used varies by region, through different reporting structures.
5. Content and frequency of information flows vary in different parts of a company.
6. Managers' titles are not always descriptive of the job, for example a transport manager may be a distribution manager.
7. Managers with the same titles have different jobs.
8. Decision making levels are quite different in different parts of the company.

With these problems it is essential to find a common denominator which will serve as the basis for analysis. Usually the only common denominators are the decisions themselves. The first task then is to analyse the Decision Grids to produce a list of decisions. This is followed by relating the list to each manager's decision grid and then producing a Decision Definition Sheet.

The Decision Definition Sheet is fundamental to the analysis procedure.

It contains three main sections:

first, a definition of the decision.

second, the type and impact of the decision.

third, who the decision is made by.

The decision definition is produced by examining the interview notes to expand the brief decision title used on the key decision grid.

The importance of the decision is arrived at by placing a tick in the matrix position in which each manager who took the decision had placed that decision on his individual grid.

The illustration (Fig.27 shows that nine managers consider the decision is complex and important. One manager believes it is complex and vital. Ten managers think it is a routine decision, but still important. In this way a consensus is produced.

This part of the definition leads to the selection of the key decisions by looking at those decisions which fall into the shaded area.

The section which records who makes the decision is simply a list of the managers, by name, who claimed to make the decision during the interview.

DECISION		CAPACITY VARIATIONS	
DEFINITION			
<p>Deciding upon the capacity to be available to each unit by -</p> <ul style="list-style-type: none"> a) controlling the manpower, b) controlling the level of mobile plant, c) deciding to optimise operating levels for the unit concerned. <p>This decision area will deal with -</p> <ul style="list-style-type: none"> i the number of men, ii the hours worked, iii no. of items of mobile plant, iv the transfer of plant from one unit to another. 			
IMPORTANCE			
IMPACT SPECTRUM	MINOR	IMPORTANT	VITAL
COMPLEX		////////	✓
ROUTINE		////////	
MECHANICAL			
MADE BY			
W. Massey W. Appleby G. Williams A. Lakin N. Place S. Philips J. Bairstow		D. Hallsworth A. Allen D. Wingfield H. Ginnie A. Brown L. Parry	
		M. Hopperton W. Henderson J. Hutton P. Logan J. Jamieson B. Taylor D. Brown	

Fig. 27

Decision Definition

The back of the Decision Definition is a Decision Information Analysis.

This forms a summary of all the information different managers said they needed to make the decision, under the four headings which have already been mentioned:

- objectives to be achieved,
- control information required,
- technical information needed, and
- background information which is useful.

8.4 Management's Information Needs

The specific information requirements of management can now be established by analysing the information contained on the back of the Decision

Definition by taking the following steps:-

- Step 1 Sort decision definitions into functional groups.
- Step 2 Prepare a sheet for all the information required by that functional group, for example, production.

The details for this will be extracted from the decision information analysis on the back of the definition sheet.

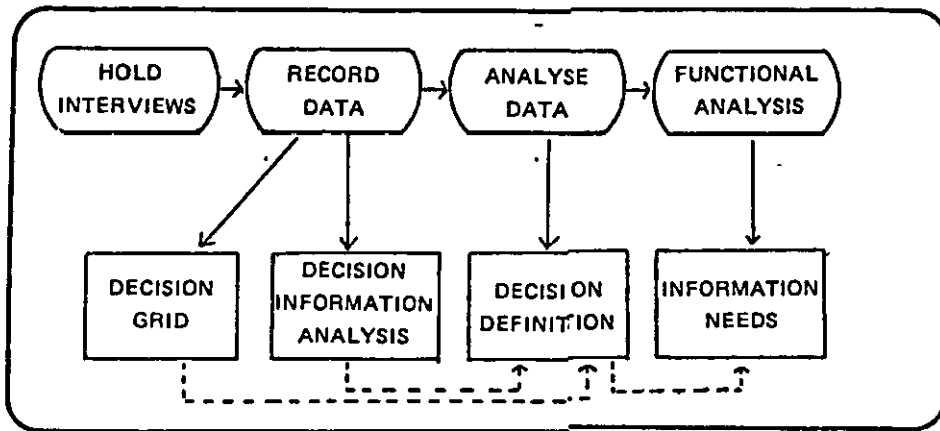
- Step 3 The information is then analysed according to the function which needs it, using a document called "Information Needs."

Inflows to one manager are often also outflows from another manager so by re-arranging the information listed as inflows it is possible to establish each manager's outflows.

The complete information analysis process which has been carried out comprises a number of steps.

- Step 1 Hold interviews with managers.
- Step 2 Record the data on the Decision Grid and then analyse it into the Decision Information Analysis.
- Step 3 Working from the Decision Grid and the Decision Information Analysis, produce the Decision Definition.
- Step 4 The fourth and final step is to prepare the document called Information Needs for each separate function of the company.

Once this analysis is complete attention can be directed to developing systems to provide the information required and to stop producing the information considered to be unnecessary.



The systems designer, by using the approach suggested earlier, should have obtained answers to the following questions:

What are the key decision areas at each level of activity?

What information is required to make the decision?

What information is lacking?

Can it be obtained and at what cost?

Does it mean amending existing systems or introducing new ones?

A systems framework can be established which will indicate what work has to be done to provide the needs of management. Existing systems cannot be withdrawn and replaced overnight, so a plan has to be formulated. This is done in two stages.

Stage 1 Prepare an improvement programme indicating the priority areas.

Stage 2 Simplify the existing procedures.

8.5 Conclusion

A detailed review of decisions and information needs will undoubtedly produce a different opinion from the one already held, of the way in which company systems are structured.

The design of effective information systems depends upon a clear understanding of,

- their purpose,
- the need of the users,
- the timescale.

These three factors are crucial to the success of any systems development programme. Each system must achieve its purpose and at the same time link with the next level so that information flows smoothly through the organisation being used as and when appropriate.

Developing new information systems should be a process of evolution.

There are several reasons for this.

1. People do not welcome change unless it occurs slowly.
2. There is a considerable amount of work to be done and it can't be done overnight.
3. People have to learn new methods and this takes time.
4. The existing system must continue.

The process of change must be carefully handled if management are to be provided with:

- The right data, at
- the right time, in
- the right place, for
- the right reasons.

Chapter 9

General Conclusions and Suggestions for Further Work

General Conclusions and Suggestions for Further Work

9.1 Information Needs can be Defined

The conclusions that can be drawn from this research are as follows:-

- a) that management's Information needs can be identified;
- b) that Information needs can be related to specific decisions;
- c) that these decisions can be formed into an appropriate decision hierarchy;
- d) that a systems framework based on the information flows in a company can be designed;
- e) that information needs can be related to managers' jobs by looking at the decision grouping;
- f) that information flows, both in and out, can be defined for each management job;
- g) that knowledge of the information needs of specific decision areas is fundamental to the effective design of information systems.

In addition, the research has shown how step by step analysis can provide the means of producing a very sound base for the development of information systems giving due cognisance to the needs for balanced systems of both formal and informal information flows and indicating how formal systems can be devised to meet the needs of management efficiently and effectively.

Management's information needs will naturally vary considerably dependent upon the environment in which the organisation operates. It would be extremely difficult to translate the information needs for decisions across organisational boundaries, even if the decision definitions appeared similar.

It is, however, perfectly feasible to use the methods designed in this research to identify the information needs of any group of managers. There are, however, a number of constraints which would have to be overcome before this could be achieved. These fall into four categories.

- a) Organisational.
- b) Social.
- c) Political.
- d) Knowledge and Training.

Organisational

It is necessary to obtain a total commitment of top management before a survey to identify information needs could be carried out. The management would have to be prepared for a most searching review which is almost certain to find things which they would rather have remained hidden.

The investment in time and money that would need to be made would only be recouped if the management were prepared to act upon the recommendations, including considering changing the decision structure as well as re-designing information systems.

Social

People are generally resistant to change. They feel threatened by the prospects of having to cope in a new environment. They worry about the implications on their present security and their future potential. These social problems exist in every survey which is involved with change, but in a survey as fundamental as the one described in this research it is even more important that the social problems are overcome. If they are not then the high level of co-operation required to make the project a success will just not be forthcoming.

Political

There is no way that such a detailed survey can avoid some involvement in the organisation's politics. Managers will try to use the opportunity to play politics and to attempt to improve the way they appear to other managers. The analyst will have to be particularly aware of political implications and to make sure that they do not affect the relevance of the work being done.

Knowledge and Training

The knowledge and training of the analyst must be such that he is a skilled interviewer and has sufficient knowledge of the functions of management. He will also require some knowledge of the individual organisation and if he is not already a member of the management team, he will have to obtain such knowledge by a preliminary review. The analyst will also need an extensive knowledge of the relationship of information to decisions as well as knowledge of the systems design.

The managers who will be involved in the survey will also need some additional knowledge and training and this can be built into the initial stages of the survey as it was in this research.

These constraints can all be overcome as evidenced by the success of this research project, but they must not be underestimated. The stability and soundness of any structure is dependent upon the foundations that are laid and this is particularly true of research projects of this nature.

9.2 Consequences of Information Analysis

A survey as detailed and thorough as the one described here will have a number of consequences which the company concerned will have to handle.

These consequences will affect three areas of the business.

1. The information system.
2. Management attitudes.
3. The decision hierarchy.

Information Systems

The company applying the techniques described in this research will almost certainly find, as Tilcon did, that their present information systems are inadequate.

The problems of using the present system will be highlighted and managers will be keen to develop improved systems to meet the needs that have been identified.

This was perhaps the most significant effect at Tilcon leading to the further work described in the next section.

Management Attitudes

Management attitudes are likely to be affected in two ways:-

- a) Their approach to decision making;
- b) The decisions they take.

The first consequence of the research on the manager was demand placed on him to examine the decisions he took and the way he used information to take the decision. The effect of this self-appraisal of his job was to open the manager's eyes to the role he plays and the way he plays it.

In Tilcon the effects varied from surprise to shock. One manager who had been thinking about his job before the interview, wrote a memo to the researcher suggesting that there was no point to the interview as he couldn't think of a single decision he made.

In most cases managers will discover that they are taking decisions at the present time, without crucial information. This became apparent when the information needs of managers in similar positions were compared on the decision definition sheets. On checking back with the managers they either agreed that the information used by the other manager was useful or occasionally commented -

"Goodness knows what he needs that information for."

The fact that different managers approach similar decisions in quite different ways was illuminating to everyone involved in the survey. This has led not to a regimentation of decision making methods, but to a better understanding of the need for the information system to be flexible enough to provide individual managers with the information they need.

The Decision Hierarchy

No matter where this technique of analysis is applied, there will be a need to review the decision hierarchy. This could involve several steps.

1. A discussion among managers to resolve overlapping or conflicting ideas of who is responsible for what decisions. This could lead to the next step.
2. A re-structuring of the decision hierarchy to remove misunderstanding.
3. The third and more wide-reaching step would be to re-think decision levels and to re-structure the decision hierarchy to place decision making closer to the source of information.

In Tilcon all three steps have been taken in one or other of the Regions involved in the research.

The Region managed autocratically took the first step to clarify the overlapping decision areas, and in most instances the senior manager involved took clear responsibility for the decision.

In the Region managed by the benevolent autocrat the decision hierarchy was amended in areas of conflict to place the decision where it was felt it was most appropriate.

In the democratic Region the Managing Director had already started to re-organise activities and the research added additional fuel to his argument that managers down the line should be given more power and authority.

Naturally such changes do not always stem directly from the research project. They filter gradually into the system of change as managers' attitudes change.

9.3 The Value of the Research to the Systems Designer

Design is concerned with function and elegance. Function is what the design has to achieve, the objective and elegance is the way that it is achieved. This is as true for systems design as any other form of design.

Unfortunately, in the case of information systems design, the designer can be so overwhelmed by the elegance of his design that he loses, misunderstands or misinterprets the function.

One of the major benefits of the information analysis approach is that it provides the systems designer with a firm functional framework for his design. He is starting from clearly defined needs and clearly defined information flows that enable him to design each sub-system as a part of a complete framework.

Having a clear definition does not prevent the designer from producing elegant solutions, but it does prevent him from drifting too far from his objective.

In Tilcon the research has provided a firm base for the development of management information systems as part of an overall framework, but in such a way that individual functional needs can be met in full by the appropriate sub-system.

9.4 Suggestions for Further Work

In any piece of research there will be areas that, though of interest and relevant to the work being done, are not of direct concern to the researcher. In this research project a number of interesting areas for further work have been identified. These can be seen in two distinct ways.

- a) further work within the sponsoring company, and
- b) further work of a wider nature with more general implications.

Further Work in Tilcon

The company sponsoring the research now has available a complete schedule of the information needs of the management concerned in the research. It also has a basic systems framework within which individual sub-systems will be designed to meet those needs.

This work is continuing at present in the design of certain sub-systems which have been selected by management as being particularly important in meeting their information needs. The selection of these sub-systems and the priority given to them was based to a large extent on the analysis of information needs which showed up areas of need which were not being met at all, or if they were being met, were being met inadequately by the present systems.

These sub-systems are -

Plant Maintenance and Life Cycle Costing.

Accounting Information.

Sales and Marketing Information.

In the case of the first two items a good deal of basic work is required as over the past six or seven years very little work has been done in this area and inadequate data collection systems need to be put right before management's needs can be met effectively.

In the area of accounting, and sales and marketing a good deal of effort has been spent designing an effective data collection system which has now stood the test of time and is achieving high levels of data accuracy. Because of this it is felt feasible to move on now to provide better information for management linking information on the sales of the company's products with the accounting information to produce reports which analyse the contribution being made by products, customers and market areas. This work is being programmed over a three-year period starting in 1978 with the completion of basic systems work during 1979, and the full operation of the systems during 1980.

By this time it is estimated that 80% of the formal information needs identified by management during this survey will have been met. In addition the opportunity should be there to amend the decision structure and to ensure that the communication system enables information within the system to reach the point where it is needed to take decisions.

Plant Maintenance and Life Cycle Costing

This review, which stems from the M.I.S. survey, will involve detailed examination of current procedures in the Group to establish management's needs in this area. This, together with work already carried out on vehicle maintenance will be put together into a design report indicating alternative approaches which would be taken by the Group to improve information and control in these areas.

This should be linked, as far as possible, with the current work being done in the area of terotechnology and energy conservation, which will initially be primarily concerned with the collection and analysis of basic data for local control. The initial report was produced on 28.4.78.
(See APPENDIX F)

Accounting Information

The systems in existence at the time of the research were a mixture of manual and accounting machine nominal ledgers with the accounting reports being produced manually. All divisions operated their own accounts code system.

It was recommended in a report dated 3.10.78 (APPENDIX G) that new accounting systems should be developed based on a new Group coding structure.

The development of improved accounting systems should be examined in two main sections:-

- a) Improved nominal ledger leading to the production of accounting reports on the computer for those divisions already using the computer based nominal.
- b) The development of local business machines (mini-computers) for those divisions using accounting machines, which will be capable of being linked to the main computer for the transfer of information from central files to the local machines.

These developments are well in hand and will be completed by the end of 1980.

Sales and Marketing Information System (SAMY)

During the research a good deal of work had been done on producing an improved sales data collection system, and it was proposed that this should be extended to provide marketing information.

The system should be developed in three phases.

- a) Produce the present analysis information whilst introducing new coding into the input.
- b) Introduce a form of interrogation facility which will enable managers to request specific information using a questionnaire style interrogation form.
- c) Provide direct access to computer files.

It was recognised that throughout the phases of the systems introduction a major requirement would be the continuation of the present information flow.

The specific aims of SAMY would be:-

- a) Enhance existing analyses.
- b) Reduce the volume of computer printout by providing interrogation facilities.
- c) Permit the correction of historic data.
- d) Provide a revolving (or moving average) database on the current 12 months information.
- e) Provide printed information in answer to managers' questions.
- f) Produce exception report against pre-determined standards.
- g) Compare actual performance against budgeted performance.

Benefits

The benefits of an information system are often difficult to measure in financial terms. SAMY is no different in this respect. The benefits of the system will arise from meeting the needs of management as detailed below.

Marketing Information Needs

In this research a number of needs were established which could not be met from existing information sources. These needs are concerned with:-

- a) Calculation of product contribution.
- b) Economic trading areas.
- c) Market contribution analysis.
- d) Market distribution analysis.

To meet the above needs it will be essential that a series of linked files (data base) is created on a different basis from that which has been done in the past, which has basically been concerned with the regular production of analyses from each month's data.

The needs expressed by general and marketing management indicated that the information held on the data base would have to be accessible in an almost unlimited number of combinations, with at least a 24 hours response to the request.

Such access will be provided in the new system at three distinct levels:-

- a) Routine reports produced monthly primarily of an accounting nature.
- b) Regular reports produced monthly and possibly weekly providing specific marketing information.
- c) Ad hoc requests covering unspecified combinations of information.

In the case of the ad hoc reporting this would initially be by written or verbal request but could eventually be developed to direct access via terminals if this was considered desirable and economic.

The problem with this kind of system is to justify the cost of its implementation. It is not known whether, by meeting marketing management's information needs as described above, profits will be increased. However, one can only assume that senior management's demands for this form of information are based on their belief that this is precisely what will occur. This decision has already been taken in several divisions where staff are now employed in searching for, analysing and re-analysing marketing information. This is one of those occasions when the decision of management to incur the cost must be seen to be a justification in itself for the expenditure.

The further work that is being done in the company to meet the information needs identified in the research clearly shows the degree of support and confidence which management have given to the research. This is particularly encouraging as often the real benefits of extensive research are lost due to the lack of opportunities afforded the researcher to implement the findings of his research.

In this case the potential for further research outside the company also exists.

Further Areas for General Research

Throughout the research it was quite clear that this particular area of research is really wide open. Little existing research has been done into meeting the specific information needs of management.

Several areas of interest have arisen during the research which would form an excellent basis for further work. These are as follows.

1. The relationship of formal and informal information in the decision making process, and the relative values of each type of information as seen from the decision maker's point of view.
2. It was quite noticeable that different managers in the same function placed the emphasis on different types of information for the same decision. It would be interesting to try to establish, first of all why there were differences in the prime information needs for what was apparently the same decision, and secondly whether or not the results of decisions based on this different information were the same, better or worse.
3. During the research no effort was made to try to analyse the way decisions were made and the criteria by which decisions were arrived at. The point of this research was to establish information needs. It was noticed, however, that very often the criteria for decision making were extremely vague and even in areas where it was apparent that rules could have been established, these rules had not been established.

4. One of the apparent needs of the managers was in training in the use of information. They expressed their needs in a variety of ways, but it was apparent to the researcher that in many cases, though the information was recognised as being necessary, there was considerable doubt or uncertainty as to how the information could best be used to aid the decision making process.

These four areas could be summarised as:-

1. To examine the relative values of formal and informal information to the decision maker.
2. To examine the sensitivity of decision results to the type of information available.
3. To examine why managers were unaware of the criteria for taking decisions.
4. To examine the use of information by the decision maker.

Each of these areas is worthy of considerable further study. The use management make of information is directly linked to the design of information systems. Unless more knowledge on management's use of information is made available, system designers will continue to design information systems which, though based on an analysis of needs, would be rigid unless the sensitivity of those needs and the relative value of the information produced was known.

It is considered extremely important to establish information needs and to meet those needs. But it is also felt that a greater understanding of the needs would lead to even better information systems.

References

<u>Author</u>	<u>Title</u>	<u>Publisher/Date</u>
(1) R.I. Tricker	Management Information and Control Systems	John Wiley & Sons. 1976
(2) James D. Gallagher	Management Information Systems and the Computer	American Management Association, N.York 1961. P. 17.
(3) T.J. Bentley	Designing a Management Information System	Conference Proceedings 1975 O & M International
(4) Charles Stein Jr.	Some Organisational Effects of Integrated Management Information Systems. The changing dimensions of Office Management	Management Report No. 41, American Management Assoc. N.Y. 1960 pp 82-83
(5) R. Beresford Dew Kenneth P. Gee	Management Control and Information	Macmillan 1973
(6) Kenneth P. Gee	Specifying and Satisfying the Control Information Requirements of Middle Management	Doctoral Thesis Manchester University
(7) T. J. Bentley	Designing an Information System that Meets Management's Needs	Management Accountant November 1974
(8) Edward D. Dwyer	Some Observations on Management Information Systems, in Advances in EDP and Information Systems	American Management Assoc. NY 1961 pp 16 - 17
(9) Gerald L. Phillippe	What Management Really Wants from Data Processing Data Processing Today A Progress Report	Management Report No. 45. American Management Assoc. N.Y. 1960
(10) Edward T. Elbourne	Factory Administration and Accounts	The Library Press 1914
(11) Kenneth P. Gee	See (6)	
(12) Peter Drucker	The Practice of Management	Heinemann 1955
(13) C. West Churchman	Managerial Acceptance of Scientific Recommendations	Californian Management Review (1964) pp 31-38
(14) Peter Drucker	Management	Heinemann 1979 p 470

<u>Author</u>	<u>Title</u>	<u>Publisher/Date</u>
(15) Peter P.Schoderbek	Management Systems	John Wiley & Sons 1971
(16) James G. March Herbert A.Simon	Organisations	John Wiley & Sons 1959
(17) Peter P.Schoderbek	See (15)	
(18) Robert L.Johnson Irwin H.Derman	How Intelligent is your MIS?	Business Horizons Feb. 1970
(19) J.W.Konvalinka H.G.Trentim	Management Information Systems	Management Services (Sep-Oct 1975)pp 27-39
(20) John F.Burlingame	Information Technology and Decentralisation	Harvard Business Review (Nov - Dec 1961) pp 121 - 126
(21) Adrian M. McDonough	Information Economics and Management Systems	McGraw-Hill 1963
(22) W.R. King	Probability for Management Decisions	John Wiley & Sons 1968
(23) Peter F.Drucker	Management	Heinemann 1955
(24) R. I. Tricker	See (1)	
(25) Machiavelli	The Prince	Penguin 1961
(26) Trevor J.Bentley	Report on "Development of Group Systems"	21.2.73 Tilcon
(27) Trevor J.Bentley	" " "	17.5.73 Tilcon
(28) William M. Zani	Blueprint for MIS	Harvard Business Review Nov/Dec 1970
(29) Trevor J. Bentley	Defining Management Infor- mation Needs (an Audio Visual training programme)	I.C.M.A. 1979

Bibliography

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
ACCA	Electronic Data Processing	Penguin
Ackoff, R.L.	Management Misinformation Systems	Management Science December 1967
Ackoff, R.L.	Towards a System of System Concepts	MS July 1971 661 - 671
Albrecht, L.K.	Organisation & Management of Information Processing Systems	Macmillan 1973
Alexis, Marcus, Wilson, C.S.	Organisational Decision Making	Prentice-Hall 1967
American Institute of Certified Public Accountants	Management Information Systems for the Smaller Business	N.Y. The Institute 1969
American Management Association	Advances in EDP and Infor- mation Systems	N.Y. The Association. 1962
American Management Association	Computer-Based Management for Information and Control	N.Y. The Association. 1963
American Management Association	Advances in Management Infor- mation Techniques	N.Y. The Association. 1965
Amey, L.R.	Readings in Management Decision	Longman, 1973
Andrew, J.I.	Planning & Flow of Corporate Information	Accountants Weekly 2 Feb. 1973 18-19
Ansoff, H.I.	Business Strategy	Penguin 1969
Ansoff, H.I.	Corporate Strategy	McGraw-Hill 1965
Anson, C.J.	Profit from Figures	McGraw-Hill 1971
Anthony, R.N.	Planning & Control Systems	Harvard University Press 1965
Appleby, R.	Modern Business Administration	Pitman 1976
Ashton, D.	Management Decisions	M.C.B. 1970

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Athananslades, J.C.	The Distortion of Upward Communication in Hierarchical Organisations	Academy of Manage- ment Journal, June 1973
Avots, I.	The MIS Mystique: How to Control It	Management Review Oct '70 32-40

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Bahiri & Martan	Effective Costing Through Productivity Costing	Incomtec 1968
Bahiri & Norman	Productivity Measurement and Incentives	Balleriols 1974
Baker, N.R. & Freeland, J.R.	Structuring Information Flow to Enhance Innovation	Management Science Sept. 1972 105-116
Banbury, J.	Unknowns in MIS	Data Processing July/Aug '71 272/4
Barnett, Arnold	Preparing Management for MIS	Jan '72 40-43
Barnett, John H.	Information Systems: Breaking the Barrier	Journal of Systems Management May '69 8 - 10
Barrington, R.L.	Impact of Computers on Management Information and Decisions	Wolverhampton Inst. of Cost & Works Accts. Conference 1970
Bates, W. S.	Security of Computer Based Information Systems	Datamation V.16 No. 5 May '70 Page 60
Battersby, A.	Sales Forecasting	Penguin 1970
Bedford, N.M.	The Concept of Management Information Systems for Managers	Management International Review V. 12 1972
Beishon, R.J.	Information Flow & Managers' Decisions	Management Accounting Nov. 1970
Benninger, L.J.	Utilization of Multi-Standards in the Expansion of an Organizations Information System	Cost & Management Jan - Feb 1971 23-28
Bentley, T.J.	Return on Investment "Useless" in Assessing Performance	Management Accountant May 1973
Bentley, T.J.	Designing an Information System that meets Needs of Management	Management Accountant Nov. 1974
Bentley, T.J.	Designing a Management Information System	Conference Proceedings O & M International February 1975

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Bentley, T.J.	Project Control & Development In Practice	Conference Proceedings O&M International Feb. 1975
Bentley, T.J.	Identifying Unnecessary Costs	Management Accounting Dec. 1975
Bentley, T.J.	Developing Management Infor- mation	Accountancy Age December 1975
Bentley, T.J.	Getting Data Right on Time	Accountancy Age 16 Jan. 1976
Bentley, T.J.	Balancing Time Men and Materials	Accountancy Age 20 Feb. 1976
Bentley, T.J.	Cash on Delivery Saved	Accountancy Age 19 March 1976
Bentley, T.J.	O & M and the Management Accountant	Management Accounting May 1976
Bentley, T.J.	The Paperwork Explosion	Management Services May 1976
Bentley, T.J.	Save Cash on Buying	Accountancy Age 11 June 1976
Bentley, T.J.	Defining Management's Infor- mation Needs	AFIP 1976 NCC Conference Proceedings June 1976
Bentley, T.J.	Project Planning & Control	The Executive Engineer June/July 1976
Bentley, T.J.	Computers Too Clever for Man	Accountancy Age 30 July 1976
Bentley, T.J.	Information, Communication and the Paperwork Explosion	McGraw-Hill 1976
Bentley, T.J.	Direct Costing on the Margin	Accountancy Age 10 October 1976
Bentley, T.J.	Coding the Costs	Accountancy Age 13 October 1976
Bentley, T.J.	Flowcharts	Management Accounting October 1976

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Bentley, T.J.	Full Cost or Contribution	Accountancy Age 10 Dec. 1976
Bentley, T.J.	Auditability & Control of Computers	Management Accounting January 1977
Bentley, T.J.	Departmental Efficiency	Management Accounting January 1977
Bentley, T.J.	Return on Capital Employed	Management Accounting March 1977
Bentley, T.J.	You've got to have A.R.P.	Accountancy Age April 1977
Bentley, T.J.	Forecasting through the Past - Darkly	Accountancy Age April 1977
Bentley, T.J.	Systems Design	Management Accounting May 1977
Bentley, T.J.	Eliminating Production Delays	Management Accounting June 1977
Bentley, T.J.	Management & Control of Systems Development	Management Services September 1977
Bentley, T.J.	Introducing Change	Management Accounting October 1977
Bentley, T.J.	Work Study	Management Accounting December 1977
Bentley, T.J.	Abacus	Accountancy Age 1977
Bentley, T.J.	Cost Reduction	Chapter in "Financial Management Handbook" Kluwer-Harrap 1977
Bentley, T.J.	Value Analysis	Management Accounting January 1978
Bentley, T.J.	Charging for Computer Services	Management Accounting February 1978
Bentley, T.J.	Activity Resource Planning	Management Accounting March 1978
Bentley, T.J.	Trimming Down Your Waste Measurement	Accountancy Age 17 Feb. 1978

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Bentley, T.J.	No Hope for Fixed Costing	Accountancy Age 17 March 1978
Bentley, T.J.	What is Indirect Labour?	Management Accounting April 1978
Bentley, T.J.	Who Controls Cost?	Management Accounting May 1978
Bentley, T.J.	Product Diversification	Management Accounting May 1978
Bentley, T.J.	O & M for Accountants	Accountants Weekly May 1978
Bentley, T.J.	Productivity Schemes	Management Accounting June 1978
Bentley, T.J.	How to Cut a Path Through the Paperwork Jungle	Datapro Research USA June 1978
Bentley, T.J.	Everyone Needs a Data Base	Management Accounting July/Aug. 1978
Bentley, T.J.	Management Information Systems	Singapore Accountant July 1978
Bentley, T.J.	Start Thinking About an Efficiency Audit	Management Accounting October 1978
Bentley, T.J.	Project Planning and Control	Management Accounting October 1978
Bentley, T.J.	Preventive Maintenance	Management Accounting November 1978
Bentley, T.J.	Making Cost Control Work	Macmillan, 1978
Bentley, T.J.	Report Writing in Business	ICMA, 1978
Bentley, T.J.	Materials Handling	Management Accounting January 1979
Bentley, T.J.	The Cost of Buying	Management Accounting February 1979

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Bentley, T.J.	Defining Management's Information Needs	Management Services March 1979
Bentley, T.J.	Data Base Security	Management Accounting March 1979
Bentley, T.J.	Chart Education	Audio Visual March 1979
Bentley, T.J.	Knowing how to Delegate	Management Accounting May 1979
Bentley, T.J.	Plant Replacement Decisions	Management Accounting June 1979
Bentley, T.J.	Measuring Product Profitability	Management Accounting July/Aug. 1979
Bentley, T.J.	Benefits of Audio Visual Aids	Training Officer June 1979
Bentley, T.J.	Accountant in Management Services	Accountancy Age September 1979
Bentley, T.J.	Training for Change	Training September 1979
Bentley, T.J.	The Future of the Office	Admin. Management September 1979
Bentley, T.J.	Complex Solutions in Search of Problems	Accountancy Age October 1979
Bentley, T.J.	Space Age Reporting	Accountants Weekly October 1979
Bentley, T.J.	An Audio Visual Presentation Could be the Answer	Management Accounting January 1980
Bentley, T.J.	What Microtechnology Means for the Management Accountant	Management Accounting March 1980
Bentley, T.J.	Choosing Computers	Management Services March 1980
Bentley, T.J.	Obtaining Computer Services	Management Services March 1980
Bentley, T.J.	Advanced Techniques of Financial Planning and Control	Building Society Journal April 1980

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Bentley, T.J.	Advanced Techniques of Financial Planning & Control	Journal-Assoc. of Lecturers in Accountancy March 1980
Bentley, T.J.	Practical Cost Reduction	McGraw-Hill 1980
Bentley, T.J.	Making Information Systems Work	Macmillan 1980

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Bhalla, P.N.	Periodical Reporting and Accounting Systems	Chartered Accountant (India) Aug. '70 101 - 104
Birlea, S, and Petrescu, M.	Computer Networks & Information - Processing Systems in the Economic and Social Management	Economic Computation & Economic Cybernetic Studies & Research Jan. 1972
Black, N.A.	Generalized Data Base Management Systems	IAG Journal V. 4 No.2 1971 149-154
Blanning, R. W.	The Value and Cost of Information	AIIE Conference on MIS October 26, 1967
Blumenthal, S.C.	MIS: Framework for Planning and Development	Prentice-Hall 1969
Bocchino, W.A.	MIS: Tools and Techniques	Prentice-Hall 1972
Bonini, C.P.	Simulation of Information & Decision Systems	Prentice-Hall 1973
Bonney, M.C.	Some Considerations of Cost & Value of Information	Computer Journal V.12 No.2, 1969 Page 118
Boutell, W.S.	Computer-Orientated Business Systems Selected Readings	Prentice-Hall 1973
Bower, J.B. and Welke, W.R.	Financial Information Systems Selected Readings	Boston - Houghton Mifflin 1968
Boyce, R.O.	Integrated Managerial Controls	Longmans 1968
Boyd, D. F. & Krasnow, H.S.	Economic Evaluation of Management Information Systems	IBM Systems Journal March 1963 2 - 23
Bradford University	Case Studies In the Application of Computers to Management	Management Centre Bradford 1967
Brady, D.W.	The Strategic Forces of Profit	Management Accounting NAA February 1971 17 - 20
Bridgman, P.T.	Coming to Terms with Advanced Management Information Systems	ICMA SW Conference October, 1966
Bridgman, P.T. and Green, J. F.	Advanced Management Information Systems	Management Accounting ICMA Nov. 66

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Brightman, R. W.	Information Systems for Modern Management	Collier-Macmillan 1975
Brink, V.Z.	Computers & Management: The Executive's Viewpoint	Prentice Hall 1971
British Institute of Management	Financial and Operating Ratios	The Institute (London) Note 61, 1968
Brown, W.B.	Systems Boundaries and Information Flows	Academy of Management Journal Dec. '66 318-327
Burgstaller, H.A. and Forsyth, J.D.	The Key-Result Approach to Designing Management Information Systems	Management Adviser May/June 1973 19 - 25
Burlingame, J.F.	Information Technology and Decentralization	Harvard Business Review Nov/Dec 1961 121 - 126
Burns, T.J.	The Behavioural Aspects of Accounting Data for Performance Evaluation	Accounting Symposium 1968
Bursh, J.G. and Strater, F.R.	Tailoring the Information System	Journal of Systems Management Feb. '73
Butter, David	Chargeback for Information Systems	Data Processing July/Aug. '73 250-253
Byrne, Mullally & Rothery	The Art of Systems Design	Business Books 1969

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Cahill, J.W.	Building a Common MIS Data Base	Journal of Systems Management USA Nov. 1970
Canning, R.G.	What is the Status of MIS?	EDP Analyzer Oct. '69 Page 1
Canning, R.G.	Various	EDP Analyzer V. 8 Nos. 2, 3, 4, 5. V. 9 Nos. 5 & 6.
Carr, M.R.	A Survey of Management Information and Systems Literature	Computer Bulletin June '71, 218 - 221
Carroll, D.C.	On the Structure of Operational Control Systems	Operations Research & Design of Management Information Systems 391-415
Carroll, D.C.	Implications of On-line, Real-time Systems for Managerial Decision Making	The Management of Aerospace Programs 345-370
Carroll, D.C. & Zannetos, Z.S.	Towards the Realisation of Intelligent Management Information Systems	In Walker 151 - 167
Caruth & Rachel	Business Systems	Canfield Press 1972
Caspole, J.M.	Costing from a Data Bank	NAA Management Accounting July '72 47 - 50
Chacko, G.K.	Computer-aided Decision Making	NY American Elsevier Pub. Coy. Inc. 1972
Chandor, A.	A Dictionary of Computers	Penguin 1970
Chugani, Prakash	Some Design Principles for MIS	Data Processing May-June '72 172/3
Churchill, N.C., Kempster, J.H. & Uretsky, M.	Computer-Based Information Systems for Management: A Survey	NY Nat. Assoc. of Accountants 1969
Churchman, C.W.	Managerial Acceptance of Scientific Recommendations	Californian Management Review 1964

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Churchman, C.W.	The Systems Approach	Dell Publishing Co. Inc., NY 1968
Clarke, B.J.	Capabilities of Computerised Form Management Information Systems	Accountants Journal NZ May 1973 378-381
Clarke, J.	Computers at Work	Hamlyn 1968
Clayton, E.R.	Management Information Systems, Corporate Life	S.A.M. Advanced Management Journal Jan. 1973
Cleland, D.I.	Why Project Management?	Business Horizons Winter '64 81/88
Clifton & Lucey	Accounting and Computer Systems	B.B. 1973
Cloot, P.L.	Management Information: A Systematic Approach	Henley on Thames, Admin.Staff College 1968
Cohen, B.J.	Cost Effective Information Systems	NY American Manage- ment Association 1971
Coleman, R.J. & Riley, M.J.	MIS: Management Dimensions	Holden-Day Inc. 1973
Colt, D.G.	Management Information Systems for Cash Management and Accounts Receivable Application	Management Accounting NAA June 1969 65-8
Conference Board	Information Technology: Some Critical Implications for Decision Makers	N.Y. 1972
Cooke, Graham	Management Information Systems for Action	Australian Accountant June 1973 296/8
Crabb, J.H. and Clarke, B.J.	Systems - Management Informa- tion and Mathematical Simulation	Melbourne, Australian Soc. of Accountants AICA Bulletin Feb.'67
Cyert & March	A Behavioural Theory of the Firm	Prentice Hall NC NJ 1963

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Daniel, Ronald D.	Management Information	Harvard Business Review V. 39, Oct. '61 307 - 340
Daniel, Ronald D.	Management Information Crisis	Harvard Business Review Sep/Oct. '61 111 - 121
Dearden, J.	Myth of Real-time Management Information	Harvard Business Review May/June '65 123-132
Dearden, J.	How to Organise Information Systems	Harvard Business Review, Mar/Apr. '66 65 - 73
Dearden, J. & McFarlan, F.	Management Information Systems: Text and Cases	Illinois, Irwin 1966
Dearden, J.	Computers in Business Management	Dow Jones Irwin Inc. 1966
Dearden, J.	MIS Is a Mirage	Harvard Business Review Jan/Feb 1972
Dearden, J.	Can Management Information be Automated?	Harvard Business Review
Dearden, J. and Others	Managing Computer Based Information Systems	Irwin 1971
De Bono, E.	Lateral Thinking for Managers	
Deckard, N.W.	Capturing the Development Costs of an Integrated MIS	Cleveland, Ohio Journal of Systems Management, 1970
Derman, I.H.	Do you 'MIS'understand? Identify the Disease: Apply the Remedy	Oct. '72 55 - 64 Business Horizons
Dermer, Jerry	Some Misconceptions about the Design of Management Information Systems	Cost and Management Sept/Oct. '72 21- 26
Desmonde, W.H.	Computers and their Uses	Prentice Hall 1971
De Vos, H.	Management Information System Revisited	Journal of Accountancy Aug. '66 82 - 84

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Dewhurst, J. F.	A Framework for the Analysis of Management Accounting Information Systems	Cost & Management. Nov/Dec. '72 28 - 35
Dewhurst	Business Cost Benefit Analysis	McGraw 1972
D'Imperio, M.E.	Information Structures: Tools in Problem Solving	J. of ACM Sigfidet. V. 1, No. 2, Dec. '69
Dobson, R.	Management Information & Accounts	Gee & Co. 1964
Dodd, K.	Computers	Pan 1969
Donald, A.G.	Understanding Systems	Management Accounting Feb. 1970 67 - 69
Donald, A. G.	Management Information & Systems	Pergamon Press 1967
Donald, A.G.	Systems Theory and Management Information Systems: Four Areas for Investigation	Management Accounting Nov. '70, 396-400
Dorricott, K.	Management Information Systems for CAS?	Canadian Chartered Accountant Nov. '71 379-384
Drew, R.B. & Gee, K.P.	Control Information Needs of Middle Management	Management Accounting Apr. '72 89-91
Drew, R.B. & Gee, K.P.	Management Control & Information	London, Macmillan 1973
Drucker, P.F.	The Practice of Management	Heinemann 1955
Drucker, P.F.	Managing for Results	Heinemann 1964
Drucker, P. F.	The Future of Industrial Man	Mentor 1965
Drucker, P.F.	The Effective Executive	Heinemann 1967
Drucker, P.F.	The Age of Discontinuity	Heinemann 1969
Drucker, P.F.	Technology, Management & Society	Heinemann 1970
Drucker, P.F.	The Concept of the Corporation	Mentor 1972
Drucker, P.F.	Management	Heinemann 1974

(195)

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Drucker, P. F.	Drucker on Management	MPL/BIM
Drucker, P.F.	Drucker Talks to Britain's Managers	MPL/BIM
Dwyer, Edward D.	Some Observations on Management Information Systems, in Advances in EDP and Information Systems	AMA NY 1961
Dykeman, F.C.	Financial Reporting Systems and Techniques	Prentice Hall Englewood Cliffs NJ

(196)

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
EDP Analyzer		Canning Publications Vista, California
	New Approaches to Random Access Files	May 1965
	A New Look In Management Reporting	June 1965
	Significant Progress In Optical Scanning	August 1965
	Generalized File Processing Software	October 1965
	New Views on Mass Storage	February 1966
	Trends In Corporate Data Systems	August 1966
	The Corporate Data File	November 1966
	Corporate Data File Design	December 1966
	New Management Reporting Systems	January 1967
	Advances In Fast Response Systems	February 1967
	Building Corporate Data Systems	April 1967
	Data Management: File Organization	December 1967
	Data Management: Functions	January 1968

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Edwards, G.A.B.	The Family Grouping Philosophy	International Journal of Production Research Dec. '71
Elbourne, Edward T.	Factory Administration and Accounts	The Library Press, 1914
Elliott, O.C. and Wasley, R.S.	Business Information Processing Systems	Illinois, Irwin. 1965
Emery, F.E.	Systems Thinking	Penguin 1969
Emery, J.C.	The Impact of Information Technology on Organization	Proceedings of 24th Annual Meeting Academy of Management, Chicago '64
Emery, J.C.	Where do we Stand in Implementing Information Systems?	AFIPS V.40 P. 1967
Emery, J.C.	Integrated Information Systems	Office. Jan 1972 66 - 67
Endrodyt	The Role of Complex Data Structures in Total Management Information and Data Processing Systems	"Comontrol 70" Conf. Hungary 7-11 July 1970.
Enger, N.L.	Putting MIS to Work: Managing the Management Information System	American Management Assoc. 1969
Enrick, N.L.	Why Management Information Systems Fail	ASTME VECTORS 6th Issue 1969
Evans, R.D.	Towards an Integrated Marketing Information System	Chartered Accountant in Australia Apr. '71
Experience gained in the organisation of an integrated financial accounting and information system.		Journal UEC Mar. '72 189 - 195

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Faraday	The Management of Productivity	BIM
Fertig, P.E. and Istvan, D.R.	Using Accounting Information: An Introduction	2nd Edit. NY Harcourt Brace Jovanovich 1971
Firmin, P.A.	The Potential of Accounting as a Management Information System	Management International V. 2 1966 45-55
Firnberg, D.	The Development of a D.B. and a Management Information System	D. Organisation for Maintenance & Access Conf. 1/2 Apr. '70
Firnberg, D.	Computers Management & Information	George Allen & Unwin Ltd. 1973
Fisher, G.H.	Cost Considerations in Systems Analysis	Elsevier 1971
Fredericks, W.A.	A Manager's Perspective of Management Information Systems	MSU Business Topics Spring 1971 7 - 12

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Gallagher, James D.	Management Information Systems and the Computer	A.M.A. NY 1961
Gale, J.R.	Why MIS Fail	Financial Executive Aug. 1968 44 - 48
Gee, Kenneth P.	Specifying and Satisfying the Control Information Requirements of Mid-Management	
Gerdel, J.K.	The Fundamentals of a Management Information System	Office, May 1972 62-3, 149
Gibb, C.	Leadership	Penguin 1970
Gifford, V.A.J.	Business Systems Design: The Structure and Dynamics of Management Information	ICMA 21st Summer School Sept. '70 62-84
Gillert, H.	On the Development of Information Systems	Wehrtechnik (Germany) No. 8, Aug. '72
Goldberg, Walter	Management Information Systems: Selected Papers from MIS Copenhagen '70. An IAG Conference	Princeton, N.Y. Auerbach Publishers 1971
Goldschmidt, Yaaqov	Information for Management Decisions	Cornell University Press 1970
Goode, H.H. and Machol, R.E.	Systems Engineering - An Introduction to the Design of Large Scale Systems	McGraw-Hill, New York. 1963
Gooding, J.	It's No Easy Trick to be the Well Informed Executive	Fortune Jan. '73 85 - 89
Goodman, L.	Man & Automation	Pelican 1957
Gore, W.J. and Dyson, J. W.	The Making of Decisions	The Free Press of Glencoe. Collier Macmillan Ltd. 1964
Gore, W.J.	Administrative Decision Making	John Wiley & Sons Inc. NY 1964

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Gosden, J. A.	The Making of a Management Information Data Base	Computing Decision V. 4, No. 5 '72 20-23
Gosden, J.R.	The New Role of Management Information Systems	4th Generation Computers 75 - 89
Greenwood, W.T.	Decision Theory and Information Systems	Edward Arnold 1969
Grindley & Humble	The Effective Computer	McGraw 1973
Gruber, W.H.	Step-by-Step Management Innovation (Case Study)	Management Adviser Mar/Apr. '72 21-27
Gruenberger, F.	Information Systems for Management	Prentice Hall 1972
Guess, Carr L.	Mis-concept or Misconception	Journal of Systems Management Dec. '72 13/15

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Halford, D.R.C.	Business Planning	Pan 1967
Hamilton, B.P.	Which information for Stock-holders?	Management Accounting Dec. '68 13-16
Hanold, T.	Accounting U.S. Management Information Systems	CPA Journal 1972 557-560
Hart, B.L.J.	Dynamic Systems Design	Business Books 1964
Hartman, W.	Information Systems Handbook	McGraw 1969
Harvard Business Review	Control Series	Harvard University 1973
Harvey, A.	Are Total Systems Practical?	Business Automation June '69 72-76
Hay, L.E.	What is an information system?	Business Horizons February 1971
Head, R.V.	Manager's Guide to Management Information Systems	Prentice Hall 1972
Heany, D.F.	Development of Information Systems: What Management Needs to Know	Donald Press N.Y. 1968
Hebden, J.E.	The Importance of Organizational Variables in the Computerization of Management Information Systems	Journal of Management Studies May '71 179-198
Hecht, G.	The New Management Information System: Should Auld Accounting Be Forgot?	Management Accounting May '69 15 - 16
Henderson, D.C.	Reducing the Flow of Regular Information Reports	Management Services In Government May '73 55 - 58
Henry, H.	Information: The Under Utilised Asset	Sept. '72 18 - 21
Hertz, D.B.	New Power for Management: Computer Systems & Management Science	McGraw-Hill 1969

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Higgins, J.C.	Management Information Systems and the Management Scientist	Management Decision Spring '72. 20 - 27
Hindman, W. R. and Kettering, F.F.	Integrated MIS: A Case Study	NAA Management Accounting Aug. '73 20 - 27
Hodge, Bartow & Hodgson, R.N.	Management and the Computer in Information and Control Systems	McGraw-Hill 1969
Hodson, L.G.	The Use of Management Information	Office Management Autumn '70 119-122
Hofstede	The Game of Budget Control	Tavistock, 1968
Holtham, Clive	Information Systems in Local Government	Local Government Studies Oct. '73 45-57
Hooper, D.W.	The Computer as an Aid to Management	ICA in England and Wales Gen.Educational Trust 1968
Houkes, J.M.	Management Information Systems and the Information Specialist Symposium - Proceedings	Lafayette, Indiana The University 1966
House, W.	The Impact of Information Technology on Management Operations	Auerbach 1971
Hull, T.E. & Day, D.D.F.	Computers and Problem Solving	Addison-Wesley 1970
Hunt, O.M.	How do Data Base Systems Relate to Today's Information Systems?	Canadian Data Systems Nov. '71 Page 32
Hunt & Shelley	Computers & Common Sense	Prentice Hall 1975

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
I.C.W.A.	The Presentation of Information to Management	I.C.W.A. 1950
I.C.W.A.	Reporting to Supervisory Levels of Works Management	The Institute Wolverhampton and District Branch Research sub- Committee 1961
I.C.W.A.	Management Information Systems & The Computer Pt. 1 The Design of a Management Information System	The Institute 1967
I.C.W.A.	Management Information Systems	I.C.W.A.
I.P.M.	Productivity Measurement	I. P.M. 1971
Institute of Chartered Accountants in England and Wales	Studies in Management Information	London. The Institute. General Educational Trust '69
Iscol	Management Information & Control Systems	Iscol 1971 96-123
Iscol	The Systems Approach	Management Information & Control Systems 1971 158-170

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Jay, Anthony	Effective Presentation	B.I.M. 1970
Jettie, J.L.	MIS: A Subjective Study	Management Accountant India. June '71 344-347
Johnson, R.A., Kast, F.E. and Rosenweig, J.E.	The Theory & Management of Systems	McGraw-Hill 1973
Johnson, R.L. & Derman, I.H.	How Intelligent Is your MIS?	Business Horizons Feb. 1970
Jolley, J.L.	Data Study	Weidenfelt & Nicholson 1968
Joplin, H.B.	The Accountant's Role in Management Information Systems	Journal of Accountancy March '66 43-46

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Kanter, Jerome	Management Oriented Management Information Systems	Prentice Hall 1977
Kashyap, R.N.	Management Information Systems for Corporate Planning & Control	Long Range Planning June '72 25-31
Kashyap, R.N.	Introducing Management Information Systems for Corporate Planning and Control	Long Range Planning March '73 28-35
Kelly, Joseph F.	Computerised Management Information Systems	Collier Macmillan 1970
Kennevan, W.J.	Structuring and Managing a Management Information System	Data Management USA Sept. '72 P. 58
King, William R.	Probability for Management Decisions	John Wiley & Sons '68
King, William R.	Systems Analysis and Project Management	McGraw-Hill NY '68
King, W.R. & Cleland, D.	Manager-Analyst Teamwork in MIS	Business Horizons Apr. '71 59-68
King, W.R. & Cleland, D.	Decisions and Information Systems for Strategic Planning	Business Horizons Apr. '73 29-36
Kirk, Frank G.	Total System Development for Information Systems	John Wiley & Sons '73
Klahr, I.M.	Data Base - The Foundation of Information Structures	Bull Op.Res.Soc. AM USA V. 19 Supp. 1
Klein, Lisl	New Forms of Work Organisation	Cambridge Univ.Press 1976
Konvalnka, J.W. & Trentim, H.G.	Management Information Systems	Management Services Sep/Oct.'75 27-39
Krauss, L.I.	Computer Based Management Information Systems	AMA 1970
Kriebel, C.H.	The Valuation of Management Information Systems	IAG Journal, V.4 No. 1 1971
Kuss, J.K. Madill	A Technique for Evaluation of Generalised D. Management Systems Information	V. 10, No.3, P. 311

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Lach, E.L.	The Total Systems Concept	Systems and Procedures Nov. '60 6 - 7
Langefors, B.	Theoretical Analysis of Information Systems (1st Volume)	Lund (Sweden) 1973
Laver, M.	Introducing Computers	HMSO 1965
Lazzaro, V.	Systems & Procedures	Prentice Hall 1968
Leatt, Dill, Eyring	The Organizational World	Harcourt Brace Jovanovich 1973
Leon, Ray	Manage More by Doing Less	McGraw-Hill 1975
Li, David H.	Accounting Computers to Management Information Systems	McGraw-Hill 1968
Li, David H.	Design and Management of Information Systems	Science Research Associates, USA '72
Losty,	Effective Use of Computers in Business	Cassell 1969
Lourens, Roy	Financial Reporting in the Extractive Industries	Melbourne - Australia Society of A/Cs. '72

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
McDonough, A.M.	Centralised Systems Planning and Control	Thompson Book Co.
McDonough, A.M.	Information Economics & Management Systems	NY McGraw-Hill 1963
McGregor, Douglas	The Human Side of Enterprise	McGraw-Hill 1960
McKeever, James	Management Reporting Systems and Techniques	NY Wiley Interscience 1971
McMillan & Gonzalez	Systems Analysis	Irwin 1973
McRae, T.W.	Management Information Systems	Penguin 1971
Makridakis, S.	The Whys and Wherefores of the Systems Approach	European Business Summer '71 64-70
Malcolm, D.C. & Rowe, A.J.	Computer Based Control Systems	California Man. Review Spring '61, 4 - 15
Management Info.	Management Info. Systems I	Management Accountant Nov. '68 484-486
	Management Info. Systems II	Management Accountant Dec. '68 540-542
	Management Info. Systems III	Management Accountant ICWA Jan. '69 40-42
	The Total Information System	Accountant. April 27th 1972
Mancinelli, T.B.	Management Information Systems: The Trouble with Them	Comput. & Autom. USA July '72 11 - 13
March, James G. & Simon, Herbert A.	Organisations	John Wiley & Sons '59
Martino, R.L.	Information Management: The Dynamics of MIS	McGraw-Hill 1970
Martino, R.L.	MIS Methodology	Management Development Institute
Martino, R.L.	MIS Methodology	Management Development Institute

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Matthews, Don. Q.	The Design of the Management Information System	Auerbach Publishers 1971
Maynard, H.B.	Handbook of Business Administration	McGraw-Hill 1967
Meadow, C.T.	The Analysis of Information Systems	NY Wiley 1967
Meltzer, M.F.	The Information Centre: Managements Hidden Asset	Assoc. 1967 NY American Management
Meltzer, M.F.	The Information Imperative	American Management Assoc. Inc. 1971
Mentzel, K.H. & Hesse, J.	The Marketing-Information System as a Decision-Making Basis for Marketing Management	Management International Review V.12
Miller-Bakewell. J.B.C.	Management Information for Producers	Machinery Publishing Co. London 1971
Mills, Arthur E.	The Dynamics of Management Control Systems	Business Publications Ltd. London 1967
Mills, G.	Office Administration	Pitman 1977
Mills, G.	Office Organisation & Methods	Pitman 1978
Milward, G.	Organisation & Methods	Macmillan 1967
Ministry of Technology & the Thomson Organisation Ltd.	Management Decision Through Information, Proceedings of the Conference	London. Ministry & the Organisation 1969
Mintzberg, H.	The Myths of MIS	California Management Review Fall '72 92/7
Mitchell, R.	Computer Based Systems and the Accounting Function	Accountant 27.9.69 383-387
Mockler, Robert J.	Readings in Management Control	Appleton-Century-Crofts 1970
Monsma, J.E. & Powell, K.F.	An Executive's Guide to Computer Concepts	Pitman 1970
Montgomery, D.B.	Scrutinising MIS Myopia	European Business (Spr) 1971 34-43

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Moreau, David	Look Behind You	Assoc. Business Progs. 1973
Morris, W.T.	Decentralisation in Management Systems	Columbus Ohio State Univ. Press 1968
Murdick, R.G. & Ross, J.E.	Information Systems for Modern Management	Prentice Hall 1971
Murdick, R.G. & Ross, J.E.	Future Management Information Systems	Journal of Systems Management May '72 32 - 35
Murray, William	Figures & People or Environment Organisation & Management Controls	ICMA West Midlands Area Conf. March '69 1-20

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Narayanan, S.L.	Computer Based Information Systems & Systems Analysis	Management Accountant India July '72 442-7
National Computing Centre	Analysis of Computer Usage in the UK in 1971	
National Computing Centre	Economic Evaluation of Computer Based Systems	Manchester 1971
Nedo	Signposts to Success: A Whole-salers Guide to the Use of Management Information Techniques	London HMSO 1973
Newschal, R.F.	Management by System	McGraw-Hill 1960
Nichols, G.E.	On the Structure of Management Information	Management Accounting April 1969 9 - 15
Nichols, G.E.	Accounting and the Total Information System	Management Accounting NAA March 1971
Nijssen, G.M.	Common D.B. Key to Successful Information Systems	Papers of IB8IICC (Informatics in Gov.) PT 11 P. 524 1966

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
O'Brien, James J.	Management Information Systems Concepts Techniques & Appli- cations	NY Van Nostrand Reinhold Co. 1970
O'Brien, James J.	Management with Computers	NY Van Nostrand Reinhold Co. 1972
Ogden, Ronald	Imaginative Management Control	Routledge & Kegan Paul 1970
Olle, T.W.	MIS and Data Bases	Datamation V. 16 N. 15 Page 47
Optimer, Stafford L.	Systems Analysis	Penguin 1973

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Patterson, A.C. (IV)	Requirements for a Generalised D.B. Management System	Proceedings of the American Soc. for Information V. 8 '71 185
Patterson, A.C.	Data Base Hazards	Datamation V. 18 No.7 48-50 July 1972
Phillippe, Gerald L.	What Management Really Wants from Data Processing. Data Processing Today, A Progress Report.	Management Report No. 45 American Management Assoc. NY 1960
Plummer, J.	A Human Model for Computer Systems	Business Horizons Apr. 1971 35 - 43
Pokempner, S.J.	MIS: A Pragmatic Survey	The Conference Board Record May 1973
Pollock, N.C.	The Provision of Information	Office Management Autumn '70 113-118
Powell, R.W.	Management Information Systems	London. Industrial & Commercial Finance Corp.
Price, G.P.	The Ten Commandments of Data Base	Data Management USA V.10, No.5 14-23 May '72
Prince, T.R.	Information Systems for Management, Planning & Control	Irwin 1975
	Problem Solving and the Computer	Management Accounting ICWA March 1969 126/8
Puttnll, M.S.	Diagnosing the Weak Spots in Information & Control Systems	Management Accounting Nov. '72 358-360

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Radley, G.W.	Management Information Systems	Intertext Books 1973
Rappaport, A.	Information for Decision Making: Quantitative & Behavioural Dimensions	NJ Prentice Hall 1970
Reddin, W.J.	Managerial Effectiveness	McGraw-Hill 1970
Reddin, W.J.	Measuring your Performance	Engineering, Aug. '72
Richards, T.	Problem Solving through Creative Analysis	BIM / Gower
Roalman, A.R.	Managerial Midas: The Infor- mation Broker	Management Review Dec. '72 2 - 7
Robertson, J.H.	Design of Information-Processing Systems for Government	London HMSO 1967
Robson, Alan	Define your Kind of Management Control	Accountancy Age 7 July '72 P. 11
Robson, A.	Essential Accounting for Managers	Cassel 1970
Rogers, D.	Creative Systems Design	Anbar Publications '70
Rose, Michael	Computers, Managers & Society	Penguin 1969
Rose, T.G.	Higher Control in Management	7th.Edit Pitman '63
Rosove, Perry E.	Developing Computer-Based Information Systems	John Wiley & Sons 1967
Ross, Joel J.	Management by Information System	NJ Prentice Hall '70
Rothery, Brian	The Myth of the Computer	Business Books 1971

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Sanders, D.H.	Computers and Management	McGraw-Hill 1970
Santocki, J.	Management Audit Survey	Theses 1974 ICMA Birmingham Poly.
Sarjeant, J.A.	The Changing Role of Management Accounting in Industry	Pt. 1 Cost & Manage- ment Nov/Dec '70 5 - 8
Sayamurthi, Y.	Cost Accountants and the Necessity to Assume Leadership in MIS	Management Accounting
Schaffir, K.H. & Trentin, G.H.	Marketing Information Systems	AMACOM American Management Assoc. '73
Schluter, Louis	Beyond MIS: A Practical Total Information System	Data Processing Mag. Winter 1971
Schmeltzer, H.J.	Developing an Effective D.B. System	Data Rep. (Germany) Dec. '72 P. 15
Schoderbek, Peter	Management Systems: A Book of Readings	John Wiley & Sons Inc. I.C.A. 1971
Schoderbek, P. & Schoderbek, S.E.	Integrated Information Systems: Shadow or Substance?	Management Adviser Nov./Dec. '71 27-32
Scott, A.E.	Information Systems: How to get There from Here	4th Gen. Computers
Seller, John A.	Systems Analysis in Organiza- tional Behaviour	Richard D. Irwin 1967
Seller, K.	Introduction to Systems Cost Effectiveness	Wiley Interscience 1969
Selig, Gad. J.	Planning New Applications of Management Information & Decision Systems	Industrial Engineering June 1972 19 - 23
Senko, M.E.	File Organisation & Management Information Systems	Annual Review of Info. Sci. & Tech. V. 4, P. 111 - 143
Shakel, Prof. B.	Human Factors in the Design & Evaluation of Computer Based MIS	Loughborough Dent, Ergo & Cyber- netics

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Sharratt	Data Control Guidelines	NCC 1974
Shaw, L.W.	Management Information and Statistical Method	London Inst. C.A. in England & Wales. Gen. Educational Trust Management Info. Series No.6 '67
Shergold, J.R.	An Investigation Into the Use of On-line Computing in the Solution of Business Problems	University of Durham Thesis
Simon, H.A.	Administrative Behaviour	The Macmillan Co. NY 1959
Simon, Herbert A.	The New Science of Management Decision	Harper & Row NY 1977
Simmons, J.R.M.	Management of Change: The Role of Information	London Gee 1970
Sisson, R.L.	Management Control Systems	John Wiley & Sons NY
Sisson, R.L. & Canning, R.G.	A Manager's Guide to Computer Processing	NY Wiley 1967
Sizer, J.	An Insight in Management Accounting	Penguin 1970
Small, J.	Introduction to Managerial Economics	H.U.
Smith, P.T.	Computers, Systems and Profits	American Management Assoc. 1969
Smith, P.T.	How to Live with your Computer	American Management Assoc.
Sollenberger, H.M.	Management Control of Information Systems Development	National Association of Accountants
Sollenberger, H.M.	Major Changes Caused by the Implementation of a Management Information System	NY National Assoc. of Accountants Research Monograph No. 4 '68
Sollenberger, H.M. & Arens, A.A.	Assessing Information Systems Projects	NAA Management Accountant Sept. '73 37-42

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Spirit, J.	Information in the Decision Making Process in Czechoslovakia, Syllabus for Top Managers Training	Prague Institute of Management 1968
Spiro, B.E.	What's a Management Information System?	Data Management V. 9 No. 9, P. 48 Sept. '71
Staats, E.B.	Information Needs in an Era of Change	NAA Management Accountant Oct. '68 11-15
Stamper, Ronald	Information in Business and Administrative Systems	London: Batsford 1973
Standingford, O.	Simplifying Office Work	Pitman 1959
Stein, Charles Jr.	Some Organisational Effects of Integrated Information Systems. The Changing Dimensions of Office Management	Management Report 41 AMA NY 1960
Steinitz, Guenter B.	Get the Right Information	Management in Action March '72 24 - 25
Stewart, R.	The Reality of Management	Pan 1967
Stewart, R.	Managers and their Job	Pan 1970
Stewart, R.	How Computers Affect Management	Pan 1971
Stokes, Paul M.	A Total Systems Approach to Management Control	NY American Management Assoc. Inc. 1968
Strong, Earl Poe & Smith, R.D.	Management Control Models	Hold, Rinehart & Winston 1968
Stross, C.O.M.	Operation of a Disc Data Base	Computer Journal V. 15 No. 4 290-297
Stults, F.C.	Data Information and Decision Making	J. of Systems Management (USA) Jan. '71
Sugden, T.M.	Information Requirements of R. & D. Management	R. & D. Management Feb. '73 83 - 84
Summers, J.K. & Bennett, Edward	AESOP - A Final Report	In Walker 69 - 86

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Swyers, W.E.	Employee Compensation Accounting in a Total Information System	NAA Management Accounting July '66
Symonds, C.W.	A Design for Business Intelligence	American Management Association 1971

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Tannenbaum, A.S.	Control in Organisations	McGraw-Hill 1962
Tatham, L.	Office Efficiency	B.P.
Tatham, L.	The Use of Computers for Profits: A Businessman's Guide	McGraw-Hill 1969
Tavernier, L.	Basic Office Systems & Record	G.P. 1972
Tayler, Herbert	MIS, Purposes, Theory, Processes, Structure	Hirschfield Press 1971
Technical Association of the Pulp and Paper Industry: Operations Research and the Designing of Management Information Systems, Papers Presented at a Symposium		NY The Association 1967
Television's MIS		Data Processing Practitioner Summer '72
Thomas	The Accountant and Computers	Pitman 1967
Thornton, N.	Financial Information for Executive Management	Gee & Co. Ltd. 1967
Tillett, A. & Wills, G.	Management Thinkers	Penguin 1970
Toan, A.B.	Using Information to Manage	Ronald Press NY 1968
Toan, A.B.	Management Information Systems	Local Government Finance April 1971 112 - 119
Tomeski, E.A.	The Computer Revolution: The Executive and the New Information Technology	Collier-Macmillan 1970
Toothill, G.	Electronic Computers	Pelican 1971
Townsend, R.	Up The Organisation	Coronet 1971
Tricker, Ian R.	MIS: An Annotated Bibliography	Gen.Educational Trust of the Institute of Chartered Accountants in England & Wales
Tricker, R.I.	Ten Myths of Management Information	Management Accountant (ICMA) Aug. 1971

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER/DATE</u>
Tricker, R.I.	Research in Accounting Strategy for Further Work	London SSRC 1975
Tricker, R.I.	Management Information and Control Systems	Wiley 1976
Tricker, R.I.	Research in Accounting	University of Glasgow Press 1978
Twenty Four Hour Management Information System		Data Management May '71

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER</u>
Uhl, Kenneth P. & Schoner, Bertram	Marketing Research: Information Systems and Decision Making	NY/London Wiley 1969
Urwick Management Centre	The Role of the Computer in MIS	London. Urwick Orr & Partners 1972
Van Coot, Hare Jnr.	Systems Analysis: A Diagnostic Approach	Harcourt, Brace & World
Vardaman, George T. and Halterman, C.C.	Managerial Control Through Communication: Systems for Organizational Diagnosis and Design	John Wiley & Sons Inc. 1968

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHING</u>
Walker, D.E.	Information System Science & Technology	Thompson Book Co. Washington D.C.
Walsh, D.	Role of Management in Efficient Use of Computer Equipment	Papers of IBIICC Page 11 1972
Walton, T.F.	Company, Financial and Cost Accountants	Institute of Quarrying Ashridge Coll. Apr. '75
Wasyloka, Ray	Drawing in Data While Starving for Information	Fin. Exec. Nov. 1971 52-54, 56, 58, 60, 62, 64 & 66
Webster, W.A.R.	Handbook of O & M Analysis	Business Books, 1973
Wedekind, H.	Information System for Decision & Control	Infors. Conference Dublin August 1972
Welsch & Cyert	Management Decision Making	Penguin 1971
Whisler, T.L.	The Impact of Computers on Organizations	NY Praeger 1970
Whitehouse, Frank	Documentation	Business Books 1971
Wilensky, H.L.	Organisational Intelligence	NY Basic Books 1967
Wilkinson, Alan	Information for Managers: A Practical Approach	London, Pitman 1971
Williams, R.R.	Quarrying Costing	Cost Accountant 1929 375-379
Wilson, R.M.S.	Financial Control-A Systems Approach	McGraw-Hill 1974
Witworth, D.	Basic Digital Computer Concepts	Heinemann 1967
Worcester, R.	Electronics	Hamlyn 1969
Wright, P.L. et al	The Development of an Experience Inventory	June '71 113-118 R. & D. Management

<u>AUTHOR</u>	<u>TITLE</u>	<u>PUBLISHER</u>
Yewdall, G.	Management Decision Making	Pan 1963
Yewdall, A.G., Mead, G.P., Wicks, C.T. & Smith, C.W.	Management Information, its Computation & Communication	London, Pan
Young, Donald M.	Tailoring Information Systems to Managers Decision Making	Accountancy Feb. 1973, 18 - 27
Young, Stanley	Management: A Decision Making Approach	Dickenson Pub. Co. 1968
Zani, W.M.	Blueprint for MIS	Harvard Business Review Nov - Dec 1970 Page 95

