THE IMPACT OF DATABASE SYSTEMS ON ORGANISATIONS - A SURVEY WITH SPECIAL REFERENCE TO THE EVOLUTION OF THE DATABASE ADMINISTRATION FUNCTION

A thesis presented by

MOHAMED ALI JAMIL SHERIF

In partial fulfilment of the requirements for the degree of Doctor of Philosophy

Centre for System Analysis
City University Business School
The City University

May 1984

In the name of God, the Beneficent, the Merciful

TABLE OF CONTENTS

Page

Page

LIST OF FIGURES

The leading figure number incorporates the number of the chapter.

ACKNOWLEDGEMENTS

This research study could not have been conducted without the co-operation received from industry - DP professionals who cared sufficiently about issues affecting practice to find time for questionnaires and interviews. In particular, the researcher would like to thank those managers who volunteered detailed information about their projects and were open about the difficulties faced and the lessons learned. The encouragement offered by many was of significant personal importance to the researcher.

The study has been sustained by the interest and encouragement the researcher received from Owen Hanson and Norman Revell of The City University's Centre for Systems Analysis. He is indebted to both for their sound advice. In particular, he would like to thank Norman, not only for acting as the research supervisor, but for the particular support, encouragement and friendship offered over the duration of this protracted research exercise. Jock Schofield of CUBS made valuable suggestions at the early stages of the project - this contribution is also acknowledged with gratitude.

Finally, the researcher is grateful to Doreen Pettifer for her skill and diligence in the production of the thesis. CACI is thanked for access to a word processing system.

I grant powers to the University Librarian to allow this thesis to be copied in whole or in part without further reference to me. This permission covers only single copies made for study purposes, subject to normal conditions of acknowledgement.

ABSTRACT

Implementation of the database concept has organisational implications, the most widely recognised being the emergence of the specialist function of data or database administration (DBA) usually in data processing departments. This research study is an investigation of U.K. database projects, undertaken to obtain a view of the managerial issues and organisational consequences which arise in practice.

The findings are based on the completion of a simple postal questionnaire by 212 organisations with database projects and in-depth interviews in 21 of these organisations with the staff member bearing overall responsibility for the development. The surveys were conducted in 1976-1981.

The study employs qualitative methods to explore the inter-dependencies between organisations' objectives for embarking on a database project, features of the project environment, approaches to staffing including characteristics of the DBA function and the nature of the problems faced.

The major finding is that organisations experience more serious 'political' problems than technical ones. The predominant type of political problem is not resistance to data sharing, but rather related to the emergence of a DBA function-dissatisfaction over organisational placement and the working relationship with data processing functions such as systems development. Moreover these organisational problems occur from the earliest phase of database projects - the feasibility stage.

The study concludes that with management backing, analysis and design skills and control over database usage, the DBA function has been able to acquire technical and political weight in organisations in a relatively short period of time. The current data processing environment however contains unique opportunities for the function - in the areas of systems planning, systems development and the administration of shared data - which suggests that the notion of the DBA as the organisation's overall data resource manager is still a viable one.

1. INTRODUCTION

This study is a survey of the organisational and managerial aspects of database projects in the U.K., undertaken in order to identify common approaches and principles which may serve as a guide for information systems managers planning such a venture for the first time.

Data was obtained from over 200 organisations. The study embraced a variety of industry types and was not restricted to one computer manufacturer's or software vendor's clients. The findings reflect actual practice in largely mainframe environments in the period 1976-1981.

There is a widespread and growing interest in database systems. An indication of this trend is provided by the use of database management systems (DBMSs), software packages which have provided the technical basis for the impetus towards database systems: over 60 such products are commercially available (Datapro, 1983) excluding developments in the microcomputer realm. Market surveys and other studies confirm the trend:

- in 1979, 55% of IBM installations in the USA were expected to be DBMS users - in 1976 the figure was 20% (Nolan, 1979)

- there were nearly 300 database implementations in the U.K. in 1979, with numbers doubling approximately every year (Drafton & Poole, 1980)
- 11,000 DBMSs had been installed worldwide by the end of 1979, with a compounded 30% growth forecast for the 1980s (Krass & Weiner, 1981)
- of 100 mainframe installations surveyed in the Greater London area, 38 were DBMS users (Patel, 1982)

Irrespective of the scope of the project, database development is a venture which will tie up resources - skilled personnel and computers. In the researcher's experience it is not uncommon to find large organisations in which data processing budgets make provision for 5-10 man-years' effort - in the first year of the project. Research which seeks to improve the management of the database development process is, therefore, well justified.

The scope of database systems - their promise and organisational implications - is also being appreciated by a wider audience. An account, which appeared in the national press, conveys the essential features:

> "With Leyland Vehicles' vast product range, the problem is in supplying the spares quickly while ensuring that stocks are complete and easily locatable. The company keeps 170,000 different parts numbers, despatches 6,000 orders each day, receives into stock 800 goods receipts a day, has 2,000 customers and employs 950 people. Controlling inventory, productivity, cash flow and ultimately profitability, stems from Leyland Vehicles' development of an integrated management information system... The system aims to hold information on every aspect of a £30m inventory on the database, so that everybody has the same view of the data. It is never necessary to re-check on any part; the database is completely common to all users and is the absolute authority. Access to the database was achieved by expanding company's on-line network." [1]

The approach of developing information systems utilising the database concept is one which every organisation sooner or

1. The Times 28.9.82 'How BL keeps the trucks rolling'

later will have to evaluate. For the information systems manager it raises such questions as:

What does a database approach for our organisation mean?

Will it benefit us?

How can we best implement database?

Do we need structural changes within the DP department?

Systematic investigations of the practical aspects of database projects are , therefore, urgently needed. Subsequent sections of this chapter present:

- Key concepts and objectives of research
- Overview of previous empirical studies
- The need for further research and the research questions

1.1 KEY CONCEPTS AND OBJECTIVES OF RESEARCH

The problem being addressed in this study is not one with precise and unambiguous boundaries. The objectives of this section are to clarify basic terms and propose a research strategy.

1.1.1 Key Concepts

Three key concepts are considered - database, database administration and organisational impact of database systems. Rigid definitions are not offered - instead, attention is drawn to the background of these concepts and the notions held by database practitioners and information system specialists.

Database

The origin of the term database has been traced to a computer conference organised by the U.S. military in 1963 (Olle, 1978). The early 1960s is also the period when direct access storage devices came into use (Ashany & Adamowicz, 1976): organisations' expectations of information systems both shape, and are shaped by, innovations in computer technology.

From the earliest stages, the term has implied a store of data with a special significance. For example, Charles Bachman, one of the pioneers in the development of DBMS software, could in 1969 foresee the scope of this store and some of the management issues:

"The effectiveness of a large corporation and the ultimate limit to its size depend on how well it can store and process the data relevant to its operations and how well it can communicate between its components. The real database of an organisation is large. I don't know what large really means, but it is not 10 million or 20 million characters; 10 billion characters is more like it. This quantity at the moment is almost incomprehensible, yet we have the technical capability today to process that amount of data and we have the hardware to support it. But I am not sure whether we have the management organisation capability to collect the data, support it or train the people to use it properly." [1]

Organisational theorists were attracted to the concept of the corporate database as a foundation on which to build their schemes of the total management information system (Zani, 1970; Beer, 1972). Though in further research the notion of the total MIS was discredited (Mintzberg, 1972) the controversy served to draw attention to the difference between information and data: information was a process, data a resource (Tricker,

1. Bachman (1969), p.37

1975). This idea of data as a resource has been much explored by Nolan in the management literature (1973a, 1974, 1977, 1979). Nolan views the development of a database as an important stage in the evolution of an organisation's DP function :

> "Thus the concept of a company database has emerged. It has two key aspects:
>
> 1. The data that computer programs use are considered an important resource in themselves, separate from computer programs.
>
> 2. There is an art and approach to managing and structuring a company's computer readable data as a whole, so that they constitute a resource available to the organisation for broadrange applications - especially on an ad hoc basis." [1]

While James Martin considers the corporate database feasible in smaller organisations, he has proposed the notion of **subject** databases for the larger corporation:

> "Centrally controlled and authoratitive repositories on the major types of data

1. Nolan (1973a), p.101

of interest to the organisation - for example, customers, products, employees - capable of supporting both operational and management information systems." 1

Definitions of database given by leading practitioners also indicate that the emphasis is on the management and sharing of a pool of data, though not necessarily encompassing all of an organisation's data:

"Database approach - an approach to the management of data which is oriented towards the sharing of data by multiple users; Database - a collection of data which is managed according to a database approach." 2

A database can be shared between users because it models reality: it models some portion of the real world. As Kent (1978) has explained, this is very much a shorthand way of speaking:

"I am convinced, at bottom, that no two people have a perception of reality which is identical in every

1. Personal notes from a J.Martin seminar, 29 October 1975 London
2. Tagg(1978), p.10

detail... Views can be reconciled with different degrees of success to serve different purposes. By reconciliation I mean a state in which the parties involved have negligible differences in that portion of their world views which is relevant to the purpose at hand... If the purpose is to maintain the inventory records for a warehouse, the chances of reconciliation are again high (how high?). High enough to make the system workably acceptable to certain decision makers in management... In an absolute sense, there is no singular objective reality. But we can share a common enough view of it for most of our working purposes, so that reality does appear to be objective and stable." [1]

The implementation of a database system requires specialised software with facilities for:

- data structuring, to model the natural data relationships which exist in the real world

- data independence, so that changes in the data may not require changes in the programs, hence allowing different programs to share the same data.

1. Kent (1978), p.202-203

The software packages with these capabilities are described as database management systems - DBMSs. The technology has evolved from developments in the 1950s (Fry & Sibley, 1976) though a major influence in shaping the design of modern DBMSs has been the specifications proposed under the aegis of the Conference for Data System Languages (CODASYL). The first CODASYL proposals were published in 1968 (CODASYL, 1968). DBMSs today are sophisticated products, serving as heavy-duty application development tools (Holsapple & Whinston, 1981).

The widespread availability of DBMSs has promoted database projects and also made the term "database" commonplace:

> "When an organisation talks of moving to database, it frequently means installing and adopting one of these products in place of their existing file and data management techniques, a not unreasonable shorthand way of speaking." 1

A further semantic confusion arises because the scope of one database is defined differently by different proprietary DBMSs. For example, in IBM's IMS package, a database includes all the

1.King (1977),p.14

data in a given physical (or logical) hierarchy. In systems based on the CODASYL proposals, it includes data of any of the types defined within a 'schema' description.

A distinction should be drawn between DBMSs and stand-alone file management systems (SFMSs):

> "Although these (SFMS) are often marketed as 'database management systems', they are nevertheless merely systems for defining disjoint files, extracting data from a file, and (sometimes) merging two files on the basis of a redundant field... the masquerading of SFMS as DBMS is especially common in the micro and mini computer realms. Such systems did not evolve in response to the data handling limitations of file management systems such as COBOL." 1

While DBMS packages have provided an impetus to the implementation of database systems, it is clear their usage does not necessarily imply a shared database. The 'genuine' database consists of "an integrated collection of (interconnected) records of many types that are organised according to a logical structure in which redundancy can be minimised" (Holsapple & Whinston, 1981; p.176).

1. Holsapple & Whinston (1981), p.183

Database Administration (DBA)

Sibley has remarked that:

> "Although the generalised database management system - as it is being developed in the past few years - has some technological improvements over the operating systems of the past, it provides only one new concept: that of data administration." [1]

The scope and implications of this new function have been well expressed by Scott:

> "... Another problem to be brought to the attention of general managers is that of data administration. When data from different applications are integrated into the files of a database, the departments or individuals that previously controlled the data are no longer able to control it effectively. For example, the data will be accessible by many more programs than previously, rendering access control more difficult. The function of data and program control previously exercised by the individual departments or decentralised among many data processing personnel will now need to be centralised.

1. Sibley (1974), p.84

A central authority must police the data to ensure that the data needed are captured; database standards are maintained; data are accessible to users who need the information and not accessible to others; data that should be in the database are not retained instead by an individual user; and database updating is controlled. Beyond these policing and control functions, this authority should also act as liaison and consultant to users, maintain database indexes and documentation, control program changes, develop and monitor charge-out systems for users, and so forth." [1]

However, on reviewing the normative literature available in the early 1970s on the DBA function, Everest concluded:

"Recent literature in the field indicates that the role of database administration has become widely accepted today, in theory if not in practice. Nevertheless, considerable diversity of opinion exists concerning the functions to be performed in that role and how the role should be incorporated into the organisation. Some define the role broadly, encompassing

1. Scott (1976), p.77

everything that pertains to data processing. The role of database administrator has become a convenient rug under which to sweep any of the troublesome issues relating to database management and the use of database management systems." [1]

The management problem has also been highlighted by Turner:

> "In reading the literature on information systems, one is struck by the frequency of the use of the term "database administration." It seems that most of the difficulties of past information system developments have been conveniently transferred to this new function, including the control of a major corporate resource and the resolution of numerous internal conflicts. It is no wonder that several writers in the field have described the ideal candidate for this position as someone with superhuman abilities. Management must be careful not to create a role which is impossible to perform or staff." [2]

1. Everest (1974), p.172
2. Turner (1976), p.3

The perspective which emerges is of DBA as a new organisational function which is fundamental and instrumental in database implementation and, in spite of the controversy in the literature, intuitive notions suggest must have certain responsibilities which make it a distinct specialisation.

In the literature, the terms "data administration" and "database administration" are often used interchangeably. There have been suggestions that strategic aspects of data related issues should be allocated to the former function while retaining the tactical and technical responsibilities for database with the latter (Minami, 1976; Robinson, 1977a; 1977b).

Organisational Impact of Database Systems

The adoption of a new technology inevitably affects the organisation - technology is not neutral. Joan Woodward, for example, established a relationship between production systems and organisation structure (Woodward, 1965). In the area of information systems, Whisler's classic study "The Impact of Computers in Organisations" (1970) was an in-depth study of 19 organisations in one industry - Insurance - in the USA. The impact of computers was considered in four areas: organisational structure, decision-making, authority and control, job content.

Management writers with a sociological perspective have examined the impact of information systems on the distribution of intra-organisational power and authority (Tricker, 1977; Bariff & Galbraith,1978) and organisational values (Mumford, 1979a; 1979b). The concept of the organisational impact of database systems is vague, but unavoidable. A number of practitioners have drawn attention to the reality of projects:

> "The decisions associated with the implementation of a database management system are usually very complex, because they involve political and organisational, as well as normal technical considerations." [1]

> "Planning for the database environment involves as many management issues as technical ones. Although most of the attention is focused on technical considerations, management issues are more difficult to resolve and require more careful planning and co-ordination." [2]

1. Sibley & Merten (1973), p.26
2. Minami & Craig (1976), p.3

"The central principle of the database approach is of sharing data; a political as much as a technical issue. Organisational and people problems can cause the failure of database systems, in spite of all the design and performance problems having been overcome." [1]

The views above refer to 'political', 'organisational', 'management' and 'people' related considerations, issues and problems - the organisational aspects of database systems. The visible, observable effect on organisations is referred to as the organisational impact of database systems - the most obvious in the present context is the emergence of the DBA function.

1.1.2 Objectives of Research

A proposition of this study is that database implementation not only requires technical competence but also management preparedness. While there are numerous methodologies to guide the technician (a comprehensive review is to be found in Olle, 1982), the manager requires a framework which can make the strategic choices explicit and draw attention to the consequences of action.

1. Palmer (1980), p.15

The objectives of research should, therefore, be:

- to create concepts and a terminology to describe the richness and subtlety of actual practice

- to seek out common themes in current practice so that information systems management embarking on a database project can have an insight into the industry experience, rather than adopting the expensive process of learning by trial and error in every case

- to establish the possibilities of organisational change arising from database systems development, with particular emphasis on the evolution of the DBA function

The approach of the research has to be empirical - to develop a descriptive theory of what actually is rather than expound prescriptions of what should be. The research should set out to seek the facts, and opinions based upon direct experience of database projects. Analytical work should then be done on the data, enabling concepts to be developed which address known problems and have practical relevance. The outcome would be a theory which assists information systems management in understanding the world of database development.

1.2 OVERVIEW OF EMPIRICAL STUDIES

The objective of this section is to present a brief description of the major empirical investigations that have been conducted on database-related issues. About a dozen surveys have been identified in a literature search, spanning the period 1973-1982. The surveys have been classified into three categories:

- organisational, general
- organisational, DBA-specific
- DBMS experience-related

1.2.1 Organisational (General)

The first survey to examine the wider implications of database systems was conducted in the USA, under the sponsorship of the Harvard Business School (Nolan, 1973a). Views of data processing managers were sought on:

- current impressions of what a database should be and do
- approaches to structuring and organising a database
- strategies for building a database system
- database administration
- access and security
- organisational and technical problems associated with the database concept

The study reported that:

- respondents were generally puzzled by the term "database"
- the shared database strategy marked the next natural milestone in the evolution of DP applications
- in organisations with DBAs, in no instance had their exact responsibilities and authority been delineated
- users did not access the data directly
- the major organisational issues were the recruitment of personnel to handle the technical issues, funding and developing suitable charge-out systems and setting and enforcing standards
- organisations should acquire DBMS packages rather than build complex software in-house

1.2.2 Organisational (DBA-Specific)

Five surveys have focused on the organisational characteristics of the DBA or data administration function.

GUIDE

GUIDE Europe, an IBM user group, undertook an investigation in 1974 of DBA practice in IBM installations outside the USA and Canada (GUIDE, 1975). About 20% of the respondents were U.K.-based. The main issues considered were:

- DBA organisational placement and the function's internal structure
- duties
- skills and experiences

The results indicated that:

- more than half of DBMS users had yet to formally appoint a DBA, though the trend was towards creating such a function
- most of the DBAs were located in system support and placed two or more levels below the head of DP
- the most frequently cited responsibilities were in physical database design - data organisation method and search techniques - and maintaining database documentation. Knowledge of DBMS software was regarded as the most valued DBA skill

Wharton School

Conducted in 1976 under the sponsorship of the Wharton School of the University of Pennsylvannia, this was the first in-depth investigation of the DBA function in organisations in the USA (De Blasis & Johnson, 1977; 1978). Its objectives were to establish:

- whether the DBA portrayed in current literature existed in practice
- a practical definition of the DBA tasks

The survey conclusions were that:

- the DBA in current practice was not the policy-maker envisaged in the literature. However, the DBA was an entity with a future - a training ground for managers who need a broad view of the company's information system problems yet who need to have technical capabilities

- most DBAs were placed one or more levels below the head of DP. Their formal education was mainly in Computer Science rather than Management

- some DBAs spent 25-30% of their time 'marketing' the database concept. The activity included convincing senior management, users and development groups

- administrative problems or organisational issues surfaced as the most important problems in the great majority of groups studied. However, further research in this area was a must.

New York University

This study, carried out in the USA in 1978 (Weldon, 1979), was similar to the Wharton School survey but more restricted in scope. Its objective was to establish the factors in the DBA's environment which influenced job content. The two main conclusions drawn were:

- the length of time a DBA group had been in existence influenced several organisational characteristics. While most of the groups were placed two or more levels below the head of DP, many had changed their organisational position for the better

- DBAs in different technical environments rank-ordered a list of tasks differently. However, further research was required to develop task profiles for the several different types of DBA functions that exist in practice.

University of British Columbia

This survey, based in Canada, was the first to focus on data administration, rather than database administration. In the terminology of this survey (McCririck & Goldstein, 1980), the former had a greater co-ordination role and responsibility over data as a corporate resource. The survey's conclusions do not suggest that holders of the 'data administrator' job title possessed characteristics very different to staff described as DBAs. For example, most of the data administrators were:

- staff functions within DP departments
- formally educated as computer scientists
- concerned with the database itself rather than more global matters such as policies for data collection

The survey found that the data administration function was more likely to have been established by organisations with high profits in recent years.

IBM

During the first quarter of 1981, the IBM Systems Research Institute conducted a survey in the USA among IBM IMS account system engineers and personnel in IBM-internal IMS user organisations (Gillenson, 1982). Though termed a 'data administration' survey, most of the respondents were DBAs. The objectives were to investigate the state of data administration practice and the state of data dictionary usage. Specific issues examined included:

- data administration organisational placement and responsibilities
- the effect of installation characteristics on data administration organisational characteristics; installations were classified as large or medium on the basis of the operating and communications (teleprocessing driver) systems in use
- organisational problems

The main findings were that:

- the majority of organisations using IMS had formally created such a function. The appointment was usually made after the system was installed and running
- the majority of organisations had only one data administration group within the overall enterprise

- data administration responsibilities were unaffected by installation type; however, larger installations were more likely to have made a formal appointment than the medium installations

- in general, responsibilities weighted more heavily towards 'database administration' functions plus liaison work rather than to 'data administration' functions like long-range planning

- most existed as staff functions two or more levels below the head of DP

- organisational problems arose because of too heavy a workload, responsibilities without the corresponding power and resistance to others by changing job responsibilities

1.2.3 DBMS Experience

In six surveys, the main emphasis of the investigation has been on organisations' experiences with DBMS software. However, in some of these studies, wider issues were also addressed.

NCC

The UK National Computing Centre conducted a survey in the USA in 1973 (Davis, 1975). The objectives were to establish:

- reasons for initialling DBMS software
- selection methods
- cost-benefits achieved
- problems encountered

The main conclusions reached were that:

- the basic decision facing all organisations was whether to use a DBMS package or build a system in-house
- DBMS selection only involved DP staff
- formal cost-justifications were rarely undertaken
- the politics of shared information would become a major problem in the future as database systems become more integrated. The existing problem was mainly use of building up the necessary expertise.

EEC-NCC

As part of a brief set by the Commission of European Communities, the UK National Computing Centre surveyed DBMS users in the UK in 1978-1979 (EEC-NCC, 1979). Its objective was to know more about the true state-of-the-art in DBMS usage and user experience, though some issues of wider interest were also pursued. The scope of the survey was to investigate:

- reasons for interest in a database approach and staff initiating the idea
- the DBMS evaluation and selection process, with particular reference to management and user involvement and the use of consultants
- views on the advantages and disadvantages of using a DBMS
- operational features of applications using a DBMS - design, development and database accesses
- DBA organisational placement and tasks
- costs of the database approach
- problems faced in pursuing a database approach and installing the DBMS

The key findings were that:

- there was a confusion in the field between 'adopting the database approach' and 'using a DBMS.' No single reason emerged as mainly responsible for interest in a database approach. The idea was proposed by DP staff in the majority of cases

- there was seldom non-DP involvement in DBMS evaluation and selection decisions. Consultants were considered useful in DBMS evaluation

- it was difficult to divorce the effect of the database approach from that of on-line processing as the two are frequently implemented together. The main advantage of DBMS usage was availability of data. The main disadvantage was in the use of hardware resources

- a DBA function had been set up in the majority of organisations. There was a tendency for the DBA to act mainly as technical support to the DP department and to have little or no contact with users of applications. The DBA was invariably located in the DP department

- few respondents could indicate how development, maintenance and operating costs had been affected by the introduction of database systems, or the costs involved in database administration or DBMS support

- both organisational and technical problems were anticipated in adopting a database approach. Most organisations faced no problems in installing the DBMS.

MSSI

This was a DBMS market research survey conducted in the USA (Leavitt, 1976). The findings were mainly on operational experiences. DP managers using DBMSs indicated that if they were to repeat the process, they would devote more time and attention to:

- determining the potential impact on their operating environment
- preparation of a detailed proposal to DBMS vendors
- use of bench-mark tests

Wiorkowski

This survey was also carried out in the USA and examined the advantages and disadvantages of using a DBMS (Wiorkowski & Wiorkowski, 1978). The conclusion reached was that the overall cost-benefit favoured use of a DBMS, particularly if it was accompanied by

- introduction of on-line working
- re-design of applications to promote integration

Butler-Cox Foundation

In late 1978, the Butler-Cox Foundation surveyed the reaction of a sample of DBMS users in the UK and other European countries to their experience with database management systems (Butler, 1980). The survey posed four questions:

- reason for adopting a DBMS
- factors influencing choice
- benefits actually achieved
- satisfaction with the package

The findings indicated that

- no single reason appeared to dominate, though reduced programming effort in development was not as strong a motivator as the ability to respond faster to new requirements

- ease of use was an important criteria in selection

- users of DBMSs claimed that it had resulted in reduced programming, less duplication and more consistency of data and a quicker response to new and changing needs

QED Information Sciences

A specialised aspect of DBMS usage has been examined in this study conducted in the USA (Hoffer, 1980). User experiences with select DBMSs were compared to establish responsibilities for key selection. The survey concluded that:

- the most likely team for identifying secondary indices - alternative means for accessing the database - was the system analyst-DBA pair

- the database re-design process needs to be recognised. In most cases, new indices were created after the database came into operation, in response to originally unanticipated data selection requirements

1.3 THE NEED FOR FURTHER RESEARCH AND THE RESEARCH QUESTIONS

This section establishes the need for further empirical research and introduces the City University database project. The research questions addressed in this thesis and the thesis structure are also presented.

1.3.1 The Need for Research and the City University Database Project

The Need for Research

- The most comprehensive survey of U.K. database projects to date has been the NCC study (EEC-NCC, 1979). However, this survey was primarily concerned with experiences in the use of DBMS software. Though some wider organisational issues were addressed, its scope in this area was limited: for example it established the occurrence of organisational problems, but its objective was not to seek out a classification or probe into their nature. Moreover, a study of database in its organisational context, of the type conducted by Nolan in the USA, has never been undertaken in the U.K. Understanding of the organisational aspects of database systems in the U.K. context is incomplete.

- Previous researchers have identified practical problems faced in the field: in drawing the distinction between DBMS usage and the database approach (EEC-NCC, 1979); the different types of DBA (Weldon, 1979); the need for further research into the organisational problems (De Blasis & Johnson, 1978). Research work is needed to provide answers to very real and practical issues concerned with the implementation of a database project.

The City University Database Project

- This is an empirical study of UK organisations who are, or claim to be, involved in database projects. Its terms of reference are as outlined in Section 1.2

  The project commenced in 1976 and is based on surveys and in-depth interviews, mainly with database administrators. This thesis draws on the findings obtained in the period 1976-1981.

- The research project has inevitably been influenced by previous empirical studies, particularly that of the Harvard Business School (Nolan, 1973a). Its findings have been made available to practitioners and the research community through the following refereed papers:

  - Sherif (1977) - an initial picture was built up of U.K. organisations' approaches to database projects: staffing, factors motivating interest, the nature of the problems faced and the strategy in DBMS

  - Sherif & Hanson (1978) - an update on the above paper, together with findings obtained on DBAs' perceptions of their job

  - Sherif & Revell (1981) - a further update, together with a more detailed consideration of the implications of differing views of the database concept and the decision-making processes gone through when putting the concepts into practice

  - Sherif & Revell (1982) - a comparision of the findings of database surveys in three areas: the processes by which organisations become drawn into database implementation; their response to the requirements of, and for, new tasks and skills; views on the advantages, disadvantages and problems once database systems are in operation.

1.3.2 The Research Questions and Structure of the Thesis

Although this thesis draws together and develops many of the notions first proposed in the above papers, and concepts suggested by Revell (1977; 1981; 1982), its analysis and conclusions in the main represents unpublished material.

The thesis is structured around four groups of questions:

What is understood by the term 'database' and why is it sought-after?

When is database development appropriate?

What is the DBA role, where in the organisation is the function placed and who is appointed to this position?

Why do political problems occur and how can management cope?

Structure of this Thesis

This chapter has outlined the basic terminology of the thesis and the research objectives. The research project has been placed in the context of previous work in the field. The remaining nine chapters fall into five logical groups:

- a description of the research methodology (Chapter 2)

- findings of a preliminary survey on the organisational dimension of database projects: lines of further investigation identified (Chapter 3)

- the research questions addressed (Chapters 4-7) and concepts clarified in case study accounts (Chapter 8)

- historical expressions of the DBA role and speculations on its future (Chapter 9)

- conclusions: the research objectives re-examined (Chapter 10)

2. RESEARCH DESIGN

It was noted in the introductory chapter that the objective of this research project was to describe the organisational dimension of database development as it exists in reality. This chapter describes the strategy adopted to capture this reality and the conceptual framework which has guided analysis of the findings.

The area of investigation is one in which it is difficult to draw precise and unambiguous boundaries at the outset. The strategy for the field-work was therefore to commence with a preliminary survey, to confirm intuitively held notions and identify lines of investigation which could be further explored in a detailed survey. The research questions addressed in this thesis have evolved through a process of experiential learning.

This chapter consists of two sections:

- survey procedures
- methodological considerations.

2.1 SURVEY PROCEDURES

Data was collected by postal questionnaire in the preliminary survey and through semi-structured interviews in the detailed survey. The postal survey form and interview guide are presented in Figures 2.1 and 2.2 respectively. The surveys' design and sampling bases are described below.

Postal Survey

The postal survey form was very simple and consisted of multiple choice and short fill-in questions. It provided for 7 classificatory variables, listed in Figure 2.3. Two additional variables were obtained separately for the surveyed organisations: industry type, derived from the Standard Industrial Classification (HMSO, 1980) and period of survey data collection, by reference to the project's memorandum information. The following conventions were used in coding returns:

> **Postal Survey Q.1:** In organisations with database projects at more than one stage of development, the more advanced phase of completion was the basis of classification.

No.__________

Please tick a box in each row, or make an entry where appropriate.

1.	At what stage is data base development in your organisation?	FEASIBILITY STUDY ONLY ☐	UNDER IMPLEMENTATION ☐	IN OPERATION ☐	OTHER - - - - - - - - -
2.	What staff have you assigned (or will assign) to data base studies and implementation?	OUTSIDE CONSULTANTS ☐	ACQUIRED NEW STAFF ☐	TRAINED EXISTING STAFF ☐	OTHER - - - - - - - - -
3.	Does the data base approach result in cost-saving?	TOO EARLY TO SAY ☐	POSSIBLY ☐	DEFINITELY ☐	
4.	Does the data base approach improve the provision of management information?	☐	☐	☐	
5.	What strategy have you adopted for developing the data base?	BUILD OWN DBMS ☐	BUY PACKAGE (Please State) - - - - - - - - -	UNDECIDED ☐	
6.	What difficulties have you encountered pursuing the data base approach?	TECHNICAL MINOR ☐	TECHNICAL SERIOUS ☐	'POLITICAL' MINOR ☐	'POLITICAL' SERIOUS ☐

Please return the completed questionnaire in the enclosed self-addressed envelope.

FIGURE 2.1 : Postal survey questionnaire

Interview Check-list

Q.1 What is the interviewee's impression of what a database should be and do?

Q.2 What factors prompted your organisation to undertake a database study?
to improve the provision of management information; to reduce maintenance cost/effort; to reduce development cost/effort; to promote data sharing; OTHER

Q.3 At what management level was the proposal for a database study first initiated?

Q.4 What were the terms of reference/objectives of the feasibility study?

Q.5 What activities have been, or will be undertaken as part of the database feasibility study?

Q.6 What staff have been involved in the study?

Q.7 What strategy was adopted to obtain user involvement?

Q.8 What form did user involvement take?

Q.9 Is it important to obtain user involvement? What problems were faced in obtaining it?

Q.10 If database administration staff have been appointed, how do they view their responsibilities?

Q.11 How does the DBA fit in the reporting structure?

Q.12 What are the expected organisational problems?

FIGURE 2.2 : Interview guide

STAGE	- Feasibility - Implementation - Operational
STAFFING	- Existing staff only - Existing staff & new staff - Consultants used
VIEW ON COST-SAVING	- Too early to say - Possibly - Definitely
VIEW ON MANAGEMENT INFORMATION	- Too early to say - Possibly - Definitely
SOFTWARE STRATEGY	- Build own - Package
TECHNICAL PROBLEMS	- Minor - Serious
POLITICAL PROBLEMS	- Minor - Serious

FIGURE 2.3 : Postal Survey
Classificatory variables

Survey forms not indicating any stage, or with only a tick in the 'other' entry, were rejected as invalid responses and not included in the analysis.

Postal Survey Q.2: The 'Consultants used' category reflects projects in which consultants were utilised, irrespective of the use of existing or new staff.

Postal Survey Q.4: In organisations building a DBMS as well as using a package, the Software Strategy classification assigned was 'Build own'.

The questionnaire was usually addressed to organisations' DP managers. The covering letter assured respondents of confidentiality (Figure A1, Appendix A). UK organisations were identified by cross-referencing several different sources:

- the technical press and journals, eg. advertisements for database staff, reports of database projects

- professional sources, eg. database conference delegate lists

- contacts with other researchers, eg. the National Computer Centre's list of DBMS users.

A small number of organisations also volunteered to participate after reading accounts of the project in the technical press (Sherif, Hanson & Revell, 1977; 1978).

In the period 1976-1981 the questionnaire was sent to 285 organisations. Valid returns were obtained from 212 - a response rate of 74%.

The sampling basis was one of availability. A genuine randomised selection was not appropriate for three reasons:

- given the ambiguity in the term 'database', the imposition of a rigid definition - in order to establish a sampling frame - would have led to the exclusion of projects possibly containing vital information

- database systems as an organisational phenomenon are little understood - organisations willing to volunteer information could not be rejected as the priority was to obtain as much information as possible on real experiences

- the issues of interest, for example, the political problems of database development, are of a sensitive nature - random selectees could not always be induced to relate their experiences.

None of the previous database surveys identified in a literature search employed random sampling to select organisations.

The survey design differs from recent surveys as it was not restricted to one computer manufacturer's installations (Gillenson, 1982), or to users of DBMSs (Wiorkowski, 1978; Butler, 1980) or members of one computer services association (EEC-NCC, 1979). The survey was also the most extensive involving UK organisations:

- the National Computer Centre's initial database postal survey obtained responses from 126 organisations out of 400 - a response rate of 32% (EEC-NCC, 1979; p.19)

- the Butler Cox Foundation's DBMS postal survey obtained responses from 100 organisations out of 500 - a response rate of 20% (Butler, 1980; p.20).

The scope of both the above surveys was similar to the present study's, ie. one page questionnaires. While the postal survey was clearly not exhaustive for the U.K., the participation of over 200 organisations made it sufficiently large so as to be representative.

Interview Survey

The interview survey was an in-depth study of U.K. database projects. The questions were constructed to permit open-ended responses. The interviewees' responses were recorded verbatim for subsequent analysis and not coded according to previously defined classification schemes.

Interviews were conducted in organisations which had participated in the postal survey. The arrangements were made in a telephone conversation with the DP manager. Reference was made to the postal survey, the objectives of the follow-up interview were explained and an interview requested with the staff member with responsibility for database developments in the organisation. A period of 30-45 minutes was requested.

The interviews were semi-structured: the interview check-list was presented to the interviewee at the outset though the order in which questions were addressed was left flexible. It was not always possible to adhere to the interview plan and not all questions were always answered. The check-list was useful in controlling the discussion and the individual questions provided openings to probe the issues of interest. An overriding concern at the interviews was to obtain some understanding of the organisational and political problems, because this was information only available through face-to-face discussion and persistent questioning.

The interviewees' responses were recorded in a note book in the course of the discussion - assurances had been given that organisation identities would be held in confidence. The researcher's training as a systems analyst was invaluable in managing the interviews and recording the information - this phase of the research bore resemblances to a conventional user requirements study. Moreover, the interviewees were genuinely enthusiastic about discussing the issues raised and describing their own experiences. In some organisations the researcher was given sight of internal documents, such as system specifications, database standards and project memoranda and could take additional notes. Database feasibility study reports were also loaned by several interviewees. The interview duration was rarely the 30 minutes requested, but took up 1-3 hours.

Twenty one organisations participated in the interview survey. The organisation types and interviewees' job-titles are presented in Figure 2.4. This sample size was large enough to provide a cross-sectional representation of industry types and stages of database development. Interviews were conducted in the period 1977-1981.

ORGANISATIONS	INTERVIEWEE	STAGE OF DATABASE DEVELOPMENT
1. Toy Manufacturer	Management Services Manager	Feasibility
2. Investment House	DBA	
3. National Research Laboratory	DBA	
4. Building Material Supplier	Database Manager	
5. Transportation Company	DBA	Implementation
6. Public Corporation	DBA	
7. Local Authority-1	DBA	
8. Local Authority-2	Data Administrator	
9. Energy Supply Works	Computer Services Manager	
10. Toiletries Company	Business Systems Manager	
11. Civil Engineering Contractors	DBA	
12. Insurance House	Data Administrator	
13. Oil Company-1	Data Administrator	
14. Chemicals Company	DBA & Controller	Operational
15. Office Products Manufacturer	Planning & Development Manager	
16. Teaching Hospital	Director	
17. Computer Manufacturer	DBA	
18. Public Services Agency	DBA	
19. Electronic Components Company	Data Administrator	
20. Local Authority-3	Application Support Group Manager	
21. Oil Company-2	Data Administrator	

FIGURE 2.4 : Interview survey

- geographical location
- postal survey response to the question on political problems.

Most of the interviews were conducted in the Greater London area. Organisations noting 'serious' political problems in their postal survey responses were preferred on the grounds that these would also be more forthcoming in clarifying the nature of the political problems faced and also describing other organisational issues. The organisations selected for the interview survey were representative of the organisations participating in the postal survey in all respects except for the occurrence of 'serious' political problems. Use of the Chi-squared test does not lead to a rejection, at the 95% level of confidence, of the null hypothesis that there was no difference in the two surveys with respect to:

- Stage
- Staffing
- View on cost-saving
- View on management information

- Software strategy
- Technical problems
- Industry type
- Period of survey data collection.

However, the null hypothesis of no difference with respect to political problems can be rejected at a .001 level of significance.

The contingency tables supporting the statistical tests are presented in Appendix A (Section 3).

2.2 METHODOLOGICAL CONSIDERATIONS

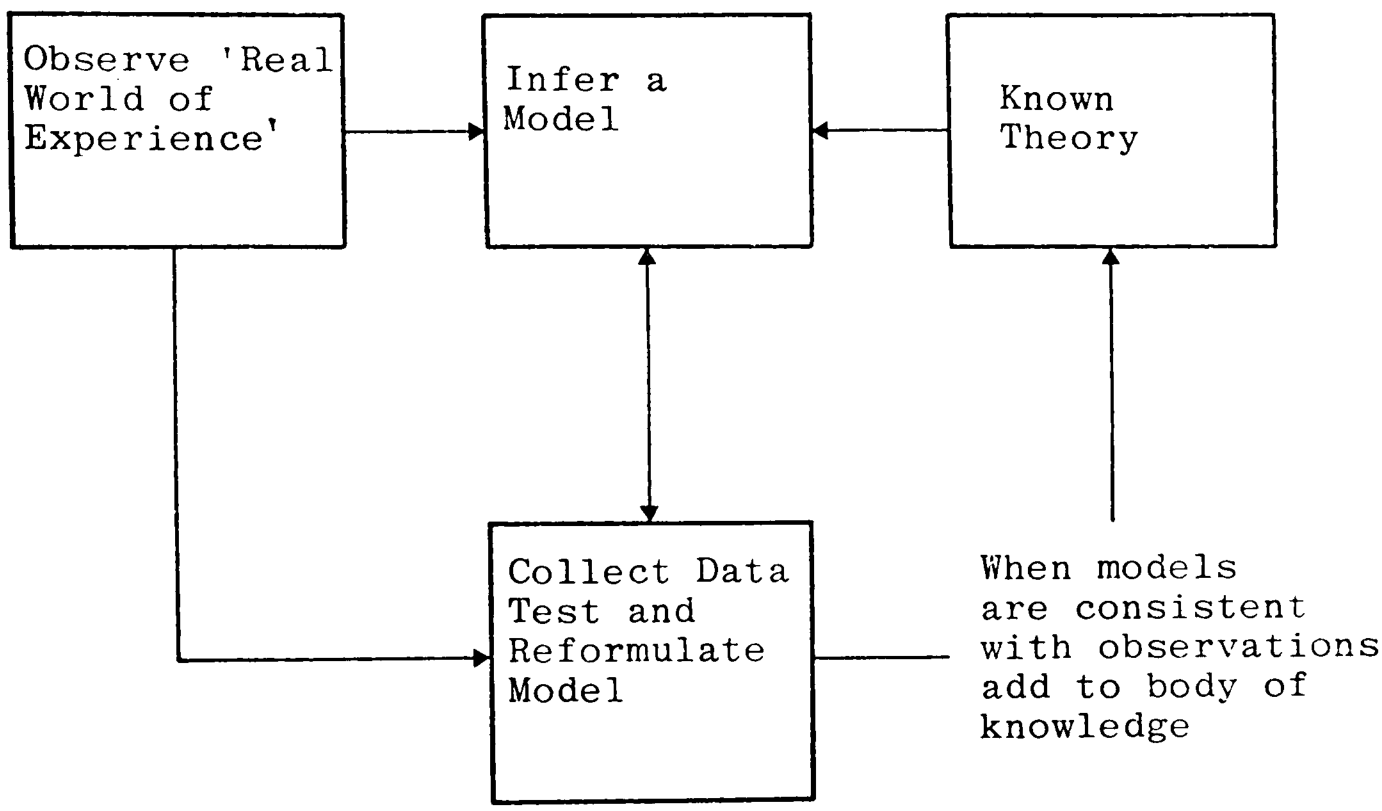
This study belongs to the comparatively new discipline of information systems management - an increasingly important inter-disciplinary area drawing together management processes and systems, data processing and organisational theory. The newness of the discipline can be gauged from the channels by which this body of knowledge is being formalised - the main academic journal in the field only commenced in 1977 (Information & Management, North-Holland Publishing Company).

Research into the organisational implications of database systems provides an opportunity for testing some methodological procedures which if successful in the special case can lead to a more general model for the furthering of knowledge in this area.

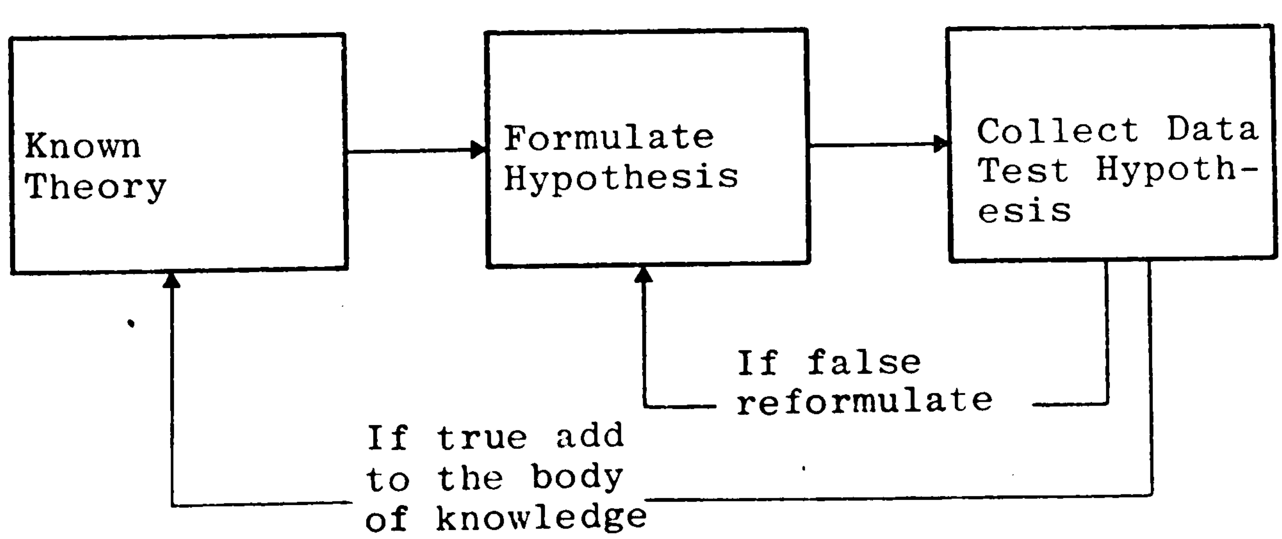
Two models of enquiry have been succinctly described by Tricker (1979) - feed-back and feed-forward. These are presented in Figure 2.5. The model for this study is the former. The feed-forward model is inappropriate in an investigational area in which there is little theory and few empirical results. It was not possible to formulate meaningful hypotheses on the organisational aspects of databases at the outset of this study, and to seek to validate these in the field. The comments which Mintzberg (1979) makes in the area of management policy are also apt to the problem at hand:

> "For the most part Management Policy is not yet ready for the hypothesis - testing of deductive research, since hypotheses are lacking, and it is not the single relationships that need to be studied so much as the system of inter-relationships .....

Feed-back model



Feed-forward model



Source: Tricker (1979) p.10

FIGURE 2.5 : Models of enquiry

Thus researchers must rely largely on the field study. A significant share of the research efforts should be devoted to intensive probes in single organisations. Small sample research will bring order to the array of **soft** variables in question."[1]

Organisational approaches to database and to database administration, the nature of the political problems and organisations' responses - these are soft variables not subject to a precise and narrow bounding.

Selection of the feed-back model places the onus very much on the researcher: a rich set of data needs to be collected and a mind has to delve deep into it in order to be able to synthesise an explanation of the phenomenon. This research philosophy has led to the adoption of a qualitative approach to the analysis of survey findings. In the interview data analysis, the responses obtained have been retained in verbatim

1. Mintzberg (1979), p.94 (researcher's emphasis)

form. The process of coding responses has always been related to an empirical base. Once the field of enquiry has matured a quantitative approach based on the feed-forward model could well be more fruitful.

The two-stage survey approach adopted in this study has offered an effective means for implementing the feed-back strategy of research. The postal survey identified important features in current practice which were then further explored and clarified in the interview survey. Specific examples of this pragmatic research methodology are available in subsequent chapters.

3. ORGANISATIONAL IMPLICATIONS OF DATABASE DEVELOPMENT - EVIDENCE FROM A PRELIMINARY SURVEY

This chapter presents findings from a survey of over 200 organisations in the U.K. who have, or claim to have, a database project. The survey methodology was described in Section 2.1, Chapter 2.

The objective of this preliminary survey has been to examine database development from an organisational rather than technical perspective, in order to uncover any general trends and identify issues for further investigation. It provides a basis for taking an informed view on the aspects of database development which should be regarded as being of organisational and managerial interest.

This chapter consists of three sections:

- survey features;
- analysis of results;
- conclusions - reality of the organisational dimension and issues which warrant further research.

The chapter makes reference to postal survey questions ('Postal Survey Q.') indicated in Figure 2.1, Chapter 2. <u>The survey data is listed in Appendix A.</u>

3.1 SURVEY FEATURES

The organisations participating in the survey may be classified in a matrix of industry type versus stage of database development, as noted in Figure 3.1(a). The latter is based on organisations' own assessment of which of three categories was most appropriate to their project (Postal Survey Q.1). Industry type was confirmed by reference to trade directories (Kompass-Confederation of British Industries, 1981) and reflects Standard Industrial Classification Codes (HMSO, 1980).

The organisations belong to the manufacturing (Utilities, Chemicals, Engineering) and service industries (Financial services/Government and other services) in equal proportions. Approximately one half were still in the process of investigating the feasibility of, or implementing, their first database project, while the other half had one or more database systems in operation.

The survey was dynamic in that as new organisations were identified as implementing database, they were sent a questionnaire and included in the study. Figure 3.1(b) indicates the survey data was collected over 6 years, classified into 3 two-year periods. The ongoing nature of the survey has provided for further validation of the results and made it possible to investigate the emergence of new trends.

(a) industry types and stages of database development

STAGE OF DATABASE DEVELOPMENT / INDUSTRY TYPE	FEASIBILITY	IMPLEMENTATION	OPERATIONAL	TOTAL NUMBER OF ORGANISATIONS
UTILITIES/CHEMICALS	11	17	15	43
ENGINEERING	16	17	28	61
DISTRIBUTION	4	5	10	19
FINANCIAL SERVICES	8	13	17	38
GOVERNMENT AND OTHER SERVICES	14	17	20	51
TOTAL NUMBER OF ORGANISATIONS	53	69	90	212

(b) data collection periods

	NUMBER OF ORGANISATIONS	% OF SAMPLE
1976-77	92	43
1978-79	52	25
1980-81	68	32
	212	100

FIGURE 3.1 : Survey features

3.2 ANALYSIS OF RESULTS

The survey responses enable a picture to be built of approaches to staffing, factors motivating development, software strategy and the type of problems faced. These database project characteristics are presented below and subsequently reviewed in the context in which development occurs - stage of systems development reached, industry type and survey period. Reference is also made to the findings of previous surveys.

3.2.1 Database Project Characteristics

(i) Approaches to Staffing

All organisations indicated the type of staff assigned to their database project (Postal Survey Q.2). The responses are noted in Figure 3.2. The majority of organisations - about 60% - have chosen to redeploy their existing staff, rather than recruit database expertise. U.K. experience indicates that database projects do not necessarily lead to the hiring of additional staff - it is not a pretext for empire-building. A number of explanations may be offered:

	NUMBER OF ORGANISATIONS	% OF SAMPLE
Existing Staff only	126	59
Existing staff and/or new staff	41	19
Consultants used	45	21
	212	100

FIGURE 3.2: Staffing of Database projects

- database staff require two types of skills - a knowledge of the business as well as expertise in database technology and methodologies. The former is only held by long-standing staff members

- staff with database expertise are difficult to recruit and there is no recourse but to train existing staff

- DP management view the database project as an internal technical issue within the competence of existing staff - or at least welcomed by them as an opportunity for enhancing their skills. The purchase of a DBMS is regarded in much the same way as the acquisition or adoption of other technical aids. The need to obtain specialist expertise through recruitment or use of consultants is, therefore, considered unnecessary

Only 1 in 5 organisations used consultants. The survey results suggest that many of the fundamental decisions on database development - for example, whether or not the approach is a viable proposition in the existing data processing environment, are made with little independent guidance or bought-in expertise. The occurrence of serious technical and political problems reported in a subsequent section may be understood in this light.

(ii) Factors Motivating Development

The extent to which two objectives - cost-saving and the better provision of management information - are considered attainable by organisations has been recorded in the survey (Postal Q 3 & 4). Organisations were asked to indicate which of three views were held, and the findings are presented in Figure 3.3. A small proportion of organisations did not respond to these questions. Only 15% of organisations were confident of obtaining definite cost-savings (Figure 3.3a). This response may reflect the practical difficulties faced in quantifying the costs and benefits of information systems projects. It is also unlikely that a database project will be cost-effective in the short-term, since there is always a high initial cost of creating the technical and organisational environment - software acquisition, staff training, for example - which cannot be easily off-set against any single application. Moreover, cost-savings may not be the prime motivating factor for database development - for example, half of the organisations were unequivocal about the beneficial impact on management information (Figure 3.3b).

(a) Views on cost saving

	NUMBER OF ORGANISATIONS	% OF SAMPLE
Too early to say	103	52
Possibly	65	33
Definitely	30	15
	198	100

(No response from 14 organisations)

(b) Views on improvement to management information

	NUMBER OF ORGANISATIONS	% OF SAMPLE
Too early to say	44	22
Possibly	52	26
Definitely	108	52
	204	100

(No response from 8 organisations)

FIGURE 3.3: Factors motivating development

The relationship between organisations' views on cost-saving and management information are further explored in Figure 3.4. This indicates that in about 200 organisations, not a single case was observed where 'definite' cost-saving could be claimed without there also being at least a possibility of improvement to management information. This confirms the unimportance of cost-savings as an objective for database development. The comparison also shows that in 88 organisations - 45% of the sample providing responses - database development was being undertaken without certainty of either the cost-saving or management information benefit.

What is it then that prompts the interest? Several organisations felt strongly enough about this issue to volunteer further information in covering letters to their questionnaire return. Some extracts are presented in Figure 3.5. These provide examples of other reasons for interest in database development. It is apparent that 'database' means very different things: from a "convenient method of storing and retrieving records for an enquiry system" (Paper Manufacturer), to a basis for meeting "the information needs of successively higher levels of management" (Pharmaceuticals Company). A classification of approaches to database is, therefore, essential to reduce the ambiguity and provide a meaningful basis for comparison.

Number of organisations

COST-SAVINGS

IMPROVEMENT TO MANAGEMENT INFORMATION		TOO EARLY TO SAY	POSSIBLY	DEFINITELY
	TOO EARLY TO SAY	38	4	0
	POSSIBLY	30	16	3
	DEFINITELY	34	44	26

195 organisations

FIGURE 3.4 : Views on Database objectives

PUBLIC ADMINISTRATION ORGANISATION

I was surprised to see that questions 3 and 4 totally discount any possibility that the implementation of a database system might not lead to cost-savings or to any improvement in the provision of management information. For our part we did not implement a database for either of these reasons. We chose to adopt the database approach in order to separate the true application code from the database handling code in order to:

* spread the load of program production;
* employ our more skilled programmers on the more complex tasks;
* enable changes to either set of software to be made without modification of the other.

CHEMICALS COMPANY

Reason for choosing database techniques - latest phase of system involve a major growth in linking existing and new files from different systems; experience of past few years show that this caused substantial increases in program maintenance without database techniques.

PHARMACEUTICALS COMPANY

A policy decision of corporate management was made early in 1975 to adopt the database approach to system development and to allocate resources to a new function to centrally develop, administer and control the corporate database. The objectives of this approach were to develop the database to provide consistent, comprehensive and corporate data to meet the information needs of successively higher levels of management

PAPER MANUFACTURER

We use the Hewlett-Packard dbms 'IMAGE' as a method of file organisation in one system and as a convenient method of storing and retreving records for an enquiry system

MECHANICAL ENGINEERING COMPANY

I have not replied to question (3) as I believe it is possible that the Database approach could result in no cost saving. I have written, personally because I think the subject is of great importance to industry generally, offering many advantages but also providing many overheads. At this company we have used the Database approach quite successfully and effectively, but one has to recognise the value of "horses for courses".

FIGURE 3.5 : Organisations' comments

(iii) Software Strategy

A further question asked of organisations was whether they intended building their own DBMS or acquiring a package (Postal Survey Q.5). As noted in Figure 3.6a, the latter approach has been dominant. No response was obtained from 23 organisations, usually because the database project was still at an early stage and consideration had not been given to these issues. A separate analysis of the survey data reveals 20 different packages in use. The three most frequently acquired packages were IBM's DL/I or IMS (56 organisations) followed by TOTAL (24 organisations) and ICL's version of IDMS (16 organisations). These products run on mainframe installations, and in the case of TOTAL, on large minis as well. The survey is, therefore, mainly representative of medium to large computer installations. The use of individual packages has not been analysed further in this thesis.

(iv) Type of Problems Faced

Organisations indicated on a simple scale the nature of the technical and political problems faced or anticipated (Postal Survey Q.6). The scale minor-serious was not defined and the findings reflect respondents' own perception of the situation in their organisation. A third of the organisations - 71 out of 212 - did not comment on their political problems. This is not surprising, given the sensitive nature of the question.

(a) Software Strategy

	NUMBER OF ORGANISATIONS	% OF SAMPLE
Build in house	17	9
Acquired Package	172	91
	189	100

(No response from 23 organisations)

(b) Type of problems

	TECHNICAL		POLITICAL	
	NUMBER OF ORGANISATIONS	% OF SAMPLE	NUMBER OF ORGANISATIONS	% OF SAMPLE
Minor	140	81	100	71
Serious	33	19	41	29
	173	100	141	100

(No response from 39 organisations)

(No response from 71 organisations)

FIGURE 3.6: Database organisational characteristics

However, in spite of this non-response bias, the findings indicate that serious political problems occurred more frequently than serious technical problems. When looking at the question of minor problems, then technical problems were found to predominate. This evidence for the occurrence of serious political problems, and their relative dominance, is a crucial finding of the survey: political problems serve as a barometer of the organisational impact of database development.

3.2.2 Organisational Context of Database Development

This section explores the effect of three factors - stage of database systems development, industry type and period of survey - on the database characteristics presented above, with the exception of the technical issues (software strategy, technical problems).

Each factor provides a basis for partitioning the sample into independent sub-sets:

- **Stage:** the categories reflect phases in the life cycle of an information systems project. Though not explicity defined in the questionnaire, the classification is common knowledge in the industry and central to information systems project management. The distinction between **Feasibility** and **Implementation** is usually based on the commencement of design work in earnest in the latter. The **Operational** stage is distinct because it means a system going live or entering production.

. **Industry Type:** the categories reflect the type of organisation.

. **Period:** the categories reflect different DP industry environments.

Stage, Industry Type and Period provide a preliminary scheme for describing the organisational context in which database development occurs.

(i) Organisational Contexts and Approaches to Staffing

Stage of database development

The pattern of mainly redeploying only existing staff on database projects, rather than bringing in new expertise, is retained irrespective of stage. As noted in Figure 3.7a, more than half of the projects at each stage had existing staff only. However, consultants were used more frequently in the earlier stages: for example, in about 1 in 4 of organisations at the feasibility and implementation stages, but in 1 in 6 of organisations at the operational stage. This suggests that organisations have a greater need for specialist expertise during the planning and implementation phases of the database project.

Industry Type

A comparison of staffing approaches in different types of organisations is presented in Figure 3.7b. The analysis indicates that in only two industry types - Distribution and Financial Services - did 50% or more of the projects recruit new staff or use consultants' services. This ability may be related

Number of organisations

STAFFING

(a) Stage

	EXISTING STAFF ONLY	EXISTING STAFF AND/OR NEW STAFF	CONSULTANTS USED	
FEASIBILITY	30	11	12	53
IMPLEMENTATION	36	15	18	69
OPERATIONAL	60	15	15	90
	126	41	45	212

(b) Industry type

UTILITIES/ CHEMICALS	34	3	6	43
ENGINEERING	36	15	10	61
DISTRIBUTION	8	5	6	19
FINANCIAL SERVICES	19	8	11	38
GOVT. & OTHER SERVICES	29	10	12	51
	126	41	45	212

(c) Period

1976-77	59	13	20	92
1978-79	30	12	10	52
1980-81	37	16	15	68
	126	41	45	212

FIGURE 3.7 : Organisational contexts & approaches to staffing

to the profitability of an industry, and an association between industry type and staffing approach is not unexpected.

Period

No significant shifts in approaches to staffing are apparent over the duration of the survey, as noted in Figure 3.7c. The initial dearth of database expertise in the industry may have prompted some job market movements, but not sufficiently to make the recruitment of new staff more widespread.

(ii) Organisational Contexts and Factors Motivating Development

Stage of Database Development

Of the 30 organisations claiming definite cost-savings, 27 already had one or more database systems in operation (Figure 3.8a). While it may be that a justification for the development is being made in retrospect, after resources have been committed and expended, it is also possible that organisations have to wait until their database systems are in operation before the quantifiable benefits are apparent. However, the analysis confirms that cost-savings are not a prime motivator in organisations embarking on a

Number of organisations

VIEW ON COST-SAVING

(a) Stage

	TOO EARLY TO SAY	POSSIBLY	DEFINITELY	
FEASIBILITY	45	6	0	51
IMPLEMENTATION	36	28	3	67
OPERATIONAL	22	31	27	80
	103	65	30	198

(b) Industry type

	TOO EARLY TO SAY	POSSIBLY	DEFINITELY	
UTILITIES/ CHEMICALS	25	11	6	42
ENGINEERING	27	21	8	56
DISTRIBUTION	5	5	6	16
FINANCIAL SERVICES	18	11	7	36
GOVT. & OTHER SERVICES	28	17	3	48
	103	65	30	198

(c) Period

	TOO EARLY TO SAY	POSSIBLY	DEFINITELY	
1976-77	48	28	11	87
1978-79	22	18	7	47
1980-81	33	19	12	64
	103	65	30	198

FIGURE 3.8 : Organisational contexts & view on cost-saving

database project. In contrast, over half of the respondents confident of a definite improvement in the provision of management information were still at the feasibility and implementation stages (Figure 3.9a). This also points to a possible basis for a two-fold classification of organisational approaches to database: those embarking on the development because of a strong recognition that the organisation's information should be put to better corporate use, and others lacking this objective. Of 200 organisations, only about 50 can be considered in the former class.

Industry Type

Views on cost-saving are not significantly affected by industry type: in all the categories, only the smaller proportion of organisations expected definite cost-savings (Figure 3.8b). However, in one category, 'Government & Other Services', only 3 out of 48 organisations identified definite cost-savings. Database development for cost-saving reasons may, therefore, be even less appropriate in certain organisational environments. Views on the improvement to management information appear to be

Number of organisations

VIEW ON MANAGEMENT INFORMATION

(a) Stage

	TOO EARLY TO SAY	POSSIBLY	DEFINITELY	
FEASIBILITY	20	14	19	53
IMPLEMENTATION	13	20	35	68
OPERATIONAL	11	18	54	83
	44	52	108	204

(b) Industry type

UTILITIES/ CHEMICALS	11	10	21	42
ENGINEERING	9	13	35	57
DISTRIBUTION	1	7	11	19
FINANCIAL SERVICES	7	11	19	37
GOVT. & OTHER SERVICES	16	11	22	49
	44	52	108	204

(c) Period

1976-77	19	24	44	87
1978-79	10	14	25	49
1980-81	15	14	39	68
	44	52	108	204

FIGURE 3.9 : Organisational contexts & view on improvement in provision of management information

independent of industry type: in all the categories, the majority of organisations identified possible or definite benefits (Figure 3.9b).

Period

The pattern of views on cost-savings and improvement to management information described above hold for the three survey periods spanning 6 years (Figures 3.8c, 3.9c). The major innovation in the industry in the time-scale - for example, small business systems - are possibly too recent to make any significant difference to the total U.K. picture.

(iii) Organisational Contexts and Occurrence of Political Problems

Stage

Serious political problems can be confronted from the earliest phases of a project. Figure 3.10a indicates that a quarter of the respondents were at the Feasibility stage. About half of the organisations identifying serious political problems were at the

Number of organisations

POLITICAL PROBLEMS

(a) Stage

	MINOR	SERIOUS	NO COMMENT	
FEASIBILITY	21	10	22	53
IMPLEMENTATION	43	10	16	69
OPERATIONAL	36	21	33	90
	100	41	71	212

(b) Industry type

	MINOR	SERIOUS	NO COMMENT	
UTILITIES/ CHEMICALS	16	9	18	43
ENGINEERING	32	14	15	61
DISTRIBUTION	8	3	8	19
FINANCIAL SERVICES	16	6	16	38
GOVT. & OTHER SERVICES	28	9	14	51
	100	41	71	212

(c) Period

	MINOR	SERIOUS	NO COMMENT	
1976-77	40	18	34	92
1978-79	24	11	17	52
1980-81	36	12	20	68
	100	41	71	212

FIGURE 3.10 : Organisational contexts & political problems

Operational stage. This is to be expected as the more advanced stages of development provide a better vantage point from which the organisational impact can be assessed. Organisations at the Implementation stage provided the least non-responses, suggesting that once database development starts in earnest, the political dimension cannot be easily ignored.

Industry Type

Serious political problems were found in all types of organisations, as noted in Figure 3.10b.

Period

The occurrence of serious political problems has remained a consistent feature in the course of the survey. Figure 3.10c indicates that in each of the three data collection periods, about 1 in 5 organisations acknowledged their existence. No innovation in the DP state of the art have markedly reduced their occurrence.

3.2.3 Comparison with other studies

Most of the issues addressed in this survey have not been examined in previous empirical studies and so only limited comparisons may be made.

Use of consultants: this issue has been investigated in the EEC-NCC survey of UK organisations (EEC-NCC, 1979). The findings are compared in Figure 3.11. Both surveys conclude that 20-25 per cent of organisations felt it necessary to obtain consultants' expertise on their database projects.

Impact of Industry Type: this study's findings suggest that the database characteristic most affected by industry type is approach to staffing. A recent Canadian survey (McCririck & Goldstein, 1980) has also observed a relationship between the creation of a data administration function and organisation types. It uncovered a statistically significant association between the emergence of a data administration function and organisations in industries with high profits in recent years The greater extent to which new staff are recruited or consultants used by organisations in the Distribution and Financial Services industry types in the UK may be explained by the greater availability of discretionary funds.

Survey:	Number of organisations EEC-NCC[1]	THIS STUDY	TOTAL
Consultants used	9	45	54
Consultants not used	26	167	193
Total	35	212	247

1 Source: EEC-NCC (1979), Q 3.5, p.80

(Chi-squared statistic = .31. At the 95% level of confidence, the null hypothesis of no difference in surveys' populations cannot be rejected.)

FIGURE 3.11: Comparison of survey findings on use of consultants

3.3 CONCLUSIONS

The survey provides factual evidence for the organisational dimension of database development and identifies lines of further investigation. This section presents the justifications for regarding a database project in organisational terms and identifies the issues which are of managerial interest and warrant further research.

Reality of the organisational dimension

- The emphasis of the survey was not on the technical aspects of database but rather organisational and managerial. The surprisingly high level of response - 74% - is indicative that the questions posed touched on issues of genuine interest. That some respondents felt strongly enough to elaborate on their own projects in covering letters is further proof of this interest. The organisational dimension is, therefore, a reality for the practitioners.

- The findings on political problems also confirm intuitively held notions on the organisational impact of database development - more organisations were found to face serious political problems rather than serious technical problems. Political problems serve as a barometer of the organisational implications of database development.

Management issues

- **Database objectives**: analysis of the factors motivating interest in database development reveal that neither cost-savings nor improvements to management information are necessarily of over-riding importance to organisations embarking on the project. The unsolicited comments point to very different concepts of what database is about and why it is sought-after. The issue of database objectives is among the first which management should clarify. Moreover, classification of organisational approaches to database is a prerequisite for further study in this area.

- **Organisational Context**: database development cannot take place in vacuum - database project characteristics are influenced by the organisational milleau and infrastructure. The survey only offers tentative evidence in this area because it is too blunt an instrument to unravel the interdependencies. The issue is of management interest because it determines when database development is appropriate in an organisation. Database objectives may need to reflect what is feasible in the organisational environment; the infrastructure may require changing in order for the objectives to be attainable. Further investigation is needed on the inter-relationship between the DP environment and approaches to database.

- Approaches to staffing: in the majority of projects only existing staff are redeployed and new expertise, for example through consultants' services, not introduced. Information systems management, therefore, have an urgent need for guidelines to assist in establishing <u>what</u> is to be expected from their specialist staff, <u>where</u> in the organisation structure they should be located, and <u>who</u> should be appointed.

- Nature of the political problems: political problems are a particular hazard in database projects. Further study is needed to establish their nature. There is much to be gained if the industry experience can be made more widely available, so that it is no longer necessary for organisations to learn by trial and error. Information systems management need to recognise <u>why</u> problems occur and <u>how</u> they may cope.

The preliminary survey has provided the initial contours of the organisational dimension of database development. Each of the management issues is explored in more detail in the subsequent chapters.

4. THE DATABASE APPROACH

When an organisation embarks on a database project for the first time, it breaks with traditional practice. The objective of this chapter is to define the vision of change in the minds of those most directly involved. It seeks to establish <u>what</u> is understood by the term 'database' and <u>why</u> it is sought after. A scheme for classifying organisations by database approach is also proposed. The chapter is based on the interview responses of 21 organisations to questions on their understanding of the database concept and the factors which first prompted interest in database development.

The chapter consists of three sections:

- survey data
- analysis and discussion
- conclusions - the organisational and management implications

The survey methodology on which this and subsequent chapters (chapters 5-8) are based has been previously described in Section 2.1, Chapter 2. The chapters make reference to interview questions ('Interview Guide Q.') listed in Figure 2.2, Chapter 2.

4.1 SURVEY DATA

All interviewees described their notions of what a database should be and do (Interview Guide Q.1), and the factors which first prompted the organisations' interest in database (Interview Guide Q.2).

4.1.1 Notion of Database

The responses, presented in Figure 4.1, suggest three levels of understanding. First, interviewees had in mind a physical file or data organisation whose main characteristic was improved accessibility. Second, database was viewed as a logical collection of data to which new disciplines of data integrity and control could be brought to bear. Finally, the term reflected a philosophy and reorientation in which database systems became a cornerstone of future information systems development in the organisation.

4.1.2 Database Objectives

A checklist of possible database objectives or benefits was presented to interviewees for ranking as 'very important', 'important' or 'unimportant' in first prompting interest in database. This checklist was left open-ended so that new entries could be added if it was considered necessary. Findings on the 'very important' objectives are presented in Figure 4.2. These indicate why organisations embarked on database development.

DATA ORGANISATION METHOD

A file which can be accessed quickly and efficiently from all directions
(Transportation Company)

A collection of files which support more than one application - as usable as a filing cabinet
(Public Corporation)

A fashionable term for an approach known to any programming manager- such as maintaining file definitions on a common library
(Energy Supply Works)

Equivalent to a conventional file using a chaining method
(Insurance House)

A data organisation which is easy to access, reasonably easy to maintain
(Public Services Agency)

DATA MANAGEMENT APPROACH

Encompasses all the company's data - should also be capable of deriving new data automatically. Contains information on the business which is accessible to users throughout the organisation
(Investment House)

Provides an easy means of storage, ensuring data integrity and security. Additionally the software to store the data should optimise the flexibility of the retrieval of the data, providing the potential for a greater range of reports and ease of interrogation
(National Research Laboratory)

A set of data which models the real world in a way to support the requirements of the local authority
(Local Authority-2)

A computer product making it easier to provide such features as data independence, security, recovery which are required for implementing certain types of systems
(Toiletries Company)

A database is a collection of data, not necessarily centralised, with minimum redundancy, which can be shared between systems and showing the relationships between data
(Civil Engineering Works)

The key concept is the centralised control of data
(Oil Company-1)

A collection of subject oriented databases which support a number of projects
(Chemicals Company)

Links all the company data and provides controlled redundancy
(Office Products Manufacturer)

Centralised store, holding each data item uniquely and providing easy access
(Teaching Hospital)

A collection of data, centrally coordinated though not necessarily centrally held at one physical location
(Computer Manufacturer)

An organised, controlled and coordinated repository of data
(Electronic Components Company)

A physical implementation of natural data relationships
(Local Authority-3)

A subject database, which contains data associated with a business subject but disassociated from any individual use of that data
(Oil Company-2)

INFORMATION MANAGEMENT PHILOSOPHY

Removes the historical constraints in the way a DP department can service users by providing greater flexibility for manipulating data
(Toy Manufacturer)

Centrally controlled repositories of master data - a means for excercising better control over information systems development
(Building Materials Supplier)

A data organisation which provides data independence, flexibility for expansion and the ability to implement new systems easily - a means for attaining a single version of the truth
(Local Authority-1)

FIGURE 4.1 : Database concept

ORGANISATIONS \ OBJECTIVES	To promote data sharing	To improve the provision of management information	To provide flexibility in processing data	To simplify operations of the organisation	To reduce duplication of data capture	To reduce maintenance cost/effort	To reduce development cost/effort	To seek replacement for obsolete file management software	To facilatate systems portability	To use a DBMS available free	To handle variable length records	To provide a file-handler capable of working in an on-line/TP environment	No choice - decision by overseas parent
1. Toy Manufacturer	O						O	O					
2. Investment House		O				O	O						
3. National Research Laboratory	O	O	O										
4. Building Materials Supplier	O		O										
5. Transportation Company												O	
6. Public Corporation		O							O				
7. Local Authority-1	O		O				O						
8. Local Authority-2		O					O						
9. Energy Supply Works											O		
10. Toiletries Company	O		O									O	
11. Civil Engineering Contractors	O	O										O	
12. Insurance House											O		
13. Oil Company-1	O					O							
14. Chemicals Company													O
15. Office Products Manufacturer		O	O				O						
16. Teaching Hospital	O												
17. Computer Manufacturer	O			O	O								
18. Public Services Agency			O									O	
19. Electronic Components Company										O			
20. Local Authority-3	O		O		O							O	
21. Oil Company-2	O	O	O	O		O							

FIGURE 4.2 : Reasons 'very important' for interest in database

The list of objectives in Figure 4.2 has been ordered. The objectives to the left indicate database development being recognised by organisations as a means for fundamental change in existing information systems. Objectives in the middle - lying region reflect the traditional concerns of DP management, for example ways of seeking improvements in productivity.

Objectives to the right indicate database development as an issue of interest to DP technicians. The left-most objective reflects the database project prompted by reasons outside the organisation's control. Most organisations indicated more than one type of objective for database development. 'To promote data sharing' emerges as the most frequently cited objective.

Some organisations provided further clarification of their database objectives, as noted in Figure 4.3. The views have been shown in two categories, to reflect contrasting approaches as suggested by the survey data. Organisations in one category (right hand box, Figure 4.3) place emphasis on the organisational and data policy issues which require a long-term perspective.

CONTRASTING

DATABASE APPROACHES

The transaction's access path was so complex that use of indexed sequential files would have led to unacceptable response times. So a file handler was required which could interface with a TP system

(Transportation Company)

The original sytem used five indexed sequential files. These were initialised at the start of each year by writing blank records and leaving an overflow area of 20%. This required the user to predict the expected records at the start of the year. Changes would rapidly lead to the filling up of the overflow area, making reorganisation necessary. Now instead of having to predict the detailed record structure at the start of each year we need only provide enough space and leave it to IDMS to decide how to pack it in. The DBMS hire costs are low and will be recovered by saving in programming effort

(Energy Supply Works)

Database is dedicated to a single, complex on-line application and is central to the system. On-line performance is the main criterion - don't really have data independence

(Public Services Agency)

Objective of the database will not be to achieve cost-reduction but organisational

(National Research Laboratory)

One objective of the Property database is to produce consistent information. The DBMS's structuring properties should enable us to eliminate redundant data but without producing high performance overheads

(Local Authority-1)

Reduction of maintenance costs is of considerable importance as the existing applications have reached the limits of effective maintainability. Excessive maintenance time arises because of data redundancy and non-standardisation, so that seemingly simple program changes become very involved. About 60 programmers are assigned full-time to the maintenance of about 25 systems - the total maintenance bill in 1978 was in the region of £300,000

(Oil Company-1)

National Research Laboratory: the wider significance of database development - to increase organisational effectiveness - has been grasped. It is recognised that such a commitment will not lead to cost-savings in the short-term.

Local Authority-1: the database is providing a new foundation for the organisation's information systems. This is because the most important type of data for a local authority - that on properties - is being reorganised so that a single, consistent version is available to users.

Oil Company-1: though the main imperative for change is a problem of maintenance costs, the malaise is recognised to lie in the current data management approach. A shared data environment may be cost-justified through reduced maintenance effort alone, without even considering the organisational benefits of improved information systems.

Organisations in the second category (left hand box, Figure 4.3) have a very different set of goals and the emphasis is on technical reasons for database development.

Transportation Company: the data structuring capabilities of a DBMS support a user requirement not previously feasible with the traditional file organisation methods. As the user requirement is on-line, the DBMS must be able to interface with a TP system. No longer-term considerations influence the database project other than fulfilling a specific user need.

Energy supply Works: the only feature of interest is the DBMS's house-keeping facilities of space management.

Public Service Agency: the DBMS is being used as a file-handler in a single application. Data independence, the DBMS facility which enables data to be shared, is not a feature of the system.

4.2 ANALYSIS AND DISCUSSION

The preliminary survey (section 3.2.1 ii,Chapter 3) indicated that neither of two objectives - cost savings or improved provision of management information - were of over-riding importance in a large proportion of organisations - 88 out of 195 (45%). The survey data presented in this chapter leads to a more complete view of the objectives for database development. This section is in two parts:

- description of a scheme for the classification of database objectives

- comparison of survey data with other studies' findings.

4.2.1 Classification of database objectives

In the light of survey findings, Revell (1977) proposed a conceptual scheme to distinguish between database adopted for long-term organisational benefits - the strategic approach-or for purely technical reasons - the functional approach. Some criteria are now proposed in order to apply Revell's scheme to the surveyed organisations.

The list of database objectives obtained from the survey have been grouped into strategic/functional categories, as noted in figure 4.4. Moreover two alternative bases (I and II) are used. An organisation is considered to pursue the strategic approach in its database development if it cites an objective in the strategic category, irrespective of whether it is also seeking functional objectives. The functional approach is considered to arise when no objectives in the strategic category are cited. The outcome of applying these conventions to the survey findings is noted in Figure 4.5. The organisations' stage of database development, as established in the preliminary survey, are also noted in the Figure. This classification has been retained in subsequent chapters.

BASIS I	Objective	BASIS II
STRATEGIC	To promote data sharing	STRATEGIC
FUNCTIONAL	To improve the provision of management information	STRATEGIC
FUNCTIONAL	To provide flexibility in processing data	STRATEGIC
FUNCTIONAL	To simplify operations of the organisation	STRATEGIC
FUNCTIONAL	To reduce duplication of data capture	FUNCTIONAL
FUNCTIONAL	To reduce maintenance cost/effort	FUNCTIONAL
FUNCTIONAL	To reduce development cost/effort	FUNCTIONAL
FUNCTIONAL	To seek replacement for obsolete file management software	FUNCTIONAL
FUNCTIONAL	To facilitate systems portability	FUNCTIONAL
FUNCTIONAL	To use a DBMS available free	FUNCTIONAL
FUNCTIONAL	To handle variable length records	FUNCTIONAL
FUNCTIONAL	To provide a file handler capable of working in an on-line/TP environment	FUNCTIONAL
FUNCTIONAL	No choice - decision by overseas parent	FUNCTIONAL

FIGURE 4.4: Database objectives - strategic & functional catagories.

CLASSIFICATION / ORGANISATIONS	BASIS I FUNCTIONAL	BASIS I STRATEGIC	BASIS II FUNCTIONAL	BASIS II STRATEGIC	STAGE
1. Toy Manufacturer		●		●	FEASIBILITY & IMPLEMENTATION
2. Investment House	●			●	
3. National Research Laboratory		●		●	
4. Building Materials Supplier		●		●	
5. Transportation Company	●		●		
6. Public Corporation	●			●	
7. Local Authority-1		●		●	
8. Local Authority-2	●			●	
9. Energy Supply Works	●		●		
10. Toiletries Company		●		●	
11. Civil Engineering Contractors		●		●	
12. Insurance House	●		●		
13. Oil Company-1		●		●	
14. Chemicals Company	●		●		OPERATIONAL
15. Office Products Manufacturer	●			●	
16. Teaching Hospital		●		●	
17. Computer Manufacturer		●		●	
18. Public Services Agency	●			●	
19. Electronic Components Company	●		●		
20. Local Authority-3		●		●	
21. Oil Company-2		●		●	

FIGURE 4.5: Database approach classification

The notion of database held by organisations with different approaches is presented in Figure 4.6. The tables only reflect organisations at the feasibility and implementation stages of database development. This is because the emphasis is on the first time introduction of database: the concept of database in organisations with one or more systems in operation is likely to be influenced by experience and hindsight.

The tables indicate that the two approaches differ markedly with respect to the concept of database that is held. For example, organisations which seek database development to promote data sharing (strategic approach, Basis I) never view database as merely a file organisation with a superior access method. Similarly, organisations exclusively concerned with a data processing problem or the use of a DBMS technical facility (functional approach, Basis II) are unlikely to associate database development with a rethinking of data management approach or information systems development philosophy. The analysis suggests that an important practical distinction between database projects lies in the adoption of the objective 'to promote data sharing'.

Number of organisations

DATABASE APPROACH

BASIS I

DATABASE NOTION		STRATEGIC	FUNCTIONAL
	INFORMATION MANAGEMENT PHILOSOPHY/ DATA MANAGEMENT APPROACH	7	2
	DATA ORGANISATION METHOD	0	4

13 organisations

BASIS II

DATABASE NOTION		STRATEGIC	FUNCTIONAL
	INFORMATION MANAGEMENT PHILOSOPHY/ DATA MANAGEMENT APPROACH	9	0
	DATA ORGANISATION METHOD	1	3

13 organisations

FIGURE 4.6 : Classification of organisations by database approach and database notion - database projects at Feasibility & Implementation stages only

4.2.2 Comparison with other studies

Notion of Database: the only previous database survey which documented organisations' own notions of what a database should be and do is that of Nolan (1973a). This study was based on interviews with DP managers of 10 companies in the USA. Unlike the present study, it was not limited to organisations with first-hand database project experience.

> "The open-ended question, 'What is the database in your company?' usually brought a puzzled expression to the manager's face, and then a request for clarification." [1]

Nolan concluded that a common view of database was as

> "shared random-access files used for periodic production programs and ad hoc management requests." [2]

In the period since Nolan's survey, the database concept has not only become more familiar to DP management but its meaning has evolved. The concept of database as a foundation for all information systems development activity was perhaps too novel a view - even in the USA - a decade ago.

1. Nolan (1973a), p.107
2. Ibid, p.108

Database Objectives: The EEC-NCC (1979) survey investigated organisations' main reasons for adopting the database approach. However, it observed

> "There was confusion between 'adopting the database approach' and 'using a DBMS'." [1]

Unlike the present study, in which one reason was cited by about half the surveyed organisations, no single reason dominated in the EEC survey. For example, the most frequently cited reason was found to be 'improved availability of information', referred to by 4 organisations out of 24 responding to this question. The findings of both studies are presented in Figure 4.7. The EEC study made no attempt to develop a classification of database approaches.

4.3 CONCLUSIONS

This section assesses the organisational and management implications of the findings presented in this chapter:

- At one level, the concept of database is understood as the adoption of DBMS in place of existing file and data management techniques. Equally, the term 'database'

1. EEC-NCC (1979), p.89

EEC-NCC study[1]	This study
Improved availability of information	Promotion of data sharing
Rationalisation of applications	Flexibility in processing data
Real-time/teleprocessing needs	Provision of management information
Reduction of maintenance costs	Reduction of development cost/effort
Improved access control	Real-time/teleprocessing needs
24 UK organisations	21 UK organisations

1. Source: EEC-NCC (1979), Table I 1.4, p88.

FIGURE 4.7 : Reasons/objectives for adopting the database approach (most frequent reason top-most)

has broadened to refer to a collection of related data not necessarily tied to a DBMS. Finally, the term reflects a policy on data which is to be the basis of future information systems development. A prerequisite of information systems planning is for management to establish where their own vision of database lies - as a means of preserving the status quo, to reform, or even to revolutionise.

- A central reason for database development is the promotion of data sharing. It is the means by which the concept of data as a corporate resource can be realised; it is the hallmark of the strategic database approach. Data sharing, together with the improved availability of data, are the reasons organisations most frequently cite for their database project. This points to the type of technical environment in which a strategic approach may be unsuitable: where all applications have their own discrete data and the information requirements are predefined and static. The influence of organisational environment on the adoption of the strategic or functional approaches is examined in the next chapter.

5. DATABASE APPROACH AND DP ENVIRONMENT

This chapter examines the relationship between database approach and characteristics of a DP environment. Its objective is to establish the organisational context and environment in which the strategic approach is adopted, in order to highlight the DP infrastructure needed if such an approach is to be viable. It therefore offers guidelines on <u>when</u> database development is appropriate. The chapter is based on interview responses of 21 UK organisations to questions on database feasibility study procedures. It consists of three sections:

- survey data

- analysis and discussion

- conclusions - the issues of interest from an information systems management perspective

5.1 SURVEY DATA

Interviewees described the decision-making background leading to the first database project: the management level at which the idea was proposed (Interview Guide Q.3.), the systems planning activity (Interview Guide Q4,5), and user involvement (Interview Guide Q.6,7,8,9). If a database feasibility exercise had not been carried out, similar information was obtained on the information systems project which first identified the need for database development.

5.1.1 Proposer of the idea

Responses indicate four types of initiators for a database feasibility study or investigation: consultants, user management, top DP management and staff within the DP department. The survey findings are presented in Figure 5.1. No response is shown for one organisation (14. Chemicals Company) as the database development was proposed by its overseas parent prior to any local initiative. The types of staff have been classified into two groups, as noted in Figure 5.1. One group, comprising of consultants, and user and DP management, point to an environment in which there is management interest and awareness in database development. The other, comprising of DP staff alone, reflect an environment in which there is a lesser degree of management interest and awareness in new information systems development possibilities.

It is interesting to note that the three organisations in which user management proposed a database study all belong to one industry type - local government. Discussion with interviewees revealed these organisations to be well informed of each other's projects and references were made to the same industry-based database studies.

ORGANISATIONS / TYPE OF STAFF	CONSULTANTS	USER MANAGEMENT	HEAD OF DP/ MANAGEMENT SERVICES MANAGER	DP STAFF
1. Toy Manufacturer			●	
2. Investment House				●
3. National Research Laboratory			●	
4. Building Materials Supplier			●	
5. Transportation Company				●
6. Public Corporation				●
7. Local Authority-1		●		
8. Local Authority-2		●		
9. Energy Supply Works				●
10. Toiletries Company			●	
11. Civil Engineering Works			●	
12. Insurance House				●
13. Oil Company-1	●			
14. Chemicals Company				
15. Office Products Manufacturer				●
16. Teaching Hospital				●
17. Computer Manufacturer			●	
18. Public Services Agency	●			
19. Electronics Components Company				●
20. Local Authority-3		●		
21. Oil Company-2	●			

FIGURE 5.1 : Staff responsible for first proposing idea of database

The survey findings indicate that the impetus for database development most frequently arose in the DP department, because of interest at both management and staff levels.

5.1.2 Planning activity

Three types of planning procedures have been identified from the range of responses obtained. These are presented in Figure 5.2. The descriptive comments and extracts from studies' terms of reference, on which this three-fold classification is based, are presented in Figure 5.3. Comments which are indicative of the planning discipline in the DP department are also included. The long-term information systems strategy-type exercise was found in 9 organisations. It was usually a comprehensive planning study, laying the foundations for future systems development work. A less comprehensive, medium-term investigation involved either an analysis of user requirements and the data in a single application area, or a data management study, not integrated with applications development planning. Such medium-term investigations were observed in 6 organisations. In 5 organisations the decision to undertake database implementation appears to have been ad-hoc, unrelated to any information system plans. No details were available from one organisation.

ORGANISATIONS / PLANNING PROCEDURE	AD-HOC	MEDIUM-TERM	COMPREHEN-SIVE	MISSING DATA
1. Toy Manufacturer		●		
2. Investment House		●		
3. National Research Laboratory			●	
4. Building Materials Supplier			●	
5. Transportation Company		●		
6. Public Corporation	●			
7. Local Authority-1			●	
8. Local Authority-2		●		
9. Energy Supply Works	●			
10. Toiletries Company			●	
11. Civil Engineering Contractors			●	
12. Insurance House	●			
13. Oil Company-1			●	
14. Chemical Company	●			
15. Office Products Manufacturer			●	
16. Teaching Hospital		●		
17. Computer Manufacturer				●
18. Public Service Agency		●		
19. Electronics Components Company	●			
20. Local Authority-3			●	
21. Oil Company-2			●	

FIGURE 5.2: Classification of DP planning procedures

AD-HOC

The DP steering committee decided to fund a bursary on relational databases. It is unlikely the design will be used in light of ICL's recent announcement of IDMS
(Public Corporation)

Only half-committed to DBMS
(Energy Supply Works)

Only half-committed to DL/1
(Insurance House)

When database work first commenced, acquired DBMS first, looked for justification later
(Chemicals Company)

The decision to use DBMS was based on gut-feeling
(Electronic Components Company)

MEDIUM-TERM

The main concern is how to organise bill of materials data. Feasibility study tasks will comprise of a study of user requirements, a review of current systems and DBMS selection
(Toy Manufacturer)

To investigate data management techniques in the light of long-term DP trends
(Investment House)

Database work was prompted while investigating data management options in the container monitoring system. Not enough time was spent on data analysis - 1-man month - as users kept changing their minds. DBMS selected after 4/5 months after completion of feasibility study. Four packages were examined in detail
(Transport Company)

The strategy study was primarily concerned with the identification and analysis of all relevent data, both logical and physical
(Local Authority-2)

A joint hospital project was set up which took 6 months for establishing definitions and formats. It recommended use of a CODASYL type DBMS. Not enough time was spent looking at strategic issues and conversion problems
(Teaching Hospital)

Management consultants were commissioned to undertake a feasibility study into alternative solutions to the problem. The project was initiated as a result of their recommendation
(Public Services Agency)

COMPREHENSIVE

To study the suitability of the database approach in supporting a more flexible system for the provision of management information.
(National Research Laboratory)

To identify long-term user requirements in the sales and marketing areas with a view of maintaining the competitive advantage and making full use of developments in information retrieval techniques
(Building Materials Supplier)

To determine the possibility of setting up and maintaining borough information files in association with an integrated system for all the clerical, administrative and accounting functions of the council. It will also examine the problems of collecting data and providing access to it
(Local Authority-1)

The information system strategy study was directed by the Management Services Manager. The major strategy decision was not the database approach, but whether to pursue a distributed processing strategy. Once it was decided to have a minis-based distributed system, data management options were considered
(Toiletries Company)

A database study was undertaken which identified systems to be replaced and requirements for new applications to solve company problems were established. The database plan is part of a system development plan which is tolerably firm for one year
(Civil Engineering Contractor)

The ability to respond to changing business needs, to consolidate in areas where we are strong and to identify further cost reduction and profit potential are of paramount importance to the company. A study has been commissioned of the systems and procedures that are needed to match these business criteria. The Company President has authorised teams to be set up in order to prepare an inventory of the information needs and submit an information systems plan.
(Oil Company-1)

2 and 5 year information systems plans are prepared by senior management
(Office Products Manufacturer)

The Borough commissioned the management services unit to investigate the long-term computer requirements. The unit approached this task by undertaking detailed investigations of 18 departments in the Borough, particular attention being paid to the use and availability of the data in each
(Local Authority-3)

The objectives of the study were to produce a clear statement of (i) what information systems were necessary to enable senior management to achieve its business objectives (ii) what value could be realised if these systems were implemented
(Oil Company-2)

FIGURE 5.3 : Comments and terms of reference - systems planning/investigation activities

5.1.3 User Involvement

Three categories of user involvement have also emerged from the survey responses. The classification, and the descriptive data on which this is based, are presented in Figures 5.4 and 5.5 respectively. The latter includes interviewees' comments which are indicative of the role of users in information systems work in the organisation.

In 4 organisations, user involvement was extensive as it included project management responsibilities. In 9 organisations the project was led by DP, with a moderate level of user involvement via the mechanism of secondments or consultative meetings. Five organisations had a minimal role for users on information systems projects. No details were available from 3 organisations.

5.2 ANALYSIS AND DISCUSSION

The survey data describes the practical framework for database development - management interest, the systems planning discipline and mechanisms for obtaining user involvement. These features form the context in which the organisation's information system activity takes place, or the DP environment, in the terms of this study.

USER INVOLVEMENT / ORGANISATIONS	MINIMAL	MODERATE	EXTENSIVE	MISSING DATA
1. Toy Manufacturer		●		
2. Investment House	●			
3. National Research Laboratory			●	
4. Building Materials Supplier			●	
5. Transportation Company	●			
6. Public Corporation				●
7. Local Authority-1		●		
8. Local Authority-2		●		
9. Energy Supply Works	●			
10. Toiletries Company		●		
11. Civil Engineering Contractors		●		
12. Insurance House	●			
13. Oil Company-1		●		
14. Chemicals Company	●			
15. Office Products Manufacturer			●	
16. Teaching Hospital		●		
17. Computer Manufacturer				●
18. Public Services Agency		●		
19. Electronics Components Company				●
20. Local Authority-3		●		
21. Oil Company-2			●	

FIGURE 5.4: Classification of User Involvement

MINIMAL

Traditionally DP anticipates user needs in this organisation. Data Management Study Team told not to make direct contact with users
(Investment House)

Users presented with a fait accompli. Users not worried how DP achieves things
(Transportation Company)

User requirements were not reestablished - the design approach has been to produce a replica of the old system in terms of reports, program structure and input formats
(Energy Supply Works)

First use of DBMS transparent to users
(Insurance House)

In original implementation (of first database system) there was little emphasis on user needs. This is now changing
(Chemicals Company)

MODERATE

One user seconded to feasibility team. Upto now users have regarded systems design and development as a DP job. This attitude is now being overcome. DP increasingly being viewed as a service function
(Toy Manufacturer)

Users participating in defining requirements but not done successfully as users have little computer background. A liasion officer has been appointed
(Local Authority-1)

Two users seconded to a team of five. User involvement is essential in data analysis. Users do data analysis quite well as their approach tends to be less blinkered
(Local Authority-2)

Users seconded to analysis and design teams. Users involvement is essential as the philosophy of the DP department is to take data processing to the users - data is being made accessible to those who need it.
(Toiletries Company)

Departmental managers were given presentations at outset of data analysis which they could follow
(Civil Engineering Contractors)

One user seconded full-time to 7-man feasibility study team- Users extensively interviewed by team
(Oil Company-1)

Meeting attended by user staff to draw up system specification
(Teaching Hospital)

The involvement of the user in the investigation and design of the system was always considered extremely important
(Public Services Agency)

Users interviewed during the systems investigation
(Local Authority-3)

EXTENSIVE

Project manager from outside DP. User participation in establishing requirements, data analysis and DBMS selection
(National Research Laboratory)

Joint project management - DP and users.Users involved in functional analysis, not data analysis; user project manager reports to Marketing Director
(Building Materials Supplier)

DP representation in the form of project leader - users appoint project manager. Perhaps we have gone too far
(Office Products Manufacturer)

User appointed project manager of 12-man information strategy study team. User involvement essential from initial stages as information systems must reflect business needs
(Oil Company-2)

FIGURE 5.5 : Comments - User Involvement

This section is in three parts:

- an analysis of the survey data to establish the interdependence between database approach and DP environment
- description of a conceptual framework
- comparison of survey data with other studies' findings

5.2.1 Database approach and DP environment

The analysis retains the classification of organisations by database approach defined in the previous chapter (section 4.2.1, Chapter 4).

Management role

The survey data indicates that the impetus for a strategic database approach comes from management and consultants. The functional approach is usually the outcome of a DP staff proposal. Figure 5.6 shows that the strategic and functional approaches differ with respect to management interest and awareness. The findings are not surprising because the strategic approach requires a longer-term perspective, more likely to be held at the management rather than technician levels.

Number of organisations

DATABASE APPROACH

BASIS I

DATABASE PROPOSER		STRATEGIC	FUNCTIONAL
	CONSULTANTS, USER MANAGEMENT, HEAD OF DP	10	2
	DP STAFF	1	7

20 organisations

BASIS II

DATABASE PROPOSER		STRATEGIC	FUNCTIONAL
	CONSULTANTS, USER MANAGEMENT, HEAD OF DP	12	0
	DP STAFF	4	4

20 organisations

FIGURE 5.6 : Classification of organisations by database approach and type of staff proposing development

Database development undertaken to promote data sharing (strategic approach, Basis I) was at the initiative of DP staff in only one organisation. Even in this case (16. Teaching Hospital) the database feasibility study was undertaken jointly with a sister organisation and so the possibility of external influences cannot be discounted. DP staff have a more prominent role when the strategic approach refers to objectives other than data sharing, for example improved provision of management information (Basis II). However, in no organisation did consultants' recommendations or management interest lead to database development merely to address a DP problem or for use of a DBMS facility (functional approach, Basis II).

Systems Planning discipline

The survey data also indicates that database approach is influenced by the systems planning procedures and disciplines. As noted in Figure 5.7, organisations with 'comprehensive' type plans adopt the strategic database approach (Basis I or II) to a greater extent than those with 'medium-term' or 'ad hoc' planning procedures. This is because the benefits of the strategic approach are more likely to be recognised as a result of an in-depth planning exercise - 8 out of 10 organisations embarking on database development in order

Number of organisations

DATABASE APPROACH

BASIS I

PLANNING PROCEDURE		STRATEGIC	FUNCTIONAL
	COMPREHENSIVE	8	1
	MEDIUM-TERM/ AD-HOC	2	9

20 organisations

BASIS II

PLANNING PROCEDURE		STRATEGIC	FUNCTIONAL
	COMPREHENSIVE	9	0
	MEDIUM-TERM/ AD-HOC	6	5

20 organisations

FIGURE 5.7 : Classification of organisations by database approach and type of systems planning

to promote data sharing had 'comprehensive' plans (Basis I, Figure 5.7). A re-examination of Figure 5.3 provides an indication of these organisations' systems planning methodology.

National Research Laboratory: a formal study was commissioned which had to evaluate the feasibility of a database approach

Building Materials Supplier: a formal study was commissioned to establish long-term user requirements and investigate new techniques for accessing data

Local Authority - 1: a formal study was commissioned to recommend new possibilities for the capture, maintenance and use of data

Toiletries Company: an informative systems strategy was prepared under top DP management direction, encompassing issues of hardware, software and data management

Civil Engineering Contractors: the company had a separate database plan which referred to application development priorities

Oil Company - 1: the company had an information systems plan, prepared with top management backing. The plan documented the organisation's main types of data

Local Authority - 3: an extensive computer requirements study had been undertaken with particular reference to the use and availability of data

Oil Company - 2: a study had been undertaken to establish senior management priorities for new information systems

The emphases reflect on the groundwork carried out by organisations leading to, or accompanying, decision-making on database development.

Mechanisms for user involvement

The survey data indicates that organisations differing in levels of user involvement also differ with respect to their database approach. As noted in Figure 5.8, the strategic approach (Basis I or II) is associated with organisations in which there is a tradition of users participating in, or are even being accountable for, information system projects. A re-examination of Figure 5.5 suggests organisations with 'extensive' or 'moderate' levels of user involvement have a particular DP philosophy:

Number of organisations

DATABASE APPROACH

BASIS I

USER INVOLVEMENT		STRATEGIC	FUNCTIONAL
	EXTENSIVE/ MODERATE	10	3
	MINIMAL	0	5

18 organisations

BASIS II

USER INVOLVEMENT		STRATEGIC	FUNCTIONAL
	EXTENSIVE/ MODERATE	13	0
	MINIMAL	1	4

18 organisations

FIGURE 5.8 : Classification of organisations by database approach and type of user involvement

Toy Manufacturer: DP is a function which provides a service

Toiletries Company: the philosophy of the DP department is to take data processing to the users

Oil Company - 2: information systems must reflect business needs

The emphasis points to a DP function which is well integrated in the organisation, identifying with user needs.

Organisations with 'minimal' user involvement have a contrasting DP philosophy.

Investment House: DP anticipates user needs

Transportation Company: users are not worried how DP achieves things

The former group of organisations are more likely to pursue database development if it can contribute to improved organisational effectiveness; the latter group will adopt a database approach for its technical efficiency or novelty.

5.2.2 Conceptual framework

The results of the analysis of the previous section are presented in a model. This conceptual framework is extended in subsequent chapters in the light of further analysis. A complete form is referred to in Chapter 8.

The model in this chapter depicts the inter-dependency between DP environment and database objectives, as noted in Figure 5.9. It reflects the conclusions arrived at from the qualitative analysis: that organisations with differing DP environments vary in their objectives for database development. Some support for this empirically-based framework is found in Nolan's Stage hypothesis (Nolan, 1979) of the way organisations assimilate computer technology. A recent version of this model is presented in Figure 5.10. It indicates the manner in which two 'growth processes' gradually unfold in six stages. The basic concepts of this model were first presented by Nolan (1973b) as a result of case research of three companies in the USA. The feature of Nolan's model of particular interest here is the prediction

> "through mid stage 3, DP management is concerned with the management of the computer. At some point in stage 3, there is a transition to management of data resources".[1]

The strategic approach to database development is, therefore, to be expected in DP environments characterised by the growth processes of Nolan's stage 3 and beyond.

1. Nolan(1979),p.116

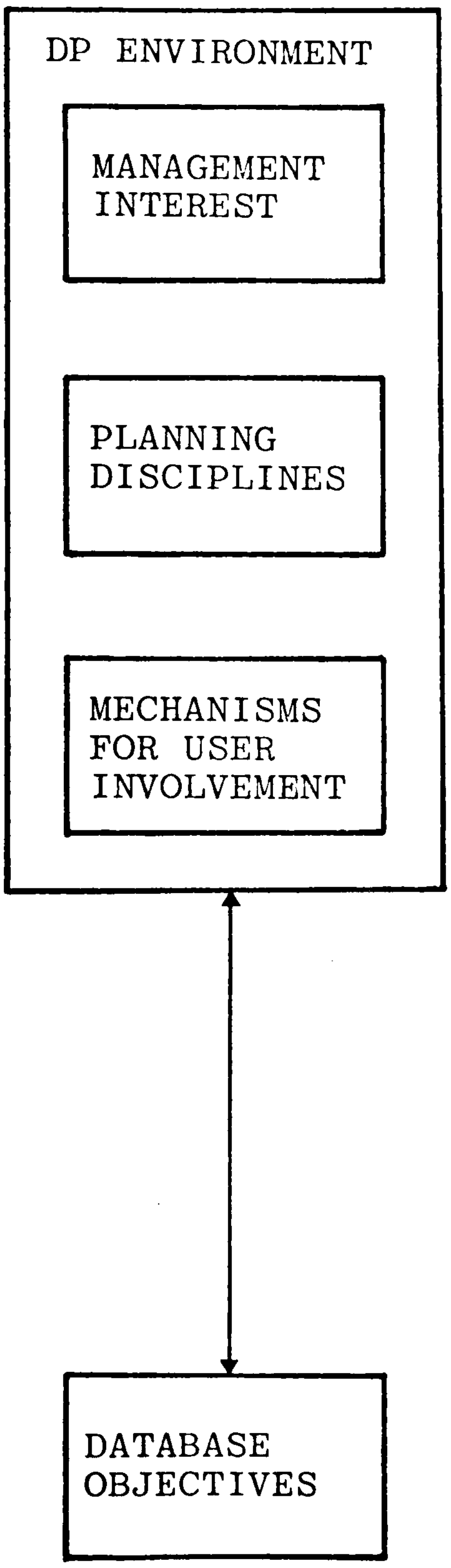


FIGURE 5.9 : Conceptual framework

Growth Processes

STAGE	DP PLANNING & CONTROL	USER AWARENESS	
VI	Data resource strategic planning	Acceptance of joint user and data processing accountability	MATURITY
V	Shared data & common systems	Effectively accountable	DATA ADMINISTRATION
IV	Tailored planning & control systems	Accountability learning	INTEGRATION
III	Formalised planning and control	Arbitrarily accountable	CONTROL
II	More lax	Superficially enthusiastic	CONTAGION
I	Lax	"Hands off"	INITIATION

Based on: Nolan (1979), p117

FIGURE 5.10: Nolan's Stage Hypothesis

The survey findings confirm that the pursuit of the functional type objective is associated with lax planning and a 'hands off' DP attitude while the pursuit of the strategic type objectives is associated with formal planning of information systems activity and user participation and involvement.

5.2.3 Comparison with other studies

The organisational issues addressed in this chapter have not been investigated in previous empirical studies, though some limited comparisons may be made with the EEC-NCC (1979) study.

Initiators of the database approach: the findings of the EEC study are compared with those of the present study in Figure 5.11. The findings in both cases point to the prominent role of the DP department in providing the impetus for database development.

User involvement: the present study observed that users had a minimal role in 5 out of 18 organisations. The EEC study examined the user role in DBMS evaluation, and found that of its sample of 21 organisations, there was no user involvement in 15 cases (EEC-NCC, 1979; p.93). The reduced user role in the technical task of software selection and evaluation is not unexpected.

EEC-NCC Study[1]		This study	
COMPUTER/DP/MANAGEMENT SERVICES DEPARTMENT	12	HEAD OF DP/MANAGEMENT SERVICES MANAGER	6
HEAD OFFICE	4	USER MANAGEMENT	3
LOCAL MANAGEMENT	2		
APPLICATION ORIENTED DP GROUP	1	DP STAFF	3
EXTERNAL CONSULTANT	1	EXTERNAL CONSULTANT	3
20 U.K. organisations (no data for 5 organisations)		20 U.K. organisations (no data for 1 organisation)	

1. Source: ECC-NCC (1979), Table I 1.3, p.88

FIGURE 5.11: Comparison of survey findings - initiators of the database approach

CONCLUSIONS

This section reviews the findings of this chapter of interest from an information systems management perspective:

- The strategic database approach is associated with more mature DP environments with respect to management interest and awareness, system planning disciplines and mechanisms for obtaining user involvement. Information systems management may, therefore, choose to defer database development till the infrastructure is in place - the database objectives need to be responsive to the DP environment. The creation of the organisational environment for database development needs to be recognised as an equally essential but very different process to the creation of the appropriate technical environment.

- The thrust of the database effort usually originates within the DP department. This is the area where the organisational impact will be most immediate. The nature of this impact is examined in the next two chapters.

6. APPROACHES TO DATABASE ADMINISTRATION

Database administration is the organisational means by which information systems management translate their objectives for database development into a reality. This chapter establishes what database administrators (DBAs) do - practitioners' own views of their essential role - where in the organisation structure they are placed, and who is appointed to this position in the first place. A scheme for classifying approaches to database administration is also proposed. The chapter is based on responses of 21 organisations to questions on DBA characteristics.

The chapter consists of three sections:

- survey data;
- analysis and discussion
- conclusions - the organisational and management implications of the findings

6.1 SURVEY DATA

Interviewees responded to questions on database administrators' main responsibilities and organisational placement (Interview Guide Q10,11). Wherever possible, information on staff backgrounds was sought in unstructured discussion. No attempt was made at the outset to clarify what was meant by the term 'database administrator' as the objective was to obtain interviewees' own perceptions and understanding of this role. This approach was possible because interviews had been arranged with the senior-most staff member with responsibility for database developments in the organisation. In the majority of cases, as noted in Figure 6.1, the interviewee nominated by the DP manager actually held the job-title 'database administrator' or a close equivalent. In 3 cases the interviewee managed staff with the job title 'database administrator' or held more senior database-related responsibilities (15. Office Products Manufacturer; 19. Electronic Components Company; 21. Oil Company -2). The survey responses apply to the senior-most position.

In a further 3 organisations the interviewee did not claim the database administrator role: in two of these (1. Toy Manufacturer; 10. Toiletries Company) a database administrator position was to be announced and the survey responses reflect the line managers' expectations and plans for this position.

JOB TITLES / ORGANISATIONS	STAFF MEMBER CLAIMING OR ASSIGNED DATABASE ADMINISTRATOR ROLE	INTERVIEWEE (IF DIFFERENT)
1. Toy Manufacturer	DBA	Management Services Manager
2. Investment House	DBA	
3. National Research Laboratory	DBA	
4. Building Materials Supplier	Database Manager	
5. Transportation Company	DBA	
6. Public Corporation	DBA	
7. Local Authority-1	DBA	
8. Local Authority-2	Data Administrator	
9. Energy Supply Works	-	Computer Services Manager
10. Toiletries Company	DBA	Business Systems Manager
11. Civil Engineering Contractors	DBA	
12. Insurance House	Data Administrator	
13. Oil Company	Data Administrator	
14. Chemicals Company	DBA	
15. Office Products Manufacturer	Planning & Development Manager	
16. Teaching Hospital	Director	
17. Computer Manufacturer	DBA	
18. Public Services Agency	DBA	
19. Electronic Components Company	Data Administrator	
20. Local Authority-3	Application Support Group Manager	
21. Oil Company-2	Data Administrator	

FIGURE 6.1 : Job titles of staff

Two organisations' responses have been excluded from the analysis in this chapter. In one of these (6. Public Corporation), a DBMS was being built in-house and the job title of database administrator was given to the project manager responsible for this software building activity. In the other (9. Energy Supply Works), database development comprised of a sole DBMS package-based applications development project which was at an advanced stage of implementation. The project was staffed by a senior analyst/programmer and a programmer, the former also being project leader with responsibility for all DBMS usage decisions. The interviewee, the project leader's line manager, indicated that the creation of a separate position of database administrator or equivalent was not under consideration.

From this point on, the abbreviation DBA will be used to represent all variations of the database administrator concept observed in 19 organisations.

6.1.1 DBA Approach

The objective of the question on DBA responsibilities was to establish the priorities foremost in the minds of interviewees and the actual emphasis of work.

The range of responses may be considered in three categories, which are presented in Figure 6.2. This three-fold classification represents alternative approaches to database administration. The responses and detailed comments on which this classification is based are presented in Figure 6.3. Responses of organisations at the feasibility or implementation stage of database development have been shown separately from those with database systems in operation (Figure 6.3 a and 6.3 b respectively).

In 5 organisations the characteristic feature of the responses is the emphasis on non-technical issues. DBAs are concerned with influencing user and DP groups' thinking on data and improving the way the organisation works. In 8 organisations DBAs emphasised technical support tasks. A characteristic feature of the responses is that DBAs had,or were expected to make, user contact. In 6 organisations DBAs had a similar advisory and support role, though without user contact.

A profile of the range of tasks claimed by DBAs is presented in Figure 6.4. This is based on descriptions of main responsibilities (Figure 6.3). The profile draws attention to the more frequently and less frequently cited DBA tasks.

ORGANISATIONS / DBA APPROACH	ADVISORY /SUPPORT (WITHOUT USER CONTACT)	ADVISORY /SUPPORT WITH USER CONTACT	INFLUENCING/ COMMUNICATING
1. Toy Manufacturer		●	
2. Investment House		●	
3. National Research Laboratory			●
4. Building Materials Supplier	●		
5. Transportation Company	●		
6. Public Corporation	–	–	–
7. Local Authority-1			●
8. Local Authority-2			●
9. Energy Supply Works	–	–	–
10. Toiletries Company	●		
11. Civil Engineering Contractors		●	
12. Insurance House	●		
13. Oil Company-1	●		
14. Chemicals Company		●	
15. Office Products Manufacturer			●
16. Teaching Hospital			●
17. Computer Manufacturer		●	
18. Public Services Agency	●		
19. Electronic Components Company		●	
20. Local Authority-3		●	
21. Oil Company-2		●	

FIGURE 6.2: Classification of DBA approaches

ADVISORY/SUPPORT - WITHOUT USER CONTACT

Evaluating and installing releases of DATAMANAGER. Identifying or responding to a need for certain types of software aids, interface programs to IMS. Later on in the year emphasis shifting to an administrative and monitoring role - assisting in the identification of shared data and in definitions and in reconciling conflicts between application teams

(Building Materials Supplier)

To lead in DBMS design and in assisting testing and implementation. To oversee day to day database operations. To evaluate new releases of DBMS software. There is no contact with users - it is not expected that database developments will require users to adopt any new standards

(Transportation Company)

DBA role will be two-fold. First to act as a software specialist, second as an organisation MIS specialist. The DBA has a support and advisory function only. For example he will conciliate when there are conflicting user requirements but if the problem persists the matter will be resolved by the Business Systems Manager. The DBA will not have any direct contact with users - this is the responsibilty of project managers

(Toiletries Company)

Responsible for ensuring databases remain secure from unauthorised access and corruption. Centre of expertise on DBMS features, utilities, versions

(Insurance House)

Installing and defining procedures for data dictionary. Cataloguing and consolidating data definitions - ultimately responsible for the nuts and bolts of data definitions. Researching into methodologies for database design

(Oil Company-1)

ADVISORY/SUPPORT - WITH USER CONTACT

Database will be important in integrating day to day activities so experienced (DBA) staff required who are familiar with business needs. The next major DBA task will be to develop standards

(Toy Manufacturer)

The next major DBA tasks are to select a DBMS and develop standards. Users will be contacted at a later stage

(Investment House)

A technical advisory role - Data auditor, responsible for integrity and security of databases. Ultimately responsible for logical and physical design though the job may be done by someone else. DBA will advise systems analysts on data structures and may see users for clarification. Data definition problems upto the DBA but standards arrived at by agreement

(Civil Engineering Contractors)

INFLUENCING/ COMMUNICATING

To get the philosophy of database across to users. Unless this is achieved and users see there are advantages to them then it is difficult to obtain real commitment

(National Research Laboratory)

Line management responsibility for developing the Property Information System. Contributing to improvements in the decision making process

(Local Authority-1)

Responsible for coordinating developments to achieve a corporate database but in practice a free agent, trying to seize any opportunity to ensure data is used most effectively from a corporate point of view - to have a set of data that can be used by the Authority for most purposes. Continiously trying to get over pressures of narrower objectives and adjusting pressures which are counter influencing developments to achieve that aim

(Local Authority-2)

FIGURE 6.3a : DBA approach-organisations at feasibility & implementation stages of database development

ADVISORY/SUPPORT WITHOUT USER CONTACT

Looking after the physical database, ensuring it is not violated or destroyed. Identifying ways of using the database more effectively and efficiently. Undertaking developments to improve flexibility. Monitoring performance and effecting changes to improve performance. Examing new application requirements to assess impact on database and ensuring enhancements can be accomodated. DBA is not supposed to speak to users.

(Public Services Agency)

ADVISORY/SUPPORT – WITH USER CONTACT

DBA controls the process, rather than the content of data analysis. To initiate and promote data standardisation. To act as the expert on database design techniques, providing training and consultancy for example on file design, coding systems and software. To work with application project teams early in the analysis and design phases of system developments. DBA does not identify user requirements but deals directly with users, together with systems staff, in preparing plans. (Chemicals Company)

A diplomat who has to work at all levels - even the shop floor. Post was created primarily to create standards and commonality in data, by the standardisation and rationalisation of codes and standardisation of data, for example identifying ownership, updating responsibilities, retention. Responsible for assigning database maintenance responsibilities to users and authorising codes. DBA advises on system audits, all system developments and data collection methods. (Computer Manufacturer)

Ultimately responsible should something happen to the Company's data. Line management responsibility for databases but advisory for conventional file design. Data administration has been particularly important in a distributed processing environment-useful to have a data model for planning. (Electronic Components Manufacturer)

To try and maintain the data in a workable state in the organisation. DBA has had to exercise a gentle dictatorship to ensure data integrity is maintained. Certain standards have been imposed on application programmers for example system programs which must be used. DBA offers advice on database implementation - acts as buffer between applications development project teams and the systems programming function. DBA not normally involved in feasibility stage of projects but jumps in whenever chance. Occassionally called on to give presentations to users. (Local Authority-3)

Responsible for determining the overall policy of the corporate database and the design of the individual databases which together make up the corporate database. In determining policy and design due consideration is to be given to user and application requirements for both the introduction of data and the subsequent use of that data. (Oil Company-2)

INFLUENCING/ COMMUNICATING

Encouraging users to participate in data and functional analysis. Preparing information systems strategy papers. Investigating new techniques for example data dictionary. (Office Products Manufacturer)

To improve the working efficiency of the Health District - need to know key staff in both the formal and informal hierarchies. (Teaching Hospital)

FIGURE 6.3b : DBA approach organisations at operational stage of database development

ORGANISATIONS \ DBA TASKS	TO INFLUENCE USER THINKING ON DATA	TO IMPROVE WORKING OF THE ORGANISATION	TO DEVELOP STANDARDS	TO ADVISE ANALYSTS ON DATA STRUCTURES/DETERMINE DATABASE DESIGN	TO ESTABLISH DATA DEFINITIONS/CONCILIATE OVER CLASHES	TO ASSIST IN SYSTEMS PLANNING	TO MAINTAIN DATA INTEGRITY/ASSIGN DATABASE MAINTENANCE RESPONSIBILITIES	TO SELECT/ EVALUATE/ INSTALL SOFTWARE	TO RESEARCH/INVESTIGATE NEW TECHNIQUES	TO CLARIFY DATA STRUCTURES WITH USERS	TO EDUCATE USERS	TO ADVISE ON SYSTEM AUDITS	TO MAINTAIN/MONITOR DATABASE OPERATIONS	
3. National Research Laboratory	○													INFLUENCING/ COMMUNICATING
7. Local Authority-1		○												
8. Local Authority-2	○													
15. Office Products Manufacturer	○					○			○					
16. Teaching Hospital		○												
1. Toy Manufacturer			○											ADVISORY/SUPPORT WITH USER CONTACT
2. Investment House			○					○						
11. Civil Engineering Contractors				○	○		○			○				
14. Chemicals Company				○	○	○								
17. Computer Manufacturer				○	○		○					○		
19. Electronic Components Company				○		○	○							
20. Local Authority-3				○			○				○			
21. Oil Company-2				○		○								
4. Building Materials Supplier					○			○						ADVISORY/SUPPORT - WITHOUT USER CONTACT
5. Transportation Company				○				○					○	
10. Toiletries Company				○	○	○								
12. Insurance House				○			○							
13. Oil Company-1					○			○	○					
18. Public Services Agency				○			○						○	

FIGURE 6.4: DBA tasks - organisations categorised by DBA approach

It also indicates that staff with job title of 'data administrator' (e.g. organistions 12, 13) do not necessarily emphasise different tasks to the 'database administrator' (e.g. organisation 11,17). It would be ambiguous to classify the DBA function on the basis of job title alone.

The objective of this study has not been to obtain a comprehensive list of tasks but rather to establish the priorities and emphases foremost in the minds of the interviewees, who in most cases were DBAs themselves.

6.1.2 DBA Organisational Placement

Three types of DBA placement have been defined in order to classify the range of reporting structures found in the surveyed organisations. The classification scheme is empirical and based on features considered to be less subject to individual organisational peculiarities of structure or job title. The findings are presented in Figure 6.5. The detailed organisation charts on which this classification is based are presented in Appendix B.

ORGANISATIONS / DBA PLACEMENT	TWO OR MORE LEVELS BELOW HEAD OF DP	REPORTING TO HEAD OF DP	REPORTING TO GENERAL MANAGEMENT DIRECTLY
1. Toy Manufacturer		●	
2. Investment House	●		
3. National Research Laboratory			●
4. Building Materials Supplier	●		
5. Transportation Company	●		
6. Public Corporation	-	-	-
7. Local Authority-1			●
8. Local Authority-2	●		
9. Energy Supply Works	-	-	-
10. Toiletries Company	●		
11. Civil Engineering Contractors	●		
12. Insurance House	●		
13. Oil Company-1		●	
14. Chemicals Company	●		
15. Office Products Manufacturer		●	
16. Teaching Hospital			●
17. Computer Manufacturer		●	
18. Public Services Agency		●	
19. Electronic Components Company	●		
20. Local Authority-3	●		
21. Oil Company-2		●	

FIGURE 6.5: DBA organisational placement

In 3 organisations DBAs reported to a general management function directly. In 6 organisations the function reported to the senior-most information systems manager, referred to subsequently as the 'Head of DP'. Where an organisation possessed a DP Manager or Head of Computing Services reporting to a higher level functional manager (for example, Management Services Manager or Information Systems General Manager), the latter has been considered Head of DP. In 10 organisations DBAs were placed two or more levels below the Head of DP. In these cases the function was equally distributed in various DP departments: Systems Development (2); Systems Planning (3); Technical Support (2); Systems, or Systems & Programming (2); other (1).

6.1.3 DBA Background

In unstructured discussion at interviews, information was sought on the DBA's previous appointment and background of staff. The findings are presented in Figure 6.6. This background information was mainly obtained from organisations at the feasibility or implementation stages of database development. Many of the DBAs in organisation with database systems in operation had held this position for several years

ORGANISATIONS	DBA BACKGROUND	DBA STAFF BACKGROUND	CLASSI-FICATION BUSINESS/ TECHNICAL BIAS
1. Toy Manufacturer	application maintenance group project leader	application analyst	BUSINESS
2. Investment House	Systems management	systems analyst with O & M background	BUSINESS
3. National Research Laboratory	user management project controller	(No staff)	BUSINESS
4. Building Materials Supplier	Programming manager	systems programmers	TECHNICAL
5. Transportation Company	Senior analyst	systems programmer	TECHNICAL
6. Public Corporation	-	-	-
7. Local Authority-1	DBA in another authority	systems analysts	BUSINESS
8. Local Authority-2	Computer liason Officer	management services	BUSINESS
9. Energy Supply Works	-	-	-
10. Toiletries Company	-	-	-
11. Civil Engineering Contractors	Operation Research	(No staff)	BUSINESS
12. Insurance House	programming manager	systems programmer	TECHNICAL
13. Oil Company-1	operations manager	systems programmers	TECHNICAL

FIGURE 6.6 : DBA background - in organisations at the Feasibility and Implementation stages

(14. Chemicals Company, six years; 19. Electronic Components Company, six years; 20.Local Authority - 3, six years; 21. Oil company-2, three years) and previous job experience would not be relevant in explaining current characteristics.

On the basis of these findings, a two-fold classification of the expertise of the emerging DBA function is proposed:

- business bias, where the DBA or staff's background lies in the user area, management services or applications development
- technical bias, where this background lies in computer operations, programming management or systems programming

In one organisation (1. Toy Manufacturer), a DBA had not been formally appointed but the line manager had knowledge of the staffing decision. Of the 10 organisations in which this information was available, the DBA function had a business bias in 6, and a technical bias in 4.

6.2 ANALYSIS AND DISCUSSION

The survey findings provide a rich seam of information on current DBA practice. The analysis and discussion is in four sections:

- maturity of the DBA function
- analysis of DBA characteristics
- extension of a conceptual framework
- comparison of survey data with other studies' findings

6.2.1 Maturity of the DBA function

The profile of DBA tasks previously presented in Figure 6.4 point to a consensus on what the job is about:

. <u>Analysis and design</u>

Advising analysts on data structures

Determining database design

Establishing data definitions

Conciliating over clashes (of data definition & access requirements)

. <u>Accountability for data</u>

Maintaining data integrity

Assigning database maintenance responsibilities

* <u>Assisting in systems planning</u>

The above tasks are those most frequently cited by the group of DBAs. It is this type of agreement which makes the DBA function a valid, distinct specialisation in U.K. organisations today.

A further dimension to DBA practice is provided by the approach the function seeks, or is allowed, to pursue. DBAs who place emphasis on influencing the way the organisation works and communicating with users in order to change their way of thinking on data differ in approach to those content with a technical advisory and support role in which there is no access to users. Figure 6.7 illustrates the impact of these differences of approach on the organisational arrangements and styles with which DBAs undertake their tasks. The examples are drawn from the survey data presented in Figure 6.3a,b.

Figure 6.7 conveys a notion of the evolution of the DBA function. As a function emerges from the purely technical back-room role, its effectiveness as an agent of change in the organisation increases - the less mature functions make a minimum impact on the organisation, the more mature functions are able to make a greater impact. This concept of DBA evolution, therefore, places importance on the visibility of the function in the organisation.

APPROACH \ TASK	ANALYSIS AND DESIGN	ACCOUNTABILITY FOR DATA	INFORMATION SYSTEMS PLANNING
ADVISORY/ SUPPORT (WITHOUT USER CONTACT)	DBA as technical designer	DBA as system programmer - responsible for procedures, utilities for back-up, recovery	DBA as consultant for technical assessment of proposals
ADVISORY/ SUPPORT (WITH USER CONTACT)	DBA as business analyst	DBA as data auditor - ensuring data integrity is maintained	DBA as consultant on general DP policy
INFLUENCING/ COMMUNICATING	DBA as project manager for information system development	DBA as resource manager, seeking to ensure data used most effectively from corporate point of view	DBA as information systems strategy formulator

FIGURE 6.7: DBA roles - examples of present-day practice

6.2.2 Analysis of DBA Characteristics

The discussion below examines the influence of three factors in shaping DBA approach - database objectives, DBA organisational placement and DBA staff background. To facilitate comparison, two conventions have been adopted for simplifying the DBA approach categories:

- The categories in which the emphasis is on a support role have been grouped together (advisory/support, with or without user contact). This grouping reflects a DBA approach which will be reactive. The remaining category will be highly interactive.

- The categories in which there is user contact have been grouped together (influencing/communicating and advisory/support with user contact). This grouping reflects a DBA approach which will be visible. The remaining category will be transparent outside the DP department.

The classification of database approach first presented in Chapter 4 (section 4.2.1) has been retained.

DBA placement & database objectives

The survey data indicates that DBAs placed within the DP department and those reporting to general management differ with respect to their approach. Figure 6.8 shows that all 3 DBAs reporting to general management were 'highly interactive', seeking to influence the way the organistion worked and users' thinking on data. Only the much smaller proportion of DBAs within DP adopted such an approach - 2 out of 14.

Figure 6.8 also indicates that DBAs reporting to management - DP or non-DP - and those placed well within the DP hierarchy also differ in their approach. Again, DBAs at the less senior level tend to be 'reactive' - ensuring standards and procedures are adhered to and responding to problems, rather than actively seeking change or disseminating ideas.

The senior organisational placement of DBAs provides evidence of a long-term management commitment to database development; this backing is required for the DBA to be effective as an agent of change in the organisation.

In three organisations the DBA reported directly to general management:

National Research Laboratory: the DBA and the DP manager both reported to a Management Committee, equivalent to a Board. The environment of this organisation was possibly unique - the whole Laboratory was dominated by a single major project which relied on specialists co-operating on complex problems.

Local Authority - 1: the DBA reported to a Database Committee, chaired by the Assistant Town Clerk, while the DP manager reported to a longer-standing Computer Committee, chaired by the Director of Finance. The DBA worked at the Town Hall itself, while the computer department was located elsewhere.

Teaching Hospital: as noted previously, the role of DBA was claimed by the director of the computer department.

Figure 6.8 indicates one case in which the DBA was placed 2 or more levels below the head of DP, yet adopted the 'highly interactive' approach. A further examination of this organisation's project, however, confirms the importance of a long-term management commitment. In the organisation (8. Local Authority - 2), the DBA, then a computer liaison officer, had participated in the initial database study. The

Number of organisations

DBA PLACEMENT

DBA APPROACH	REPORTING TO GENERAL MANAGEMENT	REPORTING TO HEAD OF DP/ PLACED 2 OR MORE LEVELS BELOW HEAD OF DP
HIGHLY INTERACTIVE	3	2
REACTIVE	0	14

19 organisations

DBA PLACEMENT

DBA APPROACH	REPORTING TO GENERAL MANAGEMENT/ HEAD OF DP	PLACED 2 OR MORE LEVELS BELOW HEAD OF DP
HIGHLY INTERACTIVE	4	1
REACTIVE	5	9

19 organisations

FIGURE 6.8 : Classification of organisations by DBA approach and placement

study recommended an integrated database and a DBA appointment was also made. Following appointment of a new 'Controller of Information Systems', there had been a change of emphasis, with the database strategy losing importance.

The DBA's response, presented in Figure 6.3, suggests a lack of organisational support:

> "Continuously trying to get over the pressures of narrower objectives....".

The objectives of the DBA do not coincide with management's objectives for database development.

The survey data confirms that the DBA placement varied in organisations pursuing database development for strategic or functional type objectives. As noted in Figure 6.9, in organisations at the feasibility and implementation stages of their first database project, the DBA was located well within the DP hierarchy whenever the functional approach was being pursued. The analysis, therefore, suggests that DBA organisational characteristics are not independent of the database development objectives.

Number of organisations

DBA PLACEMENT

DATABASE APPROACH (Basis I)	REPORTING TO GENERAL MANAGEMENT/ HEAD OF DP	PLACED 2 OR MORE LEVELS BELOW HEAD OF DP
STRATEGIC	4	3
FUNCTIONAL	0	4

FIGURE 6.9 : Classification of organisations by database approach & DBA placement - database projects at Feasibility & Implementation stage

DBA Background

The survey data suggests that organisations with differing DBA approaches also differ with respect to the background or previous job experience of DBA staff. Figure 6.10 indicates that in 10 organisations at the feasibility and implementation stages of their first database project, DBA staff with a 'business' bias always belonged to 'visible' DBA functions and those with a technical 'bias' were always in DBA functions transparent to users. The 'business' bias has been defined as experience in areas such as applications development and management services; the 'technical' bias stems from a background in program management or systems programming. Normally the former group require to develop formal working relationships with user departments. These type of staff are, therefore, more likely to retain this method of working when appointed to the DBA functions. However, Figure 6.10also indicates that the 'reactive' approach is not necessarily avoided through careful staff selection alone.

In only one organisation (7.Local authority-1) was a DBA recruited externally. This is in keeping with the finding of the preliminary survey that only in a minority of cases were new staff deployed on database projects (Section 3.2.1i, Chapter 3).

Number of organisations

DBA BACKGROUND

DBA APPROACH		BUSINESS BIAS	TECHNICAL BIAS
	VISIBLE	6	0
	TRANSPARENT	0	4

10 organisations

DBA APPROACH		BUSINESS BIAS	TECHNICAL BIAS
	HIGHLY INTERACTIVE	3	0
	REACTIVE	3	4

10 organisations

FIGURE 6.10 : Classification of organisations by DBA approach and DBA staff background - database projects at Feasibility & Implementation stage

6.2.3 Conceptual Framework Extended

The conceptual framework depicts the general principles emerging from the analysis of survey data. It is presented in diagrammatic form in Figure 6.11. Findings from Chapter 5 have been incorporated.

The model indicates the need to relate the organisation's objectives for database development to its policy on DBA: to support the pursuit of strategic type objectives the DBA needs to be effective as an agent of change - to be visible outside the DP department if not actively seeking to influence the way the organisation works and changing user thinking on data. This signifies a greater level of DBA maturity than if the function was transparent outside the DP department. This orientation will, however, rely on management decisions on where to place the DBA function in the reporting structure and the type of staff appointed.

The pursuit of strategic type objectives is in turn influenced by the organisational context in which information systems activity take place.

This framework is extended in the light of further analysis in the following chapter. It seeks to provide information systems management with an appreciation of the major interactions which should be taken into account when planning for database implementation.

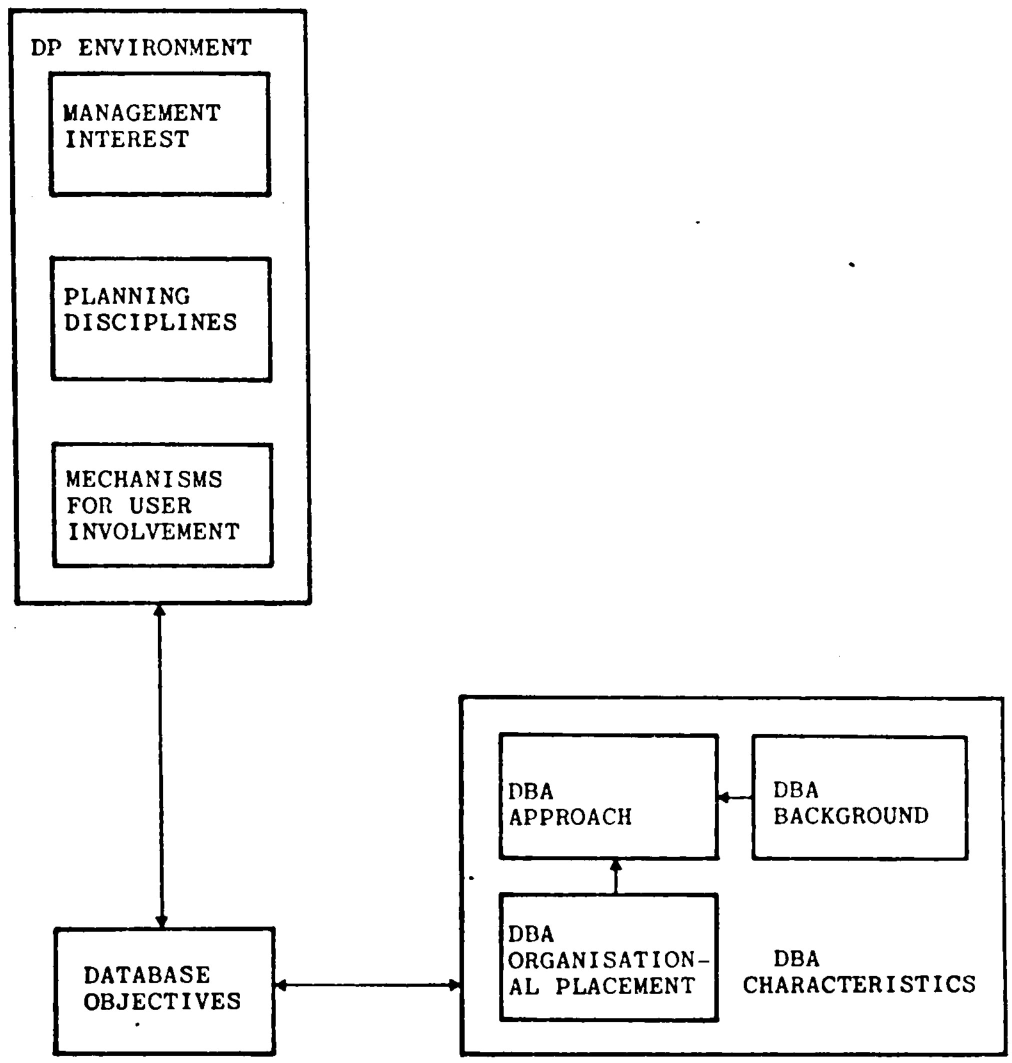


FIGURE 6.11 : Conceptual framework - extension of Figure 5.9

6.2.4 Comparison with other Studies

A comparison is drawn with the findings of previous studies in four areas: DBA creation and placement; DBA background; evolution of the DBA function and DBA tasks.

DBA creation and placement: In this study of 21 organisations claiming a database project, 16 had a formal position entitled DBA or some equivalent. In a further 3 organisations there was both a DBA and a more senior manager, the latter with the job title of data administrator or an equivalent. Other field studies have also concluded that most organisations with a DBMS installed set up a DBA function. Results of three studies are presented in Figure 6.12a. Findings on the organisational placement are compared in Figure 6.12b with two studies. There is no significant difference in the findings of the three independent surveys.

DBA Background

This study has considered the background of DBA staff in two classes: specialists with a systems programming type background and those with a systems analysis or user background. The latter background has been found to be associated with the more visible DBA approach. Other studies - Wharton (De Blasis, 1978) in the USA and a Canadian survey (McCririck & Goldstein, 1980) - have tended to focus on the formal educational background of

(a) Creation of DBA position

	PERIOD	% OF ORGANISATIONS WITH DBA
SURVEY:		
GUIDE[1]	1975	48% of IMS USERS
EEC-NCC[2]	1978-80	55% OF DBMS USERS
IBM[3]	1981	71% OF IMS USERS

Source: 1. GUIDE Europe (1975), p.13;
2. EEC-NCC (1979) Q4. 11a, p.85;
3. IBM (Gillenson, 1982) p.702.

(b) Organisational placement of DBA

SURVEY:	Number of organisations EEC-NCC[1]	WHARTON[2]	THIS STUDY
DBA PLACEMENT			
Reporting to general management/placed higher or equal to DP manager	0	5	3
Reporting to DP Manager	6	6	6
Placed 2 or more levels below DP Manager	16	12	10
TOTAL	22	23	19

Source: 1. EEC-NCC (1979) Q4. 11c, p.85;
2. De Blasis (1978), p.106

FIGURE 6.12: Comparison of survey findings on DBA function

DBAs. A recent IBM-based survey found the two most frequent backgrounds to be systems analyst and programming or project manager or leader (Gillenson, 1982; p.702). It is interesting to note that even in an early IMS - based survey (GUIDE Europe, 1975) after knowledge of DBMS software, the skill and experience considered to be 'very valuable' for a successful DBA was systems analysis experience.

Evolution of the DBA function: the New York University survey (Weldon, 1979) concluded that

> "Most of the DBA groups had changed their organisational position since their inception, most for the better. This suggests that the DBA might start low in the organisation and gain in position as the function matures." [1]

Moreover, the same survey makes an allusion to DBA maturity

> "..the organisational aspects of database administration groups are affected primarily by the length of time that the group has existed. This suggests a maturation process for DBA, perhaps similar to Nolan's stages of EDP growth." [2]

1. Weldon (1979), p.710
2. Ibid, p.711

No evidence has been uncovered in the present study which suggests that organisations differing in their stage of database systems development will differ in the seniority of the DBA. Figure 6.13 indicates that organisations at the early stages of development have placed DBAs at a senior position, while those at the advanced stages may retain their DBA well within the DP hierarchy.

This study has devised its own measures of DBA maturity, based on the visibility of this function - less mature functions are transparent outside the DP department, more mature functions are visible. The empirically-based 'highly interactive'/'visible' categories reflect the latter, and the 'reactive'/'transparent' categories the former. Figure 6.14 indicates that the more mature DBA approaches can be observed in organisations at the early stages of database development.

This study, therefore, discounts the notion that length of time of existence, or stage of systems development, influences DBA organisational characteristics such as placement or maturity.

Number of organisations

STAGE

DBA PLACEMENT		FEASIBILITY/ IMPLEMENTATION	OPERATIONAL
	REPORTING TO GENERAL MANAGEMENT/ HEAD OF DP	4	5
	PLACED 2 OR MORE LEVELS BELOW HEAD OF DP	7	3

19 organisations

FIGURE 6.13 : Classification of organisations by stage of database development and DBA organisational placement

Number of organisations

STAGE

DBA APPROACH		FEASIBILITY/ IMPLEMENTATION	OPERATIONAL
	HIGHLY INTERACTIVE	3	2
	REACTIVE	8	6

19 organisations

DBA APPROACH		FEASIBILITY/ IMPLEMENTATION	OPERATIONAL
	VISIBLE	6	7
	TRANSPARENT	5	1

19 organisations

FIGURE 6.14 : Classification of organisations by stage of database development & DBA approach

DBA Tasks: findings on DBA tasks are presented in Figure 6.15. The three most common, and three least common, tasks are indicated. The surveys are consistent in portraying the function as the administrative and technical focus for database development, but only less often with a say in application analysis and design through direct user contact. The DBA is given responsibility for defining the structure of the data but not its use. This points to an inherent tension in the present-day DBA role - the overlapping of DBA and systems development. The present study, of the three presented in Figure 6.15, is the only one to highlight information systems planning as a prominent DBA task.

6.3 CONCLUSIONS

This section summarises the organisational and management implications of the findings presented in this chapter:

- The foremost organisational change brought about by database development is the creation of a new specialisation with expertise in analysis and design, bearing responsibilities for the quality and availability of data under its control and with a say in information systems planning exercises.

IBM[1]	NEW YORK UNIVERSITY[2]	THIS STUDY
1. Liaison to systems analyst/ programmers	Maintaining data dictionary system	Advising analysts on data structures/ determing database design
2. Maintain data dictionary	Develop standards for data element names/monitoring database performance/ generating database descriptions	Establishing data definitions/ standarisation and conciliating/ maintaining data integrity
3. Generating IMS control blocks	Maintaining, reorganising, recovering databases/ evaluating software	Assisting in systems planning
THREE MOST COMMON TASKS		
1. Application design	Requirements analysis for database applications	Clarifying data structures with end users
2. Database auditing	Determining program design	Auditing systems
3. Data communications administration	Scheduling computer time	Educating users
THREE LEAST COMMON TASKS		

Source: 1. Gillenson (1982) Table II, p.703;
2. Weldon (1979) Table I, p.711.

FIGURE 6.15: Comparison of survey findings on DBA tasks

However, the key information systems management decision is not so much the formal creation of such a function, but the approach or orientation DBA is expected and allowed to adopt.

- The DBA function can have a high level of visibility, actively seeking to influence thinking on data and the way the organisation works, or it may adopt a back-room role within the DP department. The approach is influenced by information systems management decisions on organisation placement and staff selection. The choice of approach should be made in the light of management's objectives for database development and the DP environment. In its turn, DBA needs to respond to changes in objectives, so that the function's approach remains appropriate.

- In present-day practice, the DBA bears considerable responsibility for defining the data and making technical design decisions - for the content of the information system - but is only rarely involved in analysing user requirements - the form of the information system. As the two responsibilities cannot be rigidly separated, management should anticipate organisational problems in the DP department over allocation of work and task interdependencies between DBA staff and applications systems analysts. This issue is further examined in the next chapter.

7. DBA APPROACH AND POLITICAL PROBLEMS

This chapter examines perceptions of the organisational problems occurring during database development. It seeks to define the nature of the problems - why they occur and how an organisation may cope. This chapter is based on information obtained from 21 organisations to questions on the political problems of database development. It consists of three sections:

- survey data
- analysis and discussion
- conclusions - the management implications

7.1 SURVEY DATA

A question on the political problems of databases development was put to organisations (Interview Guide Q.12). No definition was provided at the outset as to what was meant by political problems - the responses reflect interviewees' own perceptions of this term. The question was raised towards the end of interview sessions, so that where a rapport had been established, the issues could be discussed more openly. Responses described both outstanding or unresolved problems, actual and anticipated, as well as views on the lessons learned and approaches adopted.

Three categories of organisational problems have been identified. This classification is presented in Figure 7.1. Many organisations faced more than one type of problem:

- data policy-related, arising from issues of data ownership and maintenance

- DBA-related, arising from concerns over organisational placement and changes in roles and responsibilities of established DP functions

- DP environment-related, arising from features of the DP environment rather than being directly attributable to the database project

The detailed comments on which this classification of political problems is based are presented in Figures 7.2-7.5. The DBA-related problems of organisation structure and role have been presented separately (Figures 7.3 & 7.4, respectively).

Many organisations faced more than one type of problem. The most frequently occurring were DBA-related. Of the 21 organisations in the sample, a DBA function has been considered to exist in all cases except for two: the Public Corporation (organisation No. 6) and the Energy

ORGANISATIONS / PROBLEM	DP. ENVIRONMENT-RELATED	DBA STRUCTURE & ROLE-RELATED	DATA POLICY-RELATED
1. Toy Manufacturer		●	
2. Investment House			●
3. National Research Laboratory			●
4. Building Materials Supplier		●	
5. Transportation Company		●	
6. Public Corporation	●		
7. Local Authority-1			●
8. Local Authority-2		●	●
9. Energy Supply Works	●		
10. Toiletries Company		●	
11. Civil Engineering Contractors		●	●
12. Insurance House		●	
13. Oil Company-1		●	
14. Chemicals Company		●	
15. Office Products Manufacturer	●		
16. Teaching Hospital			●
17. Computer Manufacturer	●		
18. Public Services Agency		●	
19. Electronic Components Company		●	
20. Local Authority-3		●	●
21. Oil Company-2	●		

FIGURE 7.1: Classification of Political problems

PROBLEMS

The first project is likely to be a customer database. Centralisation of customer records must result in a pruning of clerical staff in admin departments and some departments will have to give up exclusive control over their data. In any case there will be some loss of empire which will result in user resistance. As database development, like previous information systems activity in the organisation is DP-led rather than user-led, it is not clear what will happen when the crisis comes to a head. (Investment House)

Assigning responsibility for monitoring the validity of data; assigning updating responsibility - who and when. (National Research Laboratory)

Establishing standard definitions of data items is leading to clashes with the computing department. (Local Authority-1)

Planners see themselves as the fountain-head of information and are unwilling to give up their data and rely on others - Housing and Finance. (Local Authority-2)

Data on man-hours is central to the business - of interest to Payroll, Manpower Estimating and Recruitment departments. Payroll department reluctant to share data - see salary data as their domain. (Civil Engineering Contractors)

Because of sensitivity of data some information requests are ignored. A strict 'need to know' rule is applied.(Teaching Hospital)

Some users have developed unofficial systems for example clerical systems which rely on some data item on the database. They are then affected if this item is updated - legitimately - by another user. Shared databases require peoples responsibilities and limits to be defined more closely. (Local Authority-3)

RESPONSES

Users will be told by top-management directive that data will be shared - though data definitions will be negotiated. (Civil Engineering Contractors)

Initially user involvement not seen necessary in database work but a number of practices have now evolved to obtain user participation; as members of project teams; user committees review data analysis findings and data standardisation proceedures. User involvement is important because database is not merely a technical issue - need to recognise that the shared use of data cuts across departmental boundaries. (Chemicals Company)

Database makes users more aware of data and the implications of data corruption. Users are trained - no longer under control. (Office Products Manufacturer)

Each section of the Marketing database has a user department nominated as controller who is responsible for update. For example the Machine Population file is used by 3 divisions: Manufacturing, Engineering and Finance, but one manager in Finance has been made responsible for its data entry and update. Staff in Finance are beginning to complain because of the number of users they have to consult if a change is to be made. (Computer Manufacturer)

A subject database on products is in operation which is shared by a number of users: the Health & Safety department, Sales & Stock Accounting departments, Logistics. Though the database is shared, sections have been designated to various owners who are responsible for update and maintenance. This may be a specific department or an application system. One of the users is also Custodian of the database. The Custodian controls the root segment and is also responsible for maintaining data items no department wants to claim responsibility for. (Oil Company-2)

FIGURE 7.2 : Data policy-related problems and responses

PROBLEMS

Business analysts in Business Systems Group. Data analysis not done by them but yet they are influential in deciding whether or not to go database.
(Transportation Company)

In practice the Data Administration function has no authority but can only influence. Problem is getting project managers to appreciate database. Users don't need some rigorously analysed rigid system but flexibility - data to be at their finger tips. Computer staff are conventional DP people not appreciating that a lot can be got out of proprietary software and simple ad hoc programs. DP management attaches greater importance to the project teams because it lacks a strategic appreciation of the database approach.
(Local Authority-2)

Interface between DBA and systems analysts not clearly worked out. Systems Manager thinks analysts should do more database design.
(Civil Engineering Contractors)

Problem in separating out role of DBA away from systems work, for example over definition of access controls, privacy controls - who is responsible for recovery, dumping, defining the effects of not recovering.
(Insurance House)

Difficulty in establishing role of data analysts while application teams are analysing user requirements - danger of being viewed as a bureaucratic bottleneck.
(Oil Company-1)

System analysts faced with a changing role. They have to follow standards when presenting their data requirements. Programmers and analysts initially resented giving up physical design responsibilities to DBA - systems analysts need to be trained to work with DBA.
(Chemicals Company)

Systems analysts' traditional responsibilities have been altered. A new elite of database designers is emerging. These are the best people because problems they have to address are more complex, bear greater responsibility and need greater versatility - adept in analysis, design and business implications.
(Electronic Components Company)

RESPONSES

DBA needs two qualifications - an appreciation of company data and understanding of the software. Both a technical and management job
(Civil Engineering Contractors)

As database standards are not well-developed and the data admin jobs are new it is important to develop a consistent style. Continuity of data admin staff is particularly important
(Chemicals Company)

It is important to get the right balance of skills in the DBA function - company knowledge and technical ability.
(Office Products Manufacturer)

Communication between analysts particularly important in database environment.
(Teaching Hospital)

The DBA should be able to talk to analysts in their language. The DBA should know how the company works
(Computer Manufacturer)

Function of business analysis and systems design have been split from the start. Systems analysts have a user interface and designers are technical. DBAs work closely with analysts. In practice found DBA staff should have business knowledge
(Electronic Components Company)

DBA's ultimate weapon is that it is responsible for schemas and subschemas
(Local Authority-3)

Data analysts and application analysts work jointly. The concept of a joint team - while the analysts investigated the functions, data analysts would analyse the data. Obviously the two roles cannot be separated out clearly, a knowledge of functions and data being required for each role, but it expresses the prime responsibilities. While user requirements are being defined and confirmed, the role of the data analyst is to identify all the data needs of the project, document the data items and produce data management recommendations and designs. While meeting the time constraints imposed by application projects an overview of the use of the data in subsequent systems will be required. This will be the responsibility of the data analyst but should be with the understanding of the application team
(Oil Company-2)

FIGURE 7.4 : DBA role-related problems and responses

PROBLEMS

Users do not understand costs
(Public Corporation)

The early trials only skimmed the surface of the problem. Serious design work only began after it was decided to use DBMS. The first schema, though basically sound, required considerable revision as the design work progressed. The design has in fact taken much longer than estimated because the problem was more complicated than at first realised. Also it began from a particular solution (to the problem) and it was not until the design was nearly complete we could see the problem as a whole
(Energy Supply Works)

Problem if database approach is oversold - leading to disappointments when conversion and development effort exceeds estimates
(Office Products Manufacturer)

Organisational policy on centralisation - decentralisation varies from year to year. Present policy is for centralisation in manufacturing but decentralisation in commercial operations. Marketing wanted to make sales staff more responsible for invoicing/debt collection. However these are traditional finance tasks. So database implementation becomes a political issue
(Computer Manufacturer)

We have not done enough to sell the concept to management. The pendulum has swung the other extreme towards decentralisation. Large, long lead time DP projects now avoided
(Oil Company-2)

RESPONSES

The first database project is requiring protracted data collection. So it is important to have something to show to users soon
(Local Authority-1)

Taking a gradual approach - bits of data at a time rather than single large database. Reasons: to have something visible to show to users; to provide project milestones; to reaffirm approach is still feasible
(Civil Engineering Contractors)

With or without a DBMS, a data standardisation programme requires firm support from management to moderate the customary autonomy of project leaders.

Management recently committed to the preparation of an information systems plan - 5 years after DBMS work first commenced. Without a long-term plan, DP activities are driven hither and dither by systems staff who respond to latest user needs
(Chemicals Company)

The whole of the DP department should be committed - database development should be regarded as a major rather than incidental project
(Office Products Manufacturer)

FIGURE 7.5 : DP environment related problems & responses

Supply Works (organisation No. 9). The reasons for excluding these organisations have been previously stated (Section 6.1, Chapter 6). Therefore, of the 19 organisations considered to have DBA functions, 12 had problems associated with its emergence. Figures 7.2-7.5 also present interviewees' comments on the experiences gained and approaches adopted which are appropriate to the type of problem under consideration. This juxtapositioning is subjective but the method of presentation facilitates comparison of problems and potential solutions or responses. The survey findings on the experiences gained by organisations have been summarised in Figure 7.6. This indicates whether organisations did or did not present any evidence of this learning process. The stage of database development is also shown.

7.2 ANALYSIS AND DISCUSSION

A consistent trend in the preliminary survey has been the more frequent occurrence of serious political problems rather than serious technical problems in database projects (Section 3.2.liv, Chapter 3). The follow-up studies confirm the reality of the organisational dimension of database development - the interview question was rarely brushed aside as unwarranted. Moreover, the emergence of empirical classifications and common themes suggest this to be an area amenable to systematic study.

ORGANISATIONS / ORGANISATIONAL LEARNING	COMMENTS MADE ON EXPERIENCES GAINED	NO COMMENTS MADE ON EXPERIENCES GAINED	STAGE
1. Toy Manufacturer		●	FEASIBILITY & IMPLEMENTATION
2. Investment House		●	
3. National Research Laboratory		●	
4. Building Materials Supplier		●	
5. Transportation Company		●	
6. Public Corporation	●		
7. Local Authority-1	●		
8. Local Authority-2		●	
9. Energy Supply Works		●	
10. Toiletries Company		●	
11. Civil Engineering Contractors	●		
12. Insurance House		●	
13. Oil Company-1		●	
14. Chemicals Company	●		OPERATIONAL
15. Office Products Manufacturer	●		
16. Teaching Hospital	●		
17. Computer Manufacturer	●		
18. Public Services Agency		●	
19. Electronic Components Company	●		
20. Local Authority-3	●		
21. Oil Company-2	●		

FIGURE 7.6: Evidence of organisational learning

This analysis and discussion is in three sections:

- analysis of political problems and responses
- implications of DBA approach
- extension of a conceptual framework
- comparison of survey data with other studies' findings

7.2.1 Analyses of Political Problems and Responses

This section reviews the survey findings on political problems and the responses, in order to establish more precisely the organisational impact of database development.

(i) <u>Data policy-related problems and responses</u>

Figure 7.2 indicates that 7 organisations faced a data policy-related type of problem, although in only 2 cases was it user resistance to data sharing (Local Authority -2; Civil Engineering Contractors). In one of these organisations, this problem was being overcome by a directive from top management. The other responses, however, point to the successful evolution of various organisational arrangements for obtaining user co-operation.

Chemicals Company: Initially, user involvement not seen necessary in database work, but now a number of practices have evolved to obtain user participation: as members of project teams; user committees review data analyses findings and data standardisation procedures

Office Products Manufacturer: Database users more aware of data. Users are trained - no longer under control

Computer Manufacturer: Each section of the marketing database has a user department nominated as controller who is responsible for update

Oil Company - 2: Though the database is shared, sections have been designated to various owners who are responsible for update and maintenance. One of the users is also custodian of the database

The emphases highlight the changes in working practice, conferring users with a greater control and responsibility over data than existed in the traditional data processing environment.

(ii) DBA structure-related problems and responses

Figure 7.3 indicates that 6 organisations viewed their current organisational placement of the DBA function as unsatisfactory. The view belongs to both DBAs' line managers (Toy Manufacturer; Toiletries Company) and the job holders themselves. The concern of the former was with DBA seniority, while the latter sought a relocation because current placements were inconsistent with responsibilities. Extracts from the DBAs' views are noted below.

> **Building Materials Supplier:** The only ongoing support it (the systems planning department) provides is on operating systems and compilers. The DBA function does not fit

> **Transportation Company:** DBA reporting to a project manager but also expected to provide a service to other project managers

> **Public Services Agency:** Organisation structure like that of a conventional DP structure with DBA added as a limb... need to give DBA complete responsibility for issues such as data quality and security

Local Authority - 3: Difficult to see how the corporate role of DBA can be met within conventional DP structure. <u>DBA responsibilities cut across each level of DP</u>

The emphases highlight the reasons for seeking change. The responses indicated in Figure 7.3 point to the problems being resolved to the advantage of the DBA function.

Local Authority - 1: ...database project team set up independently <u>within the Chief Executive's department</u> so as to be above departmental loyalties

Office Products Manufacturer: The reporting structure was changed, in order to provide <u>a promotion</u> path for the DBA

Electronic Components Company: DBA first placed under technical support and looked upon as a technical designer. The first database project was a disaster because it was led by systems analysts ...after this disaster, <u>top management authorised appointment of a DBA project leader</u> with responsibility for database design decisions

The emphases suggest the emergence of a function visible to senior management, with increased authority in the organisation.

(iii) DBA Role-Related Problems and Responses

Figure 7.4 indicates that in 7 organisations the political problems arose over demarcation of analysis and design work. In one group of organisations, decision-making rested mainly with the analysts, leading to DBA dissatisfaction (Transportation Company; Local Authority - 2). In a second group, the DBA held greater authority but were becoming a new elite (Chemicals Company; Electronic Components Company). In a final group, the tasks and responsibilities of DBA in systems work were in a state of flux (Civil Engineering Contractors; Insurance House; Oil Company - 1). The responses in Figure 7.4 provide examples of the organisational arrangements devised to reduce this conflict of responsibilities between DBA staff and application systems analysts, or at least ensure that it had a constructive influence on the systems development activity. The first approach explicitly recognises that the DBA should not be confined to the task of technical design.

Civil Engineering Contractors: DBA needs two qualifications - <u>an appreciation of company data</u> and an understanding of the software

Office Products Manufacturer: It is important to get the right balance of skills in DBA - <u>company knowledge</u> and technical ability

Computer Manufacturer: The DBA should <u>know how the company works</u>

Electronic Components Company: In practice, found DBA staff <u>should have business knowledge</u>

The second approach explicitly recognises the difficulty in separating out database design and systems analysis tasks, and proposes joint project teams.

Oil Company - 2: ... while the (application) analysts investigated the function, data analysts (DBA staff) would analyse the data. <u>Obviously the two roles cannot be separated out cleanly, a knowledge of functions and data being required for both,</u> but it expresses the prime responsibilities... While meeting the time constraints imposed by application projects, <u>an overview of the use of the data in subsequent systems will be required. This will be the responsibility of the data analyst</u>

The emphases highlight the reason why application analysts traditional methods of working are inevitably affected in a database environment. The responses of two organisations (Teaching Hospital; Local Authority - 3) provide further examples of the impact on system analysts' methods of working.

(iv) DP environment-related problems and responses

Figure 7.5 indicates political problems in 5 organisations which were not a consequence of database development, but related to features of the DP environment. In 3 of these, the problem arose from limitations in the systems development methodology.

> **Public Corporation:** Users do not undertand costs
>
> **Energy Supply Works:** ...the problem was more complicated than at first realised
>
> **Office Products Manufacturer:** Problem if database approach is oversold

The emphases suggest a need to improve the data processing department's communication with users, particularly in establishing the problem to be addressed and the cost and benefits of development. The absence of standards in these areas would create difficulties in any information systems project - not just a database project.

In a further organisation (Oil Company - 2), the DBA's main concern was with retaining management backing for database development. Political problems may also arise as a consequence of changes in organisation structure. In one case (Computer Manufacturer), a policy of decentralisation resulted in an increase in the responsibilities of one part of the company at the expense of another: issues of database ownership and access provided a convenient focal point for argument between the company divisions.

The responses indicated in Figure 7.5 describes project management approaches and the organisational environment required for database development.

> **Local Authority - 1:** ...<u>it is important to have something to show to users soon</u>

> **Civil Engineering Contractors:** <u>Taking a gradual approach ....to have something to show to users (soon)</u>

> **Chemicals Company:** With or without a DBMS, a data standardisation programme requires <u>firm support from management</u> to moderate the customary autonomy of project leaders... <u>without a long-term plan, DP activities are driven hither and thither by systems staff who respond to latest user needs</u>

Office Products Manufacturer: The whole of the DP department should be committed

The emphases point to the increased importance of systems planning in a database development environment - to allow phased implementation, to impose a discipline on systems development activity, and to formalise the management commitment.

7.2.2 Implications of DBA Approach

This section examines the interdependency between organisational approaches to DBA and the occurrence of data policy or DBA-related problems. The classification of DBA approach defined in the previous chapter (Section 6.2.1, Chapter 6) has been retained. The occurrence or absence of the problems is indicated in Figure 7.1.

The survey data presented in Figure 7.7 indicates that the data policy-related problems are more often perceived in organisations where DBAs have 'highly interactive' or 'visible' approaches. The DBAs with 'reactive' or 'transparent' approaches are not in a position, or do not

Number of organisations

DATA POLICY-RELATED PROBLEMS

DBA APPROACH		OCCURRING	NOT OCCURRING
	HIGHLY INTERACTIVE	4	1
	REACTIVE	3	11

19 organisations

DBA APPROACH		OCCURRING	NOT OCCURRING
	VISIBLE	7	6
	TRANSPARENT	0	6

19 organisations

FIGURE 7.7 : Classification of organisations by DBA approach and occurrence of data policy-related type of problems

seek, to influence organisational thinking on data and are, therefore, unlikely to confront users objecting to data sharing or the taking on of new updating responsibilities. No organisation in which the DBA approach was transparent outside the DP department faced such types of problems. Paradoxically, the occurrence of a problem is evidence of DBA effectiveness, rather than negligence.

Figure 7.8 indicates that the occurrence of DBA-related problems of structure and role - where to place the function and what to do about the task interdependencies with systems analysts - is also affected by DBA approach. This type of problem is found in most organisations with 'reactive' or 'transparent' DBAs.

The analysis suggests an almost Darwinian process of natural selection in which less mature DBA functions (reactive/transparent categories) are locked in disputes of authority and responsibility and it is only once these have been overcome that the function reaches a new level of maturity (highly interactive/visible categories) and can commence tackling the real issues of interest.

Number of organisations

DBA-RELATED PROBLEMS

DBA APPROACH	OCCURRING	NOT OCCURRING
HIGHLY INTERACTIVE	1	4
REACTIVE	11	3

19 organisations

DBA APPROACH	OCCURRING	NOT OCCURRING
VISIBLE	6	7
TRANSPARENT	6	0

19 organisations

FIGURE 7.8 : Classification of organisations by DBA approach and occurrence of DBA structure/role-related type of problems

7.2.3 Conceptual Framework Extended

The objective of the conceptual framework is to summarise the general principles emerging from the analysis of survey data. It is presented in diagrammatic form in Figure 7.9.

The inter-relationships between DP environment, database objectives and DBA characteristics were identified in previous chapters. The analysis in this chapter has uncovered:

- an interdependence between DP environment and the political problems and responses. For example, in several organisations, the implementation of a shared data environment resulted in an increased user control over data (Section 7.2.1 i). This leads to new mechanisms for obtaining user involvement in information systems analysis, design and maintenance. Moreover, database development provides an impetus for more comprehensive systems planning (Section 7.2.1 iv)

- an interdependence between DBA characteristics and the political problems and responses: The dominant type of problem-relating to data policy issues or the emergence of the DBA - is a function of the approach and orientation the DBA seeks or is allowed to pursue (Section 7.2.2)

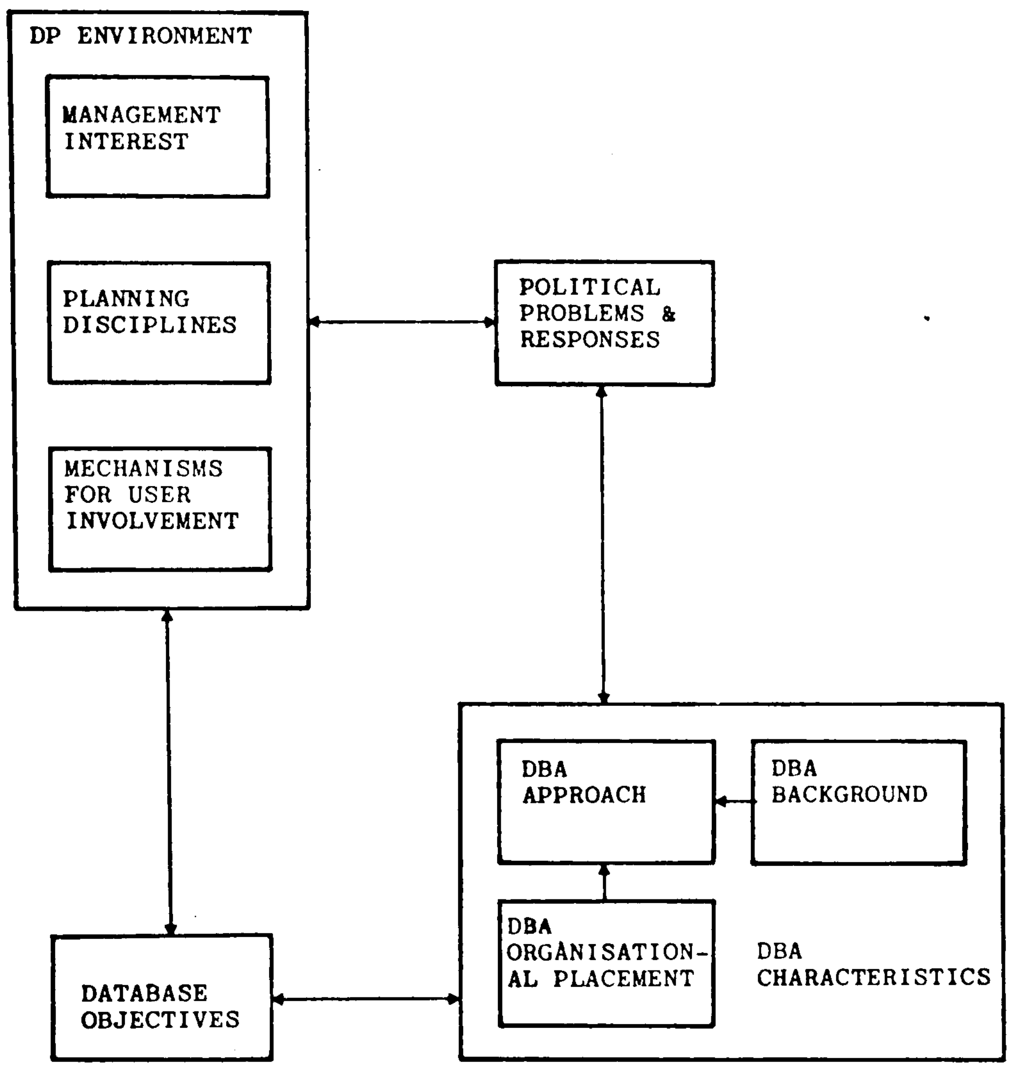


FIGURE 7.9 : Conceptual framework - extension of Figure 6.11

As most database projects are embarked on without outside guidance (Section 3.2.1i, Chapter 3), the organisational learning strategy is one of trial and error. It is, therefore, not surprising that evidence of the learning process was mainly confined to organisations at the most advanced stage of database systems development (Figure 7.6).

The conceptual framework describes database development from its organisational perspective. Database implementation is a dynamic process: the objectives for database development are influenced by the existing infrastructure for information systems activity. The type of objectives adopted influence the DBA function. The DBA function is associated with specific types of problems - a learning process is prompted in the face of problems - leading to changes in the DP environment. These in turn may lead to a change in database objectives.

7.2.4. Comparison with Other Studies

An accurate picture of the political problems is unlikely to be obtained through postal questionnaire or telephone interviews. Face-to-face interviews provide a better opportunity to probe the issues of real importance in this area. Two previous studies using the interviewing technique have drawn some conclusions on organisational problems, but unlike the present study, the topic was not regarded as a central one. The findings are, therefore, not to the same level of detail as those reported in the chapter.

The Wharton Survey

The Wharton survey (De Blassis, 1978), based on interviews in "about 20" organisations, concluded that

> "Administrative problems, or organisational issues, surface as the most important problems in the great majority of the group studied. After insisting on technical people to staff the group, the DBA manager cited that his critical problems occurred in a variety of administrative areas. These problems were often a function of the point of evolution of the group. The group just starting up cited top management support, co-operation from user groups, and training or education as their most frequent problems. The more mature groups cited control and co-ordination problems, along with evolving technology difficulties .... their concerns about participating in system change decisions and about data control problems were more pronounced." [1]

1. De Blassis (1978), p.107

The Wharton survey does not support its conclusions with any tabulations - it is also of interest to note that the interview questionnaire used for survey data collection (De Blassis & Johnson, 1977; appendix - DBA questionnaire) lacked an explicit question seeking interviewee's views on the organisational or political problems faced.

The problems categorised as DP environment related in the present study bear a similarity to three problems the Wharton survey associates with the DBA groups 'just starting up': top management support, co-operation from user groups, training or education. However, this chapter has identified three further categories of problems - data policy-related, DBA structure-related and DBA role-related - which have a correspondence to Wharton's single type: control and co-ordination. The Wharton survey suggests that control and co-ordination problems are to be found in DBA groups in existence for a period of time. The present study has uncovered no evidence to suggest that either data policy or the DBA related problems are a function of stage of database development. Figure 7.10 indicates that the data policy-related and DBA structure and role related problems are also to be found in organisations still at the feasibility or implementation stages of their first database project. The Wharton survey and the present study both concur that the type of problems faced are a function of the point of evolution of the DBA group.

Number of organisations

STAGE

DATA POLICY-RELATED PROBLEMS

	FEASIBILITY/ IMPLEMENTATION	OPERATIONAL
OCCURRING	5	2
NOT OCCURRING	8	6

21 organisations

DBA STRUCTURE AND ROLE-RELATED PROBLEMS

	FEASIBILITY/ IMPLEMENTATION	OPERATIONAL
OCCURRING	8	4
NOT OCCURRING	3	4

19 organisations

FIGURE 7.10 : Classification of organisations by stage of database development and type of political problems

However, in the former, evolution is measured by stage of database development; in the latter, by the visibility of the DBA in the organisation.

<u>The EEC-NCC Survey</u>

In the EEC survey the question put to interviewees was specific: "Have there been problems with the sharing of the same data by several users?" (EEC-NCC, 1979; Annex D, p.150). Of 21 organisations providing a response in the EEC survey, 5 acknowledged data sharing problems (EEC-NCC, 1979; p.106). In the present study, in a sample of similar size, only 2 organisations could provide specific examples of data sharing problems.

Both surveys are, therefore, in agreement that the predominant political problem in database development does <u>not</u> arise from user resistance to data sharing. This empirically-based conclusion contrasts with a common notion in the normative literature - 'Sharing produces conflict.'

7.3 CONCLUSIONS

The political problems of database development are an issue of practical concern for information systems management with responsibility for database planning or implementation. The survey findings clarify the nature of these problems and the management role.

- The most widespread political problems do not arise from resistance to data sharing but rather from the emergence of a DBA function. Moreover, the latter problem - dissatisfaction over organisational placement and the working relationships with systems analysts - are characteristic of the less mature DBA functions.

- The organisational changes brought about by database development are four-fold: data policy-related, the creation of a shared data environment leads to greater user control over data; DBA structure-related, the DBA function emerges as an entity with a future in the organisation; DBA role-related, the traditional role of application systems analysts is circumscribed; DP environment-related, systems planning acquires greater importance.

- Database development is a dynamic process in which political problems need to be understood and addressed in light of other prevailing organisational factors such as DBA characteristics, objectives of database development and the DP environment. A change of one factor may result or require an adjustment of others. Examples of these interdependencies are provided in the next chapter.

8. CASE STUDY ACCOUNTS : THE ORGANISATIONAL DIMENSION OF DATABASE DEVELOPMENT

This chapter presents accounts of four database projects. Their emphasis is on the organisational forms and arrangements which evolve in the course of a database project.

The accounts are based on interview discussions and information obtained from organisations' internal reports. The accounts highlight different aspects of database projects - a reflection of the type of information made available. The selection, however, provides a contrast of the organisational problems and responses arising in real projects. The four accounts are:

- Oil Company - 1: 'Change in DBA approach'
- Chemicals Company: 'Information Systems Planning'
- Electronics Components Company: 'Emergence of a DBA Function'
- Oil Company - 2: 'Administration of a shared Database'

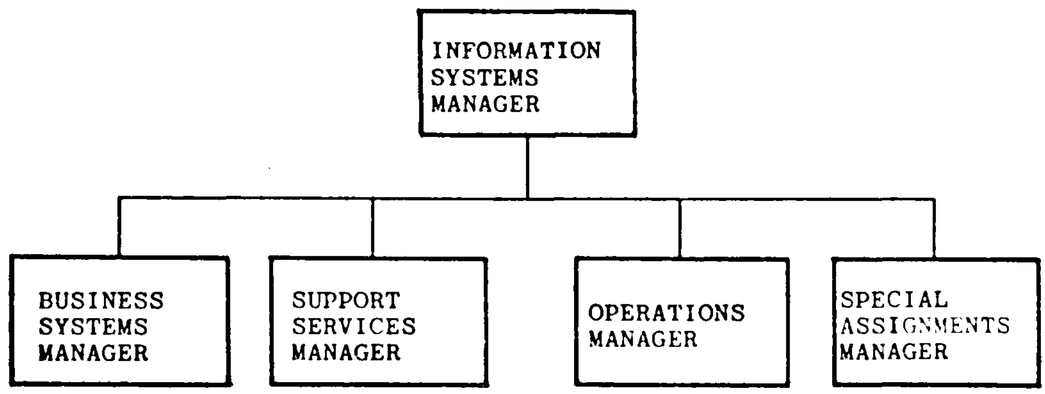
In one organisation (Chemicals Company), the DBA interviewed arranged a discussion with the senior-most information systems manager. The specific types of documentation to which interviewees provided access included system specifications, standards and internal memoranda.

The Chapter concludes with a discussion of the case studies in the light of the empirical concepts developed in Chapters 4-7.

8.1 OIL COMPANY - 1: CHANGE IN DBA APPROACH

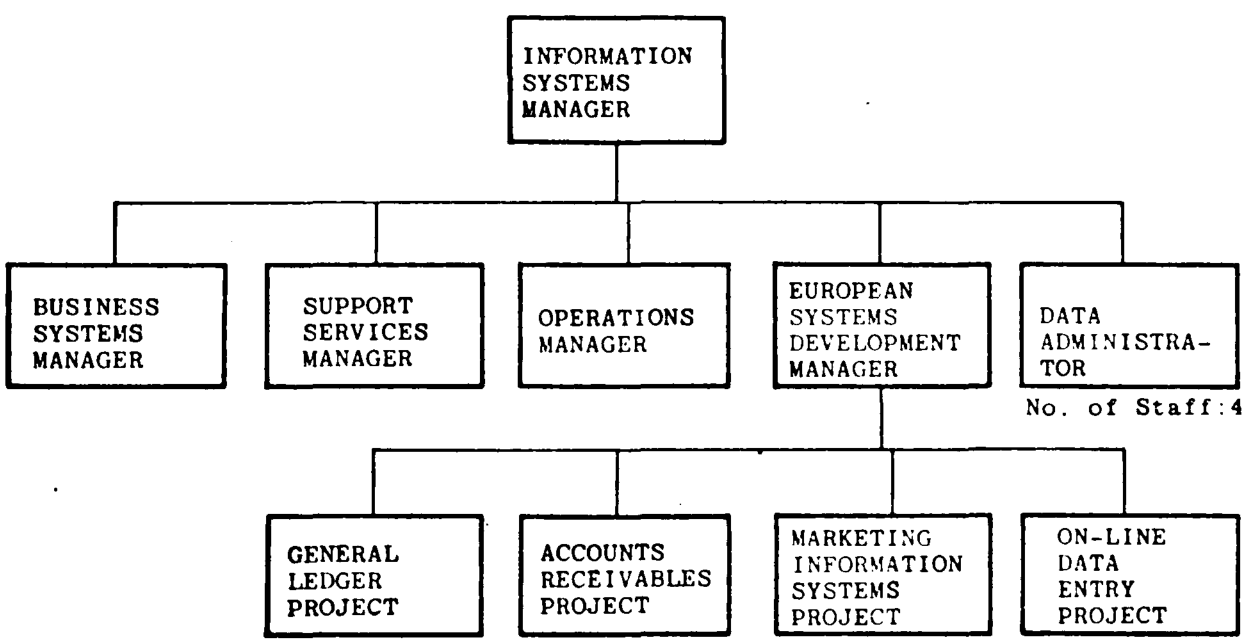
The organisation was at the early stages of implementing an ambitious information systems strategy, which aimed to replace most of the existing applications over a period of 5 years. The 'Information Systems Division' was re-organised in a major way to implement this strategy. Figure 8.1 shows the before and after situation. Two additional departments were created, one for systems development and the other for data administration. For the systems development project teams, their first task was clear: user requirements had to be identified and assigned priorities, systems specifications were to be prepared and detailed plans produced for subsequent phases. The project teams were staffed with experienced

BEFORE



Total No. of Staff: 150

AFTER



Total No. of Staff: 167

FIGURE 8.1 : Reorganisation to implement an information systems strategy

business systems analysts, most of whom, like their manager, had been newly recruited. Within a month of the project teams' formation, analysts were beginning to interview users.

The terms of reference set for data administration are noted in Figure 8.2. The data administration manager had long-standing DP experience in the organisation, formerly having served as operations manager and also a special projects manager. His staff mainly comprised of experienced systems programmers, 2 of whom had been recently recruited. None of the team members possessed any previous database experience. The initial tasks the data admininstration manager set his staff were to:

- define data dictionary procedures
- install and test the data dictionary package
- test the data dictionary procedures
- commence cataloguing existing master file data on the dictionary

As the DP standards did not provide guidance, the data administrator undertook some research into existing analysis and design methodologies appropriate for a database environment. In a memo to the systems development manager, the data administrator specified the type of information that would be required by his

The development of the European Corporate Database by the Data Administration team will proceed in stages as outlined below:

i) Catalogue and analyse all known definitions, existing and future, using a Data Dictionary package called Data-Manager, in order to eliminate synonyms, identify homonyms and rename data types where necessary.

ii) Analyse data requirements with the aid of Data-Manager and produce Logical Database designs using the Database Management System ADABAS. The Corporate Database will initially be designed as discrete databases to satisfy the priority projects then subsequently integrated and optimised. Logical Designs will be produced for the following sub-databases: On-Line Accounts Receivables; Retail Reporting; On-Line Financial System; Sales Forcasting and Budgetting.

iii) Prepare firm cost estimates for the development of the physical database for submission to Controller's.

iv) Development of the physical database using ADABAS.

v) Installation of the Database.

Once the Corporate Databse has been installed it will require maintenance by the Data Administration team if it is to accomodate the data requirements of future projects. The performance of both the Data Dictionary and the Database Management System will also be monitored with a view to optimising the database.

(Oil Company-1)

FIGURE 8.2: Terms of Reference for Data Administration

department, based on one of these methodologies. The memo included a database conference paper describing the use of this methodology. Extracts from the memo are presented in Figure 8.3.

The systems development project leaders' first reaction was to view data administration as a bureaucratic bottleneck. They had no plans of identifying data items by the end of the current 'Analysis' phase of their projects. Normalisation was ruled out as a technical job for data administration staff. Little benefit was also seen in cataloguing existing master file data in the dictionary, as this would become obsolete with the new developments.

At the initiative of the systems development manager, meetings were held between the data administrator and project analysts. One of the agreements reached was for the secondment of data administration staff to project teams as data analysts. The project leaders undertook to provide the information requested by the end of the 'Definition' phase of their projects. However, the transition for the data administration staff was not an easy one to make, as most lacked business systems analysis experience and had to join teams well advanced in analysis work.

From our own experience gained to-date, together with what we have learned from the ADABAS D.B. Design Course, Date Administration are now in a position to indicate to you what information we require from ESD, in order for us to complete the Data Base Design Process for a given application.

Basically, we need for each application (Priority Project), the following:

1. Specific data items, with their logical attributes and their volumes (number of item occurrences).
2. Application areas with descriptions, priorities, and processing frequencies.
3. The Third Normal Form (TNF) for each group with its items.
4. The Processing Matrices.
5. The Logical Hierarchical Data Structures.

The attached appendices will serve to clarify the above 5 items.

Data Administration will use the above material to perform the following:

A) Enter the Hierarchal Data Structures and data item definitions into the Data Dictionary.

B) Superimpose the System Design structure for the application, into the Data Dictionary.

C) Design the Physical Storage Structure(s) of the relavant Data Base.

D) Compile Query and update simulation procedures to run against the Data Structure(s).

E) Design the Physical Data Base, and load data if relevant.

(Oil Company-1)

FIGURE 8.3: Extracts from memo from data administrator to systems development manager

8.2 CHEMICALS COMPANY: INFORMATION SYSTEMS PLANNING

The company is part of an American multi-national. In the early '70s, several common systems were developed at Corporate headquarters for use by the operating companies in sales and stock accounting and to ensure common reporting to corporate management. Operating systems, programming languages and utilities were also standardised across the larger companies. At corporate instruction, the UK company installed a DBMS for local applications. No particular application had been year-marked. The head of the systems analysis group in the DP department was appointed DBA. Both the job holder and the organisational placement of the DBA have remained unchanged over the five years since use of the DBMS commenced. The DBA placement is indicated in Figure 8.4.

The role of the DBA was altered by a data standardisation programme which commenced in the mid-'70s, again at the initiative of Corporate headquarters. The objective of the programme was to make it easier to install common systems. Involvement in this activity extended DBA responsibilities from physical database design work to include conventional file design and subjects such as the design and control of coding systems. Training and consultancy developed as important DBA activities. The

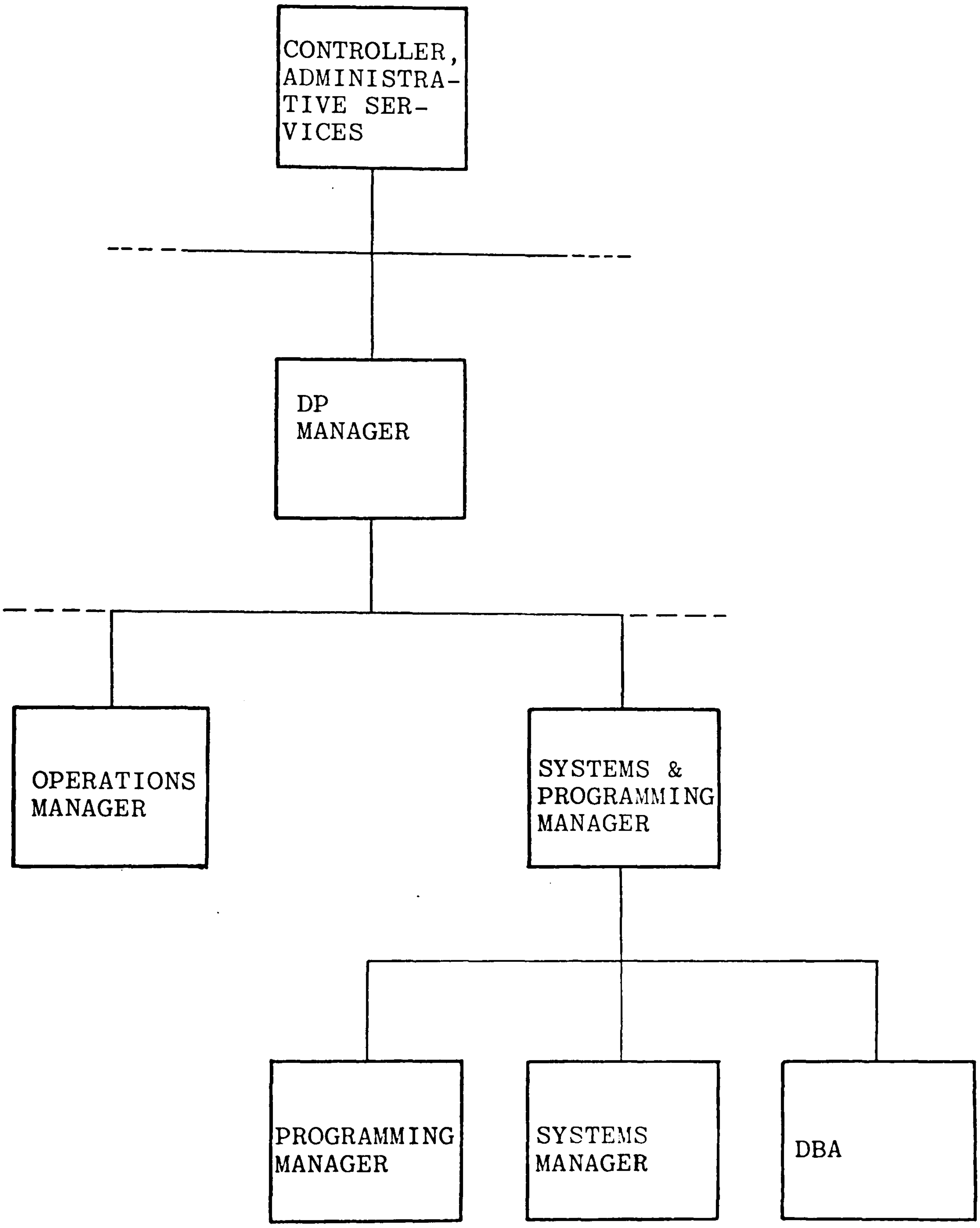


FIGURE 8.4 : DBA organisational placement

increasing importance of data standardisation also led to the use of a data dictionary for data design and documentation. This new role gave the DBA direct contact with users, up to factory manager level. This was necessary in order to seek views on proposed data standards and check their suitability for supporting information requirements. The DBA was surprised at the extent to which higher level management needed educating. The DBA was also concerned with the way systems staff responded to the latest user requirements.

The DBA saw in information systems planning an opportunity to involve higher level management and also provide a discipline for the systems development project leaders. The DBA struggled hard to make his own management more appreciative of the need for such plans, and eventually succeeded in convincing the Controller. An exercise was commenced with the help of external consultants. This study sought information at board-level on business targets and measures of performance. Figure 8.5 reflects the Controller's own perceptions of how information system plans will be formulated.

STRATEGIC PLANNING COMMITTEE
sets targets e.g. on RoI, unit costs

▼

STRATEGIC PLANS ON HOW TARGETS MIGHT BE ACHIEVED

▼

IMPLICATIONS OF PLANS ON OPERATING UNITS

▼

FUNCTIONAL MANAGERS CONSIDER WHAT TOOLS ARE AVAILABLE e.g. Better inventory control

▼

OUTCOME: MIS FOR ORDER PROCESSING, INVENTORY

(Chemicals Company)

FIGURE 8.5: A controller's perceptions of the information systems planning process

8.3 ELECTRONICS COMPONENTS COMPANY: EMERGENCE OF A DBA FUNCTION

When the organisation replaced its mainframe supplier in 1972, a DBMS was made available as bundled software. A systems analyst proposed that the next development project should use the DBMS. The proposal was approved by DP management and a linked payroll-personnel system was nominated. The availability of sophisticated data management facilities free of charge was an important factor influencing the decision.

The systems analyst who initiated the idea was appointed the DBMS specialist, reporting to the technical support manager, as noted in Figure 8.6(a). However, in the course of the project, the main direction and design decisions came from the application analysts. The role of the DBMS specialist was restricted to systems implementation. Use of the DBMS in the payroll system proved inefficient and the whole project was considered as a disaster. The DBMS specialist, with the active and influential assistance of the mainframe supplier's database consultant, then sought to give himself greater responsibilities. Senior management were convinced and a new organisation structure was set up, indicated in Figure 8.6(b).

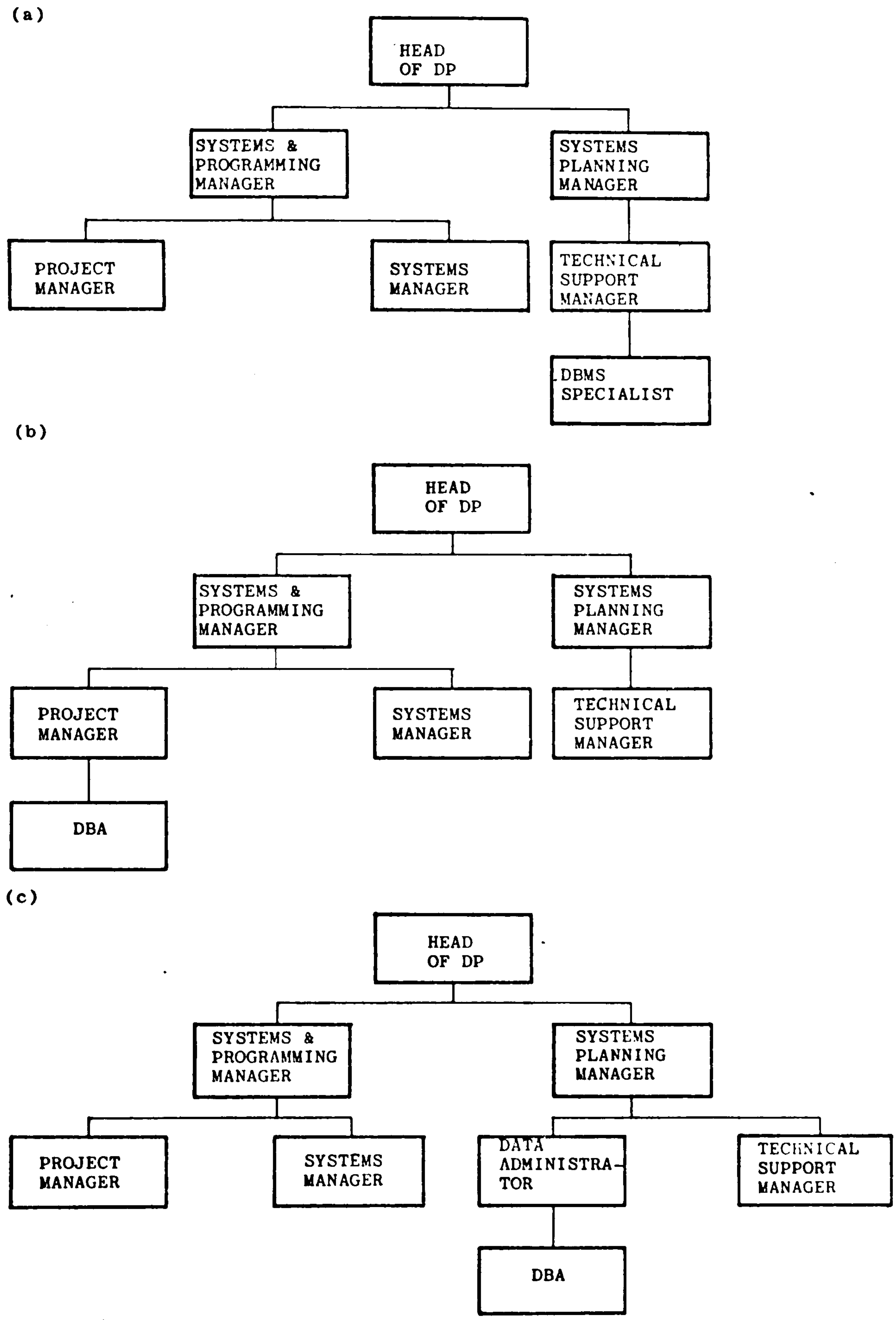


FIGURE 8.6 : DBA placements

The DBA was directed to work on a major project in which the organisation's manufacturing systems were to be re-written. The DBA exerted his influence by three means:

- Standards

  The DBA developed data modelling conventions and set standards for the detail the application analysts were to provide in the systems specification. If these were not met, directives were obtained from the head of DP. The analysis and design phases took much longer than previous projects, but the DBA was able to overcome the project manager's apprehensions. About 8 months were spent ensuring that ideas on data structuring and requirements were valid, of which only one month was spent on database design.

- Test Database

  The DBA designed a single, comprehensive test database for use by the development teams. The DBA became involved in co-ordinating tests and ensuring that errors were followed up.

- Data Dictionary

  The DBA team spent about 2 man-years' effort to incorporate a facility in the DBMS's data dictionary, so that it could be used to generate sub-schemas and other procedural codes. Project teams found it easier to use the dictionary than to try and sidestep it.

The manufacturing database contained about 60 record types and over 500 fields. It had an overall size of 600 M bytes and supported about 200 programs, of which 50 were on-line. The complete project was the result of 36 man-years' effort. On its completion, a new position of data administrator was created, to which the DBA was promoted. The current reporting structure in indicated in Figure 8.6(c).

The data administrator now manages a team of DBAs, each responsible for a number of projects. The data administration staff are considered to be among the best in the DP department, possessing both technical expertise and an understanding of the business. All development projects submit their data models to data administration. The data structures are examined to establish the overlap with a global data model maintained by data administration. Decisions are made on whether implementations should be based on indexed sequential files or database systems. Data administration also use the data dictionary to control systems maintenance work.As programs' access requirements are on the dictionary, it is possible to evaluate the impact of any proposed change. Programs requiring logic changes can be distinguished from those only requiring, say, recompilation.

The data administrator reports to the systems planning manager and more recently participated in the preparation of long-term information system plans. The original design of the manufacturing database has since proved suitable in other divisions of the company operating in different business fields.

8.4 OIL COMPANY - 2: ADMINISTRATION OF A SHARED DATABASE

The organisation has implemented, over a 4-year period, a number of subject databases to support marketing applications - on Customers, Company Locations, Vehicles and Products. The databases are accessible by an on-line query language and updated mainly in real-time. The data items are separately defined in a data dictionary. In addition to the subject databases, all shared tables previously embedded in application programs and used for functions such as validation, translation and decision-making, are centrally administered in a system termed 'Business Factors'.

The organisation structure of the data administration function at the time when initial phases of the Product subject database and the Business Factors System were in operation is indicated in Figure 8.7. The remaining data subjects were at an advanced stage of implementation. The data administration management team were company men of long-standing. Both the data administrator and the project leader responsible for database analysis and design were formerly managers of systems maintenance groups, while the database operations project leader had extensive systems software building experience gained in-house.

<u>The Product Database</u>

The Product subject database is intended to serve as the sole authority on, and a repository of data of, the company's products. Analysis had identified 16 applications with a total of 122 programs using product-related information. The initial implementation of the database supports three new applications, while also providing a basis for generating the master files for two of the larger existing applications. In this first phase, the database contains about 1,000 data items. The logical structure of the database is indicated in Figure 8.8. Sections of the database have been designated to various 'owners' who are solely responsible

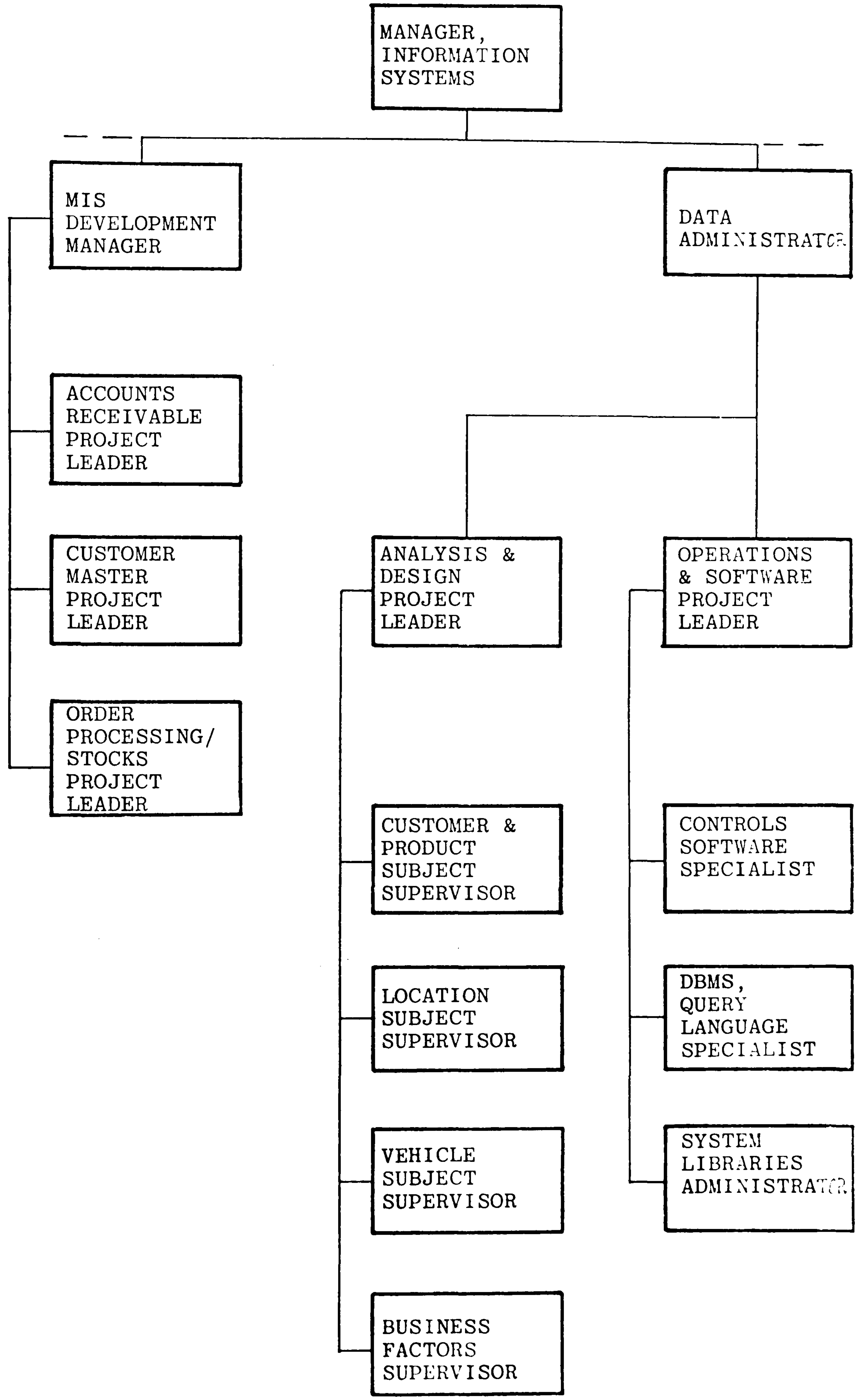


FIGURE 8.7: Data administration organisation

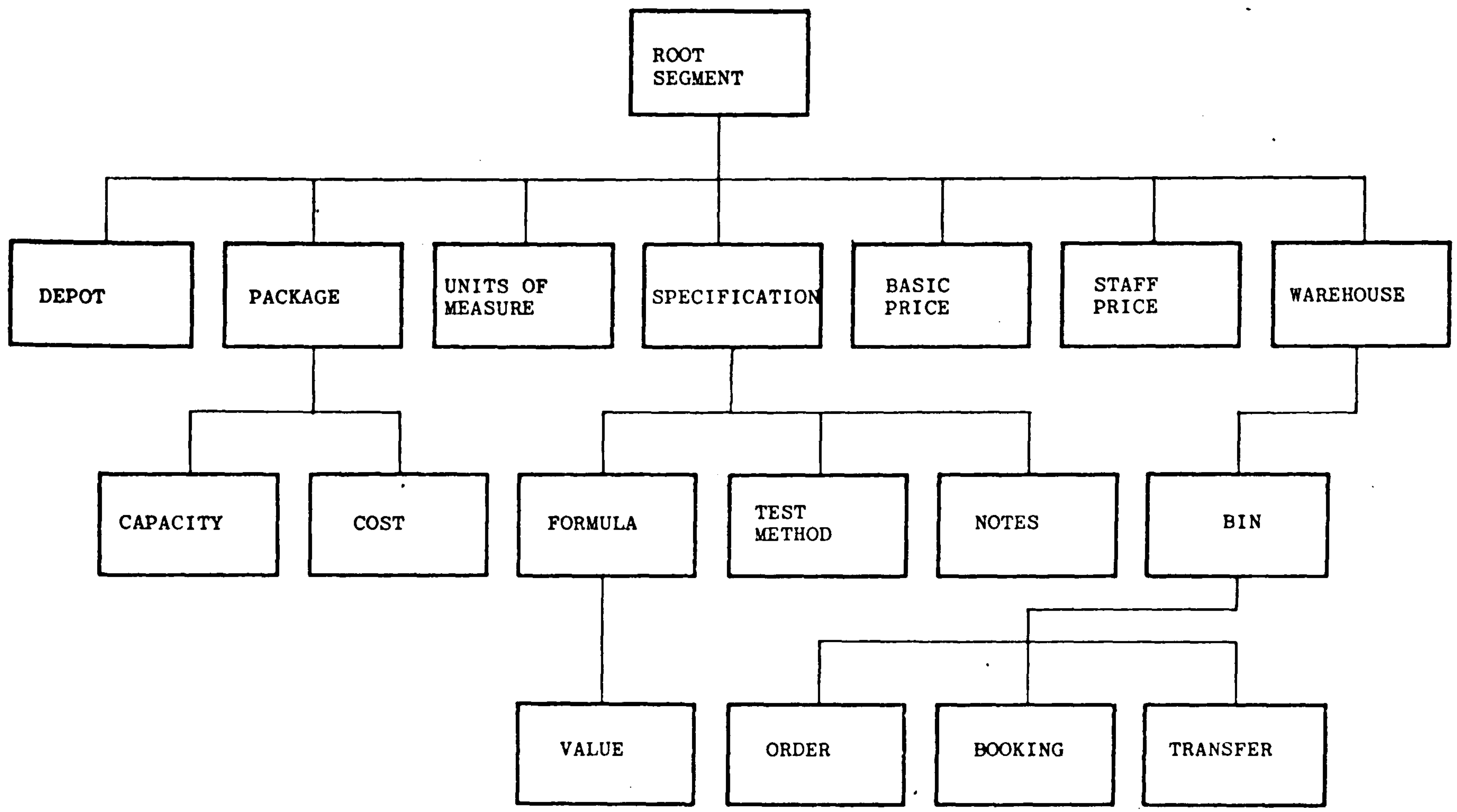


FIGURE 8.8 : Product subject database

for updating and maintenance. This owner may be a user department or an application system. No user or application can update any part of the business it does not own. About 850 of the 1,000 data items have such a specific owner.

The remaining 150 data items may be considered to be of common ownership. The items are of two types: data which must be centrally updated to preserve the integrity of the database, and shared business data. An example of the former would be flags to indicate whether a product should be deleted. Examples of the latter are shared data in which the originator only has a one-time interest. Some items belong to both categories, such as the key of the database - Product code - which has to be unique. Reponsibility for maintaining this common data has been assigned, by agreement within the division, to one of the owners, the sales accounting department. This department is known as the product database 'custodian' and the segments under its control are the 'common' segments. The main responsibilities of the sales accounting staff member acting as custodian are:

- allocating root key values once a request for a new product has been received

- initiating requests to the originating departments for their part of the shared data, accepting modifications and entering new or revised data

- maintaining controls and checking accuracy of the data

- maintaining manual records to provide an audit trail of changes; deleting records from the database if a product is no longer of interest to any department

Figure 8.9 indicates the common segments and the co-ordination role of the custodian. This organisational arrangement has enabled responsibility for the collection of data for the common segments and its input to be retained within one department.

The major administrative change has been in procedures for allocating product codes. Previously, four different departments assigned these codes to new products - Refineries, two sections within Marketing Stocks and Product Research. This led to many anomalies: for example, an analysis undertaken by data administration revealed that in a group of 700 refinery products, in over 100 cases the same code had been used for a different product by another part of the company.

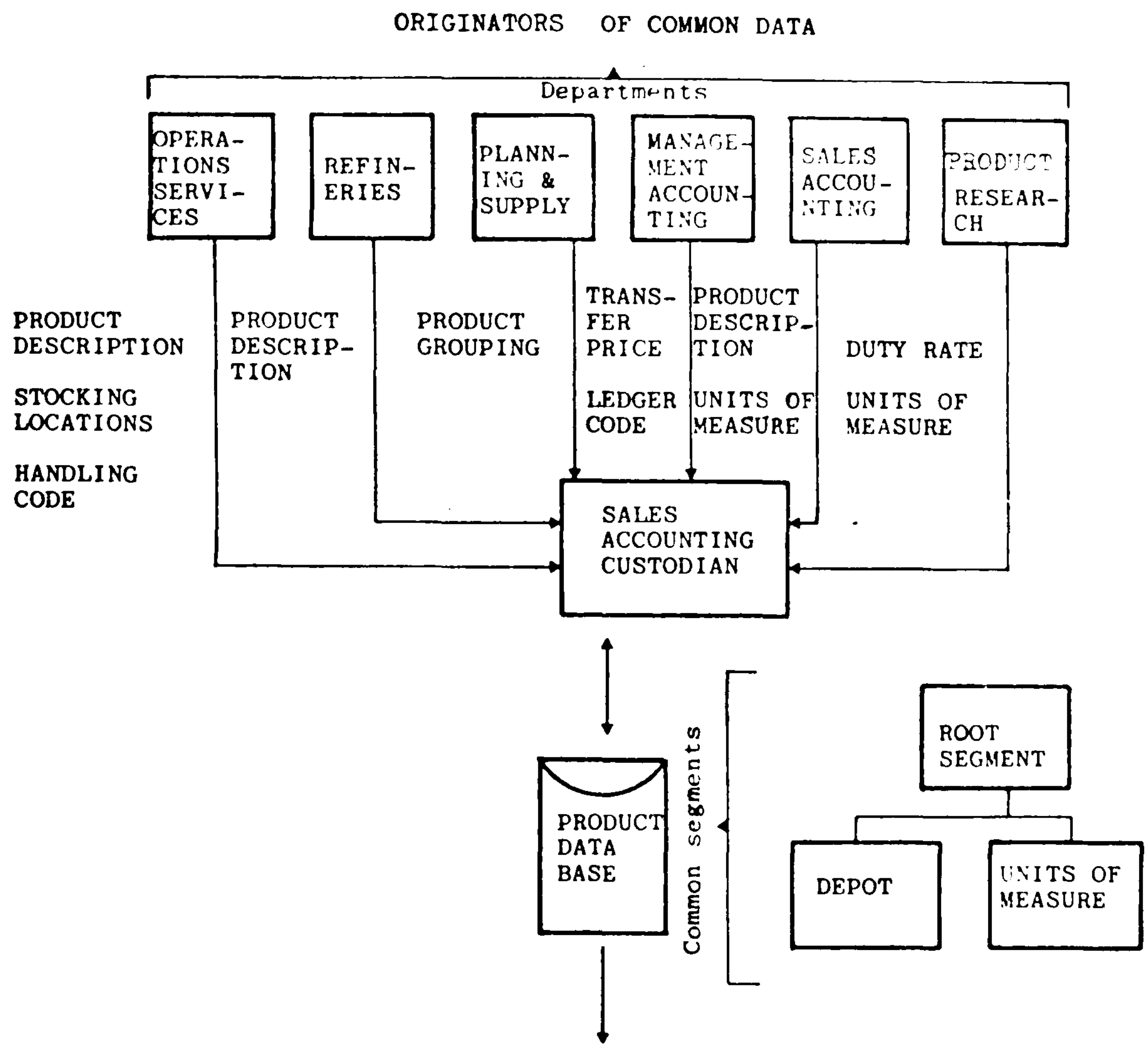


FIGURE 8.9 : Coordinating role of the custodian

The Product database supervisor, in the data administration group, acts as the custodian's main source of advice and assistance on all aspects of database procedures, from help in formulating a query language request, to changing validation rules or discussing the impact of creating a new code. The supervisor, in consultation with Internal Audit, also designed audit trails for sensitive data. The custodian has access to the data dictionary maintained by the supervisor. The owners of the non-shared section of the database are supported by application analysts. However, the overall design of the database, re-organisation, back-up and definition of recovery procedures are all centrally controlled by the data administration supervisor.

The main political problem preoccupying the data administrator did not stem from user resistance to data sharing but changes in senior management thinking on DP policy. A new manager of information systems had been appointed from a user department. This manager had successfully installed a micro in his former department and was keen on reorienting DP so that it could respond quickly and cost-effectively; for example, through greater use of packages and micros.

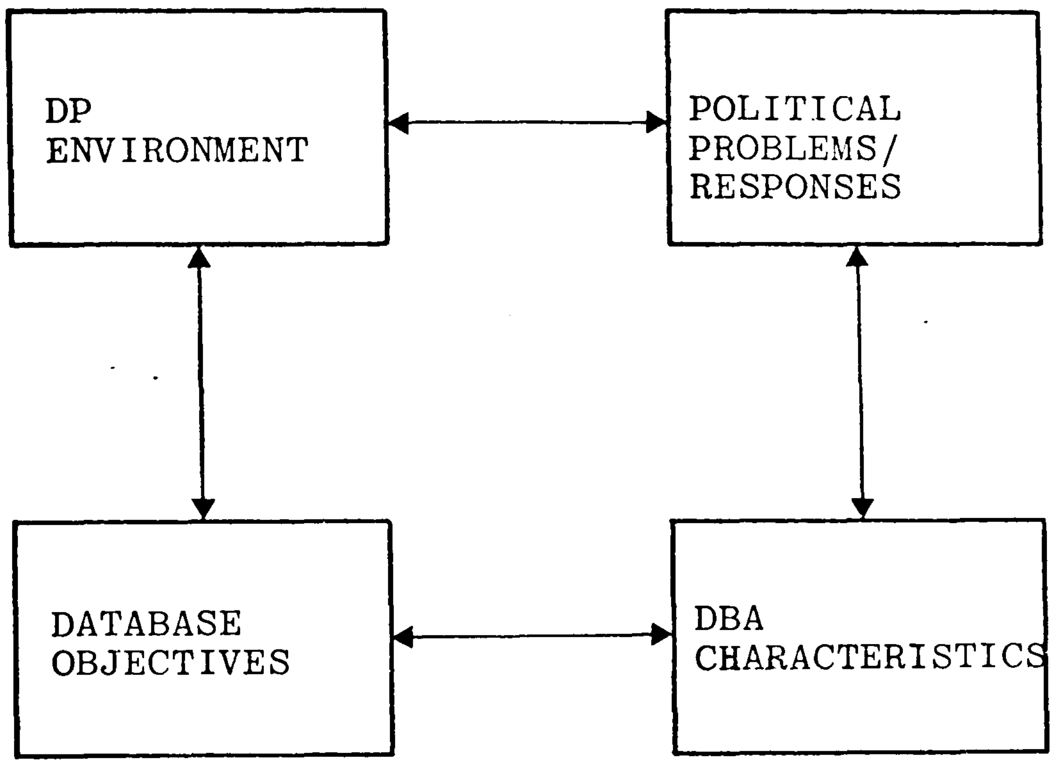
8.5 CONCLUSIONS

The preceding descriptions of four database projects illustrate the many organisational facets of database implementation. Two empirically-based frameworks which seek to explain this complexity and direct management attention to the key organisational issues are presented in Figure 8.10. The first depicts database development as a dynamic process, requiring the continual review and adjustment of inter-related organisation factors. The second indicates the themes of change evident in present-day practice - the areas in which database development has a visible organisational impact. The frameworks are considered below in the context of the individual database projects. The objective is to provide examples of the use of these concepts in the management of database projects.

- Oil Company - 1 (Section 8.1)

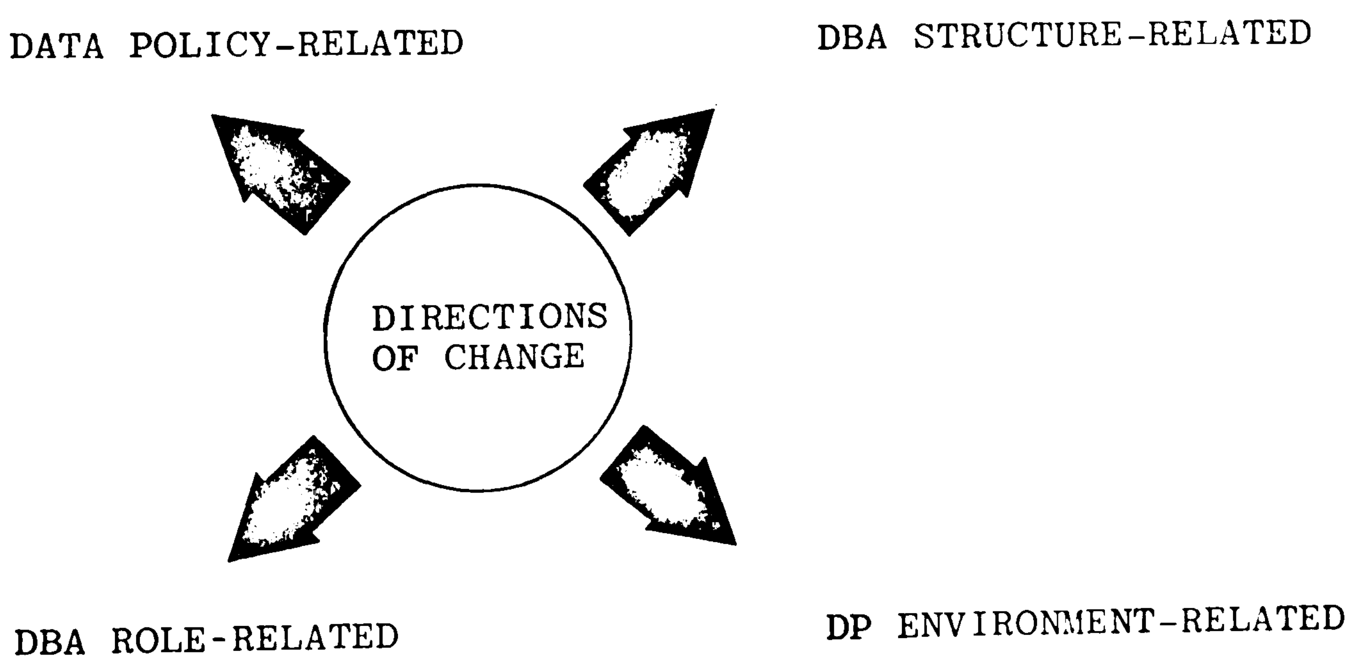
  The project description indicates the interdependence between the objectives or expectations from database

(a) Database development as an organisational process



(Based on Figure 7.9)

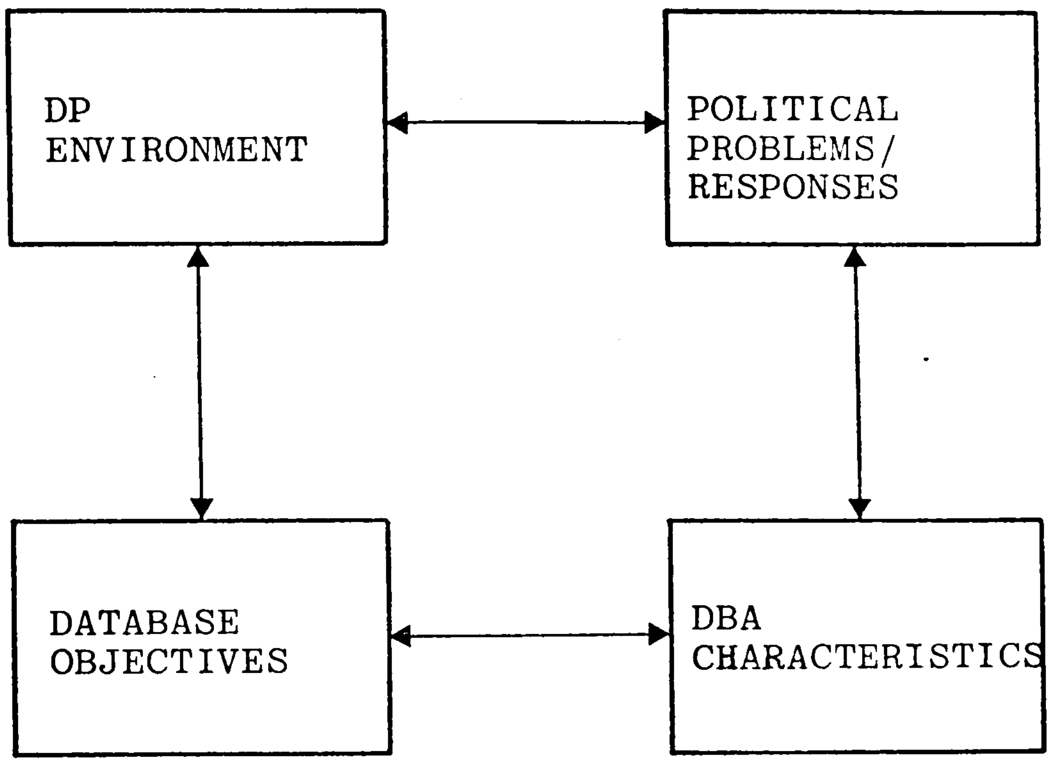
(b) Themes of organisational change in database development



(Based on analysis in Chapter 7)

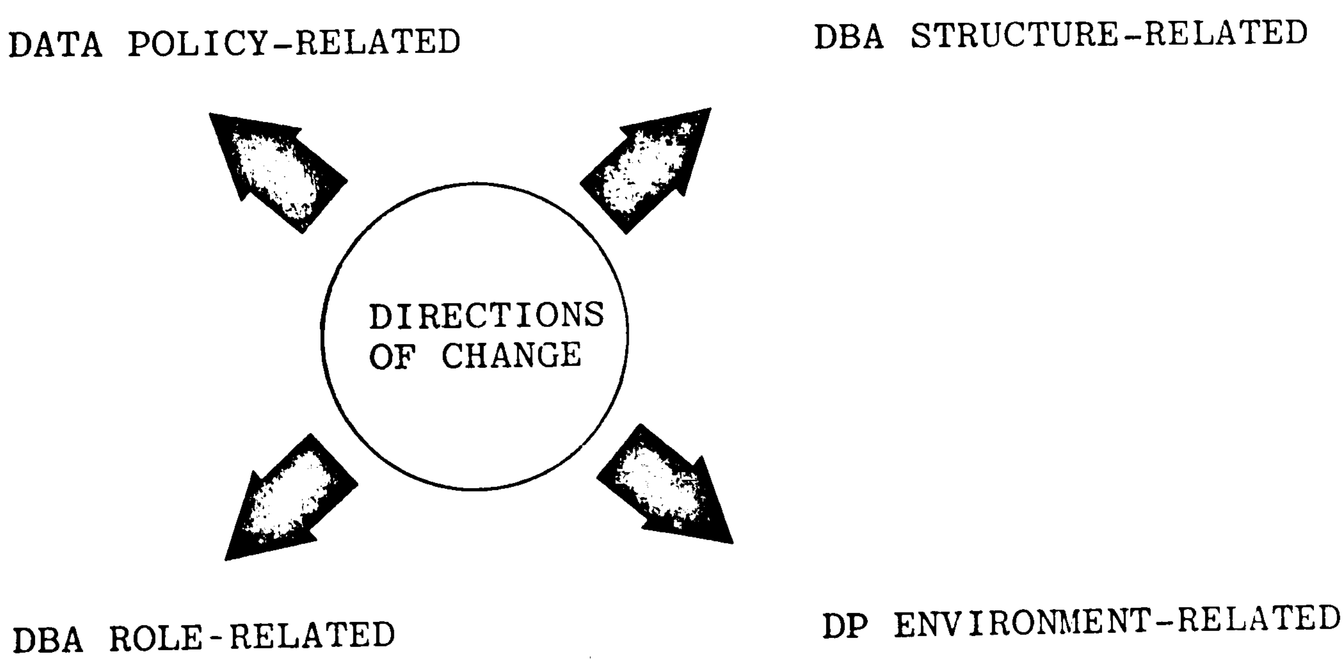
FIGURE 8.10 : Empirical models of database development

(a) Database development as an organisational process



(Based on Figure 7.9)

(b) Themes of organisational change in database development



(Based on analysis in Chapter 7)

FIGURE 8.10 : Empirical models of database development

development and the DBA function. The objective of developing a corporate database would require the DBA function to be in the forefront, rather than adopting a reactive role. By recruiting systems programmers and directing attention to technical aspects of the data dictionary, the DBA misjudged the approach required. Credibility could only be restored by seconding staff to project teams. This increased visibility was causing a new type of political problem as the staff were not able to integrate easily. The theme of organisational change was DBA role-related: the creation of joint teams would inevitably affect application analysts' methods of working.

- <u>Chemicals Company (Section 8.2)</u>

This case study illustrates the interdependence between DP environment and database objectives. Certain types of objectives may only be viable if the organisational context is appropriate. The DBA was made acutely aware of the problems of creating data standards when the organisation lacked systems planning discipline. The DBA's persistence may have prompted far-reaching changes in the organisation's DP environment.

- Electronics Components Company (Section 8.3)

The project description illustrates the interdependence between DBA characteristics and the type of political problems faced. The increased authority of the DBA function, made possible by management backing and the skillful use of technical tools such as the data dictionary, has led to the emergence of a new elite. The themes of change are both DBA structure- and role-related: various organisational placements have been tried and the function is well established to the extent of possessing an internal structure - DBAs reporting to a data administrator; application analysts now find their actions constrained, not only in design, but also in analysis, implementation and maintenance.

- <u>Oil Company - 2 (Section 8.4)</u>

  The case study account reveals the interdependence between DP environment and database objectives. The creation of a shared data environment has perhaps only been possible because of the tradition of good working relationships between DP and users: the project team which recommended the database strategy had been chaired by a user. The account also illustrates the interdependence between DP environment and the type of political problems occurring. A change in the management commitment to an existing information systems strategy was a matter of concern for the DBA. The theme of change is data policy-related: the creation of a shared data environment has changed user responsibilities over data.

The conceptual frameworks therefore offer information systems management with a descriptive theory with which to view the world of database development. The concepts <u>are</u> simple, but the outcome of systematic empirical research.

9. THE FUTURE OF THE DBA FUNCTION

> "Karl Marx said that accountants are the jackals of capitalism. Maybe Database Custodians will be the hyenas of bureaucracy." [1]
>
> Sibley (1974)

From the analysis presented in Chapters 6-8, the DBA emerges as a key figure in the database development process and at the centre of the organisational changes. The objective of this chapter is to provide information systems management with a perspective of the longer-term implications of decisions made today on the creation of a DBA function in their organisation. The chapter explores the future of database administration - will it succeed in becoming the indispensable and pervasive function of the modern enterprise?

The chapter consists of three sections:

- survey findings, a profile of present-day practice
- DBA as data resource manager, the concept and scenarios for change
- the future of DBA.

1. In Jardine (1974) p.275

9.1 SURVEY FINDINGS

This section presents a profile of the present-day DBA with particular reference to the factors contributing to its success. The section draws together the essential findings of the survey on DBA, though some data not previously cited in earlier chapters is also presented.

9.1.1 The Survey

The approach of the survey has been to seek out staff with overall responsibility for database development in their organisation. In the majority of cases the nominated manager held the job title 'database administrator' (16 organisations). In a few organisations there was a hierarchy in database administration and in the perspective of this survey the more senior manager has been regarded as DBA (3 organisations). Of the 21 organisations surveyed, only 2 were considered not to possess a DBA function. Though the DBA is one of the most recent of information systems specialisations, it is a concept which is now generally well recognised in organisations with database projects.

9.1.2 Task Emphasis

The responsibilities of DBAs were found to vary from organisation to organisation. However, two types of DBA can be identified:

- those acting as technical support to the DP department with little or no contact with users of applications

- those with line management responsibilities in data-related issues and for whom liaison and contact with users forms an important element of the job.

These are referred to as the 'transparent' and 'visible' DBA approaches.

<u>The transparent approach</u>

Three DBAs' views of their main responsibilities are noted below. The database projects are at the feasibility, implementation and operational stages respectively:

- "Evaluating and installing releases of DATAMANAGER (data dictionary). Identifying or responding to a need for certain types of software aids, interface programs to IMS. Later on in the year emphasis shifting to an administrative and monitoring role - assisting in the identification of shared data and in definitions and in reconciling conflicts between application team."

- "To lead in DBMS design and in assisting testing and implementation. To oversee day-to-day database operations. To evaluate new releases of DBMS software. There is no contact with users - it is not expected that database developments will require users to adopt any new standards."

- "Looking after the physical database, ensuring it is not violated or destroyed. Identifying ways of using the database more effectively and efficiently. Undertaking developments to improve flexibility. Monitoring performance and effecting changes to improve performance. Examining new application requirements to assess impact on database and ensuring enhancements can be accommodated. DBA is not supposed to speak to users."

The visible approach

The views of three DBAs in this category are presented below. In all cases the organisations have one or more database systems in operation:

- "DBA controls the process, rather than the content of data analysis. To initiate and promote data standardisation. To act as the expert on database design techniques, providing training and consultancy, for example on file design, coding systems and software. To work with application project teams early in the analysis and design phases of system developments. DBA does not identify user requirements but deals directly with users, together with systems staff, in preparing plans."

- "A diplomat who has to work at all levels - even the shop floor. (DBA) post was created primarily to create standards and commonality of data, by the standardisation and rationalisation of codes and the standardisation of data, for example identifying ownership, updating responsibilities, retention. Responsible for assigning database maintenance responsibilities to users and authorising codes. DBA advises on system audits, all system developments and data collection methods."

- "Responsible for determining the overall policy of the corporate database and the design of the individual databases, which together make up the corporate database. In determining policy and design, due consideration is to be given to user and application requirements for both the introduction of data and the subsequent use of that data."

Characteristics of the effective DBA

The 'transparent' DBAs have a technical back-room role and cannot be effective in bringing about major changes in the management and use of the organisation's data. The survey has additionally uncovered the following differences:

- DBAs with the transparent approach have a programming management or systems programming background. DBAs with the visible approach were formerly in systems development, management services or user departments.

- Dissatisfaction over organisational placement and working relationships with other DP groups were the main political problems cited by the transparent DBAs; DBAs with the visible approach were more concerned with data policy-related issues - users objecting to data sharing or the taking of new updating responsibilities.

- Of the 19 DBA functions surveyed, 16 were located within the DP hierarchy, while 3 reported to general management. All the DBAs in the latter category were highly visible, placing emphasis on their role in influencing, and communicating with users.

9.1.3 Sources of DBA Power and Authority

The responsibilities most frequently claimed by both the 'transparent' and 'visible' DBAs - in analysis and design, accountability for data, systems planning - previously belonged to others. The DBA is a functional specialisation carved out of existing DP, user and management activities. The DBAs have had to seek means in order to create and preserve an identity in the face of competition and resistance to change. An analysis of these means provides an insight into the organisational survival of the DBA function. Study of the successful or 'visible' DBAs point to three requirements:

Management interest

The survey findings suggest that it is only with management backing that DBAs can be effective and tackle the real issues of interest. This is because without such backing the DBAs remain preoccupied with questions of organisational placement and working relationships with other DP groups.

Obtaining such backing is not a problem if the objectives of database development are strategic - long-term benefits of data sharing are sought-after - rather than functional - where a DBMS is being used for some technical facility only. The survey indicates that of 11 organisations with a DBA function and still at the feasibility or implementation stages of the project, in all cases where the DBA reported directly to general management or the head of DP, the database objectives were strategic. In all cases where the objectives were functional the DBA was placed 2 or more levels below the head of DP.

DBAs who seek the strategic objectives without the initial impetus coming from management are often disappointed. The survey findings indicate that if there is a suspicion that management's interest is only lukewarm, the forces opposed to change will overwhelm the project, however hard the DBA strives:

> "In practice the Data Administration function has no authority but can only influence. Problem is getting project managers to appreciate database. Users don't need some rigorously analysed rigid system but flexibility - data to be at their finger tips. Computer staff are conventional DP people not appreciating that a lot can be got out of proprietary software and simple ad hoc programs. DP management attaches greater importance to the project teams because it lacks a strategic appreciation of the database approach."

In a second organisation participating in the survey, DBA had begun de facto when a senior analyst became the DP department's DBMS specialist. It required a major "disaster" - a sizeable application development project to fail performance criteria - for top management to recognise the DBA must be provided with the authority it demanded. In the next project, lapses by application system analysts in meeting the DBA-set standards were brought to management attention and directives obtained.

Staff Skills

The emergence of an effective DBA function also means the creation of a new type of information system specialist - DBA staff need both business knowledge and technical skills. One of the most distinct themes of the survey has been the emphasis placed by DBAs on the combination of skills. For example, one successful Data Administrator noted of his staff:

> "These are the best people because the problems they have to address are more complex; (they) bear greater responsibility and need greater versatility - adept in analysis, design and business implications."

In two organisations participating in the survey the DBA function had acquired an internal structure: a number of junior-level DBAs reported to a senior data administrator. In these instances staff at the junior level had been assigned to application development projects or to data 'subject' areas. This arrangement reduces the need for staff to possess a knowledge of the overall company operations and allows specialisation. However, it does not remove the need for DBA staff to possess both business knowledge and technical skills. For example, in one of these organisations the requirements of such staff were expressed as follows:

> ".... must have a sound knowledge of (the company's) business in the product area and needs, therefore, to be a business analyst rather than a computer-trained person.... the assigned person will need a working knowledge of database transactions and audit rules, but after a brief familiarisation period, this should present no problems...."

Control over data

> "DBAs' ultimate weapon is that it is responsible for the schemas and subschemas."

This statement, made by a DBA in one of the organisations surveyed, highlights the basis of the function's power. The DBA has central control of the organisation's databases and their use. Several DBAs were unambiguous of their line management responsibility for data

> "Ultimately responsible should something happen to the company's data."

> "The DBA has had to exercise a gentle dictatorship to ensure data integrity is maintained. Certain standards have been imposed on application programmers, for example system programs which must be used."

Application development project teams no longer create and alter their own data structure because all stored data structures are under the control of the DBA. A common approach to ensure this discipline is only to allow those programs access to the data which have been recorded in the data dictionary. It is the insistence that data dictionary standards should be complied which frequently results in the DBA being described as "bureaucratic" or a "bottle-neck". In one organisation surveyed, the DBA sought to encourage project teams by providing facilities of immediate advantage: the DBA team spent about 2 man years to incorporate a facility in the DBMS's data dictionary so that it could generate subschemas and procedural code.

9.2 DBA AS DATA RESOURCE MANAGER

There have been two themes in the normative literature on DBA. In one the DBA is discussed in the context of the DBMS and its facilities. This literature provides the practicing DBA with a sound technical basis for supervising the DBMS and maintaining smooth operations. (CODASYL, 1971a, 1971b; BCS-DBAWG, 1975; BCS-DBSWP, 1977). In the other, the DBA is viewed in a broader perspective

- as the manager of the data resource. This concept provides a longer-term vision for the organisational evolution of the DBA. The first section below clarifies the concept, with reference to the database and information systems literature. The second explores the possibilities for change in current practice which can provide a basis for the evolution of the present-day DBA.

9.2.1 Historical expressions of the DBA role

Among the first accounts in which the DBA was placed in the broader DP context, rather than solely a DBMS context, is that of Nerad (1973):

> "The data administrator should be the production controller for the computer systems development personnel. He should be the information source, the co-ordinating force, and where necessary the expediting force. In this fashion he can

provide the control that is necessary. These should be his initial functions. If he gets involved with database management systems, his efforts will be dissipated by the mechanics of these sophisticated tools." [1]

Nolan had contributed to the thinking on data as a resource (1973a) and it is therefore not surprising that he proceeds to develop a role for the DBA:

> "Similar to the evolution of specialisation in the activities of other basic resources (materials-production, money-finance, market-marketing, human-personnel), one can expect specialisation in the activities of dealing with the data resource.... Emergence of the Data Base Administrator position is a natural evolutionary step in the specialisation of the data resource function. To deny its existence is to deny that data is a basic resource; to deny that the division of labour in organisations will increase further; and to deny any further impact of advances in technology on the division of labour." [2]

1. Nerad (1973), p.272
2. Nolan (1974), p.39

The DBA's overall responsibility for the organisation's data was also proposed by Everest:

> "If data is considered a valued corporate resource, the chief executive officer is ultimately responsible for its availability and integrity. To discharge his responsibility he may delegate the task to an appropriate subordinate. Alternatively, when data resources are shared, the community of users may elect to have a single person responsible for managing those resources. The role of database administrator is an ambivalent one, reflecting both dictator and slave. On the one hand, he is subservient to and works for using organisational units, while on the other hand, he has authority over several using organisational units. This is not unlike the personnel manager who serves other units in the organisation but is directly responsible to top management." [1]

1. Everest (1974), p.182-183

The notion of the DBA as data resource manager is now conventional knowledge and is to be frequently found in the technical press:

> "Data administration is the management of data as a resource of the business. Just as plant, people, premises and all the other assets of a business need to be managed to be effectively utilised, data must also be organised and controlled in order to derive the maximum benefit from its use." [1]

A more detailed study of the concept has been made by ANSI (1977) who propose an organisational position of Enterprise Administrator. This is a manager responsible to the board for the company's resources of data. The Enterprise Administrator defines the organisation's data and establishes its meaning. With this 'conceptual schema', it can then separately specify:

- the various formats in which this data is to be made available to application processes

1. Rock-Evans (1980), p.20

- the physical organisation in which the data is to exist in the machine

The above tasks can be assigned to other staff members: administration of the 'external schema' to an applications administrator, who co-ordinates the different views that applications require; administration of the 'internal schema' to a DBA who is also the resident expert on the facilities provided by the DBMS. The ANSI model points to a possible hierarchy of the data resource management function. However, its main implication is the emergence of a high level central authority for data in the organisation.

Specific proposals on data resource management were also made by Davenport (1980). Policy was formulated by a Data Administrator and implemented by a Database Administrator - responsible for the non-computerised data systems.

> "The Data Administrator('manager of the data resource') is responsible for establishing,

> monitoring and, when necessary, modifying an organisation's policy for data gathering and utilisation. He should ideally be responsible for all data, not just that which is computerised.....the Data Administrator as well as being responsible for Data Analysis, including such matters as maintaining the Entity Model, establishing data standards, coding systems and ownership of data has to be responsible also for establishing policies and trade-offs. The latter is necessary since, with the shared data approach, priorities between applications needs to be established."[1]

The Data Administrator in Davenport's account emerges as a figure who is familiar with the use and meaning of all the data of the organisation.

Attempts at defining the role of such a figure have also recently been undertaken by a U.K.-based group - The Data Administration Working Party (DAWP). As ANSI's Enterprise Administrator and Davenport's Data Administrator, DAWP envisage a function with responsibility for defining the organisation's data. The function exercises its control through the data dictionary.

1. Davenport (1980), p.507

The role is defined as follows by DAWP:

> "Like other functions such as personnel or finance, the data administration function involves an overall company responsibility for its functional area - data. This means that it is the responsibility of the data administrator to identify any new data issues or problems that arise in the company, to advise management about it and to initiate action to resolve them. Data administration differs from other functions in that it is much newer and also its area (data) is changing far faster than any of the other functional areas." [1]

The above review indicates the scope of the DBA function when the philosophy of data as a corporate resource is adopted. The DBA needs to be a Janus-like figure, understanding user views and the meaning of data, as well as capable of guiding the technical implementation of the shared data environment. In the light of what is known about present-day DBAs, the possibility of attaining such a pervasive organisational role is explored in the following section.

1. Haegerty (1982)

9.2.2 Scenarios for Change

This section discusses three challenges facing information systems management. The strategies adopted can impact on the organisational evolution of the present-day DBA function.

Information systems planning

Two types of problems can be identified in present-day systems planning activity. First, while it is generally accepted that information systems development should reflect business policy, the procedures to be used for deriving and maintaining systems plans from business strategy are unclear. An example of how a DBA may be affected is provided by an organisation in which decisions on the centralisation or decentralisation of operations were reversed every few years. The marketing database was at the centre of controversy because a decision had been made to centralise manufacturing operations and decentralise commercial operations. Second, when organisations do possess a comprehensive information systems plan there is the possibility of the strategic view developed at corporate level to be lost or threatened during implementation. For example, the objective of creating a shared data environment may be downgraded because greater emphasis is placed on the applications plan or a change in DP management has led to some other shift of emphasis.

To overcome some of the problems in systems planning, the concept of a 'systems architect' has been proposed (Ben-Nathan, 1980). This is a new staff member who participates in formulating information system plans and has the technical know-how to monitor the application development projects and provide direction on issues of principle.

The DBA is well placed to contribute to systems planning and there is a case for it to be made systems architect. The present-day DBA is qualified because of the unique insights - into systems development and interdependence of organisational activities - which the job provides. To some extent, this is recognised in present-day DBA practice. Survey findings indicate that DP management seek DBA views on strategic issues such as planning for distributed processing. Greater responsibility for information systems planning will secure the organisational future of the DBA function.

Information Systems Development

The shared database approach requires a change in methods of system development. Information system builders now need to be competent not just in defining the business processes using the data, but also in analysing the data independently of individual application requirements. The group traditionally responsible for delivering the organisation's information systems, systems development, is particularly affected. The survey findings, for example, indicate that a typical response of DBA functions has been to acquire an overall competence - the business requirements and the underlying data structure. Moreover, the evidence also indicates that while DBA staff bear considerable responsibility for defining the data and in technical design decisions, it is only rarely involved in analysing user requirements. A response is, therefore, needed from information system management to create suitable organisational forms and arrangements for the system building activity - existing forms and arrangements are outmoded. One possibility is for the DBA function to encompass the existing systems development management role within DP. This arrangement already exists in embryo form today in cases where a DBA heads a project team staffed by both application analysts and designers.

Administration of shared data

In one of the organisations surveyed, a product 'subject' database contained about 150 items which were shared by departments and systems. In many instances, the originating departments only had a one-time interest in the data. While the originator was willing to share the data, it did seek to be encumbered with ownership or updating responsibilities. Consequently, a 'custodian' had to be found to maintain the data.

Two organisations participating in the survey had adopted such a 'custodian' approach for the administration of shared data. In both cases a user department had been selected. In one of these organisations, however, the arrangement was proving unsatisfactory because of the workload - albeit clerical - involved for the custodian: not just in data entry but communicating with other users.

An alternative would be to place the custodianship responsibility in the DBA function. It would mean transferring a unit of clerks drawn from one or more user departments into DBA. Such a move would inevitably be accompanied by an increased authority for the function and points to a trend which may lead to DBA emerging as a central management function.

9.3 FUTURE OF THE DBA

The preceding sections provide a vantage point from which an informed view on the organisational survival of the DBA function may be taken. The discussion below assesses the continuing value of the concept of DBA as data resource manager.

Management backing, analysis and design skills and control of database usage have allowed the DBA function to acquire technical and political weight in organisations in a relatively short period of time. The 'visible' DBAs have acquired line management responsibilities and are instrumental in introducing the database approach into their organisations. Almost invariably, this evolution has been within the data processing department and with reference to computer systems data.

An organisation's manager of the data resource, on the other hand, is at par with the personnel manager or the chief accountant - with overall responsibility for a company resource. The scope of this function is much wider than the bounds of the present-day DBA.

There is an inherent momentum for change in the information systems activity: issues relating to information systems planning and development, the administration of shared data, will have to be resolved. While these issues provide opportunities for the logical advancement of the DBA function, their fundamental nature and wide-reaching implications suggest that decisions will not be made in the short to medium term (5 to 7 years). Moreover, demands for the full blown positioning of the DBA will be unlikely unless people with an information systems background reach the top management levels.

The present-day DBA, however, has not yet reached the plateau of its organisational evolution. Even in the present survey, based on the views of practitioners rather than theorists, a respondent remarked:

> "DBA may become a line management function for MIS, with technical jobs handled by DP."

While the notion of the DBA as data resource manager may not be realisable immediately, it remains a long-term possibility. It is not difficult to anticipate some of the political problems to come: can DBA analyse and manage the company's data without affecting the traditional line management jobs? Will the need to master the diversity of company data spawn a large bureaucracy? The organisational impact of database systems is likely to remain a subject of research for a considerable period.

As has been observed earlier (Section 3.2.1 iii, Chapter 3) the survey findings presented in this study portray the state-of-the-art in mainframe installations: about a third of the postal survey respondents were users of DL/1 or IMS, IBM's DBMS only available on medium to large computers. During the survey period 1976-1981 database implementations were not viable on small computer systems. It is only more recently that 'genuine' DBMSs (for example MDBS - Holsapple & Whinston,1982) have become commercially available for use on microcomputers. Products have also been announced which enable the linking of micros and mainframes to share a corporate database (Black, 1983). The DBA today is therefore at the confluence of many wide-reaching developments. Some of the organisational implications of these technological trends are taken up in the next chapter, in the discussion on the areas of further investigation.

10. CONCLUSIONS

The aims of this research project were to

- create concepts and a terminology to describe the richness and subtlety of actual practice

- provide practical guidelines for the information systems manager embarking on database development for the first time

- establish the possibilities of organisational change, with particular emphasis on the evolution of the DBA function

This chapter summarises the findings and assesses the contribution made to the existing body of database and information systems management research. Areas of further investigation are also noted.

10.1 SUMMARY OF FINDINGS

10.1.1 Empirical Concepts

On the basis of field work, previous researchers had concluded that the standard text book accounts fell short in describing substantive realities of database projects:

- there was more than one database approach (EEC-NCC, 1979)
- there were different types of DBA (Weldon, 1979)
- the organisational problems required further understanding (De Blasis & Johnson, 1978)

As a result of data collected from in-depth interviews in 21 U.K. organisations with database projects, this study has uncovered a number of patterns which provide new, empirically-based variables for describing the organisational aspects of database development. The four main classifications devised are:

Database Concept

- data organisation method - a physical file or data organisation

- data management approach - a logical collection of data to which new disciplines of integrity and control can be brought to bear

- information management philosophy - a reorientation in which database systems become a cornerstone of future information systems development

Database Approach

- strategic - an objective of database development is the promotion of data sharing

- functional - objectives are to use a DBMS for its technical facilities; data sharing is not sought-after

DBA Approach

- visible - DBAs with line management responsibilities in data-related issues and for whom liaison and contact with users form an important element of the job

- transparent - DBAs acting as technical support to the DP department with little or no contact with users of applications

DBA Staff Background

- business - previous experience in a user department, management services or applications development

- technical - previous experience in systems programming or operations or programming management

Political Problems

- data policy-related - arising from issues of data ownership and maintenance

- DBA-related - arising from concerns over organisational placement and task interdependencies with DP functions

- DP environment-related - arising from features of the DP environment rather than being a consequence of database development

Additionally, subsidiary classification schemes were devised to describe sources of the database idea in organisations, systems planning procedures and the user role in database feasibility studies and DBA organisational placement.

10.1.2 Practical Guidelines for Information Systems Management

The traditional management role in information systems development projects is project planning and control - task allocation and scheduling. Database projects, however, place new demands on information systems management. To assist the practitioner, the specific issues which require attention have been highlighted and a conceptual framework developed.

Specific Issues

Assessing the DP environment: the creation of the organisational environment for database development is as essential as the creation of a technical environment. The strategic database approach is associated with more mature DP environments with respect to management interest and awareness, systems planning disciplines and mechanisms for obtaining user involvement. The requirements for management education and the current systems development methodology need to be assessed before embarking on a project which seeks to create a shared data environment.

Orientation of the DBA function: the DBA function can have a high level of visibility, actively seeking to influence thinking on data and the way the organisation works, or it may adopt a back-room role within the DP department. The approach is influenced by management decisions on organisational placement and staff selection. DBAs placed outside the DP hierarchy tend to be highly visible; DBA functions with a technical background tend to be transparent outside the DP department. Management should first establish whether the DBA function is expected to serve as an instrument for organisational change - and make appointments in the light of this decision.

Recognising the Political Problems: the different types of political problems need to be explicitly recognised because they call for different responses. Conflicts arising from data sharing are not the only - or predominant - type of problem occurring. The most widespread problem relates to the emergence of the DBA - its placement and working relationships with DP functions.

A Conceptual Framework

The conceptual framework is a mental model of the organisational dimension of database development. Database development is pictured as an interplay of four variables - DP environment, database objectives, DBA characteristics and the political problems and responses. The model has been represented diagrammatically in previous chapters (Figure 8.10a). It directs management towards taking an integrated view of the project: the existing infrastructure or DP environment influences the objectives of database development; database objectives in turn influence the DBA function; the DBA's approach is associated with specific types of problems - a learning process is prompted in the face of problems - leading to changes in DP environment. This may lead to a change in database objectives, prompting a fresh iteration. With such a model in mind, the manager with responsibilities for database introduction will be better prepared to face the complex reality of the project situation. For example, a DBA will not be encouraged to adopt a more visible profile without assessing the prevailing status of, and likely implications on, the other organisational variables; a change in database objectives will not be effected without anticipating some impact on the DBA function. The model is only tentative, as it is based on observations of database projects in large U.K. organisations only.

10.1.3 Organisational Change and DBA Evolution

The study has found that organisations differing with respect to industry type respond in generally similar ways in their database projects:

- shared databases confer users with a greater responsibility for data than existed in the traditional data processing environments

- DBAs emerge as an important and instrumental function, particularly affecting application analysts' traditional methods of working

- systems planning becomes increasingly important - to allow phased implementation, to impose a discipline on systems development and to formalise the management commitment

These represent tangible changes in organisational forms and arrangements - evidence that database development is not neutral but a phenomenon with a wider organisational impact.

The central role of the DBA function in the introduction of the database approach within the organisation had been established in previous empirical work in the USA (De Blasis & Johnson, 1978; Weldon, 1979). The present research confirms this view but differs with the conclusions drawn on the evolution of the DBA function:

- the claim had been made that organisational aspects of DBA were primarily affected by the length of time that the group had existed - DBAs start low in the organisation but gain in position as the function matures (Weldon, 1979). The U.K. experience indicates that organisations at the early stages of a database project have placed DBA at a senior position while those at advanced stages may retain their DBA within the DP hierarchy. Similarly, the visibility of the DBA - taken as a measure of maturity - is not necessarily a function of stage of database systems development.

- a further claim made was that control and co-ordination problems were to be found in DBA groups in existence for a period of time, rather than in those just starting up (De Blasis & Johnson, 1978). In the U.K. experience problems of data policy or DBA role - the control and co-ordination problems - can be found in organisations from the earliest stages of a database project - the feasibility study.

The present study proposes its own notion of DBA evolution based on observations of the type of political problems perceived by DBAs. The less mature functions are those locked in disputes of authority and responsibility, and it is only once these have been overcome that the DBA reaches a new level of maturity and can commence tackling the real issues of interest - creating the shared data environment. Moreover, analysis of the means DBAs have used to create and preserve an identity in the face of competition and resistance to change point to three requirements for successful evolution:

- management backing

- possession of both business knowledge and technical skills

- line management responsibilities for database - their content, usage and integrity

This strategy has allowed the DBA function to acquire technical and political weight in organisations in a relatively short period of time.

On the basis of the research, some speculation may be made in the future of the DBA function. The paradigm of the DBA as a data resource manager - a company vice-presidential level figure with overall responsibility for data - should still be retained. There are indications of an inherent momentum for change in the present-day information systems environment which can place the DBA on a new organisational plateau:

- the need for new concepts, methodologies and roles in information systems planning

- the need to replace outmoded DP department organisational forms

- the need to establish long-term organisational arrangements for the administration of shared data

In the opinion of the researcher, the breakthrough for the full-blown positioning of the DBA will not be made in the short to medium term (5 to 7 years) because of the fundamental issues at stake. Until these issues are addressed, or unless people with an information systems background reach top management levels, the DBA is likely to achieve a permanence within the DP department and in the context of computer systems data.

10.2 ASSESSMENT OF THE RESEARCH PROJECT AND AREAS OF FURTHER INVESTIGATION

Revell has observed that

> "Much of the research work to date in the database area has been concerned with two aspects, namely DBMS and the Data Model. In a way, these may be viewed as tactical issues, since both have been **functionally** necessary in order to produce working database systems. Much less work has centred on the wider issues of the database in the organisational environment. Whilst the tactical issues may impinge on the organisation, e.g. the existence of a high-level query language may be a determinant of the level of management involvement in an operational database system, it can be argued that technical issues do not have a **fundamental** bearing on the way in which organisations use database systems." [1]

1. Revell (1981), p.197

By deliberately eschewing the technical aspects of database systems, this study has sought to provide an insight into the practical, organisational issues involved.

The issues investigated are primarily of interest to database researchers and practitioners. However, database systems are only a special case of information systems and the data collected on the political problems in particular make the study relevant to a wider audience. A group in mind are the next generation of systems and data analysts, because

> "There have been few studies of the political aspects of information systems development. The topic is rarely discussed in text books and even the literature on implementation deals with it only peripherally. Yet when one tries to reconstruct or observe the progress of any major project, this is an obvious and important feature. It is absurd to ignore it or treat it as somehow an unsuitable subject for study or for training MIS specialists."[1]

1. Keene (1981), p.31

This study has been exploratory in scope, as reflected in the research methods used. There is need for ongoing investigation into the organisational implications of database systems and there is a case for preserving the research approach used in this study. Four areas of further research are noted:

- **political problems:** database systems are still in their infancy in the U.K.; the full impact of data sharing has not yet permeated widely through organisations. If shared databases confer users with greater responsibility for data - a finding of this study - the impact on the data processing department is likely to be significant

- **small organisations:** the present study took shape at a time when database systems were a technological novelty only afforded by the larger organisations. It is now a proven approach, and with the availability of DBMSs on micro computers, shared database systems could become the norm in smaller organisations. The research question is whether the introduction of complex software will lead to an identity crises for the user; should he invest in acquiring data structuring and physical database design skills - the DBA role - or remain content as an 'unskilled worker' at best using the DBMS as a file handler. The survey findings have indicated the importance of the DBA in creating and maintaining the shared data environment. The need for a DBA is likely to arise, even in the small system environment. A possible solution may be in the emergence of the 'external' DBA, a data management consultant well-known to the organisation who is retained to make regular audits and is also available 'on call'.

distributed databases: the surveys did not uncover any implementations of distributed systems with database capabilities. However the corporate use of micros now provides an impetus for such systems. The fragmentation of an organisation's data, which is inevitable once stand-alone systems proliferate in user departments, could be avoided through a network of micros and mainframes which share the data resource.

The development will provide a test to this study's thesis that the dominant political problem facing DBA is not overcoming user resistance to data sharing. The main problem is likely to be one of organisational forms and arrangements, for example the evolution of 'local' and 'central' DBAs.

- **economics of the database approach:** this study deliberately placed the issue of database cost justification outside its area of investigation. Though organisations do not embark on database development to achieve cost savings, there is need for research into quantitative techniques by which management can assess whether the investment is justified.

APPENDIX A

Survey data on 212 U.K. organisations

This appendix lists the data for 212 U.K. organisations participating in the postal survey. The results of this survey have been reported in Chapter 3. As indicated in the covering letter to the survey questionnaire (Figure A1), respondents were assured of confidentiality. For this reason, organisation identities have not been revealed.

This appendix is in three sections: the first describes the coding scheme and lists the coded data; the second provides a reference to the organisations also participating in the interview survey; the third compares the postal survey responses of organisations not interviewed with those interviewed.

The SPSS package was used for the tabulation and statistical analyses reported in the main body of the thesis and in this appendix.

THE CITY UNIVERSITY
GRADUATE BUSINESS CENTRE

Dear Sir,

The Systems Group at the Centre is undertaking a research project on the design of databases and information systems. The objectives of the research are to examine the reasons why organisations have adopted the database approach, the costs and benefits involved, and the impact databases have had on information systems. The research is intended to produce results and analyses that would be of practical benefit to organisations in the planning of database systems.

As part of this study, a preliminary questionnaire is being sent to a limited number of organisations in the UK, known to have an interest in the database approach to information systems. Your assistance in completing the enclosed questionnaire would be of considerable value to us. It is appreciated that you are likely to be very busy, so the questionnaire has been structured to enable it to be completed in a few minutes. Your response will be treated with absolute confidence, and individual company information will not be disclosed to third parties.

A stamped self-addressed envelope is enclosed for returning the questionnaire.

Yours faithfully,

J. Sherif

Encs.

LIONEL DENNY HOUSE, 23 GOSWELL ROAD, LONDON ECIM 7BB 01-253 4399

FIGURE A1 : Covering letter to postal survey questionnaire

Section 1 : Coding Scheme and Data Listing

Responses to postal survey questions 1-5 are represented by variables I-V. Responses to postal survey question 6 are represented by variables VI-VII. Variables VIII-X are additional data on the survey respondents: Variable VIII, the Standard Industrial Classification, was confirmed by reference to trade publications (Kompass-Confederation of British Industry, 1981); Variable IX is derived from the SIC; Variable X is based on project memorandum information on questionnaire despatches. The coding scheme is outlined below:

Variable name/categories

I. STAGE

0. FEASIBILITY
1. IMPLEMENTATION
2. OPERATIONAL

II. STAFFING

0. EXISTING STAFF ONLY
1. EXISTING AND NEW STAFF
2. CONSULTANTS USED

III. VIEW ON COST-SAVINGS

9. NO COMMENT (MISSING DATA)
0. TOO EARLY TO SAY
1. POSSIBLY
2. DEFINITELY

IV. VIEW ON MANAGEMENT INFORMATION

9. NO COMMENT (MISSING DATA)
0. TOO EARLY TO SAY
1. POSSIBLY
2. DEFINITELY

V. SOFTWARE STRATEGY

9. UNDECIDED (MISSING DATA)
0. BUILD OWN
1. PACKAGE

VI. TECHNICAL PROBLEMS

9. NO COMMENT (MISSING DATA)
0. MINOR
1. SERIOUS

VII. POLITICAL PROBLEMS

9. NO COMMENT (MISSING DATA)
0. MINOR
1. SERIOUS

VIII. STANDARD INDUSTRIAL CLASSIFICATION (SIC)

(HMSO, 1980)

IX. INDUSTRY TYPE

1.	UTILITIES/CHEMICALS	SIC 1n, 2n
2.	ENGINEERING	SIC 3n-5n
3.	DISTRIBUTION	SIC 6n, 7n
4.	FINANCIAL SERVICES	SIC 8n
5.	GOVERNMENT AND OTHER SERVICES	SIC 9n

X. PERIOD OF SURVEY DATA COLLECTION

77. 1976-77
79. 1978-79
81. 1980-81

POSTAL QUESTIONNAIRE DATA

REF. NO.	I. STAGE	II. STAFF	III. COST VIEW	IV. MIS VIEW	V. S/W STRATEGY	VI. TECHNICAL PROBLEM	VII. POLITICAL PROBLEM	VIII. SIC	IX. INDUSTRY TYPE	X PERIOD
1	0	0	0	2	9	0	9	49	2	77
2	0	2	1	2	1	1	1	81	4	77
3	0	0	0	0	1	1	1	94	5	77
4	0	2	0	1	1	0	1	24	1	81
5	1	0	0	2	1	0	0	76	3	77
6	1	0	1	2	0	0	0	97	5	77
7	1	1	0	1	1	0	0	91	5	77
8	1	2	1	2	1	9	1	91	5	81
9	1	0	0	0	1	0	1	15	1	79
10	1	0	1	1	1	0	0	25	1	79
11	1	1	1	2	1	0	0	50	2	79
12	1	2	0	0	1	0	1	83	4	79
13	1	1	1	1	1	0	0	61	3	79
14	2	0	1	1	1	1	1	37	2	77
15	2	0	0	1	1	0	1	33	2	77
16	2	0	0	0	0	1	1	95	5	77
17	2	1	1	2	0	1	1	33	2	77
18	2	2	0	2	1	0	9	91	5	79
19	2	1	2	9	1	0	1	34	2	79
20	2	1	0	1	1	0	1	91	5	79

POSTAL QUESTIONNAIRE DATA

REF. NO.	I. STAGE	II. STAFF	III. COST VIEW	IV. MIS VIEW	V. S/W STRATEGY	VI. TECHNICAL PROBLEM	VII. POLITICAL PROBLEM	VIII. SIC	IX. INDUSTRY TYPE	X PERIOD
21	2	2	2	2	1	0	1	61	3	81
22	2	0	1	1	1	0	1	95	5	77
23	0	0	0	1	9	0	0	91	5	77
24	1	0	1	0	1	0	0	91	5	77
25	1	1	1	2	1	1	0	91	5	77
26	0	0	0	0	9	1	0	91	5	77
27	2	2	1	2	0	0	9	91	5	77
28	0	1	0	2	9	0	0	17	1	77
29	0	1	0	2	9	9	9	17	1	77
30	0	0	0	0	9	9	0	16	1	77
31	1	0	1	9	1	0	9	16	1	77
32	2	0	1	2	0	0	1	16	1	77
33	1	0	0	1	1	0	1	16	1	77
34	0	0	0	0	9	9	9	16	1	77
35	0	0	0	2	1	0	1	16	1	77
36	1	2	0	1	1	1	0	22	1	77
37	2	0	0	2	1	1	0	22	1	77
38	2	0	2	2	1	0	9	11	1	77
39	2	0	1	2	1	0	0	97	5	77
40	2	1	0	2	1	0	0	93	5	77

POSTAL QUESTIONNAIRE DATA

REF. NO.	I. STAGE	II. STAFF	III. COST VIEW	IV. MIS VIEW	V. S/W STRATEGY	VI. TECHNICAL PROBLEM	VII. POLITICAL PROBLEM	VIII. SIC	IX. INDUSTRY TYPE	X PERIOD
41	2	1	1	2	1	0	9	93	5	77
42	2	0	2	1	1	0	1	93	5	77
43	2	2	2	2	1	0	0	71	3	77
44	0	2	0	1	9	9	0	75	3	77
45	0	0	0	0	1	1	1	72	3	77
46	2	0	0	2	1	0	9	74	3	77
47	0	2	0	2	1	0	9	17	1	77
48	2	1	1	2	1	1	0	91	5	77
49	2	0	2	2	1	0	0	95	5	77
50	2	0	1	2	1	0	0	95	5	77
51	2	0	1	1	1	0	9	95	5	77
52	2	0	9	9	1	9	9	95	5	77
53	2	2	9	9	0	1	0	91	5	77
54	1	2	0	0	1	0	9	91	5	77
55	0	0	0	0	9	0	0	42	2	77
56	1	0	0	0	1	0	0	24	1	77
57	1	0	1	2	1	0	9	25	1	77
58	0	0	0	1	9	0	9	25	1	77
59	1	0	0	0	1	9	9	25	1	77
60	1	0	0	0	1	0	0	25	1	77

POSTAL QUESTIONNAIRE DATA

REF. NO.	I. STAGE	II. STAFF	III. COST VIEW	IV. MIS VIEW	V. S/W STRATEGY	VI. TECHNICAL PROBLEM	VII. POLITICAL PROBLEM	VIII. SIC	IX. INDUSTRY TYPE	X PERIOD
61	2	0	1	2	1	0	0	25	1	77
62	0	0	0	0	1	9	9	25	1	77
63	2	2	2	2	1	0	1	25	1	77
64	0	0	0	0	9	9	0	91	5	77
65	0	0	0	0	9	9	0	91	5	77
66	1	1	0	2	1	0	9	91	5	77
67	2	0	1	1	1	0	0	32	2	77
68	0	1	0	1	1	1	1	36	2	77
69	2	0	2	2	1	0	9	33	2	77
70	2	2	1	1	1	1	1	34	2	77
71	1	0	0	1	1	0	9	34	2	77
72	1	0	1	2	1	0	0	34	2	77
73	1	2	9	2	1	0	1	25	1	77
74	0	0	0	2	1	1	0	42	2	77
75	2	0	0	1	1	0	1	42	2	77
76	1	0	0	0	1	0	0	32	2	77
77	2	0	1	2	1	0	0	42	2	77
78	0	0	0	1	9	1	0	42	2	77
79	1	0	0	2	1	0	0	42	2	77
80	2	2	0	2	1	0	0	64	3	77

POSTAL QUESTIONNAIRE DATA

REF. NO.	I. STAGE	II. STAFF	III. COST VIEW	IV. MIS VIEW	V. S/W STRATEGY	VI. TECHNICAL PROBLEM	VII. POLITICAL PROBLEM	VIII. SIC	IX. INDUSTRY TYPE	X PERIOD
81	1	1	0	1	1	0	0	82	4	77
82	2	2	9	0	0	1	9	81	4	77
83	2	0	2	2	1	0	0	82	4	77
84	0	0	0	1	9	9	9	82	4	77
85	2	2	1	0	1	1	9	81	4	77
86	2	0	1	2	1	0	0	82	4	77
87	2	0	2	2	1	0	9	83	4	77
88	2	0	2	1	1	0	9	82	4	77
89	2	0	1	1	1	0	0	81	4	77
90	0	2	0	1	1	9	9	82	4	77
91	2	0	1	0	1	9	9	82	4	77
92	1	0	1	2	0	9	9	82	4	77
93	0	1	0	1	1	9	9	81	4	77
94	1	0	0	2	1	0	9	82	4	77
95	2	0	2	2	0	1	9	82	4	77
96	1	0	0	2	1	9	9	97	5	77
97	1	2	1	2	1	9	0	82	4	77
98	0	1	0	2	1	0	0	82	4	77
99	2	2	9	9	0	0	9	32	2	77
100	2	0	0	9	1	0	1	32	2	77

POSTAL QUESTIONNAIRE DATA

REF. NO.	I. STAGE	II. STAFF	III. COST VIEW	IV. MIS VIEW	V. S/W STRATEGY	VI. TECHNICAL PROBLEM	VII. POLITICAL PROBLEM	VIII. SIC	IX. INDUSTRY TYPE	X PERIOD
101	1	2	1	1	1	0	0	81	4	77
102	0	2	0	2	1	9	9	47	2	77
103	2	2	2	2	0	0	9	47	2	77
104	0	1	1	1	1	9	9	61	3	79
105	1	1	0	1	1	0	0	81	4	79
106	0	0	0	1	1	0	0	31	2	79
107	1	0	0	1	1	9	0	24	1	79
108	1	0	0	2	1	0	0	32	2	79
109	2	0	9	2	0	0	1	33	2	79
110	0	2	0	0	9	9	9	33	2	79
111	1	2	0	2	1	1	1	37	2	79
112	0	0	0	0	9	9	0	91	5	79
113	0	0	0	0	9	9	9	91	5	79
114	0	0	0	2	9	0	1	16	1	79
115	2	0	1	2	1	1	9	16	1	79
116	1	0	2	2	1	1	9	76	3	79
117	0	2	0	0	1	0	0	94	5	79
118	1	0	9	2	1	9	1	93	5	79
119	0	2	0	0	1	0	0	95	5	79
120	0	0	0	0	9	9	9	25	1	79

POSTAL QUESTIONNAIRE DATA

REF. NO.	I. STAGE	II. STAFF	III. COST VIEW	IV. MIS VIEW	V. S/W STRATEGY	VI. TECHNICAL PROBLEM	VII. POLITICAL PROBLEM	VIII. SIC	IX. INDUSTRY TYPE	X PERIOD
121	2	0	2	2	1	0	9	25	1	79
122	2	0	1	2	1	0	0	25	1	79
123	1	1	1	2	1	0	0	25	1	79
124	2	0	0	1	1	0	9	25	1	79
125	1	0	0	1	1	0	9	25	1	79
126	2	1	2	2	0	0	0	32	2	79
127	2	0	1	2	1	1	1	36	2	79
128	2	0	1	2	1	1	0	49	2	79
129	1	0	1	1	1	0	0	32	2	79
130	1	1	0	1	1	0	0	32	2	79
131	0	2	0	1	9	9	9	32	2	79
132	2	0	0	2	1	1	0	36	2	79
133	2	1	2	2	1	0	0	33	2	79
134	0	2	0	0	1	9	1	34	2	79
135	2	2	9	2	1	0	0	41	2	79
136	1	0	1	1	1	0	0	42	2	79
137	2	0	1	2	1	0	0	64	3	79
138	1	2	1	2	1	1	9	65	3	79
139	2	0	9	9	1	9	9	83	4	79
140	1	0	1	1	0	0	0	83	4	79

POSTAL QUESTIONNAIRE DATA

REF. NO.	I. STAGE	II. STAFF	III. COST VIEW	IV. MIS VIEW	V. S/W STRATEGY	VI. TECHNICAL PROBLEM	VII. POLITICAL PROBLEM	VIII. SIC	IX. INDUSTRY TYPE	X PERIOD
141	2	1	2	2	1	0	1	82	4	79
142	2	1	2	2	1	0	9	82	4	79
143	2	0	1	0	1	0	9	33	2	79
144	1	0	1	2	1	0	0	47	2	79
145	0	0	1	2	1	0	0	47	2	79
146	2	0	9	9	1	0	9	47	2	79
147	0	0	1	2	1	1	9	45	2	79
148	1	1	1	1	1	0	1	91	5	81
149	1	0	1	1	0	0	0	91	5	81
150	2	0	2	2	1	0	9	91	5	81
151	1	1	0	0	1	0	0	91	5	81
152	1	0	0	1	1	0	0	91	5	81
153	1	2	1	2	1	1	0	91	5	81
154	1	2	0	2	1	9	9	91	5	81
155	2	2	0	0	1	0	0	91	5	81
156	1	2	0	0	9	0	0	91	5	81
157	0	0	0	2	1	0	0	91	5	81
158	0	0	0	2	1	0	1	91	5	81
159	2	0	0	1	1	0	0	91	5	81
160	1	1	0	0	1	9	0	91	5	81

POSTAL QUESTIONNAIRE DATA

REF. NO.	I. STAGE	II. STAFF	III. COST VIEW	IV. MIS VIEW	V. S/W STRATEGY	VI. TECHNICAL PROBLEM	VII. POLITICAL PROBLEM	VIII. SIC	IX. INDUSTRY TYPE	X PERIOD
161	1	0	1	2	1	0	0	91	5	81
162	0	0	0	0	9	9	9	16	1	81
163	1	0	0	1	1	0	0	16	1	81
164	2	0	0	0	1	0	0	17	1	81
165	2	1	9	1	1	0	9	76	3	81
166	0	0	0	2	1	1	0	84	1	81
167	2	1	2	2	1	0	9	61	3	81
168	2	0	2	1	1	0	0	74	3	81
169	2	0	2	2	0	0	0	76	3	81
170	0	1	9	1	1	9	9	76	3	81
171	2	2	9	1	1	0	1	76	3	81
172	1	0	1	2	1	0	9	72	3	81
173	0	0	0	1	9	9	9	95	5	81
174	2	0	1	2	1	0	9	25	1	81
175	2	0	2	2	1	0	0	25	1	81
176	1	2	2	2	1	0	0	25	1	81
177	2	0	1	2	1	0	9	25	1	81
178	2	0	1	1	1	1	1	14	1	81
179	1	0	0	0	1	0	9	25	1	81
180	1	1	1	2	1	0	9	34	1	81

POSTAL QUESTIONNAIRE DATA

REF. NO.	I. STAGE	II. STAFF	III. COST VIEW	IV. MIS VIEW	V. S/W STRATEGY	VI. TECHNICAL PROBLEM	VII. POLITICAL PROBLEM	VIII. SIC	IX. INDUSTRY TYPE	X PERIOD
181	2	1	0	0	1	0	0	45	2	81
182	2	1	0	2	1	9	0	37	2	81
183	2	0	2	2	1	0	1	34	2	81
184	1	0	0	0	1	0	0	34	2	81
185	1	1	1	2	1	0	0	32	2	81
186	2	0	2	2	1	9	0	25	1	81
187	0	1	1	2	1	0	9	34	2	81
188	1	1	0	2	1	0	0	32	2	81
189	0	1	0	2	1	0	0	35	2	81
190	2	0	2	2	1	0	9	47	2	81
191	2	0	1	2	1	0	0	36	2	81
192	1	0	2	2	0	0	0	34	2	81
193	0	1	0	0	1	0	9	32	2	81
194	0	2	9	0	1	9	1	42	2	81
195	2	0	0	2	1	0	0	42	2	81
196	1	0	1	2	1	1	0	32	2	81
197	2	0	1	2	1	0	0	48	2	81
198	1	1	0	2	1	1	9	81	4	81
199	2	0	0	0	1	1	9	97	5	81
200	1	2	1	2	1	0	0	83	4	81

POSTAL QUESTIONNAIRE DATA

REF. NO.	I. STAGE	II. STAFF	III. COST VIEW	IV. MIS VIEW	V. S/W STRATEGY	VI. TECHNICAL PROBLEM	VII. POLITICAL PROBLEM	VIII. SIC	IX. INDUSTRY TYPE	X PERIOD
201	2	0	2	2	1	9	9	83	4	81
202	1	2	0	1	1	1	0	82	4	81
203	2	0	1	2	1	0	9	91	5	81
204	2	0	1	2	1	0	0	83	4	81
205	1	0	0	2	1	0	0	83	4	81
206	2	0	0	0	1	0	9	82	4	81
207	1	2	0	2	1	0	1	82	4	81
208	0	0	0	0	1	9	1	83	4	81
209	0	2	0	2	1	9	9	82	4	81
210	2	0	0	1	1	0	0	82	4	81
211	2	1	0	0	1	0	1	83	4	81
212	1	2	1	2	1	0	0	97	5	81

Section 2: Organisations Participating in the Interview Survey

DESCRIPTION	REFERENCE NUMBER (Data Listing)
Toy Manufacturer	1
Investment House	2
National Research Laboratory	3
Building Materials Supplier	4
Transportation Company	5
Public Corporation	6
Local Authority - 1	7
Local Authority - 2	8
Energy Supply Works	9
Toiletries Company	10
Civil Engineering Contractors	11
Insurance House	12
Oil Company - 1	13
Chemicals Company	14
Office Products Manufacturer	15
Teaching Hospital	16
Computer Manufacturer	17
Public Services Agency	18
Electronics Components Company	19
Local Authority - 3	20
Oil Company - 2	21

N.B. The two oil companies were concerned with 'downstream' operations and have, therefore, been assigned to the 'Distribution' industry type. The Chemicals Company's area of business was photographic materials and it has been assigned to the 'Engineering' industry type.

Section 3: Comparison of postal and interview surveys

This section presents nine contingency tables which compare the postal survey responses of two samples:

- organisations participating in the postal survey but not interviewed
- organisations participating in the postal and interview surveys

Each table presents the results of the Chi-squared test:

- the Chi-squared statistic
- df - the degrees of freedom
- p - the probability of obtaining the Chi-squared value if the null hypothesis of no difference was true. If p is greater than .05, the null hypothesis cannot be rejected at the 95% level of confidence

Missing values have not been allowed to enter the statistical test.

Sample comparison : Stage of database development

Number of organisations

	POSTAL SURVEY ONLY	INTERVIEW SURVEY	
FEASIBILITY	48	4	52
IMPLEMENTATION	61	9	70
OPERATIONAL	82	8	90
	191	21	212

Chi-squared statistic = 1.07
df = 2
p = .59

Sample comparison : Staffing

Number of organisations

	POSTAL SURVEY ONLY	INTERVIEW SURVEY	
EXISTING STAFF ONLY	117	9	126
EXISTING & NEW STAFF	35	6	41
CONSULTANTS USED	39	6	45
	191	21	212

Chi-squared statistic = 2.70
df = 2
p = .26

Sample comparison : View on cost-saving

Number of organisations

	POSTAL SURVEY ONLY	INTERVIEW SURVEY	
TO EARLY TO SAY	92	11	103
POSSIBLY	57	8	65
DEFINITELY	28	2	30
	177	21	212

Chi-squared statistic = .69
df = 2
p = .71

Sample comparison : View on management information

Number of organisations

	POSTAL SURVEY ONLY	INTERVIEW SURVEY	
TOO EARLY TO SAY	40	4	44
POSSIBLY	45	7	52
DEFINITELY	99	9	108
	184	20	204

Chi-squared statistic = 1.08
df = 2
p = .59

Sample comparison : Software strategy

Number of organisations

	POSTAL SURVEY ONLY	INTERVIEW SURVEY	
BUILD OWN	14	3	17
PACKAGE	155	17	172
	169	20	189

Chi-squared statistic = .34
df = 1
p = .56

Sample comparison : Technical problems

Number of organisations

	POSTAL SURVEY ONLY	INTERVIEW SURVEY	
MINOR	125	15	140
SERIOUS	28	5	33
	153	20	173

Chi-squared statistic = .17
df = 1
p = .68

Sample comparison: Industry type

Number of organisations

	POSTAL SURVEY ONLY	INTERVIEW SURVEY	
UTILITIES/ CHEMICALS	40	3	43
ENGINEERING	55	6	61
DISTRIBUTION	16	3	19
FINANCIAL SERVICES	36	2	38
GOVERNMENT AND OTHER SERVICES	44	7	51
	191	21	212

Chi-squared statistic = 2.90
df = 4
p = .57

Sample comparison : Period of survey data collection

Number of organisations

	POSTAL SURVEY ONLY	INTERVIEW SURVEY	
1976 - 77	82	10	92
1978 - 79	44	8	52
1980 - 81	65	3	68
	191	21	212

Chi-squared statistic = 4.15
df = 2
p.= .13

Sample comparison : Political problems

Number of organisations

	POSTAL SURVEY ONLY	INTERVIEW SURVEY	
MINOR	94	6	100
SERIOUS	28	13	41
	122	19	141

Chi-squared statistic = 14.35
df = 1
p = .0002

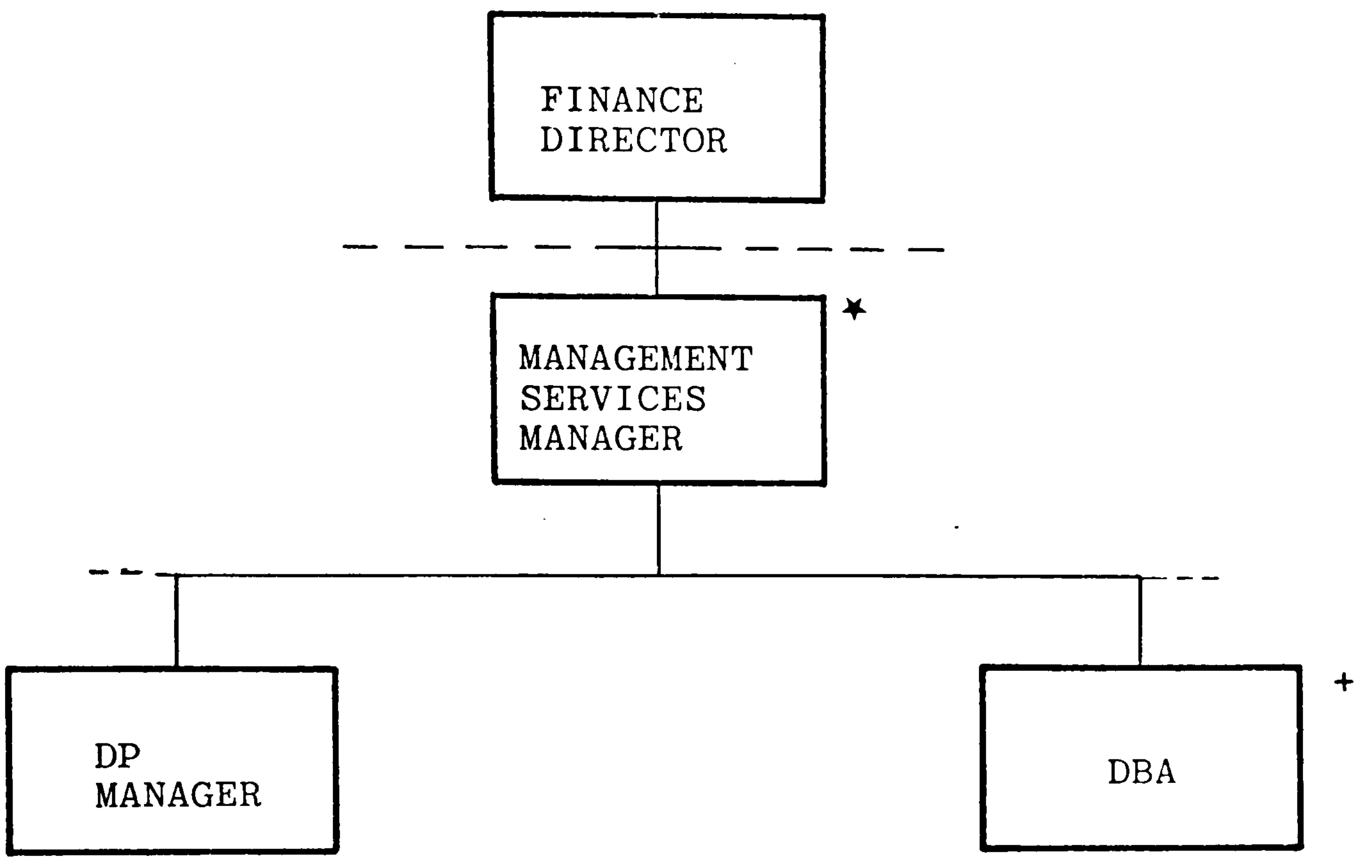
APPENDIX B

Organisation charts obtained in the course of interviews are presented in the appendix.

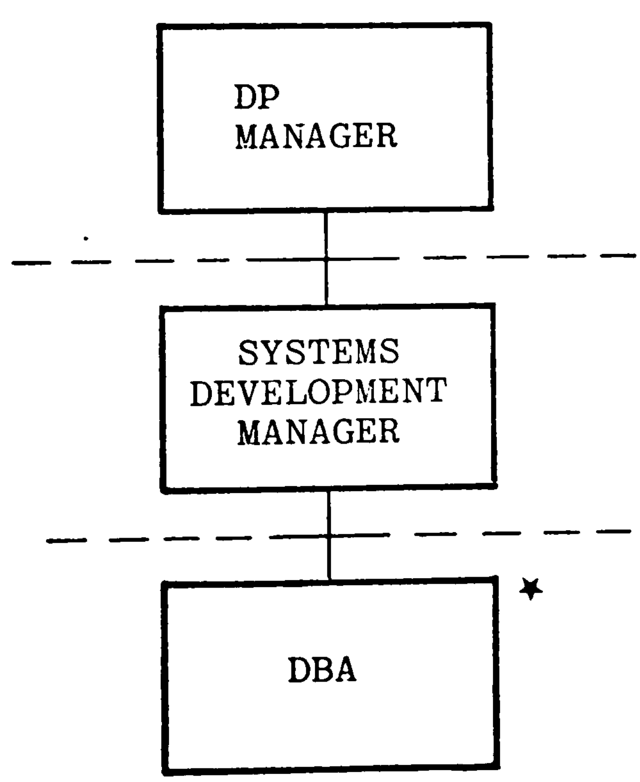
The interviewee's position is indicated with an asterisk (*).

The DBA's position, if different, is indicated with a plus (+) sign.

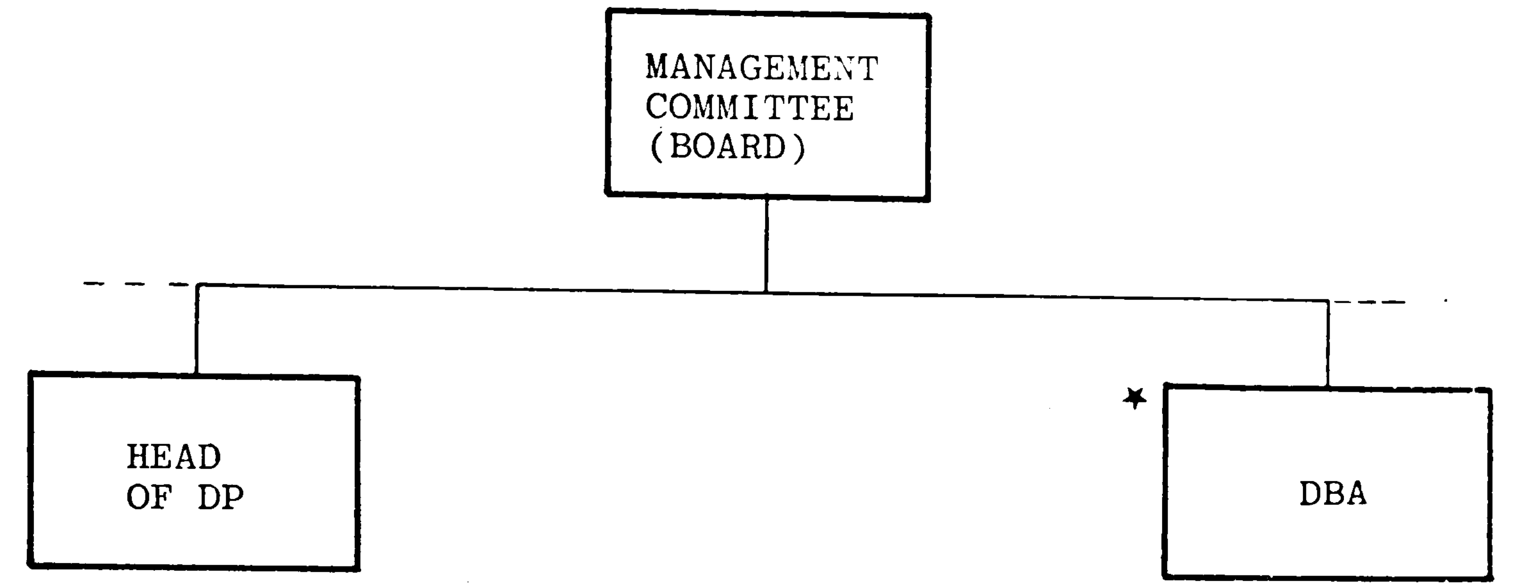
1. TOY MANUFACTURER



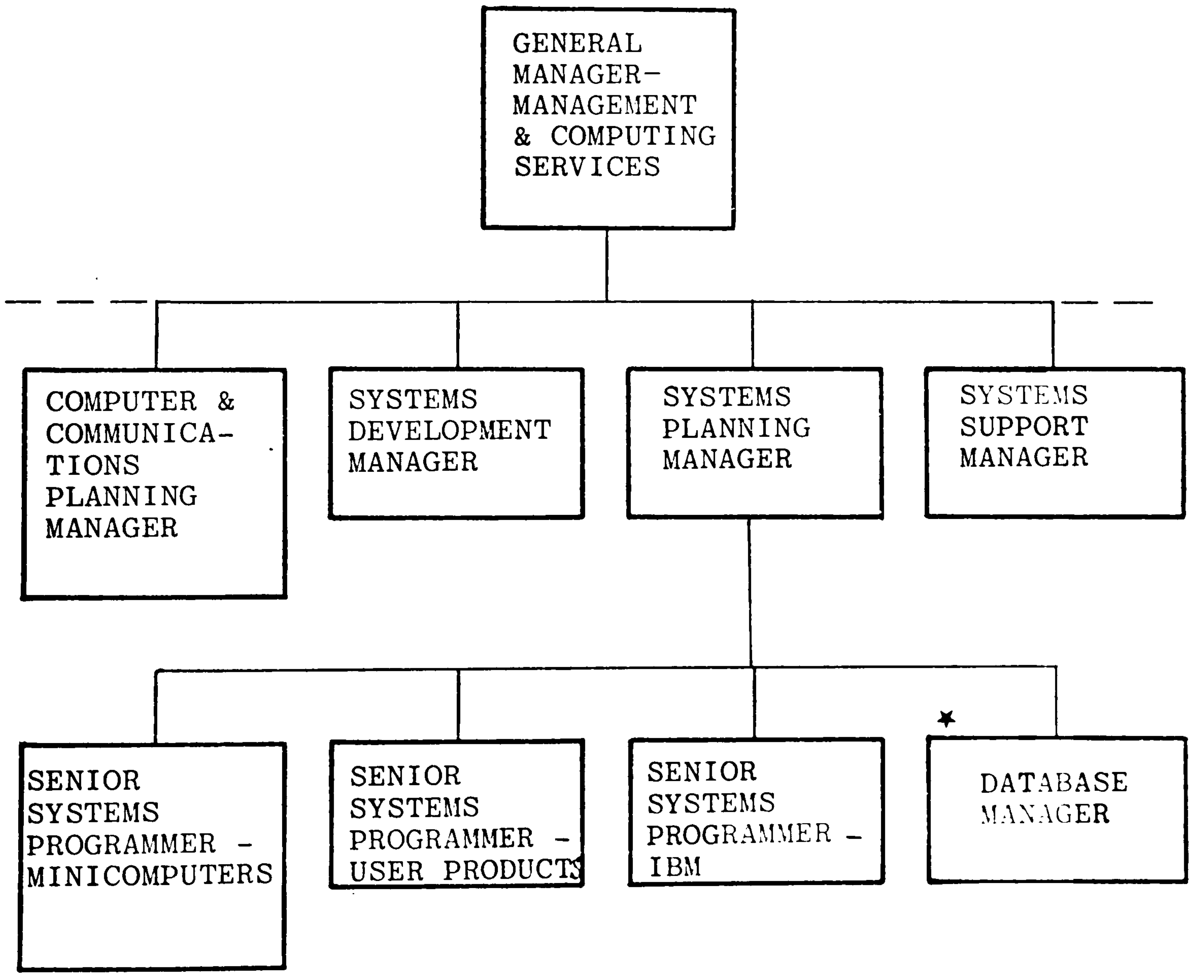
2. INVESTMENT HOUSE



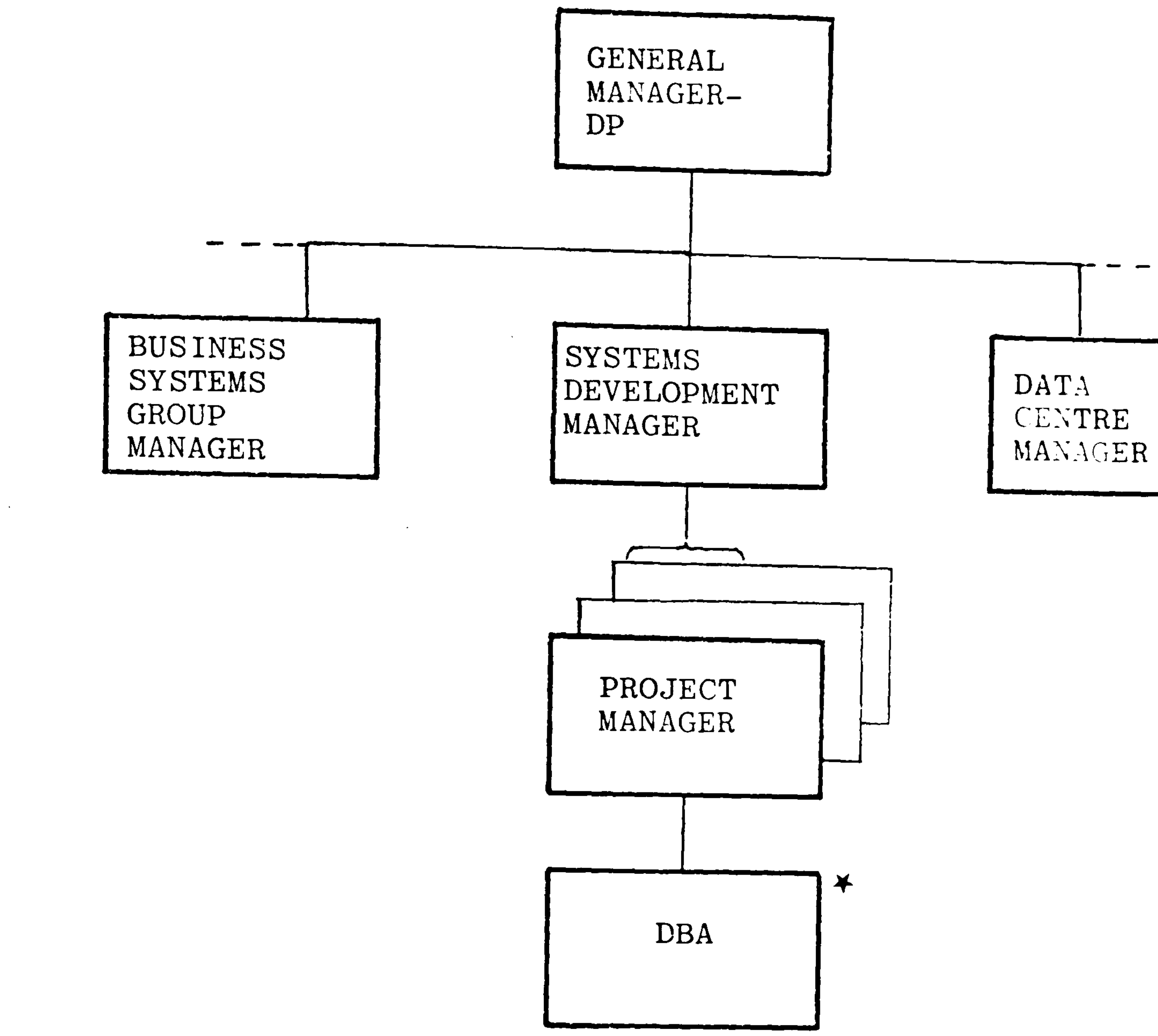
3. NATIONAL RESEARCH LABORATORY



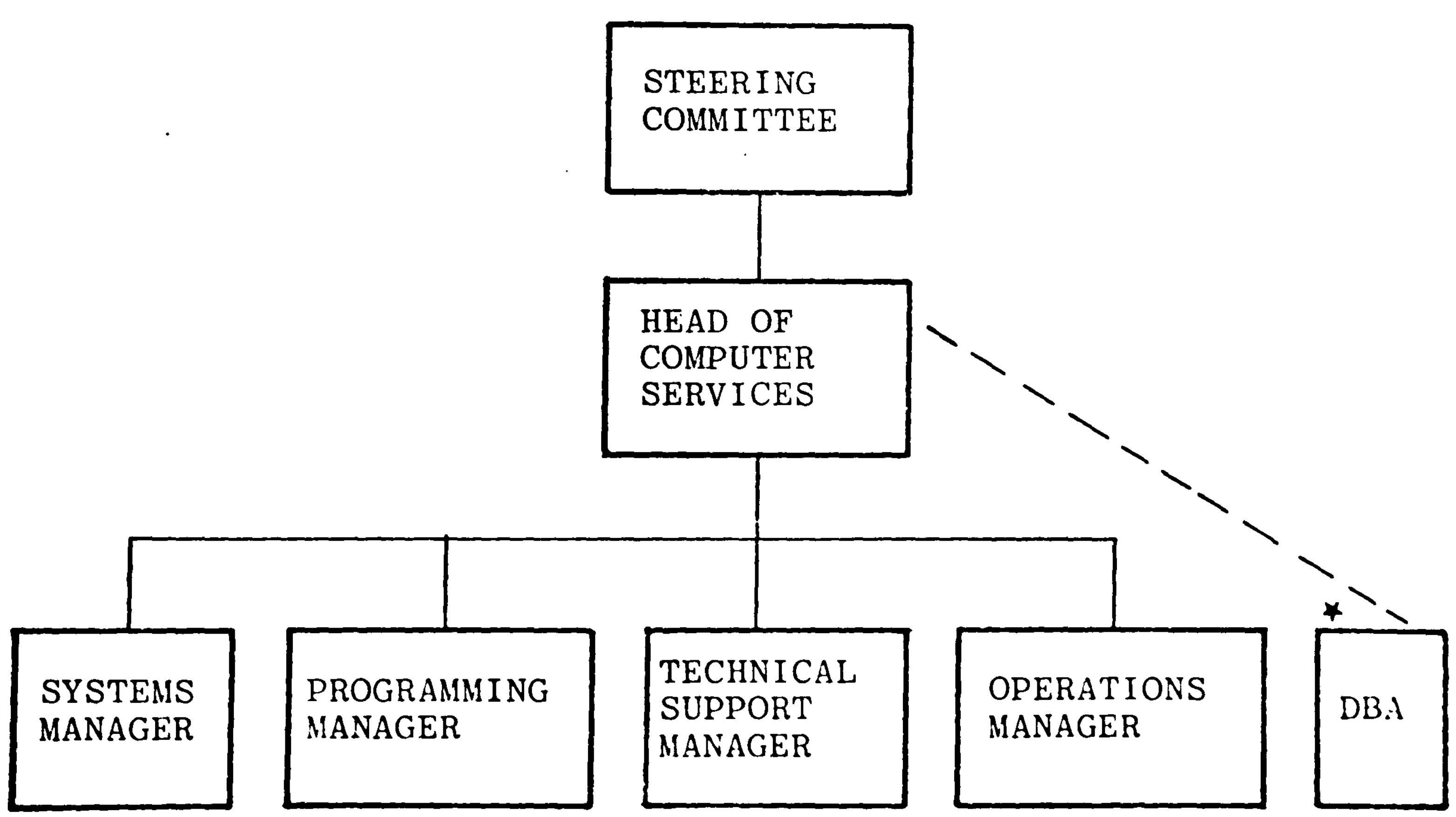
4. BUILDING MATERIALS SUPPLIER



5. TRANSPORTATION COMPANY

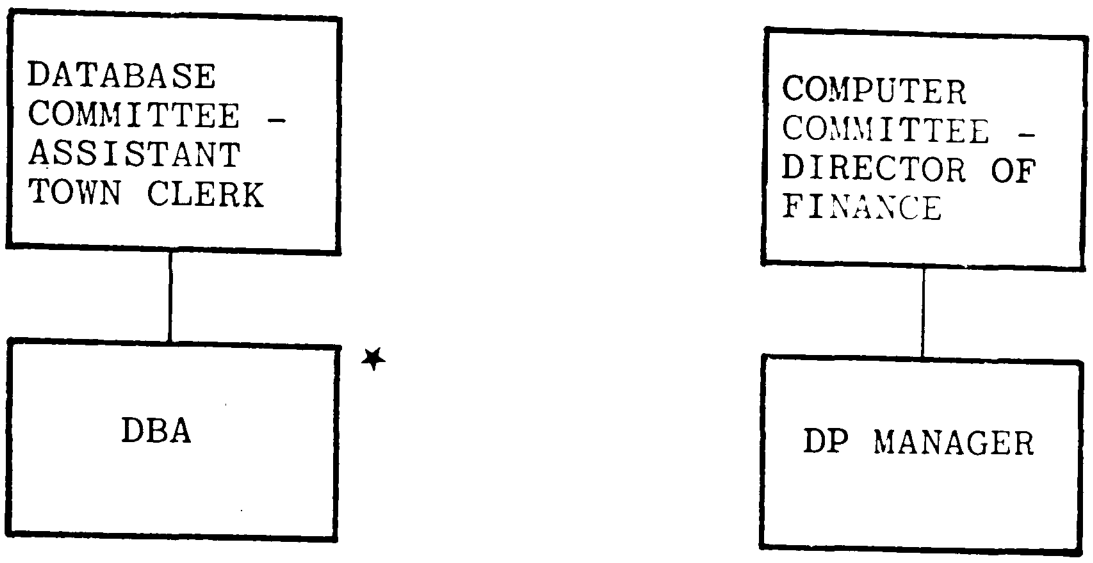


6. PUBLIC CORPORATION

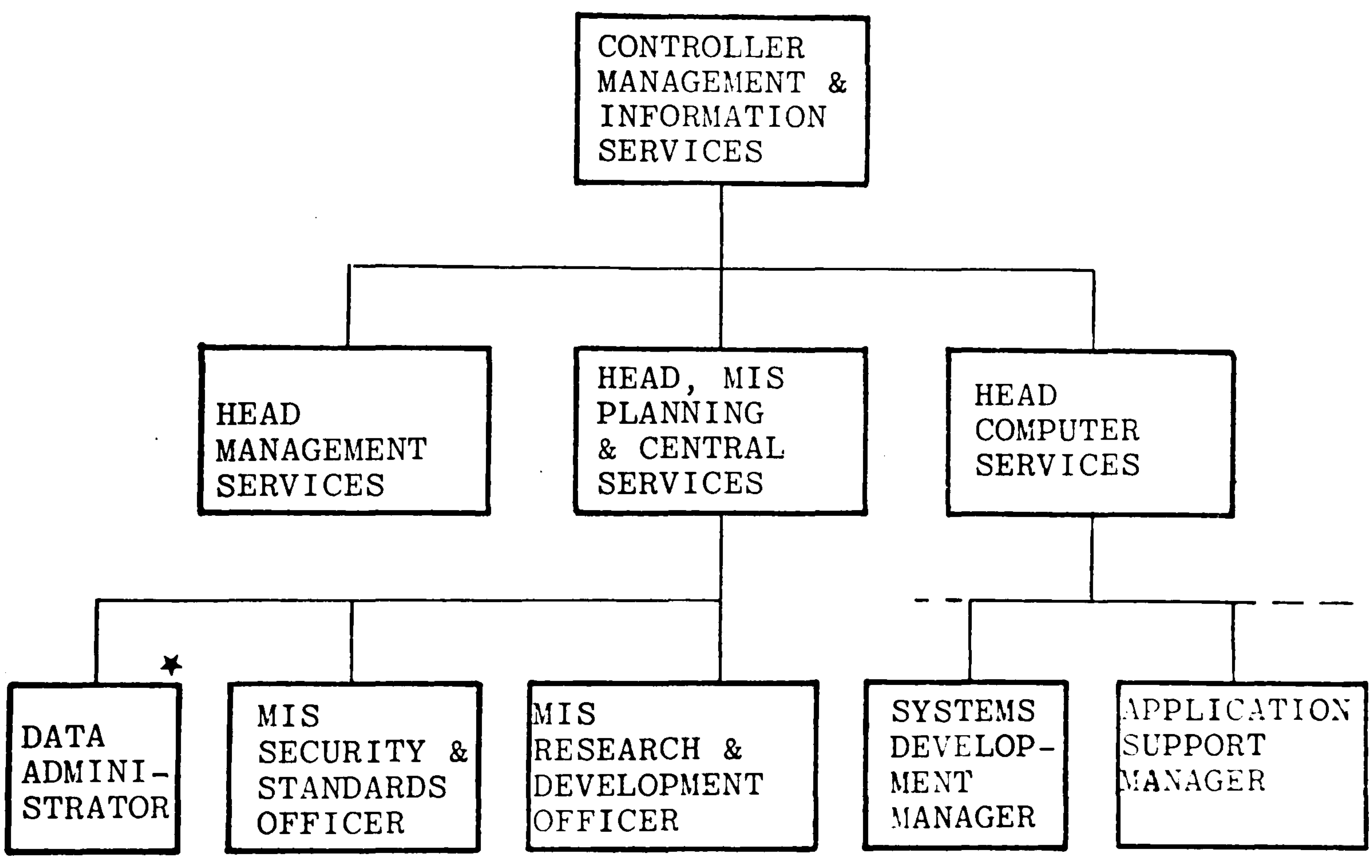


(N.B. : Dotted relationship drawn by interviewee - DBA has software building role.)

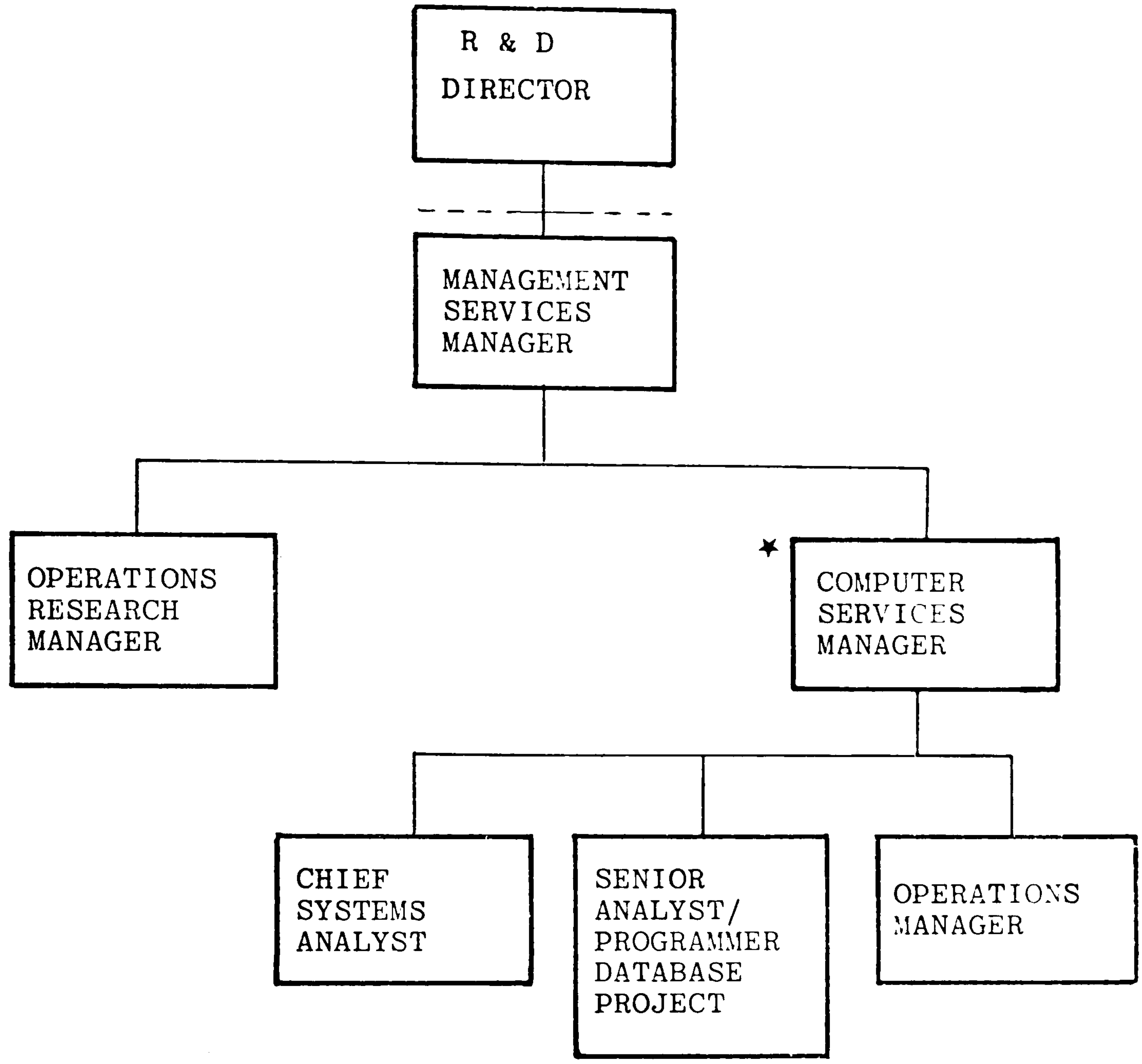
7. LOCAL AUTHORITY-1



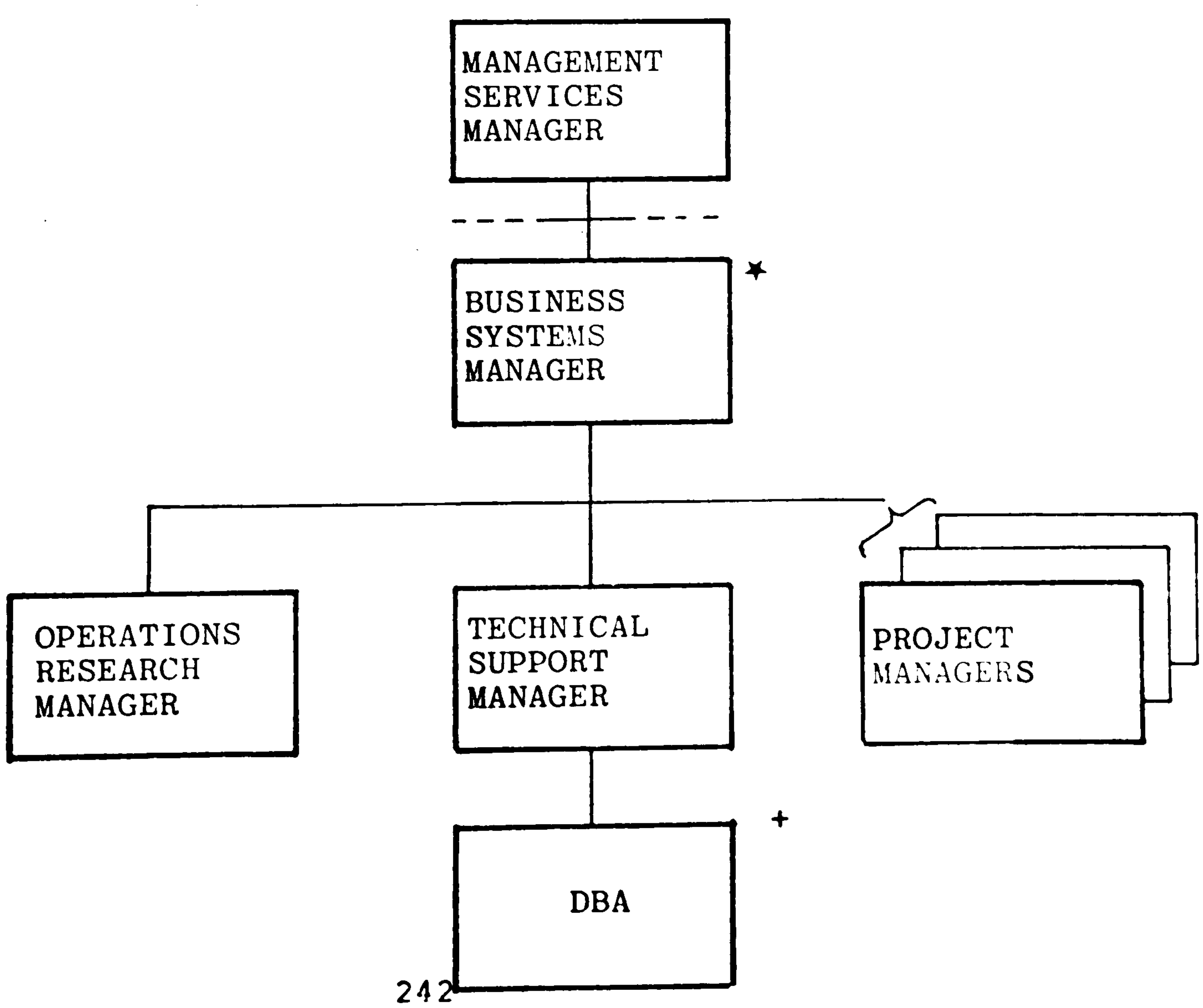
8. LOCAL AUTHORITY-2



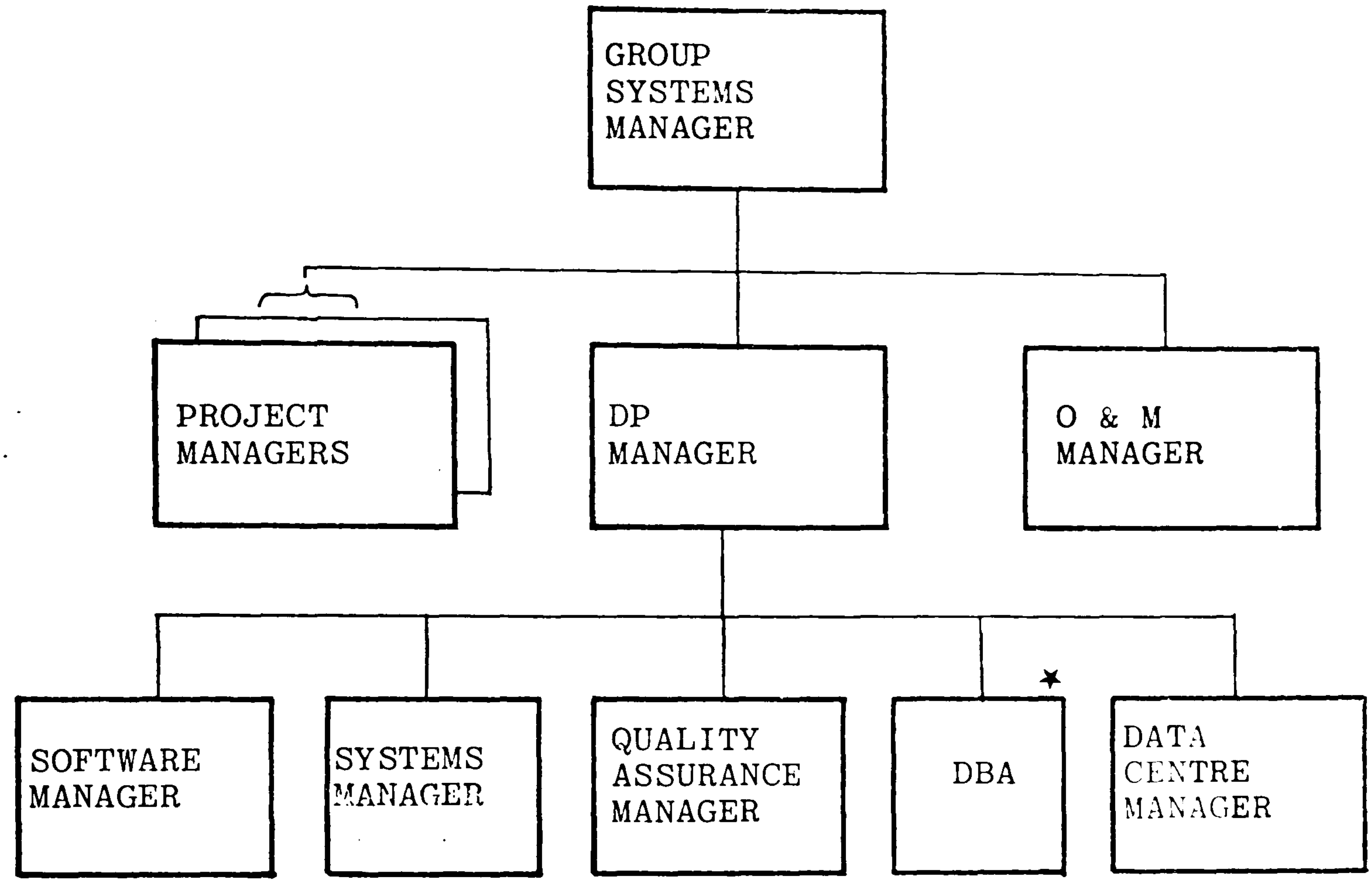
9. ENERGY SUPPLY WORKS



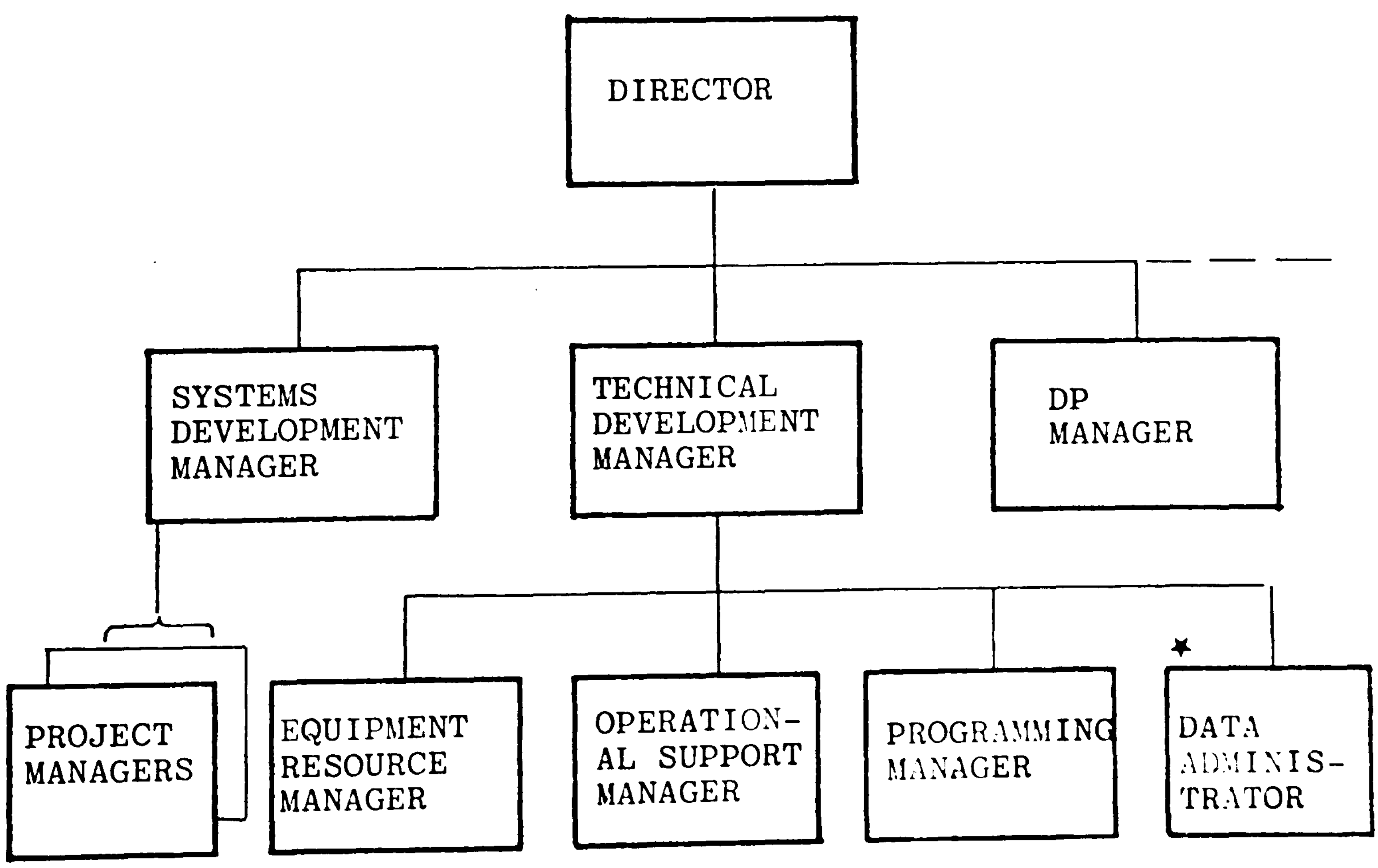
10. TOILETRIES COMPANY



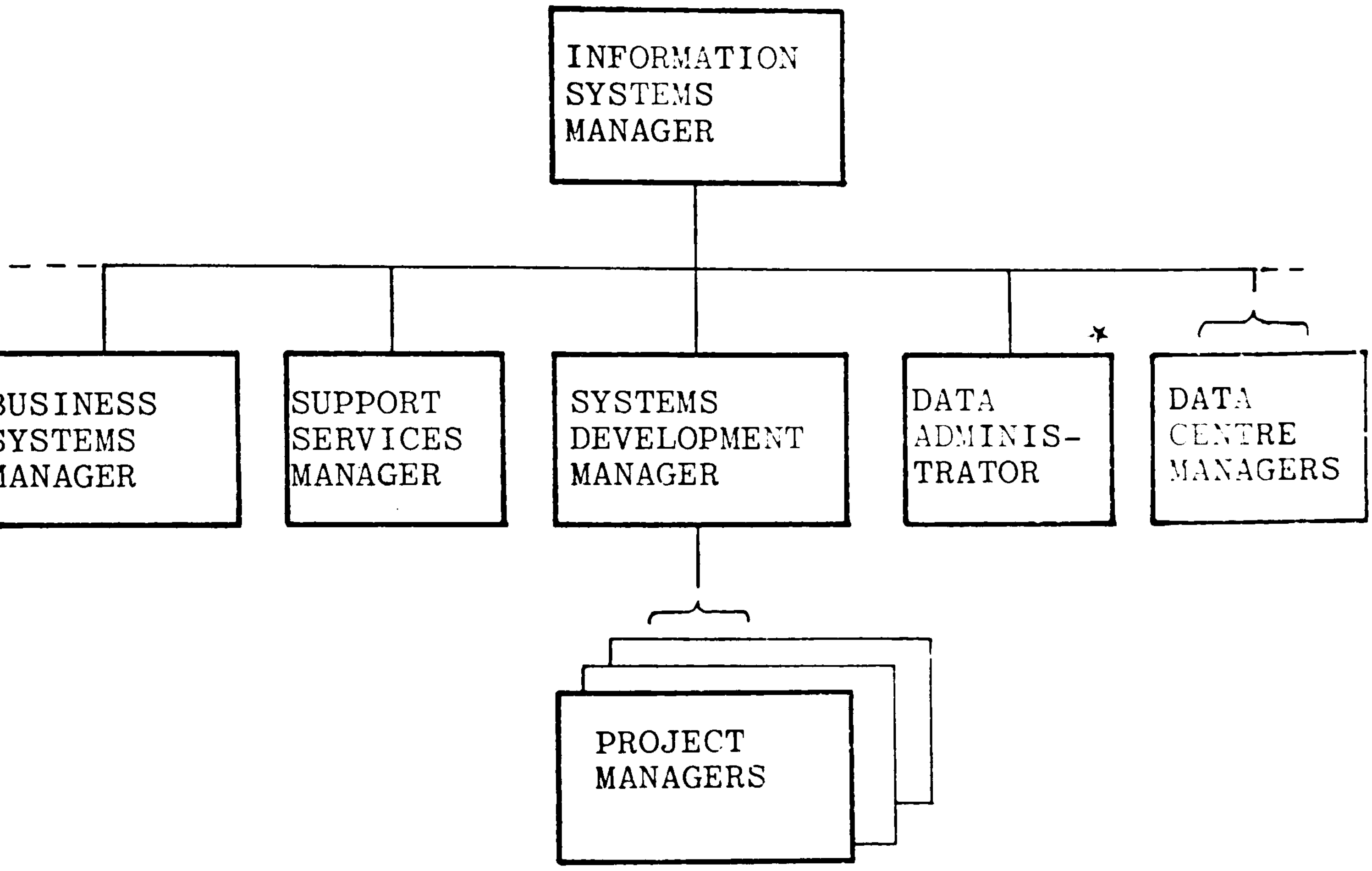
11. CIVIL ENGINEERING CONTRACTORS



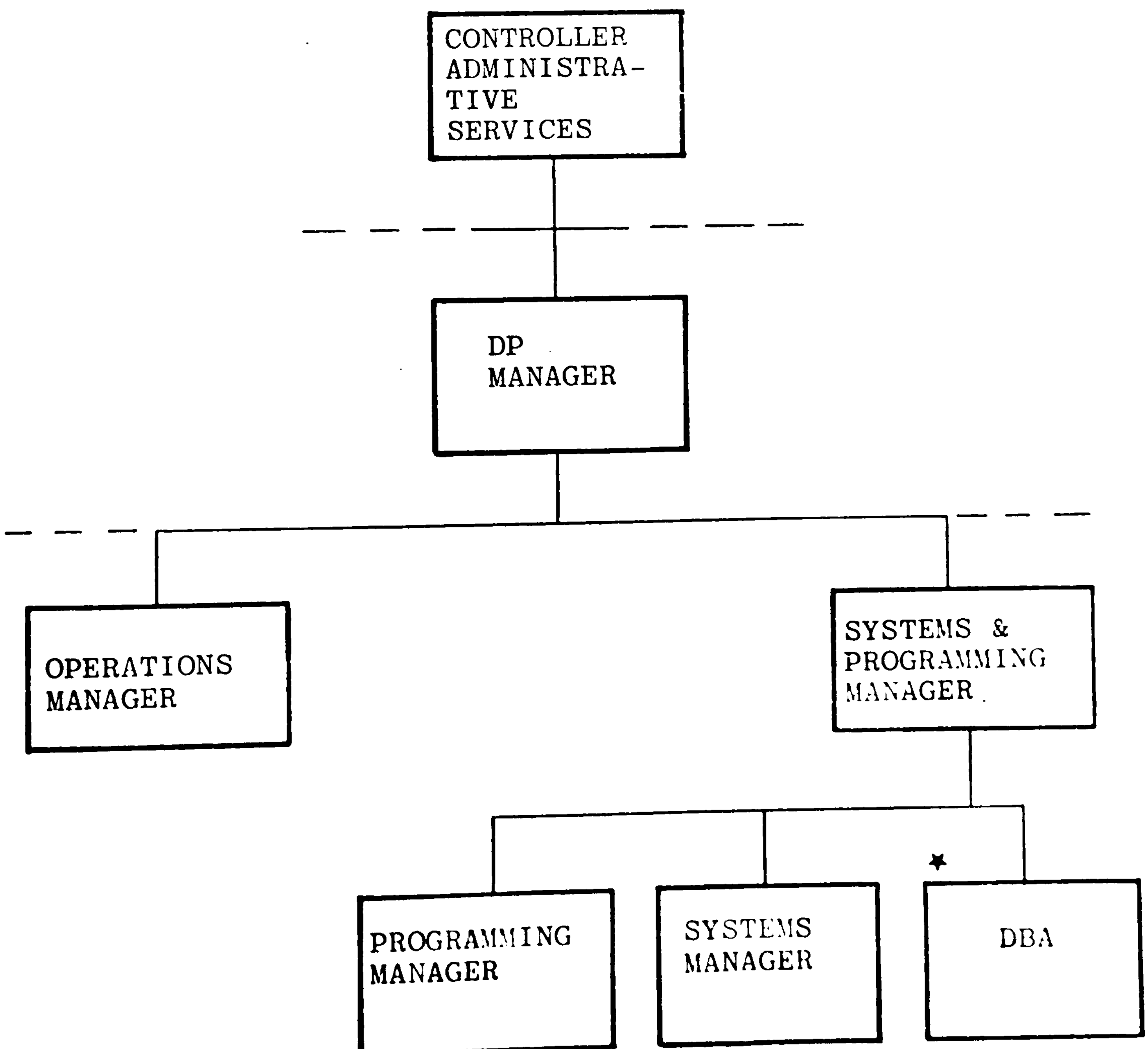
12. INSURANCE HOUSE



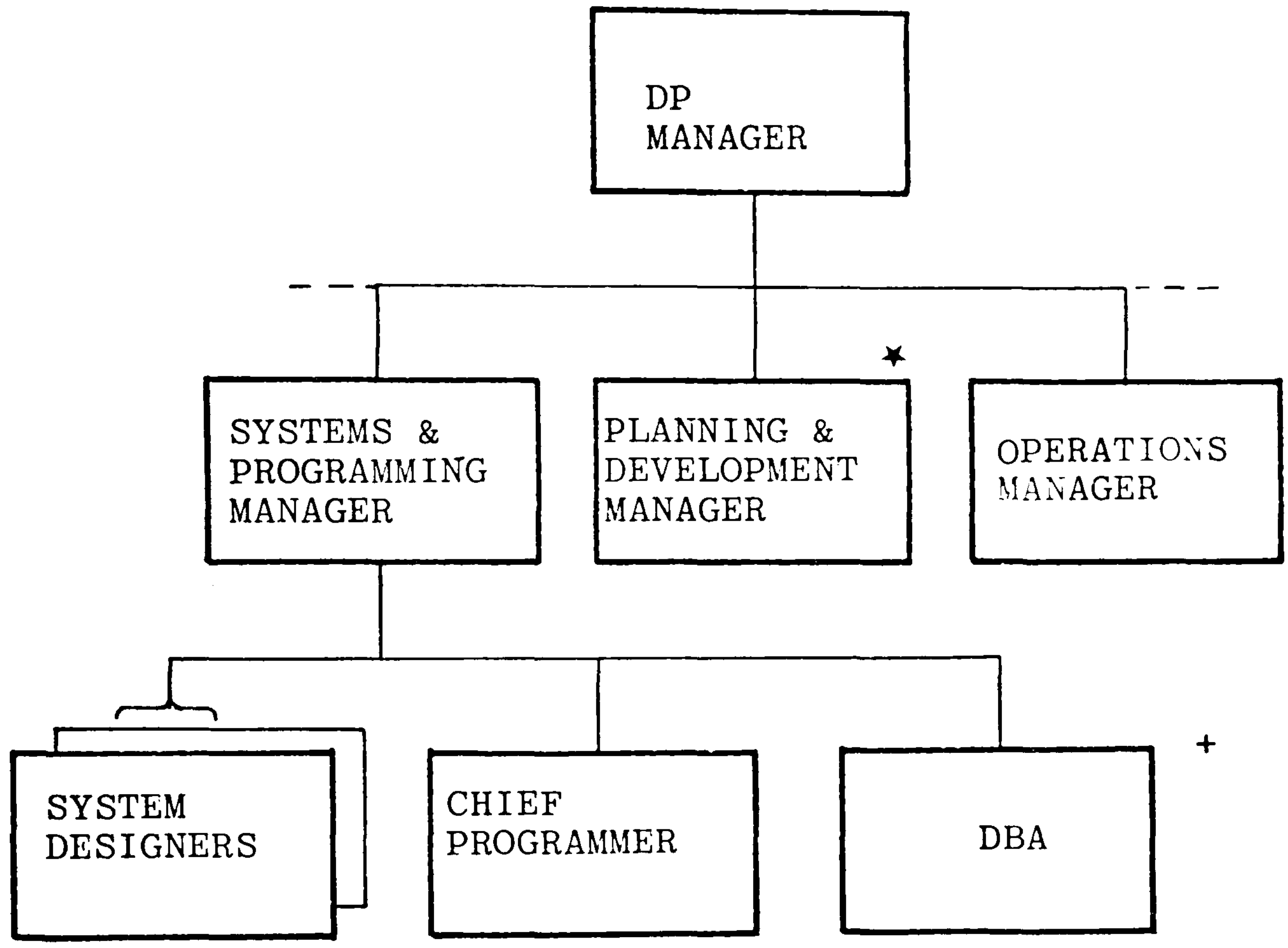
13. OIL COMPANY-1



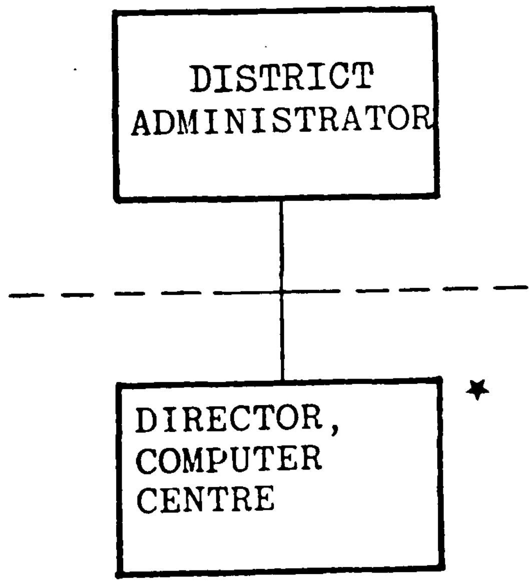
14. CHEMICALS COMPANY



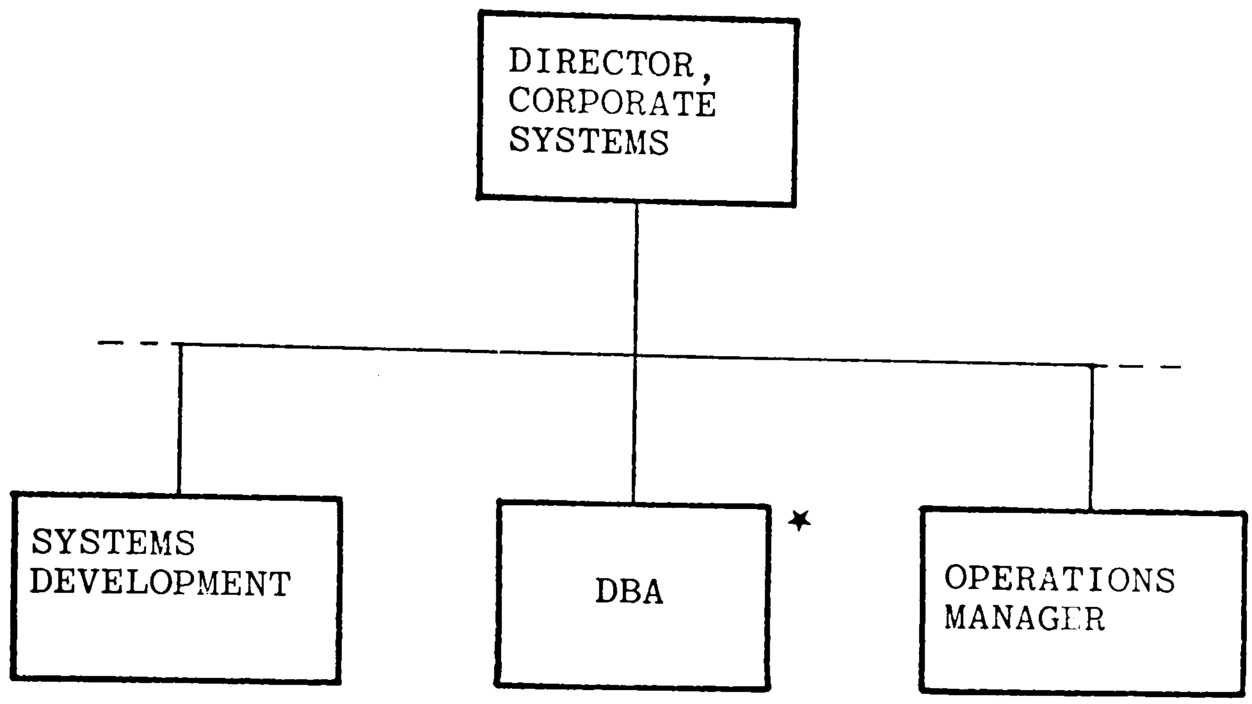
15. OFFICE PRODUCTS MANUFACTURER



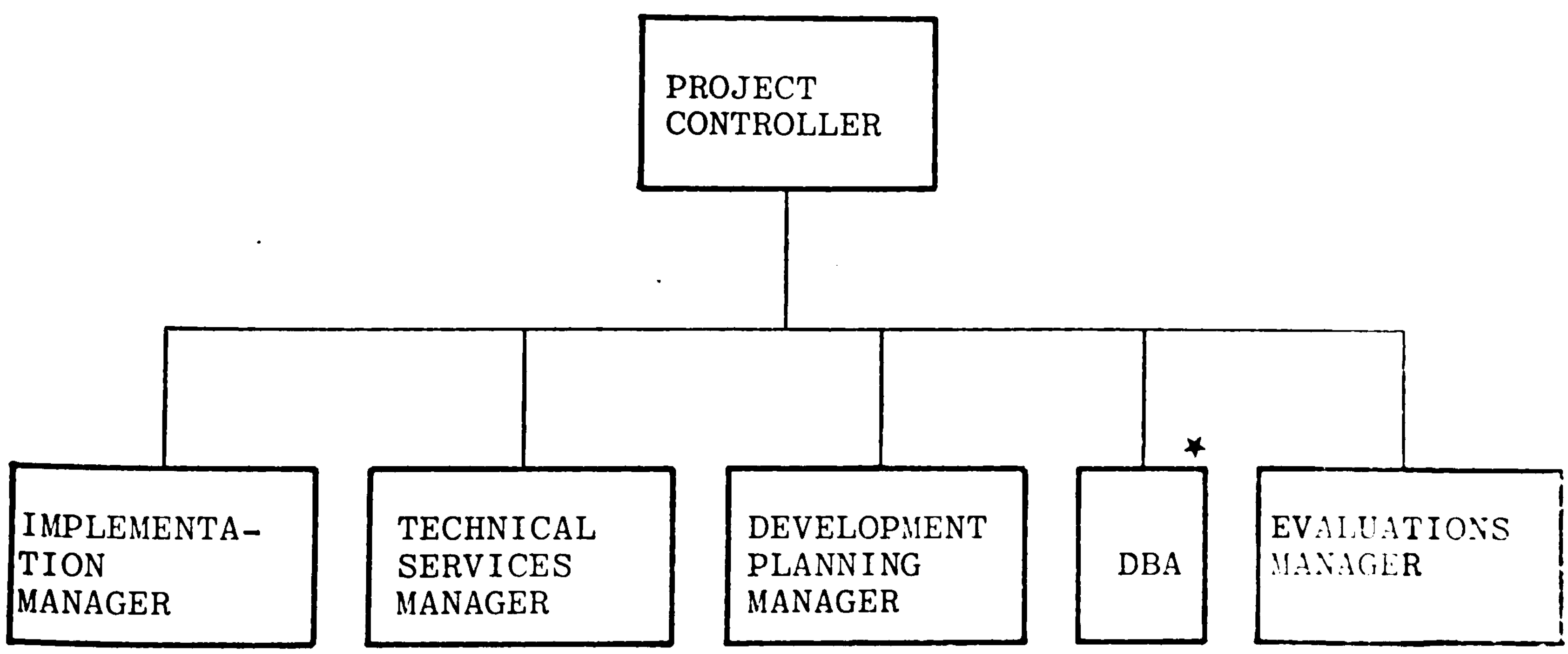
16. TEACHING HOSPITAL



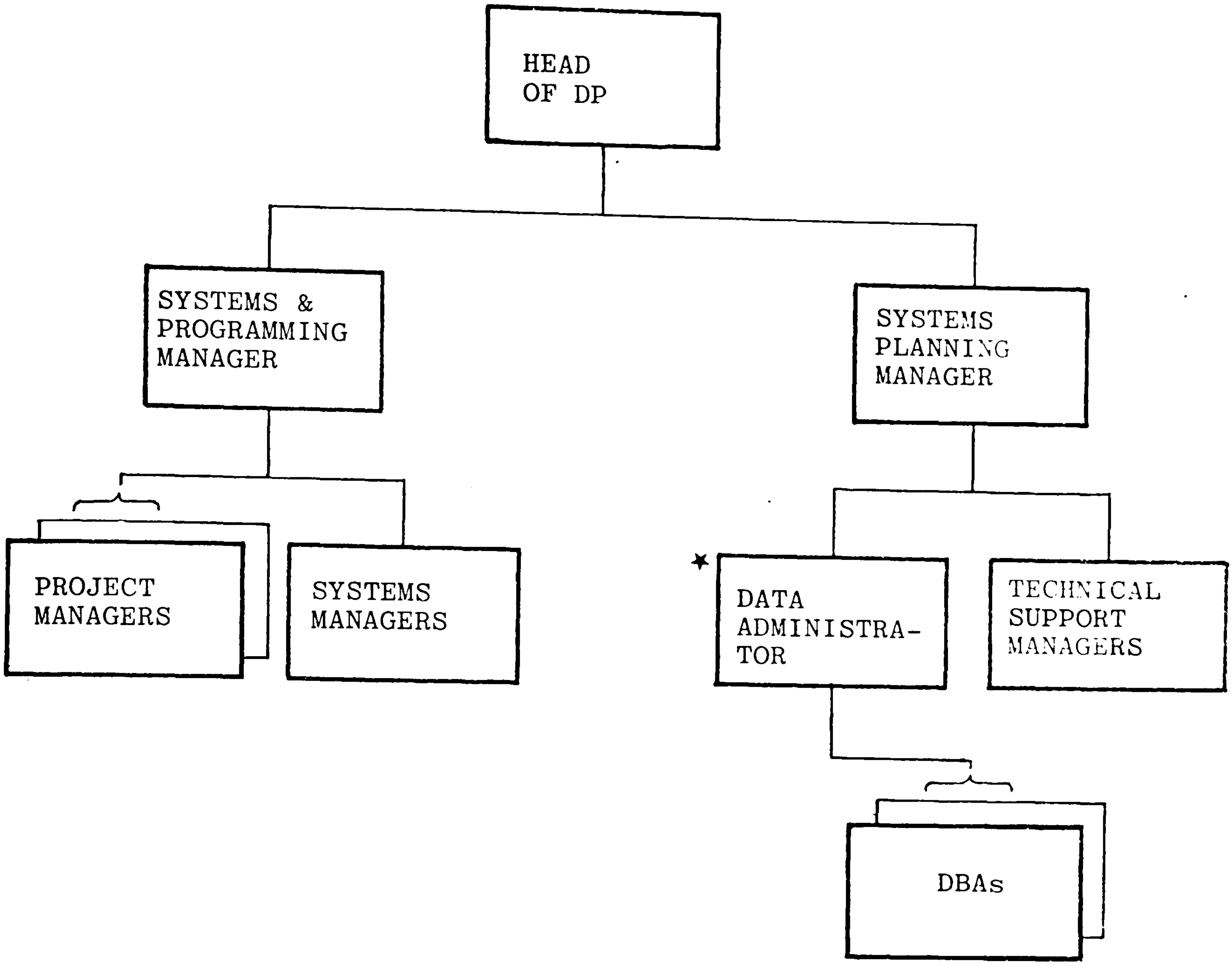
17. COMPUTER MANUFACTURER



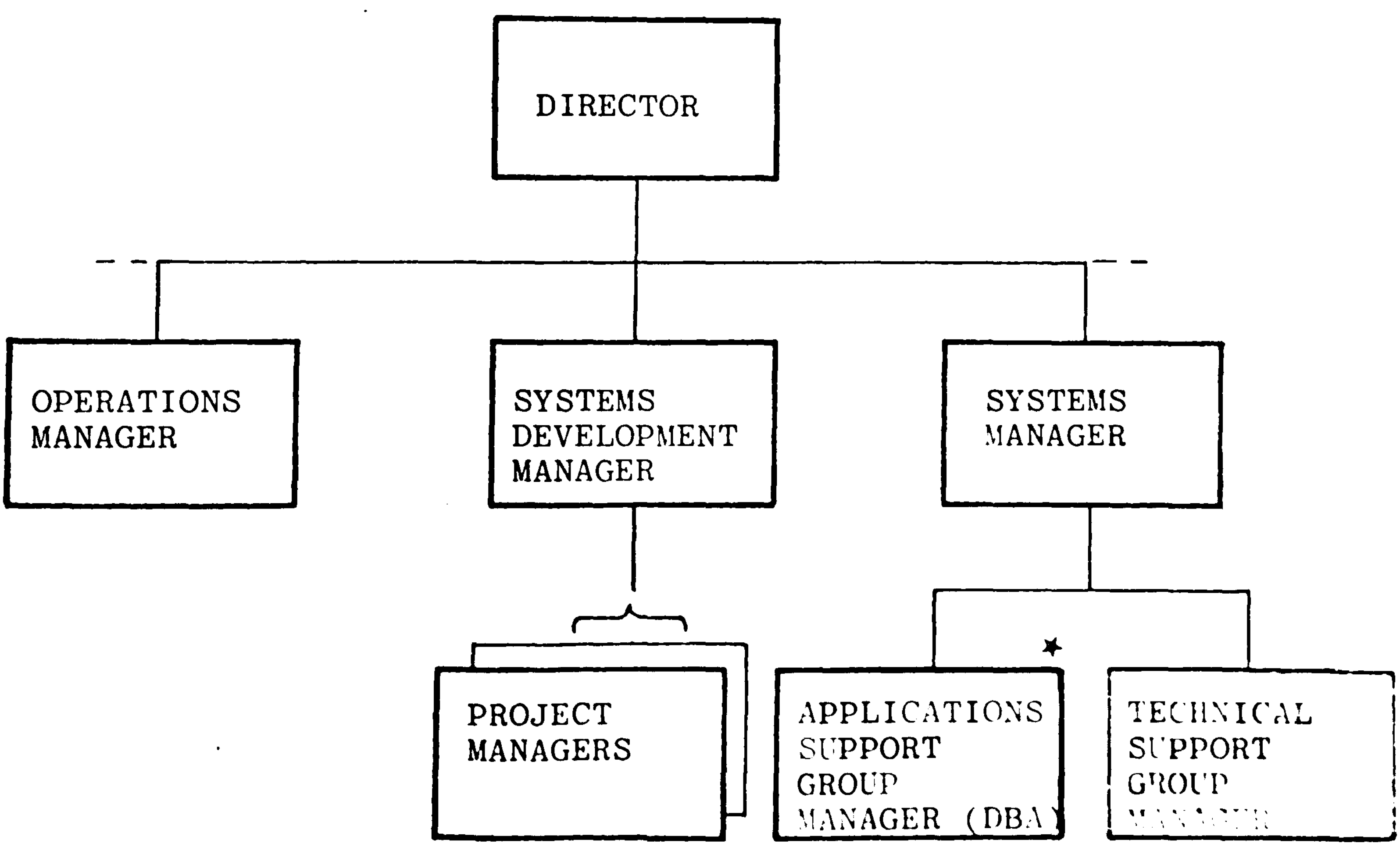
18. PUBLIC SERVICES AGENCY



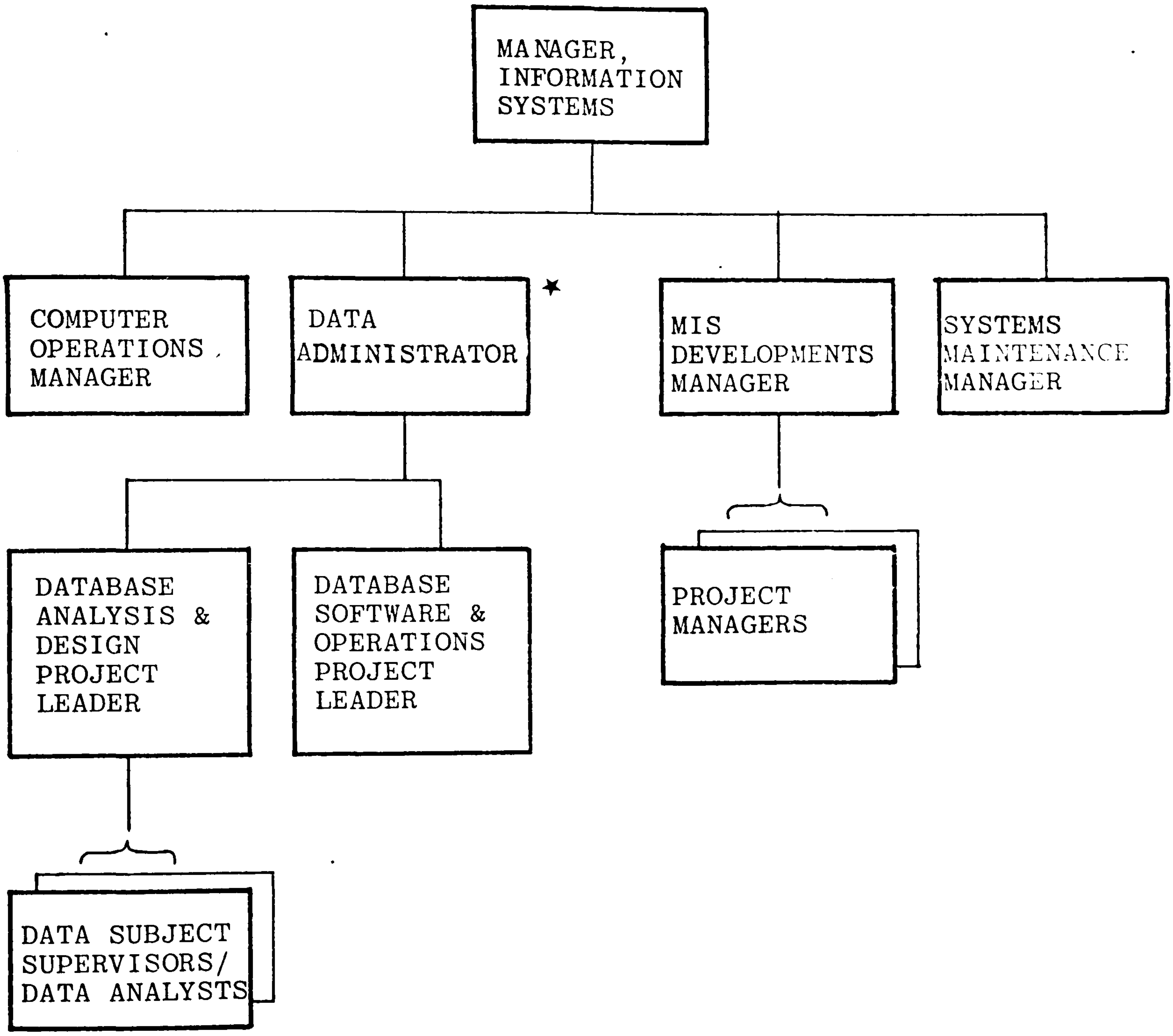
19. ELECTRONIC COMPONENTS COMPANY



20. LOCAL AUTHORITY-3



21. OIL COMPANY-2



LIST OF REFERENCES

ANSI (1977). The ANSI/X3/SPARC DBMS Model. Ed. D.A. Jardine. Amsterdam: North-Holland

ASHANY, R. and ADAMOWICZ, M. (1976). Readings in database systems. IBM Systems Journal, vol. 15, no. 3, pp. 253-263.

BACHMAN, C.N. (1969). Database management: The Keystone of applied systems architecture. In: Critical Factors in Data Management. Ed. F. Gruenberger, Englewood Cliffs, N.J.: Prentice Hall, pp. 33-40.

BARIFF, M.L. and GALBRAITH, J.R. (1978). Intraorganisational power considerations for designing information systems. Accounting, Organisation and Society, vol. 3, no. 1, pp. 15-27.

BCS-DBAWG (1975). Report of the CODASYL data description language committee database administration working group. (Available from BCS, 13 Mansfield Street, London W1, or Chairman, CODASYL DDLC, PO Box 124, Monroeville, Pennsylvania 15146).

BCS-DDSWP (1977). Report of the data dictionary systems working party. Data Base, vol. 9, no. 4.

BEER, S. (1972). The brain of the firm. London: Lane.

BEN-NATHAN, E.A. (1980). The information systems architect and systems development. In: Proceedings IFIP TC 8.2 WORKING CONFERENCE ON THE INFORMATION SYSTEMS ENVIRONMENT, Bonn, 1979. Ed. H.C. Lucas, E.F. Land, J.J. Lincoln, K. Supper. Amsterdam: North-Holland, pp. 275-290.

BLACK, G. (1983). Cullinet tries to avoid a takeover. Computer Weekly, 16th June, p.

BUTLER, D. (1980). Testing the story of an ordinary user. Computing, vol. 8, no. 6, (7 February), pp. 20-21.

CODASYL (1968). COBOL extensions to handle databases. Database task group report to the COBOL committee. PB 177 682.

CODASYL (1971a). Introduction to 'Feature Analysis of Generalised Database Management'. Communications of the ACM, vol. 14, no. 5, pp. 308-318.

CODASYL (1971b). Database task group report of the CODASYL programming language committee. New York: Association for Computing Machinery.

DATAPRO (1983). Directory of Software. Report no. D30-100-004.

DAVENPORT, R.A. (1980). Data Administration - the need for a new function. In: Proceedings IFIP, Tokyo & Melbourne, 1980. Ed. S. Lavington. Amsterdam: North-Holland. pp. 505-510.

DAVIS, B. (1975). Database management systems: user experience in the USA. Manchester: The National Computer Centre.

DE BLASIS, J-P. and JOHNSON, T.H. (1977). Database administration in U.S. organisations. The Wharton School, University of Pennsylvania Working Paper 77-08-08.

DE BLASIS, J-P. and JOHNSON, T.H. (1978). Review of database administration functions from a survey. In: INTERNATIONAL CONFERENCE ON MANAGEMENT OF DATA, Austin, Texas, 1978, pp. 101-108. (Available from Dept. of Decision Sciences, The Wharton School, University of Pennsylvania).

DRAFFAN, I.W and POOLE, F. (1980). The classification of distributed data base management systems. In: Distributed Data Bases - an advanced course. Ed. I.W. Draffan and F. Poole. Cambridge: Cambridge University Press. pp. 57-81.

EEC-NCC (1979). Experience of DBMS usage in Europe. Report to the Commission for the European Communities. The National Computer Centre, Manchester.

EVEREST, G.C. (1974). Managing corporate data resources: objectives and a conceptual model of database management systems. Unpublished doctoral dissertation, Wharton SChool, University of Pennsylvania.

FRY, J.P. and SIBLEY, E.H. (1976). Evolution of database management systems. ACM Computing Survey, vol. 8, no. 1, pp. 7-42.

GILLENSON, M.L. (1982). The state of practice of data administration - 1981. Communications of the ACM, vol. 25, no. 10, pp. 699-706.

GUIDE (1975). The database administrator today. Database administration project of the database division of the G.U.I.D.E. Europe. (Available from GUIDE, 111 East Wacker Drive, Chicago, Illinois 60601).

HEAGERTY, R. (1983). Responsibilities of the Data Administrator. Document of the Data Administration Working Party of the BCS Database Specialist Group. (Available from BCS, 13 Mansfield Stret, London W1).

HOFFER, J.A. (1980). Survey of users turns up range of strategies for database. Computerworld, 27 October, p.13.

HMSO (1980). Standard Industrial Classification-Revised 1980. London: Her Majesty's Stationery Office.

HOLSAPPLE, C.W. and WHINSTON, A.B. (1981). Guidelines for DBMS selection. In: Proceedings NATO ADVANCED STUDY INSTITUTE, Estoril, Portugal, 1981. Ed. C.W. Holsapple and A.B. Whinston, Dordrecht: D. Reidal Publishing Company, pp. 175-191.

JARDINE, D.A. Editor (1974). Database management systems. Amsterdam: North-Holland.

KEEN, P.G.W. (1981). Information Systems and organisational change. Communications of the ACM, vol. 24, no. 1, pp. 24-33.

KENT, W. (1978). Data and Reality. Amsterdam: North-Holland.

KING, P.J.H. (1977). Rather rigid definition of a database not helpful. Computer Weekly, no. 542, 24 March, p. 14.

KOMPASS-CBI (1981). Register of British industry and commerce. East Grinstead: IPC Business Press.

KRASS, P. and WEINER, H. (1981). The DBMS market is booming. Datamation, vol. 27, no. 9, p. 153.

LEAVITT, D. (1976). Users wish they had taken more time picking DBMS. Computerworld, 25 October, p. 17.

McCRIRICK, I.B. and GOLDSTEIN, R.C. (1980). What do data administrators really do? Datamation, vol. 26, no. 8, pp. 131-134.

MINAMI, W.N. (1976). Data Administration - key to better management. Journal of Systems Management, vol. 27, no. 5, pp. 40-44.

MINAMI, W.N. and CRAIG, S. (1976). Management issues in the database plan. Auerbach Database Management Portfolio 21-02-03.

MINTZBERG, H. (1972). The myth of MIS. California Management Review, vol. 15, no. 1, pp. 92-97.

MINTZBERG, H. (1977). Policy as a field of management theory. The Academy of Management Review, nol. 2, no. 1, pp. 88-102.

MUMFORD, E. (1979a). Human values and the introduction of technical change. Manchester Business Review, vol. 3, no. 2, pp. 13-17.

MUMFORD, E. (1979b). Uncertain visions and values - the management of new technology. Manchester Business Review, vol. 4, no. 1, pp. 13-15.

NERAD, R.A. (1973). Data administration as the nerve centre of a company's computer activity. Data Management, vol. 11, no. 10, pp. 26-32.

NOLAN, R.L. (1973a). Computer databases: the future is now. Harvard Business Review, vol. 51, no. 5, (September-October), pp. 98-114.

NOLAN, R.L. (1973b). Managing the computer resource: a stage hypothesis. Communications of the ACM, vol. 16, no. 7, pp. 399-405.

NOLAN, R.L. Editor (1974). Managing the data resource function. St. Paul, Minn.: West Publishing Company.

NOLAN, R.L. (1977). Restructuring the data processing organisations for data resource management. In: Proceedings IFIP, Toronto, 1977. Ed. B. Gilchrist. Amsterdam: North-Holland, pp. 261-265.

NOLAN, R.L. (1979). Managing the crises in data processing. Harvard Business Review, vol. 57, no. 2, (March-April), pp. 115-126.

OLLE, T.W. (1978). The CODASYL approach to database management. Chichester: Wiley.

OLLE, T.W. et al. Editors (1982). Information systems design methodologies: a comparative review. Amsterdam: North-Holland.

PALMER, I. (1980). The snakes and ladders of database systems. Computing, 31 January, pp. 14-15.

PATEL, R. (1982). Final Year student dissertation. The City University (Available from Mr. O. Hanson, Director, Centre for Systems Analysis. The City University, St. John Street, London EC1.)

REVELL, N. (1977). Some practical aspects of database systems. In: Proceedings INTERNATIONAL CONFERENCE ON COMPUTER APPLICATIONS, Bangkok, 1977. Ed. J.A. Jordan and K. Malawongs, vol. 1, Asian Institute of Technology, pp. 533-550.

REVELL, N. (1981). Managing the development of database systems. Information & Management, vol. 4, no. 4, pp. 197-205.

REVELL, N. (1982). The database approach in a small systems environment. In: Proceedings SOUTH EAST ASIAN REGIONAL COMPUTER CONFERENCE, 4th, Kuala Lumpur, 1982.

ROBINSON, S.L. (1977a). Data administrator encompasses functions of DBA. Computerworld, 25 July, p. 22.

ROBINSON, S.L. (1977b). Data administrator duties differ from DBA's. Computerworld, 26 September, p. 24.

ROCK-EVANS, R. (1980). Survival plans for the better-informed office. Computing, 5 June, pp. 20-21

SCOTT, G.M. (1976). A database for your company? California Management Review, vol. 19, no. 1, pp. 68-78.

SHERIF, J. (1977). Management experiences in planning for databases. In: Proceedings INTERNATIONAL CONFERENCE ON COMPUTER APPLICATIONS, Bangkok, 1977. Ed. J.A. Jordan and K. Malawongs, vol. 1, Asian Institute of Technology, Bangkok, pp. 513-532.

SHERIF, J. and HANSON, P. (1978). The impact of implementing database systems in organisations. In: Proceedings AUSTRALIAN COMPUTER CONFERENCE, 8th. Canberra, 1978. Vol.4, Australian Computer Society, pp.1612-1626

SHERIF, J., HANSON, O. and REVELL, N. (1977). Politics and databases. Computing, vol. 5, no. 6 (10 February), p. 20.

SHERIF, J., HANSON, O. and REVELL, N. (1978). Perspectives on database. Computing, vol. 6, no. 36 (14 September), pp. 16-17.

SHERIF, J. and REVELL, N. (1981). Database implementation - a study of some key factors and their organisational implication. In: Proceedings INTERNATIONAL CONFERENCE ON COMPUTING FOR DEVELOPMENT, Bangkok, 1981. Asian Institute of Technology, Bangkok.

SHERIF, J. and REVELL, N. (1982). The management decision to go database - a comparative organisational study. In: Proceedings SOUTH EAST ASIAN REGIONAL COMPUTER CONFERENCE, 4th, Kuala Lumpur, 1982. Ed. C.F. Lau. Malaysian Computer Society, pp.313-322

SIBLEY, E.H. (1974). Data management systems - user requirements. In: Proceedings SHARE WORKING CONFERENCE ON DATABASE MANAGEMENT SYSTEMS. Montreal, 1973. Ed. D.A. Jardine. Amsterdam: North-Holland, pp. 83-104.

SIBLEY, E.H. and MERTEN, A.G. (1973). Implementation of a generalised database management system within an organisation. Management Information, vol. 2, no. 1, pp. 21-31.

TAGG, R. (1978). Database by any other name. Datalink, 16 January, p. 10.

TRICKER, R.I. (1975). Management information requirements and criteria. In: MANAGEMENT INFORMATION SYSTEMS, 1975. Infotech State of the art report. Infotech, Maidenhead, pp. 239-255.

TRICKER, R.I. (1977). The impact of information systems in organisational thinking. In: Proceedings IFIP, Toronto, 1977. Ed. B. Gilchrist. Amsterdam: North-Holland, pp. 213-221.

TRICKER, R.I. (1979). Research in accounting - purpose, process and potential. Accounting and Business Research, vol. 10, no. 37, pp. 3-15.

TURNER, J.A. (1976). Organisational evolution of database administration. Auerbach Database Management Portfolio 22-05-04.

WELDON, J.L. (1979). The practice of database administration. In: Proceedings AFIPS-NCC, New York, 1979. Montvale: AFIPS Press, pp. 709-712.

WHISLER, T. (1970). The impact of computers on organisations. New York: Praeger.

WIORKOWSKI, G.K. and WIORKOWSKI, J.J. (1978). Does a database management system pay off? Datamation, vol. 24, no. 4, pp. 109-114.

WOODWARD, J. (1965). Industrial organisation. London: Oxford University Press.

ZANI, W. (1970). Blueprint for MIS. Harvard Business Review, vol. 48, no. 6, pp. 95-100.

SELECTED BIBLIOGRAPHY

The selected bibliography presents additional references, not cited in the main body of the thesis, which have influenced the research. The literature addresses themes related to the research's form and content: information systems management; organisational theory; research method

I. Information Systems Management

BARTEZZAGHI, E. et al (1981). Computers, Management and Organisation. Information & Management, vol. 4, no. 4, pp.239-258

CAMPAGNE, J.P. et al (1982). Introduction of change in data systems within an organisation: the predesign change. In: Proceedings IFIP TC8 WORKING CONFERENCE ON EVOLUTIONARY INFORMATION SYSTEMS, Budapest, 1981. Ed. J. Hawgood. Amsterdam: North-Holland, pp.217-230

CANNING, R.G. (1978). Planning for DBMS conversions. EDP Analyzer, vol. 16, no.5

CURTICE, R.M. (1976). Planning for database systems. Q.E.D. Monograph Series No. 2. (Available from Q.E.D. Information Services Inc., 141 Linden Street, Wellesley, Mass. 02181).

EARL, J. (1978). Prototyping systems for accounting, information and control. Accounting, Organisations and Society, vol. 3, no. pp.161-170.

EARL, M.J. and HOPWOOD, A.G. (1980). From management information to information management. In: Proceedings IFIP TC8.2 WORKING CONFERENCE ON THE INFORMATION SYSTEMS ENVIRONMENT, Bonn, 1979. Ed. H.C. Lucas, F.F. Land, J.J. Lincoln, K. Supper. Amsterdam: North-Holland, pp.3-14.

FEENEY, W. and SLADEK, F. (1977). The systems analyst as a change agent. Datamation, vol. 23, no. 11, pp.85-88.

FLINT, D. (1979). Trends in database management systems. Butler-Cox & Partners Report series no. 12. (Available from Butler-Cox, Morley House, 26 Holborn Viaduct, London EC1A 2BP).

GINZBERG, M.J. (1981). A prescriptive model for systems implementation. Information & Management, vol. 4, no. 1, pp.33-46.

KEEN, P.G. and GERSON, E.M. (1977). The politics of software systems design. Datamation, vol. 23, no. 11, pp. 80-84.

LAND, F.F. (1980). A critical view of some recent assertions about MIS and DBMS. Information & Management, vol. 3, no. 3, pp. 129-131.

LAND, F.F. et al (1980). Discussion on 'new approaches to systems analysis and design'. The Computer Journal, vol. 23, no. 1, pp. 28-33.

LAND, F.F. (1982). Concepts and Perspectives: A review. In: Proceedings IFIP TC8 WORKING CONFERENCE ON EVOLUTIONARY INFORMATION SYSTEMS, Budapest, 1981. Ed. J. Hawgood. Amsterdam: North-Holland, pp. 3-12.

MARTIN, J. (1982). Strategic Data-Planning Methodologies. London:Prentice-Hall

McFADDEN, F.R. and SUVER, J.D. (1978). Costs and benefits of a database system. Harvard Business Review, vol. 56, no. 1, pp. 131-139.

McKASKILL, T.P. (1978). Effective computer-based information systems operations: a comparative organisational study. Unpublished doctoral dissertation. London Business School of Graduate Studies, University of London.

PETTIGREW, A. (1980). The politics of organisational change. In: Proceedings THE COPENHAGEN CONFERENCE ON COMPUTER IMPACT-78, Copenhagen, 1978. Ed. B. Andersen. Amsterdam: North-Holland, pp. 39-52.

ROBEY, D. (1979). User attitudes and management information use. Academy of Management Journal, vol. 22, no. 3, pp. 527-538.

SLEGTENHORST, R. (1979). Various political considerations and management aspects of setting up a university information system using a DBMS. SHARE European Association. (Available from the author, Leiden University Computer Centre, Wassenaarseweg 80, 2333 AL Leiden, Holland).

TOZER, E. (1978). The impact of data analysis on system design methods. Computer Bulletin, Series 2, no. 17 (September), pp.8-10.

TRICKER, R.I. (1976). Management information and control systems. London: John Wiley.

TRICKER, R.I. (1980). Order or Freedom - the issue in information system design. In: Proceedings THE COPENHAGEN CONFERENCE ON COMPUTER IMPACT - 78, Copenhagen, 1978. Ed. B. Andersen. Amsterdam: North-Holland, pp. 152-162

II. Organisational Theory

CHILD, J. (1973). Predicting and understanding organisation structure. Administrative Science Quarterly, vol. 18, pp. 168-185.

PERROW, C. (1967). Framework for the comparative analysis of organisations. American Sociological Review, vol. 32, no. 2, pp. 194-208.

PUGH, D.S. et al (1971). Writers on organisation. Penguin Books.

III. Research Method

GLASER, B.G. and STRAUS, A.L. (1967). The discovery of grounded theory - strategies for qualitative research. London: Weidenfeld and Nicolson.

KONJIN, M.S. (1973). Statistical theory of sample survey design and analysis. Amsterdam: North-Holland.

MUELLER, J.H. et al (1970). Statistical reasoning in sociology. New York: Houghton Mifflin.