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IMPLEMENTING MANAGEMENT INFORMATION SYSTEMS IN THE NATIONAL HEALTH SERVICE

by

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ABSTRACT

As a discipline Management Information System (MIS) is relatively new. Its short history has been characterised with epistemological dialectism. The current conflict and debate about MIS inquiry is broadly between the advocates of the social systems and technical systems perspectives. Few authors have made positive contributions toward clarifying the meaning and nature of MIS, and the appropriate design framework for MIS development. This thesis adds to their effort by using a MIS designed and implemented through action research at the North Western Regional Health Authority.

There are seven Chapters in this thesis. Chapters One and Two examine the nature of the problem addressed by this research; the project history, ontological assumptions and research strategy. Chapter Three examines the debate, nature and conflicting views about MIS. It defines the theoretical problem addressed by this thesis and proposes a new concept of MIS. The theoretical problems are dealt with in Chapter Four. In Chapter Five the application of the theoretical concepts developed in Chapter Four is demonstrated in the design of MIS. Chapter Six relates some of the findings of this thesis to the work of other authors. It also examines the problem of human inquiry and the suitability of action research for MIS research.

The main findings of this research summarised in Chapter Seven provide a new perspective of MIS as a purposeful system; the taxonomy of purposeful systems; primary context and secondary context of MIS; context analysis and context evaluation of MIS.

CONTENTS

ACKNOWLEDGEMENT

1. INTRODUCTION **1**

1.1 THE EVOLUTION OF FINANCIAL PLANNING IN THE NATIONAL HEALTH SERVICE (NHS) AND NORTH WESTERN REGIONAL HEALTH AUTHORITY (NWRHA) 1

1.2 THE THESIS STRUCTURE 25

REFERENCES 29

2. THE PROJECT HISTORY, ONTOLOGICAL ASSUMPTIONS AND RESEARCH STRATEGY **32**

2.1 A BRIEF HISTORY OF THIS PROJECT 32

2.2 ONTOLOGY AND EPISTEMOLOGY 42

2.3 THE RESEARCH STRATEGY 59

REFERENCES 72

3. MANAGEMENT INFORMATION SYSTEM (MIS) AS A PURPOSEFUL SYSTEM **77**

3.1 THE NATURE OF MIS 77

3.2 MIS AS A PURPOSEFUL SYSTEM 97

REFERENCES 104

4. MIS AS A PURPOSEFUL SYSTEM: ITS TAXONOMY AND FRAMEWORK FOR DESIGN **108**

4.1 THE TAXONOMY OF PURPOSEFUL SYSTEMS 108

4.2 THE UNIFYING FRAMEWORK FOR MIS DESIGN 126

REFERENCES 152

5. MIS AS A PURPOSEFUL SYSTEM: ITS APPLICATION IN THE DESIGN OF MIS **156**

STAGE ONE: NAMING THE MIS 156

STAGE TWO: UNDERSTANDING THE MIS ELEMENTS (ANALYSIS) 160

STAGE THREE: ORGANISING THE MIS ELEMENTS (DESIGN) 197

STAGE FOUR: IMPLEMENTATION AND MIS SUCCESS 208

REFERENCES 212

6. THE VALIDITY OF MIS RESEARCH OUTCOME **214**

6.1 RELATED WORK 214

6.2 HUMAN INQUIRY 225

6.3 THE VALIDITY OF THE RESEARCH APPROACH 235

REFERENCES 249

7. CONCLUSION **253**

7.1 A SUMMARY OF THE RESEARCH FINDINGS 255

7.2 FURTHER RESEARCH 275

REFERENCES 280

APPENDIX A 283

APPENDIX B 284

BIBLIOGRAPHY 287

LIST OF FIGURES

CHAPTER FOUR:

FIGURE 1 A TREE 111

FIGURE 2 A SCHEMA FOR A HIERARCHICAL FILE 113

FIGURE 3 A TAXONOMY OF PURPOSEFUL SYSTEMS 117

FIGURE 4 THE UNIFYING FRAMEWORK 127

FIGURE 5 MIS DEFINITION 131

FIGURE 6 CONTEXT ANALYSIS 135

FIGURE 7 CONTEXT EVALUATION 138

CHAPTER FIVE:

FIGURE 8 A TAXONOMY OF PURPOSEFUL SYSTEMS 162

FIGURE 9 CONTEXT ANALYSIS 164

FIGURE 10 CONTEXT EVALUATION 193

FIGURE 11 AND 11B DFD SAMPLE 198

FIGURE 12 CONTEXTUAL DIAGRAM 201

FIGURE 13 FUNCTIONAL DIAGRAM 202

FIGURE 14A, 14B, 14C OPERATIONAL DIAGRAM 203-205

LIST OF ABBREVIATIONS

CIP	Cost Improvement programme.
DFD	Data Flow Diagram.
DHA	District Health Authority.
DHSS	Department of Health and Social Security.
DOH	Department of Health.
ENIAC	Electronic Numerical Integrator and Calculator.
ERAS	Equitable Resource Allocation System.
ETHICS	Effective Technical and Human Implementation of Computer-based Systems.
FHSA	Family Health Services Authority
IRAP	Integrated Resource Allocation and Planning system.
ISRAS	Integrated Strategic Resource Allocation System.
KES	Korner Episodes System.
NHS	National Health Service.
MANGRS	Maximum Net Gain of Resource System.
MIS	Management Information Systems.
NWRHA	North Western Regional Health Authority.
RAWP	Resource Allocation Working Party.
RAWG	Resource Allocation Working Party Group.
RHA	Regional Health Authority.
SASP	Summary Analysis of Strategic Plans.
SPM	Service Provision Model.

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CHAPTER ONE

1. INTRODUCTION

Resource planning and allocation is a major problem which the North Western Regional Health Authority (NWRHA) management acknowledges and has sought to tackle through various initiatives. This thesis is concerned with the development of a Management Information System (MIS) to support the financial planning and allocation decisions of the NWRHA management.

A brief history of financial planning within the organisation is examined in section 1.1. This is aimed at providing a background to the planning system that the MIS is to support. The section also contains a brief discussion of the theoretical and practical problems to be tackled by this thesis. The structure by which this thesis addresses its practical and theoretical problems is presented in section 1.2.

1.1 THE EVOLUTION OF FINANCIAL PLANNING IN THE NHS AND NWRHA

The NWRHA was one of the fourteen Regional Health Authorities (RHAs) created in England in the 1974 National Health Service (NHS) reorganisation. Within the NWRHA there are nineteen District Health Authorities (DHAs) and one hundred and twenty eight hospitals. A DHA has the responsibility for managing the hospitals within its administra-

tive boundary. A key responsibility of the NWRHA is to ensure that its resources are effectively deployed to meet the health needs of its population. One of the ways whereby it accomplishes this responsibility is through the implementation of resource allocation methodologies that ensures the equitable distribution of resources amongst the nineteen DHAs. Before discussing the history of resource allocation in the NWRHA, the evolution of financial planning in the NHS is briefly examined.

THE EVOLUTION OF FINANCIAL PLANNING IN THE NHS

The NHS is the third largest employer of labour in the world (behind the Russian army and the Indian Railway service) and directly consumes 6% of the national wealth produced each year. It was expected to spend £18,352,000,000 in 1988/89 (Resourcing the NHS, 1988). However large or extensive the size of the resources available to the NHS might seem, it is widely acknowledged that demand for health care is virtually unlimited and, that supply for health care can never keep pace with the rising demand placed upon it. Given that health care demand outstrips the supply facility, it is necessary to have a planning system which ensures that the available resources are distributed and deployed equitably amongst the population.

The first attempt to plan, or to begin to plan the equitable distribution of the resources available to

the NHS came in 1975 with the appointment of the Resource Allocation Working Party (RAWP) by the Department of Health and Social Security (DHSS). This was 27 years after the inception of the NHS. Before 1975, resource distribution within the NHS had "been largely determined by history" (National Association of Health Authorities (NAHA), (1987, p.41). The hospital services inherited by the NHS at its inception had existed by the effort of private benefactors and by local authorities. The areas with wealthier and generous benefactors enjoyed better and larger hospital facilities than the less fortunate areas. This resulted in an imbalance of hospital facilities between different areas. After the inception of the NHS this "imbalance endured, ... for the very reason that whatever the NHS did it had first and foremost to sustain inheritance. The better endowed parts of the country needed larger sums of money to fund their existing services and as money flowed in it naturally consolidated those advantages" (NAHA, 1987, p.41). The effect of the historic imbalance in hospital facilities amongst different areas on the distribution of NHS resources was expressed in Sharing Resources for Health in England (SRHE), (1976, p.7) thus : "supply of health facilities is, in England as elsewhere, also variable and very much influenced by history. The methods used to distribute financial resources to the NHS have, since its inception, tended to reflect the inertia built into the system by history. They have tended to increment the historic basis for the supply of real resources (e.g. facilities and

manpower); and, by responding comparatively slowly and marginally to changes in demography and morbidity, have also tended to perpetuate the historic situation". One of the implications of this imbalance in hospital facilities amongst different geographical locations is that people at equal risk (health need) would not have equal opportunity of access to health care.

RAWP was set up to address this imbalance, and to establish a method of securing a pattern of distribution that would respond objectively, equitably and effectively to the relative need of the population. The RAWP was appointed with the following terms of reference: "To review the arrangements for distributing NHS capital and revenue for RHAs, AHAs [Area Health Authorities] and Districts respectively with a view to establishing a method of securing, as soon as possible, a pattern of distribution responsive objectively, equitably and efficiently to relative need and to make recommendation" (SRHE, 1976, p.5). It produced its main report in 1976 and its proposal was accepted by the Secretary of State. The RAWP report SRHE (1976, p.8) states: "health care is for people and clearly the primary determinant of need must be the size of the population. This must therefore be the basic divisor used to distribute the resources available to each level required". In general the RAWP methodology determines target allocations for each RHA by applying weighting factors to the projected population figures for the year of allocation. For each RHA a weighted population is produced for six service groups: non-psychiatric inpatients, day and

outpatients, mental illness, mental handicap, community health and ambulance. The weighted population derived for each of the six service groups were aggregated and used as indicator of a Region's target allocation. From 1976 the RAWP formula was used by the DHSS as a methodology for allocating resources between the RHAs.

The task of securing equitable distribution of resources through the RAWP methodology faced technical problems. For example the RAWP methodology's effectiveness as a tool for equitable distribution of resources depends very much on the accuracy and adequacy of the weighting factors employed in the resource calculations. Defining adequate indicators for factors such as social deprivation is problematic given current data and controversy about how to measure social deprivation (Mays and Bevan, 1987; Townsend, Phillimore and Beattie, 1988). Townsend, Phillimore and Beattie (1988, p.34) argued that "deprivation [is] a concept which takes a variety of forms and has different meanings ... Some recent attempts to create an operational definition of deprivation have rested on confusing foundations and led to confusing results". Without adequate and accurate weighting factors the objective to secure through the RAWP methodology a situation in which there would be "equal opportunity of access to health care for people at equal risk" (SRHE, 1976, p.7) would remain an aspiration than reality. Mays and Bevan (1987, p.30) argued that except for the broad objectives of RAWP, "every other aspect of RAWP, both conceptually and technically ... has been the subject of continuous criticism and debate since

1976".

The criticism of the RAWP formula led to the NHS management board being asked in 1985 to review the operations of the RAWP methodology, with the following terms of reference: "To report to the Minister by the end of 1986 with proposals for improving the way in which the national RAWP formula measures relative need for the hospital and community health services, taking account of consultation with the NHS and related interests ... The report should include recommendations as to the timing of any proposed change" (Review of the Resource Allocation Working Party Formula, (RRAWPF), 1988, p.1). In general the review recommended that changes be made to certain weighting factors (e.g. the need for additional age band, under 75 Standard Mortality Ratio (SMR), and exclusion of weighting by sex). It also made recommendations about the treatment of the cross-boundary flow adjustment within the RAWP formula (e.g. the need to include proxy measures for out-patient flows and to explicitly show cost of flows in the target calculations). In a press release that announced the publication of the NHS management board's final report on its review of the RAWP formula the Secretary of State states: "The review of the RAWP formula was already close to completion when the Government began its wide-ranging review of the NHS. The Government will consider this report [RAWP review] within the context of the wider review of the NHS" (Moore, 1988, p.2).

As a result of the Government review of the NHS the RAWP methodology was abandoned in 1990. The Government

gave the following reasons for discarding the RAWP methodology: "When the [RAWP] formula was introduced Regions were on average over eight per cent away from their RAWP targets, with a range from 11 per cent below to 15 per cent above. Now 11 of the 14 are within three per cent ... [this implies that RAWP has relatively achieved its aim of equalising resources amongst the Regions] ... [The Government also states that] the undesirable result of the present system [RAWP formula] is that there is no direct relationship between the amount of money a District is allocated and the number of patients its hospitals are treating. This is partly because the movement of patients across Regional boundaries is reflected only retrospectively in the [RAWP] formula, and because the resulting changes affect only target, not actual allocations. Allocations to Districts also reflect historical patterns of service use and pay insufficient regard to varying levels of efficiency and performance ... The RAWP system has proved a useful method of producing a better distribution of resources nationally. But the Government has applied it over the years to such effect that the major differences have gone and it is no longer necessary. It would steadily become an academic exercise to try to get all Regions ever closer to complicated, ever-changing targets" (Working for Patients, 1989, p.30-32). The RAWP formula was replaced with a funding system based on population numbers within each RHA weighted for age, health and the cost of providing services. This funding system is discussed further in the next part of this Chapter and also in Chapter Five.

THE HISTORY OF FINANCIAL PLANNING IN THE NWRHA

In 1978 the NWRHA adopted the national methodology, RAWP, for allocating resources between its Districts. The application of RAWP methodology by the NWRHA was abandoned after a period of five years (1978/79 - 1982/83). The RAWP methodology as used in the NWRHA involves the calculation of weighted population in each District for four service groups: in-patient, out-patient, community services and ambulance services. The national expenditure weightings were then applied to the weighted population for the service groups to derive revenue targets for each District.

The main criticism of the RAWP was that it provided management with no real link between the resource targets and plans for future service levels. It primarily used population figures for its resource target calculation and did not allow planners to check how compatible the resource targets were with service plans.

As RAWP was abandoned, the NWRHA adopted a new planning policy of relating the allocation of monies for service developments to service targets. This was broadly achieved by a process known as the Summary Analysis of Strategic Plans (SASP). The SASP process basically costs the current levels of service provision across the Region and predicts the cost of services over a ten year period that constitutes the Regional strategic plan period.

While the SASP was still in use there was an initiative to develop a new planning model that would be an adequate alternative to the discarded RAWP. The new model known as the Service Related Approach to Resource Allocation (SRARA) was expected to meet the Region's need to link more closely the methods for resource allocation and service planning that would ensure equitable distribution of resources between Districts. In general, this approach uses a process known as the Service Provision Model (SPM), (SRARA, 1985), to translate current and future service targets into financial terms in order to permit the magnitude of allocation to be related to Districts' relative requirements for services planned. The financial targets derived by the SPM provided a measure of Districts' relative efficiency in achieving their current levels of service. It also showed how Districts' levels of expenditure would need to change if they were to achieve the strategic service targets.

Structural development of the SPM started in 1984 and was completed in 1985. A policy document about the SPM was issued in 1985 with the following comment by the chairman of the NWRHA, "I believe that it represents a decisive step forward in implementing policy changes and will help us to put our resources where they are most needed" (SRARA, 1985, P.1). An advisory group was set up to monitor and advise on the development and use of the SPM. The advisory group members consisted of Regional and District officers. Each member was selected on

the basis of the perceived relevant input he would make to the SPM process.

As a planning tool the SPM attempted to include all factors that could be quantified. The basic input to the SPM system were standard costs, and current and future service levels. The basic outputs were the current and future revenue targets at District and Regional levels for the following service groups :

1. In-patient and day-cases
2. Out-patients
3. Day patients
4. Accident and Emergency services
5. Other hospital patients
6. Community services
7. District Administration
8. Regional Administration
9. Regional services

As mentioned earlier, two targets (current and future) covering the above service groups were calculated for each District.

The current targets were used to influence the decision on the level of contribution a District should make to the annual cost improvement programme. The level of contribution a District was expected to make towards the revenue saving programme depended on whether the District's relative cost per item of service provided was above or below the District's current target produced by the SPM. The current target acted as a standard against which the Districts' relative perfor-

mance could be measured.

The future target was used as a financial framework to influence the amount of growth money allocated to each District for service development. It provided an indicator of Districts' relative future resource requirement.

The complexity and structure of the SPM necessitated an integrated computer model to ensure feasible implementation and utilisation of the SPM principles. In 1986, the NWRHA decided to use an external consultant for the development of the SPM computer model.

MY INVOLVEMENT WITH THE SPM

The Sheffield Business School approached the NWRHA to ascertain the possibility of securing projects for its 1985/86 MSc students. Following this inquiry I was one of those invited for an interview by the NWRHA, and given my technical background and experience in computing I was offered the task of designing the SPM computer model. My task was concerned mainly with the technical aspect of the system and not the implications and use of the SPM as a planning model. Broadly my duty was :

(a). To produce an integrated and common database to be shared by the SPM sub-systems.

(b). To incorporate refined procedures and allow for flexibility in generating standard and adhoc reports.

(c). To reduce the need for manual input of data.

(d). To develop the SPM such that it could be used locally by the Districts.

The above tasks were mainly concerned with "improving" efficiency in the operation and performance of the system.

In February 1986, the 1984/5 SPM calculations were first put into use in the NWRHA.

Despite consultation with the Districts during the SPM development and the RHA's statement (SRARA, 1985, p.1-8) about the SPM, that "the precise method (which is obviously determined by the existing data) will change as information changes and improves", and that "the proposals for the use of the resource targets have been developed with the constraints imposed by the data base very much in mind", the SPM as a planning tool could not survive its criticism and rejection by the Districts.

The criticism of the SPM approach had centred more on the method or technical structure rather than the principle or concept entailed in the approach. The basic argument of its opponents were:

(i). That the unit cost derived from a statistical model was not an accurate measure of the actual cost and would strongly bias the target calculations.

(ii). That the SPM did not adequately reflect case-mix in its treatment of specialties.

(iii). That the SPM did not acknowledge outcomes, effectiveness or quality. That is, the quality of service might be compromised if performance was measured only in terms of output.

(iv). That the model did not reflect building stock

(v). That its measure of service did not reflect local needs.

(vi). That it was very complex for the Districts to understand.

Although development work on the model did continue and the SPM advisory group did acknowledge most of the criticism, the above limitations were very problematic and difficult for the model to address. This can be attributed to three main reasons:

(a). It would be a considerable challenge to implement them given the existing data. For example, defining an indicator for quality given current data on effectiveness and quality would be difficult and would require large resources to accomplish.

(b). The SPM created a new set of losers and gainers of regional resources amongst the Districts. Those depicted by the SPM as being relatively inefficient and in need of lesser resources resisted the use of SPM as a planning model. The designers of SPM concentrated most of their effort on the technical excellence of the model with little attention to political issues inherent in a budgetary planning process. The political issues generated by the SPM was a major factor that led to the SPM being eventually discarded by the NWRHA.

(c). Most of the regional officers who pioneered the SPM left the NWRHA to join other organisations. Their expertise, influence and sustained interest in the SPM development were difficult to replace.

The principles of the SPM were accepted by both the spenders (Districts) and guardian (Region) of resources, however its technical structure did not survive the criticism of its opponents (Districts). In 1988 the SPM was discarded by the NWRHA.

The "increased emphasis on the management of change and using resources cost effectively" (NAHA, 1987, p.73), that resulted from the Griffiths (1983) report and the NHS briefing processes, provided unabated interest in the search for a more satisfactory planning system by the NWRHA.

The search was still on when the Government White Paper, "Working for Patients" (1989), was published. The White Paper fundamentally altered the resource allocation and planning process on which previous models (e.g. the SPM) were based. Before the White Paper was published, the resource allocation policy in the NWRHA had been service led. The service targets were directly linked to financial targets. That is, resource allocation was firmly based on the policy of relating the allocation of monies for service developments to agreed service targets (SRARA, 1985). Instead of allocating resources on the basis of service to be provided, the White Paper envisaged that money will be given to Authorities on the basis of their resident populations, regardless of their existing utilisation rates or of the hospitals currently run by each Authority. Theoretically Health Authorities would then be free to buy services for

their residents from whatever source they wished. The project on which this PhD is based is the design of a resource allocation system to implement the new funding arrangement introduced by the White Paper.

THE PHD PROJECT

The White Paper's third proposal states :

" (1). Replace the present complicated system (RAWP) which has largely achieved its purpose of equalising the distribution of money across the Regions.

(2). Institute a simpler system for funding Regions and Districts based on population numbers weighted for age, health, and the cost of providing services.

(3). Ensure that money required to treat patients is able to cross administrative boundaries.

(4). Change the funding of all hospitals to a system based on management budgets and specific contracts. No effect on guaranteed immediate access for emergency treatment" (Speaking Notes, 1989, p.5).

The White Paper essentially required that Authorities be funded on the basis of their residential population, not on catchment population. This principle of funding Authorities strictly on their residential population introduces the concept of the purchaser/provider dichotomy within the NHS. As a purchaser an Authority only has responsibility for meeting the health needs of its resident population. In theory the purchasers can buy services wherever they wish, and a provider can sell or

charge for its services. A notion that has to be understood to appreciate the nature of the new NHS funding arrangement is the concept of "cross boundary flow" and this section briefly explains the concept.

CROSS BOUNDARY FLOWS

A cross boundary flow occurs when one patient residing in one administrative boundary is provided with treatment by a hospital situated within another administrative boundary. Such flows can occur at District level (one District providing a service to a patient from another District) or at the Regional level (patients from one Region being provided treatment in another Region). The inter-regional flows generate net inflows and outflows of resources to and from a Regional Health Authority (RHA). Net inflows and outflows of resources also occur at the District level, that is between the Districts within a RHA.

By introducing the concept of purchaser and provider dichotomy in the NHS the White Paper "Working for Patients" (1989) brought far reaching changes to the way in which the NHS functions. These changes may be understood by examining the concept of internal market in the NHS. It is the concept of an internal market that the next part of this discussion briefly examines.

THE INTERNAL MARKET

Before the publication of the White Paper "Working for patients" (1989) the DHAs were funded on the basis of

the services they provide. The DHAs directly managed all hospitals within their administrative boundaries. The hospitals are the actual units that provide services to patients. Since the hospitals were directly managed by the DHAs, the DHAs may be viewed in a broader context as providers of services to patients (i.e. they provided services to patients through their hospitals). In this position the DHAs not only controlled the resources (money) available for patient care but also controlled the facilities (hospitals) for providing health care. Put in another way, the DHAs were providers and at the same time purchasers of health care. This type of arrangement does not encourage competition between DHAs or amongst hospitals. One fundamental aim of the White Paper "Working for Patients" (1989) is to encourage efficiency in the NHS by introducing limited market style competition in the NHS. The market is known as an internal market and is to be carefully controlled. In a market there has to be a provider (seller) seeking customers, and also a purchaser (buyer) seeking suppliers. This means that for a market to operate within the NHS the DHAs can no longer retain their traditional role of being both purchasers and providers of health care. There has to be a clear separation of responsibilities between purchasers and providers of health care.

The DHAs were given the role of purchasers in the internal market. As purchasers DHAs "will assess the needs of their local populations and then [purchase or] secure services [for their residents] (whether within their own Districts or elsewhere" (Edmundson, Horsley and Popplewell,

1990, p.1). Some General Practitioners (GPs) were also expected to be budget holders and to act as purchasers of health services for their patients. The White Paper states: "at the start of the new scheme [internal market], GP practices with lists of at least 11,000 patients ... will be free to apply for their own NHS budgets for a defined range of hospital services. They will be able to obtain these services from either NHS or private sector hospitals" (Working for Patients, 1989, p.48-49). According to the White Paper, the benefits of having GPs as purchasers of health care include "a real incentive [for the GPs] to put patients first, ... better care for patients, shorter waiting lists, and better value for money". These benefits were supposed to materialise as a direct consequence of GPs having the freedom to buy health care for their patients wherever they wished.

The hospitals were given the role of providers of health care. As providers the hospitals have to compete with each other for patients and resources from purchasers. The manner in which services were provided in the NHS before and after the introduction of the internal market is described by Strong and Robinson (1990, p.185). They state: "The NHS has provided services for defined populations and did so on a largely monopolistic basis. There was little competition between GPs and none at all between hospitals. Now, however, doctors would start to compete for patients as well as resources, while ... [hospitals] would have to compete with one another ... In this process, or so it was hoped, they would be forced to jack up their standards; the

market would apply its own sanction to all those who failed".

The process of buying and selling of services between the purchasers and providers has to be made through the "NHS contracts". "NHS contracts are the agreements between purchaser and provider which formalise the required quality, quantity and cost of services to be secured" (Edmundson, Horsley and Popplewell, 1990, p.1). Before the purchaser enters into such contract he has to be aware of the level of resources available to him. The time and level of resources available to purchasers will have a major impact on their ability to purchase services and the overall operation of the internal market. The transition from a monopolistic pattern of service provision to an era of internal market may be problematic and has to be approached as a gradual process. The recognition of this has led the NWRHA to adopt the following principles for managing the transition:

"**A seamless service must be delivered** - the transition must be smooth so that the individual patient is hardly aware of any changes to the funding and contracting arrangements which surround his or her need for health care.

A stable service must be provided - there must be minimum service disruption in 1991/92 as a result of the revised funding and contracting arrangements so that there are no adverse effects on patients.

A secure service must be ensured - the services provided ... must be managed so as to be affordable within the cash limits set by the contracting process" (Edmundson,

Horsley and Popplewell, 1990, p.3).

One starting point in implementing the internal market is to decide on the level of resources to be made available to each purchaser. This has to be done by implementing the new funding arrangements introduces by the White Paper "Working for Patients" (1989).

To implement the new funding arrangement the NWRHA needed to perform two tasks:

THE FIRST TASK

The Department of Health (DOH) resource allocation formula "allocates resources to the Regions in respect of their resident population by taking projections of resident populations and weighting by age and under 75 SMR [Standard Mortality Ratio] ... The weighted population figure is then used to produce a weighted per capita sum attracted by each member of the resident population" (Edmundson, 1990, p.2). This mode of funding implies that a RHA has responsibility to purchase services only for its residents and, where it provides services to residents of other RHAs it has to charge those RHAs for these services. To recoup the money spent on the residents of other RHAs required that the following activities be performed:

(1). The identification of appropriate costing methodology.

(2). The identification and classification of patients (i.e. their Region of residence and type of treatment received).

(3). Determination of costs associated with patient treatment.

(4). Strategy for negotiating with other Regions.

These activities (1 - 4) constitute the first task in implementing the new funding system.

The first problem or objective of this PhD project was to design a Management Information System (MIS) that would assist the managers in dealing with these activities (1 - 4) that constitute the first task of implementing the new funding system.

THE SECOND TASK

The White Paper "proposes that ultimately Districts should be funded on broadly the same basis as the Regions" (EL90MB/22, p.3), and stresses that District allocations should be directly related to their resident population. That is, the current system of funding the Districts on the basis of the services they provide will be replaced by a system based on their resident populations. Each District is to act as an agency responsible for purchasing services for its resident population. The system of funding the Districts on the basis of their resident population is known as per capita funding. The DOH guidance (EL90MB/22, p.4) to Regions on District allocation formulae states, "Given an element of Regional discretion, it is important that :

(1). There should be a presumption towards clarity, simplicity and stability in the allocation mechanism.

(2). The allocation mechanism should be the subject of consultation with districts in advance of its application, and made known and explicit.

(3). Funds should as far as possible go directly to Districts in accordance with an agreed transitional pattern.

(4). There should be clarity in the funding of Districts as purchasers with a proper measure of financial responsibility at District level."

To fund the Districts on the per capita basis involves the following activities:

(a). Determination of Districts resident spend.

(b). Determination of weighted population.

(c). Calculation of target allocation based on Districts weighted population.

(d). Identification of Districts position from target allocation.

(e). Deciding on the strategy for moving Districts to their target allocation level.

The second problem or objective of this PhD project was to design a MIS that would assist the managers in dealing with these activities (a - e) that constitute the task of the per capita funding process.

The MIS that was designed and implemented by this PhD project was known as the Integrated Strategic Resource Allocation System (ISRAS). *This PhD research had as its practical problem the design of ISRAS to accomplish the two objectives stated above.*

THE THIRD TASK

The third task of this PHD project is about the theoretical aims of this thesis.

The theoretical aims of this thesis are to contribute to the debate in the MIS literature on ways to proceed in MIS development. This thesis adds to the ongoing debate by offering a new concept of MIS. The new concept supports and extends the work of Ackoff (1971), Swanson (1974), Mumford (1983a) and Banbury (1987). This thesis will derive a unifying framework that can be applied in the development of MIS. It will also provide concepts for identifying relationships amongst MIS variables in the form of a framework to guide researchers responsible for developing MIS methodologies. These theoretical aims will be amplified in Chapter Three.

The discussion of the SPM mentioned that my MSc project was done in the NWRHA. The remaining part of this section highlights the differences between the MSc and the PhD projects.

THE MSc AND PhD PROJECTS

The MSc and the PhD projects were concerned with quite different tasks and purposes. The total time spent on the MSc project, including the time for writing it up as a dissertation was six months. The MSc project was concerned with the design of the SPM computer model. The concept, structure and use of the SPM were already established by

the NWRHA by the time I was offered the SPM project. My task was purely to automate the SPM activities and the MSc dissertation was a documentation of the things I experienced in automating the SPM activities.

Towards the end of the MSc project the managers were told of my intention to undertake PhD work after leaving the NWRHA. They expressed interest in a research project and offered to support a PhD project that would centre on the development of a financial information system within the organisation. At the same time I was offered a job within the Financial Planning department. The offer of PhD support was accepted and the project was subsequently registered with the Sheffield City Polytechnic. As mentioned earlier the PhD project was concerned in part with the design and implementation of a MIS known as the ISRAS.

1.2 THE THESIS STRUCTURE

The structure by which this thesis addresses its practical and theoretical problems is as follows:

CHAPTER ONE

A brief introduction to this research project is given in this Chapter. The first section of the Chapter examines the evolution of financial planning in the NHS and NWRHA. This research project and my entry into the NWRHA are then related to this evolution. The second part of this Chapter presents the structure by which this thesis addresses its theoretical and practical problems.

CHAPTER TWO

Since the inception of this research project there have been many organisational and policy changes within the NWRHA. These changes had affected the nature and direction of this thesis. The first part of this Chapter briefly examines the history of this research project and discusses the nature and impact of these changes on the project. The second part of this Chapter discusses my assumptions about man and organisations. The aim is to provide the preliminary assumptions that underlie my concept of MIS presented in Chapter Three. The last part of this Chapter briefly discusses this research

strategy. It also defines some MIS terminologies to clarify the sense in which they are used in this thesis.

CHAPTER THREE

The first section of this Chapter examines the relevant MIS literature to highlight the debate, nature and conflicting views about MIS. The debate about the nature of MIS and the strategy for its development is broadly between on the one hand the advocates of the social systems and on the other the technical systems perspectives. The origin and arguments of both perspectives are examined in this section. The theoretical problems addressed by this thesis are also defined in this section. The second section proposes a new concept of MIS. The section identifies the characteristics of the MIS and argues that this new perspective of MIS accommodates both the social and technical systems perspectives of MIS.

CHAPTER FOUR

The theoretical problem of this thesis is dealt with in this Chapter. The first section proposes and discusses the concept of the taxonomy of purposeful systems. It argues that this concept provides a framework to alert MIS designers to the different types and levels of contexts in which MIS can be embedded in organisations, and the strategy that can be used to identify and

accommodate the special characteristics of the different levels of contexts when designing a MIS. The second section proposes and discusses a unifying framework for the design of a MIS. The framework has four components: (1) naming the MIS, (2) understanding the MIS elements, (3) organising the MIS elements, (4) implementation and monitoring of MIS outcomes.

CHAPTER FIVE

This Chapter deals with the practical problems of the thesis. It demonstrates the application of the theoretical concepts developed in Chapter Four in the design of a MIS.

CHAPTER SIX

In the first section of this Chapter some MIS literature is examined. The aim is to discuss and relate some of the findings of this thesis to the work of other authors. This research is action research based on a single case. Most of the criticisms directed against action research and case studies are voiced from the perspective of the natural science method of inquiry. The natural science method of inquiry and the problem of acquiring human knowledge are briefly examined in the second section of this Chapter. The discussion about the natural science method of inquiry is used in the third section to briefly respond to some of the criticism against

action research and to examine the validity of this research approach.

CHAPTER SEVEN

This Chapter summarises the main findings of the research and concludes with suggestions for further research.

CONCLUSION

This Chapter has provided a brief introduction to the research project. A brief history of financial planning within the organisation was examined. The aim was to provide a background to the planning system which the MIS to be developed by this research is to support. The Chapter indicated that the first major attempt to plan and ensure the equitable distribution of resources amongst the Districts within the NWRHA started in 1978 through the adoption of the national methodology known as the RAWP. Accepting that the RAWP was unsatisfactory, the management has displayed unabated interest in the search for a more effective and equitable resource planning system. This was manifested through approaches such as the SASP, SPM and management's interest in this research project.

The theoretical and practical problems to be tackled by this research were briefly introduced in this Chapter. This Chapter also presented the structure by which this thesis addresses its practical and theoretical problems.

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CHAPTER TWO

2. THE PROJECT HISTORY, ONTOLOGICAL ASSUMPTIONS AND RESEARCH STRATEGY

Section 2.1 examines the history of this project. This research was conducted in a very volatile situation. The discussion in this section showed that the conduct of this project experienced major changes in focus and process. As discussed in this section the changes were due to the changes in the client system. Section 2.2 then examines some of my assumptions about human nature which are then extended and used as my assumptions about the nature of organisations. The framework for analysis used in this research is based on my assumptions about the nature of an organisation. It also forms the basis of my concept of a MIS discussed and developed by this thesis. The research strategy and methodology used in this research is discussed in section 2.3

2.1 A BRIEF HISTORY OF THIS PROJECT

The history of this PhD started in 1987. The Regional Health Economist suggested to the Financial Planner that the NWRHA should make provision for me to do research work within the organisation. This was towards the end of my MSc project and they both knew of my intention to do a PhD project after leaving the NWRHA. The Financial Planner responded that it was a good idea and asked if I would be

interested in PhD work at the NWRHA. I showed a positive interest in doing such a project in the organisation, and the Financial Planner then decided to discuss the issue with the Chief Financial Planner to ascertain if he would support the project.

The Chief Financial Planner showed a positive interest in the idea of a PhD project within the organisation. He said the final approval for the project had to come from the top management and offered to discuss the issue with them. The top management's response was positive and a job was subsequently offered to me. The job's responsibility was defined specifically for the PhD project.

The first formal meeting to discuss the PhD project was attended by me, the Chief Financial Planner and the Head of Financial Planning and Allocations. I stated at the meeting that the PhD could not be registered with any academic institution unless there was a substantial problem on which to base the PhD. The Chief Financial Planner responded that I should inform the academic institution that "we want a model to help us plan the health needs of the four million people in the North West". He was particularly interested in developing the acute sector resource planning model. The Head of Financial Planning and Allocations said he would "like to see a further development of the existing planning model". It was a brief meeting. It ended with a broad agreement that there was a need to design a new planning model that would interface or complement the SPM. I was not particularly happy with the outcome of the meeting. I was expecting a clear and concrete state-

ment on the nature and scope of the problem to be attacked. The discussion was very general. At the end of the meeting I was still not in a position to start preliminary work on the problem. The exact nature of the problem was still not clear to me. In retrospect I could say that the failure of this first meeting was due to my poor preparation prior to the meeting.

I had wanted the outcome of the meeting to be a clear and joint definition of the problem which was to be the research focus. With hindsight this expectation was unrealistic given that I went into the meeting without adequate planning or a strategy that would prompt the meeting towards my desired outcome (lucid problem definition). I learned from this experience that it is crucial to think through issues such as time scale, roles, resources, expectations, and the best way to bring these issues into a discussion before attending an initial meeting with the users. My experience agrees with Gill's (1982, p.31) argument that "successful outcomes of the initial interaction between research consultants [researchers] and users might, in part at least, depend on ... the way the research consultant [researcher] managed the meeting".

The Head of Financial planning and Allocation was the boss of the Chief Financial Planner. As the Head of Financial Planning his support for this project was of prime importance if any change or a new system was to be successfully introduced in the organisation. In the remaining part of this section I will refer to him as the client.

The exact nature and scope of the system to be de-

signed was still to be decided when the client informed me about a computer-based strategic planning model known as the Integrated Resource Allocation and Planning system (IRAP). The IRAP was jointly developed by Thorn EMI (a computer firm) and the Chartered Institute of Public Finance and Accountancy. The IRAP was introduced to the organisation by my client's predecessor. Though no longer a member of staff of the NWRHA he could still have some influence among top management. The sudden decision to implement IRAP was rather a surprise to me. In a discussion about the IRAP, the client said there was little he could do to reject IRAP and wanted to know if the research project could be centred on the implementation of IRAP.

The client's action in accepting IRAP could be explained by his perception of his predecessor's ability to influence positive interest in IRAP within the organisation. The decision to implement IRAP was not based on the findings of any formal analysis of the organisation's planning problem.

The IRAP may differ from the SPM in terms of its technical structure and size, but the concepts of both systems were fundamentally the same. Like the SPM, the basic outputs from the IRAP were financial targets computed from estimated service levels or demands. It was a rational planning or budgetary system and could not avoid being subjected to the type of political pressure that plagued the SPM. An effective implementation strategy could, however, ensure user acceptance of the new system.

Gill, (1977) described an effective action research process as one in which the needs of both researcher and user are met. If the client's problem was the implementation and use of IRAP, then the successful implementation of IRAP could be "effective research" by contributing to the theory of implementation, and solving the client's need to implement and use the system. Whether successful implementation of IRAP would solve the client's strategic planning problem was a matter of debate and for the research to discover. The reason being that the problem as defined by the client was primarily the implementation of IRAP and not the strategic planning needs of the organisation.

The problem as defined by the client was accepted and a research proposal was registered with the Sheffield City Polytechnic. The proposal states:

"This research will be based on a packaged management resource planning system to be implemented at the North Western Regional Health Authority. The system has been developed by Thorn EMI (a computer firm) and the Chartered Institute of Public Finance and Accountancy.

The first phase of this research will involve understanding the technical nature and scope of the system. This will also include the host organisation's thinking in terms of the nature and scope of use of the system. Criteria will then be decided on which the implementation success or effectiveness will be measured. An attempt will be made to collect relevant data on packaged implementation from other

organisations within the NHS.

The PhD phase will involve :

1. Developing a model and using it for the actual implementation of the system.
2. Examination of the extent to which the criteria of implementation success has been met.
3. Examination of possible relationship between the implementation framework and other systems design methodology.
4. Investigation of the application of the model in other type of organisation.

The PhD should, therefore, represent :

A contribution to the theory and practice of implementation, especially as regard packaged system implementation and their impact on the information systems practitioner."

Preliminary work started in the client system in anticipation of the arrival of IRAP. Effort was directed towards gathering data about the client system and views about packaged systems through semi-structured interviews and archive records.

The data gathering process was still in progress when the client resigned from the NWRHA to join a consultancy firm. Before his resignation both the Financial Planner and the Chief Financial Planner had left the NWRHA and they were yet to be replaced. At the same time a reorganisation within the Finance Division was in progress. The reorganisation resulted in the merging of the Financial Planning and Allocations Department with the Monitoring and Systems Department. Two sections were created out of the new Department - namely (1) Financial Planning, Allocations and

Monitoring. (2) Strategic Planning (finance). The Financial Planning, Allocations and Monitoring Section deals with short term issues while the Strategic Planning Section focuses on long term strategic issues. The research project was subsequently located within the Strategic Planning Section.

The reorganisation placed the head of Strategic Planning as the new client for the research project. He was not very keen about pursuing the implementation of IRAP. This was mainly due to the objection raised by the Planning, Review and Implementation Division (PIR) about the Finance Division using the IRAP. The PIR Division was responsible for providing the Finance Division with service projections for all specialties within the region. IRAP was expected to provide service estimates or projections as part of its output. The PIR Division argued that the use of IRAP would be unnecessary given that it had already done substantial work in developing its own model for producing service estimates. The PIR Division probably perceived the use of IRAP by the Finance Division as an unnecessary encroachment into its area of responsibility. The use of IRAP by the Finance Division would have made it relatively independent of the PIR Division for the supply of its major input (i.e. service projections or estimates).

The resignation of the project's first client, the discarding of the IRAP and the reorganisation that took place created major obstacles for this research project. The staff union was unhappy about the reorganisation and

rejected it. They accused management of imposing the new structure on the staff and demanded that management should go through a consultation process with the staff before implementing the new structure. The management responded by suspending the new structure to allow for a consultation period. Without the new structure in place it was impossible to continue this research project. I had to wait for the new structure to be implemented so as to know and work with the staff who would be responsible for the financial planning process. After a period lasting about three months the reorganisation was accepted and the new structure was implemented.

Having discarded the idea of implementing the IRAP and, with the project now facing a new client (Head of Strategic Planning), it was necessary to define a new problem and its scope for this project. The client showed interest in implementing an in-house management planning system. He identified the acute sector services and the mental illness or handicap services as two problem areas that this project could address. He gave me the option to decide which of the two problems should be tackled by this research. I opted for the acute sector problem since it was the area I was most familiar with. A brief document was produced stating the new aim, scope and time scale for the project. The focus of the project was on developing a computer-based strategic planning model for the acute services. The broad aims of the model to be developed were :

(1). To provide the resource implications of projec-

ted service targets.

(2). To provide analysis of target changes based on computed yearly targets.

(3). To examine and match changes in service patterns against resources.

The initial phase of developing the model was still in progress when the Government White Paper, "Working for Patients" (1989), was published. The White Paper, by changing the basic principles of the existing resource allocation and planning process, made the new task of this research project obsolete. I was confronted with the reality that action research "cannot be wholly planned and directed down a particular path" (Checkland, 1981, p.153). Faced with changes outside his control, the researcher's skill "lies in understanding and accepting the complexity of the situation and creatively devising ways of furthering the content whilst at the same time managing the process" (Tranfield and Smith, 1982, p.1). My initial reaction to the changes in the research situation was one of despair. In retrospect one could say that instead of despair each change presented an opportunity. For example the change of the project's client allowed me the opportunity to work with different managers and to experience the differences in their managerial style. I now know that in action research one must express the research aim as hopes and not as fixed objectives. This would prevent despair and a premature abandonment of a project because of the unexpected changes in the research aims. It would also ensure that changes in the research situation were accepted and per-

ceived as presenting opportunities instead of hindrances.

Having abandoned the development of the acute services model due to the changes introduced by the White Paper, it became necessary to define a new problem for this research. As discussed in Chapter One the problem defined and tackled by this research was the design and implementation of a computer-based MIS to assist managers in the implementation of the White Paper's new direction in resource planning and allocation. As stated in Chapter One the MIS is known as the ISRAS. Fortunately the project did not experience any change in aim or staff during the design and implementation of the ISRAS.

The above discussion indicated that this research experienced major changes in focus due to the changes in the client system. The changes in the practical problem led to changes in the theoretical aims of the thesis. We saw the changes as opportunity to conceptualise MIS. The theoretical aims of the thesis shifted from examining the theory of packaged systems implementation to the theory and nature of MIS development. The theoretical aims of this thesis were briefly stated in Chapter One and will be presented in greater detail in Chapter Three.

2.2. ONTOLOGY AND EPISTEMOLOGY

"The rationale for a particular research strategy is grounded in a network of implicit or explicit assumptions regarding ontology and human nature that define the researcher's view of the social world. These assumptions provide the foundations of research practice, inclining the researcher to see and interpret the world from one perspective rather that from another. By identifying the researcher's assumptions about human beings and the world in which they live, we can identify the basic paradigm that serves as a foundation of inquiry" (Morgan, 1983, p.21). This section shall discuss some of my assumptions about human nature which are then extended and used as my assumptions about the nature of organisations. The framework for analysis used in this research is based on my assumption about the nature of organisations. It also forms the basis of my concept of a MIS and the framework for MIS inquiry discussed and developed by this thesis.

The first part of this section will contain general statements about my ontological assumptions. The second part of the section discusses them in greater detail.

I believe there is a world in which visible and invisible things exist. By visible things one implies those things which humans are aware of through the traditional five senses of hearing, touch, sight, smell and taste. There is "no reason to suppose that the world [things] that are accessible to humans [through the traditional five

senses] is all the world there is" (Boulding, 1987, p.110). This discussion takes as invisible things those things which one is aware of not through the traditional five senses but perhaps through the "somewhat mysterious proprioceptive sense by which we are aware where our toes are in the space around us, even when we are not wiggling them" (Boulding, 1987, p.110).

I am one of the things that exist in the world. I have an outer self and an inner self (Churchman, 1974, p.461-463). I am aware that agreements or disagreements can exist within a single object (person) or between objects (persons). The disagreement that occurs within a single person is between his outer self and inner self. I know this because sometimes I agree or disagree with the Me (i.e. my inner self). As I was writing this paragraph Me was saying to I "are you sure that what you are saying is right". Fortunately on this occasion I replied yes and the Me agreed with I. On some issues they have disagreed. In everyday life I bump into people who disagree with each other and part ways. I find more fascinating the people who disagree among themselves on some issues and still stay together and work as a unit because of the few things that they agree on. This type of unit is what "in everyday language ... [is thought of as] social systems ... [i.e. the] groupings of people who are aware of and acknowledge their membership of the group [unit]. They accept various responsibilities as a result of their membership and have certain expectations of other members" (Checkland, 1981, p.119-120). The members function as a unit despite the

disagreement that might exist amongst them. For example the employees in an organisation may disagree with the management style or some of the policies of the organisation and still remain members of the organisation. In some cases it might be that the only thing in which there is agreement between the employee and the employer is the exchange of his (employee) labour for money. My knowledge about why and how some people come together and function as a unit because of the few things they agree on is very limited. It is possible that what I have said about agreement, inner self and people acting as a unit because of the few things that they agree on were all the product of my imagination. If they were the product of my imagination, can I modify my beliefs to gain better knowledge? I am particularly interested to gain knowledge about the functioning of a unit or people who act as one because of the few things that they agree on.

As a unit they might have problems which they do not possess the skill to solve. If I have the required skill I would like to offer it to them in return for some compensation. But I believe that the possession of the required skill for a particular task is a necessary but not a sufficient condition to be able to fix the unit's problem. Without adequate knowledge of the properties and the mode of functioning of the unit I would not be able to understand the unit's problem or to resolve it. I would not be interested to know about the properties of the unit or how it functions if such knowledge does not lead me into action. For me the usefulness of knowledge is in the action

it enables me to perform. This is a rather pragmatic view of knowledge. In the literature a group of people acting as a unit on the basis of the few things they agree on is called an organisation.

The fundamental epistemological questions for me are:
(1). What are the similarities between the nature and the mode of functioning of an individual as a unit and that of an organisation as a unit?
(2). Do these similarities improve my knowledge of organisations. If so what is the implications of this knowledge for MIS inquiry?
(3). What is the process of gaining this knowledge?

The remaining part of this section will discuss the first two questions. The third question will be discussed in the next section.

IMAGES OF MIS

The first two questions above indicate that metaphors are to be employed in this discussion. First, a particular image of the nature and mode of functioning of a person is put forward. This image is then used as a metaphor for understanding the nature of organisations. This image used for understanding organisations is them extended as a metaphor for understanding the nature of MIS.

The world exists in great variety (Boulding, 1987). Our experience and knowledge of certain phenomena are better than others. When faced with phenomenon "A" which

exhibits some similarities to phenomenon "B", and our knowledge of phenomenon "B" is better than that of "A" we may use our image of "B" to explain particular aspects of "A". For example, in my village a man may be referred to as a cat. It is very difficult to pick up a cat and drop it such that the back of the cat touches the floor. In a wrestling bout to drop your opponent such that his back touches the floor is a sign of victory for you. When a man is described as a cat attention is being drawn to the fact that he is a wresting champion (in the sense that just as it is difficult to get the back of a cat to the floor so it is difficult in a wrestling bout to get the man's back to the floor). In this example the image of a cat is being used to draw attention to the catlike aspect of the man. Metaphors provide us with insight or sometimes just the descriptive language that enable us to render an explanation of some aspects of a phenomenon. Morgan (1987, p.12) states that "the use of metaphors implies a way of thinking and a way of seeing that pervade how we understand our world generally". The use of metaphors to generate insight and guide research is evident in different areas of intellectual endeavour such as organisations (Morgan, 1987), systems (Atkinson and Checkland, 1988) and intelligence (Sternberg, 1990).

The use of metaphors to generate insights are not limited to entities of the same typology. That is, it is possible to use metaphors such as images of the inanimate to generate helpful insights about the animate and vice versa. As argued by Beer (1984, p.9) "every system can be

mapped unto any other system under some transformation; thus Ashby was wont to say that the Rock of Gibraltar makes a good model of the brain, if your interest is exclusively in spatio-temporal extensity". The Viable Systems Model (VSM) developed by Beer (1984) provides much insight and explanation about "how systems are viable - that is capable of independent existence". The VSM is an example of the use of images of the inanimate to understand the animate. It was developed by mapping the set-theoretical model of the brain unto a company.

Sternberg (1990) examined the theories of intelligence and ascribed the differences in the theories of intelligence to the differences in their underlying metaphors. Sternberg (1990, p.1-19) argued that "research in the field of human intelligence ... is guided by somewhat motley collection of ... metaphors ... [and] scientists are sometimes unaware of the exact nature of the metaphor underlying the research, and may even be unclear about the particular and limited questions that their metaphor generates". He noted that a key to understanding the strength and limitations of the theories of intelligence lies in identifying and appreciating the metaphors that underlie the theories.

This type of argument may be extended to the field of MIS. The different theories of MIS may be examined by reference to their underlying metaphors. In general, there are two dominant theories of MIS. The oldest and perhaps the most dominant of the two theories may be described as the technical perspective. The image of machines provide

the underlying metaphor for this perspective. The exponents of the machine metaphor concede primacy to the technical aspects of MIS. Within this perspective MIS is taken to be a rational technical system. The second theory of MIS may be described as the social perspective. The images of "organisations as organisms" (Morgan, 1987, p.39) provide the underlying metaphor for this perspective. The exponents of the social metaphor concede primacy to the social aspect of MIS. Within this perspective MIS is taken to be a social system. The technical and social perspectives of MIS are discussed in Chapter Three.

The technical and social perspectives have made important contributions that guide research and understanding of MIS. In Chapter Three it will be argued that the social perspective emerged as a reaction against the weakness of the technical perspective. This does not mean that the social perspective has provided all the answers to problems associated with MIS development. Morgan (1987, p.13) states that "one of the interesting aspects of metaphor rests in the fact that it always produces ... one sided insight. In highlighting certain interpretations it tends to force others into a background role". This implies that the social and technical perspectives will each provide only partial view and interpretation of MIS. The view they highlight are functions of the metaphors from which they derive.

MIS is a complex phenomenon that may be understood in many different ways. It is the conviction of this thesis that greater advances toward grasping the nature of MIS may

be achieved not by being locked into old metaphors but by finding new metaphors that provide new perspectives of MIS. Swanson's (1974) work which is discussed in Chapter three viewed MIS as a purposeful system. This to us provided a novel approach to understanding MIS. A major part of this thesis is devoted to enriching and extending the concept of MIS as a purposeful system. The work of Swanson is taken as a starting point. The rest of this section discusses the basic assumptions and some concepts that will be used in developing the concept of MIS as a purposeful system. The discussion will deal with the first two questions raised on p.45.

A PERSON AS A UNIT

Rescher (1990, p.11) states: "a person is ... a complex sort of being. In consequence of this circumstance, very different conceptions of personhood are in circulation". The study of the concept and nature of a person may be motivated for a variety of reasons. The aspects of the nature of a person which one studies depends on the purpose of the study. If one is interested in artificial intelligence or robotics then the study of the brain may provide useful insights. The study of the nervous system may provide helpful insights if one is interested in the theory of control and communication. The interest of this thesis about the notion of a person is to find out if certain characteristics of a person may provide a metaphor for

understanding MIS. Certain characteristics of a person are examined briefly.

Rescher (1990, p.7-10) defines a person as "a being who can function in certain characteristic ways and goes about doing certain sorts of things - who operate in the sphere of ideation, evaluation, and action". Rescher also argued that the "it does not lie in the concept of a person that one must have a body. To be sure, one must be able to act, but this agency could in theory be purely mental". Rescher accepted that in worlds such as ours persons have to be embodied. What this alludes to is the notion of inner and outer self. In this discussion the concept of inner self takes precedence over the outer self. The outer self, including observable behaviours, are taken to be expressions of the inner self.

This discussion takes the following attributes of a person identified by Saint Augustine (1961) as the characteristics of the inner self.

"There are three things, all found in man himself ... The three things are existence, knowledge, and will, for I can say that I am, I know, and I will. I am a being which knows and wills; I know both that I am and that I will; and I will both to be and to know. In these three - being, knowledge, and will - there is one inseparable life, one mind, one essence; and therefore, although they are distinct from one another the distinction does not separate them" (Saint Augustine, 1961, p.318).

From the above statements it is clear that existence, knowledge and will are the three sides of the same thing

and that none of the three is subordinate to the other. If the conduct of the will, being and knowledge are studied they may provide insight about the nature and the mode of functioning of the one essence which they are part of. Unfortunately the will, knowledge and being are not visible things that can be directly observed or studied. One approach that may be used to understand their conduct is to study the product of their conduct. Certain characteristics of a person may be seen or be traced to the conduct of the person's will, being and knowledge. My interest is in the characteristics that are relevant to the focus of this thesis. These characteristics are purpose, activity, history, identity, structure and culture. This discussion shall imply a link between these characteristics and the will, existence and knowledge. This is to show that these characteristics (purpose, activity, history, identity, structure and culture) are the product of their (will, existence and knowledge) conduct. By studying these characteristics it may be possible to get near to understanding the nature and the mode of functioning of a person. The characteristics are discussed briefly.

PURPOSE

Purpose is a goal or an end which can be pursued. An individual is a purposeful entity because of his ability to "change its [his] goals under constant conditions; it [he] selects ends as well as means and thus displays will" (Ackoff, 1971, p.666). Without the ability to display will an entity [person] may not be capable of selecting ends as well as means and cannot be described as a purposeful

entity. Rescher (1990, p.9) puts it this way: "personhood involves autonomy and self-direction. It means that a full and adequate explanation of what an agent [person] does ... requires reference to what this agent is and wants, values, prefers ... Free agents are beings for whom conscious wants and predictions - rather than mere insights and urges alone - provide determinants of action". The display of will also implies the doing of an action or activity by the purposeful entity. The activity or action of the purposeful entity is what "verbalises" the will of the purposeful entity and makes possible the attainment of a purpose. The above statements have indicated a link between purpose, activity and will. It is argued that activity and purpose are functions of the will.

IDENTITY

Identity is "always constructed by reference to others" (Cohen, 1975, p.95). It is the awareness that I exist and that I am different from the other individual that gives me a sense of identity. This implies that identity is a function of existence and knowledge. Identity makes possible the definition and perception of boundaries. Whatever is not perceived as part of an individual's identity exists in his environment or the outside of his identity. The delineation between what is perceived as the identity and the environment is the boundary.

HISTORY

The history of a person is also a function of existence and knowledge. History refers to "our knowing and the objective reality which our knowing knows" (Casserley,

1965, p.13). That is, it refers to the events located in the past as well as to our knowledge of the events. The history of a person begins from the moment he starts to exist. Many events occur during his life time but without his knowledge ability he would not be influenced or recognise them as part of his history.

CULTURE

Culture may be described as "the deeper level of basic assumptions and beliefs that are shared by members of an organisation ... these assumptions and beliefs are learned responses to a group's problems of survival in its external environment and its problems of internal integration" (Schein, 1988, p.6). This implies that culture is a function of knowledge since it stems from "learned responses" to problems. That is, it is a group's or person's knowledge ability that makes possible his possession of culture. Culture also plays a vital role in the exercise of the will. That is, the process of selecting ends as well as means is informed by the persons culture. For example a vegan would prefer soya milk to cow milk as a means of obtaining protein because of his belief that animal products should not be eaten by man.

STRUCTURE

Structures are not a characteristic of an individual. Structures are devices that facilitate the process of achieving or exercising the characteristics of an individual. They are things such as procedures, roles or equipment.

It was argued earlier that existence, knowledge and

will are three sides of the same thing. By arguing that activity and purpose are functions of the will; that identity and history are functions of existence and knowledge; and that culture is a function of knowledge my aim is to show that purpose, activity, history, identity and culture are linked to them (will, knowledge and existence), and may provide us with some indication about the conduct of the will, knowledge and existence. And if there is one inseparable essence or person in the will, being and knowledge then it may be possible to understand that essence or person by studying his culture, history, activity, purpose and identity.

My argument is that the nature and the mode of functioning of an individual as a unit may be understood by studying the conduct of his will, being and knowledge. The nature of the will, being and knowledge precludes the possibility that they can be understood by direct observation or study. By examining the product (history, culture, purpose, activity, identity) of their conduct we may come near to understanding the nature and mode of functioning of a person.

ORGANISATION AS A UNIT

Morgan (1987, p.321-339) asserted that "organisations are many things at once" and he argued that "any realistic approach to organisational analysis must start from the premise that organisations can be many things at one and

the same time". Morgan (1987) is in a sense proclaiming a new era of unbounded approach to organisational thinking and design. He is in effect saying: there is no reason to be locked into old and established metaphors when thinking about organisations - try alternative and new metaphors for they might provide better insights about organisations. The interest of this discussion is not in providing new metaphors for studying organisations per se. By using the above discussion about the nature of a person as a possible metaphor for understanding organisation, the main aim is to highlight the basic assumptions to be used in developing the concept of MIS as a purposeful system. The concept of MIS as a purposeful system is discussed in Chapters Three, Four and Five.

The discussion about the nature and mode of functioning of a person started by identifying three characteristics of the inner self: will, existence and knowledge. If these three characteristics are to be found in organisations then the approach for understanding them (will, existence and knowledge) within the context of a person may also be used in studying them within the context of organisations. The brief discussion that follows implies that will, existence and knowledge are attributes of an organisation.

An "organisation is a purposeful system that contains at least two purposeful elements" (Ackoff, 1971, p.669). According to Ackoff a purposeful system has a "will" and can display it. His assertion implies that an organisation has a will much like the will of a person.

Organisations are capable of learning (Argyris, 1977; Espejo, 1980). To be capable of learning a system must have the ability to modify its "behaviour (i.e., to display choice) and memory" (Ackoff, 1971, p.669). This implies that the organisation not only has a will but also has a knowledge ability.

Pettigrew (1979, p.570) states that an organisation "may profitably be explored as a continuing system with a past, present and future". This indicates that organisations do exist and experience growth.

The above statements identified three things that may be found in an organisation. The three things are the will, knowledge and existence. To use a metaphor that implies that organisations as entities possess will, existence and knowledge may seem to be stretching reason beyond limits. However, we already allude to such metaphors when we refer to organisations as rational entities (Argyris, 1965), open systems (Lawrence and Lorsch, 1967), learning systems (Argyris, 1977) and cognitive systems (Morgan, 1987).

An individual does not constitute an organisation. An organisation is made up of a "social collectivities of individuals and groups" (Moorhead, 1981, p.191). An organisation must contain at least two persons (Ackoff, 1971, p.699). Schein (1988, p.210) states that the process of creating a business organisation "will usually involve some version of the following steps:

1. A single person (founder) has an idea for a new enterprise.

2. The founder brings in one or more other people and creates a core group that share a common vision with the founder ...

3. The founding group begins to act in concert to create an organisation ...

4. Others are brought into the organisation, and a common history begins to be built".

One may argue that what has taken place in what Schein described above is the synthesis of a single individual's (founder) will, knowledge and being with that of the others to create a higher order or fusion of wills, beings and knowledge called organisation. The organisation that emerged becomes a unit with its own characteristics. The difference between an organisation and an individual in terms of the will, existence and knowledge is that at an individual level these three things may be described as elementary items while at an organisation level they can be viewed as group items. By this I mean that at the organisation level there is a synthesis of the three things (i.e. a fusion of wills, beings and knowledge). One may view an organisation as a unit that contains a synthesis of the will, being and knowledge.

Following the discussion about the functioning of a person it is argued that the conduct of the will, being and knowledge of an organisation has to be studied to understand the nature and the mode of functioning of an organisation. As in the case of a person they can not be directly observed but they may be understood by examining the product of their conduct. The product of their conduct consti-

tute certain characteristics (purpose, history, identity, activity and culture) of the organisation. This view of an organisation will form the basis for my concept of MIS presented in Chapters Three and Four.

2.3 THE RESEARCH STRATEGY

"Just as we select a tennis racquet rather than a golf club to play tennis because we have a prior conception as to what the game of tennis involves, so too in relation to the process of social research; we select or favour particular kinds of methodology because we have implicit or explicit conceptions as to what we are trying to do in our research" (Morgan, 1983, p.19).

The first part of this section will discuss my preconception as to what constitutes a MIS development process. The reason is that in the field of information systems a given terminology could mean quite a different thing to different people. I will clarify the sense in which some of the terminologies are employed in this thesis. This will be followed by a brief discussion of this research methodology.

In modern academic and information systems parlance the term implementation has acquired a meaning which I find obfuscating. The research to explore the reasons for MIS failures is "often discussed under the rubric of implementation research" (Land and Hirschheim, 1983, p.91). The use of the term implementation in the literature as a rubric for discussing MIS failures gives it a meaning that embraces the general process involved in introducing a MIS into an organisation. Historically the MIS practitioners use the term implementation to refer to a specific task in the series of tasks involved in the development of a MIS

(Davis, 1974; Wetherbe, 1984; Jayaratna, 1986). I will briefly discuss the various tasks involved in developing a MIS so as to clarify the meaning of implementation within the context of a MIS development:

There are broadly five stages or tasks involved in the development of a computer-based MIS. There are sub-stages within each of the stages but I will discuss only the main stages:

(1). Analysis.

This stage refers to all the tasks aimed at understanding the client system, the problems that the MIS is expected to alleviate, and making a recommendation to the client about the project's technical, economical and social feasibility.

(2). Logical design.

The output of this stage is a descriptive and diagrammatic specification of the notional MIS to be introduced in the organisation. This stage relies on the information obtained from the analysis stage. The client needs to review the output of this stage and can either terminate the project, request that the logical design be modified or approve the logical specification.

(3). Physical design.

This is a very technical stage in the MIS development process. It is the stage at which the output of the logical design phase is turned into actual computer software and files.

(4). Implementation.

In computer parlance this stage is known as "going

live". It is the phase at which the output of the physical design stage is put into real life operation. Depending on the strategy adopted by the organisation this stage could be a gradual or immediate change-over from the old to the new system.

(5). Evaluation.

This is the stage at which an assessment is made to determine if the objectives of the new system have been met. It also involves determining if the users are happy with the system and whether the system needs modification.

It is apparent from the five stages of a MIS development process that most of what is discussed in the implementation research literature are issues that fall within the domain of the evaluation stage of the MIS development cycle. Most of the implementation studies are conducted after the MIS had been developed (Ives and Olson, 1984). By concentrating on user attitude, acceptance, involvement and "surrogate" data on system quality the studies broadly seek to address the question of whether the users were happy with the MIS. If the users were not happy with the system or do not find it useful the studies would pronounce a verdict of implementation failure on the MIS. This type of assessment is traditionally handled at the evaluation stage of a MIS development cycle.

From a practitioner's perspective I would advocate that research aimed at assessing the quality and benefit of a MIS, and whether users are happy with the MIS should be discussed under the rubric of systems evaluation rather than implementation.

The use of the term implementation in this thesis is strictly in the sense discussed under the main stages of a MIS development process. This thesis is concerned with all the stages of a MIS development process and should be viewed as a systems development project. It is not implementation research in the sense of MIS assessment discussed earlier. Its concern with implementation is only in the sense that it is a stage in the MIS development process. The term MIS inquiry as used in this thesis refers to all the stages of a MIS development process.

THE RESEARCH METHODOLOGY

Gill and Johnson (1991, p.146) identified four research strategies available to management researchers. The strategies and their concerns are : the analytical survey and experimental design (concerned with precision), action research (concerned with utilisation), descriptive survey research design (concerned with generality) and ethnography (concerned with character of context). Of the four research strategies they identified this research fits into the action research strategy because of its context (naturally occurring condition) and purpose (to generate theory through tackling a real life problem). Action research "aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually accepted ethical framework" (Rapoport, 1970, p.499). This statement indicates that there are two major

problems confronting an action researcher. The problems are the practical concerns of the people in the research situation, and the theoretical concern of the researcher. The nature of the two problems and the research situation would no doubt have a major influence on the design and conduct of the research process.

The initial stages of this research concentrated on the examination of the literature on information systems, organisations and systems theory. It was clear from the MIS research literature that one should decide or develop an appropriate research methodology before embarking on MIS research (Ives and Olson, 1984; Franz and Robey, 1987). My initial attempt at developing a research methodology met with difficulty because I had relied mostly on the research techniques I found in the MIS literature. There are two basic reasons for my difficulty in developing a methodology based on the trends in the MIS literature. Most of the research presented in the literature have different purposes from this research. The role of the researchers also differed from my role in this research. First, I examine these differences in purpose and role. Most research on MIS is either concerned with the general factors affecting the introduction of a MIS in an organisation or the application of a particular methodology to determine information requirements of managers. The research on the general factors affecting the successful introduction of a MIS in organisations concentrate on issues such as organisational politics, designer-user interactions, social change processes, quality of the information system model, and MIS usage

(Swanson, 1974; Lucas, 1978a, 1978b; Bailey and Pearson, 1983; Ives and Olson, 1984; Kwon and Zmud, 1987). Among these type of researchers the most common practice "is to conduct a cross-sectional survey at a single point in time" (Franz and Robey, 1987, p.206). Most of these studies are "based on survey data collected after system development has been completed" (Ives and Olson, 1984, p.600). As researchers they do not take on the role of actually designing the MIS so as to use their activities as designers as a means of generating or testing theories. Because their research role does not entail the actual design of the MIS they usually proceed with the review of the relevant literature and employ the interview or questionnaire approach for collecting the research data. The research data are then subjected to some statistical analysis to generate the research results. One may refer to this class of researchers as the factors researchers.

The second group of researchers i.e., those concerned with the determination of managers' information requirements and, perhaps the actual design of the MIS adopt a very different approach to those researchers mentioned above. These researchers are less common than that of the factors researchers. They are often concerned with the application of theories whose original aim were not specifically for MIS development. For example Espejo (1980) demonstrated the application of cybernetic theory in determining managers' information requirements. Miles (1987) demonstrated the application of the soft systems methodology and the cybernetic concepts in the development of MIS.

These researchers are often concerned with the actual MIS development rather than simply assessing the factors that influence MIS success. Because they are concerned with the actual specification of managers' information requirements and the MIS design, their research practice does not follow those of the factors researchers. They do not employ the survey and statistical analysis of data as their main research method. The nature of the MIS and the actual process of its development often form their research design. I will call this class of researchers the application researchers. My research aim and role is closer to this group of researchers than to that of the factors researchers. The main difference is that while most of them are theoretically concerned with demonstrating the applicability of a given theory or deriving a methodology for MIS inquiry, I am concerned with developing new concepts and relationships among MIS variables in the form of a unifying framework to guide researchers responsible for developing MIS methodologies and to help practitioners translate theory into practice. I will elaborate on this statement in Chapter Three.

I had perceived a research methodology to be a thing that must be distinct from the problem which the research is to address. This was based on my understanding of the research design of the MIS factors researchers. What I did not realise was that a research methodology should not necessarily be distinct from the problem of a research project but could itself be the very subject of inquiry. By this I mean that I did not realise, that in action research

the "researcher's intervention ... is an intrinsic part of the research design" (Gill and Johnson, 1991 ,p.57). The difficulty about developing a research methodology for this research was resolved when I realised that the MIS framework which this research sought to develop and the actual MIS design process constitutes my research design. The process of developing and assessing the usefulness of the framework could not be achieved purely by a process of interviews, questionnaires and statistical analysis of data as used by the MIS factors researchers. The framework was a model made up of four stages to guide MIS inquiry. The nature of the tasks involved in a given stage of the model determines the nature of the data to be collected and the strategy for its collection. The framework not only serves as my research design but its development also forms part of the theoretical problem addressed by this research.

It follows from this discussion that one could not discuss this research methodology without discussing the MIS framework developed by this research. The MIS framework is discussed in Chapter Four. A detailed discussion of the research methodology will be undertaken while discussing the MIS framework in Chapter Four. The remaining part of this section will discuss this research methodology in very broad terms.

PROBLEM DEFINITION

The practical problem addressed by this research originated from the client while the theoretical problem was initiated by me. The nature of the theoretical problem

was determined by the nature of the practical problem. The theoretical problem was also influenced by the data from the literature review and my past experience in MIS inquiry. Defining the theoretical problem was made more difficult by the fact that it must reflect or be derived from the practical problem. In section 2.1 it was stated that the initial practical problem as defined by the client was the implementation of a packaged system (IRAP). It was mentioned earlier that there are five stages in the development of a computer-based MIS. The task of introducing IRAP in the NWRHA required that the only activities to be performed were the activities of the last two stages of a MIS development process. The two stages are the implementation and evaluation tasks. Based on these two tasks I conceived a theoretical problem which was about the derivation of a model to carry out these two tasks and to test how successfully they have been achieved.

As discussed in section 2.1 the organisation abandoned the idea of using the IRAP and replaced it with a different practical problem. Unlike the IRAP case the new practical problem required that all the five stages of a MIS development process be performed. This meant that I had to define a new theoretical problem that would reflect all the five stages of a MIS. I had to rely again on the nature of the new practical problem, the literature and my past experience in MIS inquiry in defining a new theoretical problem. My first step in defining the theoretical problem was to pose the question: what is a MIS. To answer this question I turned to the literature on MIS and organisations. I com-

bined the data from the literature with my ontological view about an organisation to arrive at a personal definition of a MIS. The meaning of a MIS as given in the literature, my conceptualisation of a MIS and the reasoning that gave rise to this conceptualisation is contained in Chapter Three.

Having defined a MIS the next question was whether an ideal MIS inquiry framework could be developed to guide the process of developing MIS.

PRACTICE AND THEORY

In the type of MIS research identified earlier as the factors research it is entirely possible for the researcher to plan and retain control of the duration of the research project. The researcher could also structure the exact sequence of the research process and the sources of data at each stage. This type of structured control is not possible in the type of research that this thesis is concerned with. The duration of this project is determined by the time it takes to resolve the practical problem i.e. the design and introduction of the MIS in the organisation.

This thesis relied on three main sources for its data. The sources are: (1) the intervention or the MIS development process. (2) semi-structured interviews, meetings and informal staff gatherings. (3) the archived records and unpublished correspondence within the organisation.

The development of a computer-based MIS is a very demanding and time consuming task. My role as the main designer created a "goal dilemma" (Rapoport, 1970, p.505-507) for me. It was difficult to analyse and reflect on the

research data during normal working hours. The client preferred that the practical aspect of this research should take precedence over the theoretical aspect because of the urgency to solve the practical problem. The problem was made more difficult by the fact that I am a staff member of the organisation. As a member of the organisation I am expected to work towards achieving the goals of the Strategic Planning Section. Devoting more attention to the practical problem meant giving less attention to the theoretical aim of the research. The client acknowledged this problem and offered to provide the resources for typing this thesis. He also said that once the MIS was fully operational I should devote as much time as was necessary on the theoretical aspects of this research. My approach to resolving this dilemma was to spend extra hours at night and during the weekends on the theoretical issues of this thesis.

Having developed the MIS and with the users happy with the MIS outputs, I was allowed to spend most of my normal working hours on this thesis. The research methodology will be discussed in more detail in Chapter Four. In Chapter Six the criticism voiced against action research and the validity of this research outcomes are discussed.

CONCLUSION

This Chapter started with a discussion on the history of this project. It highlighted the problems faced by the action researcher when the research depends on a powerful manager and the organisation remaining unchanged throughout

the period of the research. The Chapter stated that this research experienced major changes in focus and process due to the changes in the client system. These changes were outside my control. By viewing the changes as presenting opportunities rather than hindrances and maintaining a flexible research design this research was able to continue despite the many obstacles that faced it.

The Chapter discussed my assumptions about human nature which were then extended and used as my assumptions about the nature of an organisation. It was argued that there are similarities between the nature and the mode of functioning of a person as a unit and that of an organisation as a unit. They both contain three things namely: the will, existence and knowledge. At an individual level these three things are viewed in terms of elementary items while at the organisation level there is a synthesis or fusion of the three. It was argued that the conduct of the will, existence and knowledge has to be studied to understand the nature and the mode of functioning of an organisation. As in the case of a person these three things can not be directly observed but they can be understood by examining the product of their conduct. The product of their conduct constitute certain characteristics (purpose, history, identity, activity and culture) of an organisation. The Chapter viewed an organisation as a unit that contains a synthesis of the will, existence and knowledge. This view of an organisation will form the basis of my concept of a MIS and the framework for a MIS inquiry discussed and developed by this thesis.

The Chapter ended with a broad discussion of the research strategy. It argued that the research strategy adopted by MIS researchers is determined by the purpose of the research and the role of the researcher in the MIS design process. It was argued that in most MIS research the researchers were not the actual designers of the MIS. In such cases the researcher relies more on the interview, survey and statistical analysis of data as the major part of the research design. In the less common type of MIS research the researchers take on the role of designing some or all the aspects of the MIS. These type of researchers employ a different research design from those researchers that do not take on the role of actually designing the MIS. The MIS design process or the researcher's intervention is an intrinsic part of the research design. My role in this research is that of the MIS designer. The MIS design process generated this research data. It was argued that the MIS inquiry framework developed by this research is both the research design and part of the theoretical problem addressed by this research. A detailed discussion on this research methodology is contained in the discussion of the MIS framework in Chapter Four. The validity of this research outcomes and the criticism voiced against action research are contained in the discussion in Chapter Six.

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CHAPTER THREE

3. MIS AS A PURPOSEFUL SYSTEM

There is apparent confusion and debate in the literature about the meaning of MIS and the perspective from which to proceed in MIS development. Section 3.1 examines the relevant MIS literature to highlight the debate, nature and conflicting views about MIS. The debate about the nature of MIS and an appropriate strategy for its development is broadly between the advocates of the social and technical systems perspectives of MIS. The origin and arguments of both perspectives are examined in this section. The theoretical problems addressed by this thesis are also defined in this section. Section 3.2 proposes a new definition of MIS. This new concept of MIS derives from and extends the work of Ackoff (1971) and Swanson (1974). The section identifies the characteristics of the MIS which accommodates the arguments of both the social and technical systems perspectives of MIS.

3.1 THE NATURE OF MIS

I was once asked to give a short presentation about this project at a seminar organised by the Financial Planning, Monitoring and Allocations department. I started the presentation with a discussion on the meaning of MIS. The

discussion on the traditional view of MIS as a computer system concerned with the day to day processing of data to produce information for the running of an organisation was received without any dissenting view, but as soon as I moved from the traditional view of MIS to a broader perspective of MIS there were sharp protests and disagreement from almost everyone at the seminar. They argued that my view of what constitutes a MIS contradicted what they knew MIS to be. They rejected the idea of things like the culture and history of an organisation being taken as part of the characteristics of MIS. Most of those present were accountants and had either been taught at University or read from published materials a concept of MIS that was quite different from what I was proposing. I found their reaction interesting. This reaction is not limited to accountants but typifies the controversy in the MIS literature about the nature of MIS (Dearden, 1972; Davis, 1974; Long and Long 1990).

Long and Long (1990, p.287) asserted that "if you were to ask any five executives or computer professionals to define a Management Information System, ... the only agreement you would find in their responses is that there is no agreement on its definition". Wetherbe (1984, p.62) states that "MIS is a somewhat overwhelming concept". He argued that MIS is a complex entity and to appreciate it one must have considerable "organisational and information systems knowledge and experience". Dearden (1972, p.90) argued that "MIS is a mirage". He asserted that "a company that pursues an MIS embarks on a wild-goose chase, a search

for a will-o-the-wisp ... It is difficult even to describe the MIS in a satisfactory way, because this conceptual entity is embedded in a mish-mash of fuzzy thinking and incomprehensible jargon". Dearden perceived an MIS as a single super-computer system capable of dealing with all the information needs of an organisation. He argued that to design such a system would require the knowledge of all the various activities of an organisation. Based on the notion that no individual could possess such a vast knowledge about an organisation so as to be able to design the firm's MIS he submitted that the concept of MIS was a dream that could never be realised. Davis (1974, p.3) states that "there is no agreement on the term Management Information System". Clarke and Finlay (1989, p.89) argued that the "terms Management Information Systems ... and Decision Support Systems ... are used without adequate definitions, sometimes confusedly". Surprisingly they did not perceive MIS as a single entity or a given type of system but as a general term for different types and levels of information systems. Mason and Mitroff (1973, p.475) state that the "concept of Management Information Systems ... has suffered accordingly, not because we have not analysed the components of the definition of information at all, but because we have not analysed them in sufficient and reflective enough detail". The lack of agreement about the nature of MIS has fostered confusion and conflicting perspectives from which to proceed in MIS development. The remaining part of this section will examine the meaning of MIS and the various perspectives that are used for the study and

development of MIS.

Tranfield (1983, p.83) states that "Management Information System is a generic subject culling from a wide variety of disciplines the ideas, concepts and techniques necessary for the development of human activity systems. It is a subject which straddles disparate disciplines, such as management science and organisational behaviour". Tranfield's argument broadly agrees with the findings of research conducted by Culnan and Swanson (1986, p.289). Their research was aimed at assessing the emergence of MIS as an academic field or standalone discipline. They identified computer science, management science and organisational science as the "foundational field of study from which MIS has emerged as a standalone discipline". According to Culnan and Swanson (1986, p.289-290) computer science has as its primary concern the study of "data, hardware and software"; management science focuses on "problems, models and solvers"; while organisation science has as its focus the study of the "individuals, organisations and institutions". Each of these MIS foundational disciplines is naturally sympathetic to one primary philosophy that defines its "modus operandi". No small debate, confusion and problems arise when the different disciplines with their conflicting philosophies are merged into one in an attempt to create a single discipline. Organisational science brought into MIS practice the social systems perspective. Management science brought into MIS practice "the systemic approach to problem solving, use of models, management science techniques, and computer-based solution algorithms"

(Davis, 1974, p.11). Computer science brought into MIS practice the hardware and software tools. Computer science and management science are more concerned with the technical perspective of MIS and for the purpose of this discussion I will collapse both into a single label i.e. the technical systems perspective. The debate about the nature of MIS is broadly between the advocates of the social systems perspective and the technical systems perspective. First, the technical systems perspective is examined.

THE TECHNICAL SYSTEMS PERSPECTIVE

Almost any organisation performs certain activity. The activity might be keeping records of members, purchasing materials, maintaining contact with members and those outside the organisation, selling goods or planning and controlling the way members perform their duties. Although the type of activity found in one organisation may be different from the other organisations, the activities nevertheless have certain features in common. These features may include:

"the need to maintain accurate records or files.

the need to sort, merge and tabulate the records.

the need to carry out basic calculations

the routine and repetitious nature of the manipulation performed on the record" (Bingham, 1989, p.3).

Some of these features may differ in importance depending on the type of organisation and the activity

performed. In some cases the volume and type of activity may demand tedious manual work and many man hours. The cost and tedious manual work involved in certain tasks make machines ideal tools for performing them. One of the earliest use of machines to perform a tedious data processing task was during the 1890 United States census.

In 1890 the task of collating census returns for a population of sixty three million was a tedious and major undertaking. The previous census (1880) report took about seven years to complete and there was concern that the processing of the 1890 census might not be completed before the 1900 census got under way. "It was therefore suggested by a certain Hermann Hollerith that part of the task should be undertaken by the machinery. Hollerith's idea was that the data collected by the census takers should be coded in the form of holes in pieces of plastic board" (Emery, 1979, p.1). The type of information represented by a given hole depends on its pattern and position on the card. The absence of a hole on a particular position also indicated certain information. For example a particular pattern of hole in a given position may represent a female citizen while its absence indicated that the citizen was a male. The holes were sensed electrically and totals of the various patterns of holes were accumulated using mechanical counters. With the help of Hollerith's machines the 1890 census was completed in less than three years.

By "the next census, which was in 1900, Hollerith made a number of improvements to his machine ... After the 1900 census it was estimated that Hollerith's machines had

done in one year and seven months what a hundred clerks would have taken seven years and eleven months to do" (Emery, 1979, p.1). Hollerith's machine was converted to business use and in 1896 Hollerith founded a company "to make and sell his invention. Later, this firm merged with others to form what is now known as International Business Machine Corporation (IBM) [today IBM is the largest computer firm in the world]" (Sanders, 1979, p.20). Hollerith's punch card machine was one of the two developments that led to today's commercial computers. The other development was the work of "Charles Babbage, Lucasian Professor of Mathematics at Cambridge University" (Sanders, 1979, p.25).

Babbage started the development of two machines known as Difference Engine and Analytical Engine. Although neither of the machines were completed at the time of his death, nevertheless his Analytical Engine "was the true precursor of the modern digital computer" (Emery, 1979, p.3). The first electromechanical digital computer known as Mark 1 was built in 1944 and was seen as the realisation of Babbage's dream. The Mark 1 was developed by Howard Aiken with the support of IBM at Harvard University. The MARK 1's "internal operations were controlled automatically with electromagnetic relays; arithmetic counters were mechanical. The MARK 1 was thus not an electronic computer but was rather an electromechanical one" (Sanders, 1979, p.25).

The first electronic computer known as the Electronic Numerical Integrator and Calculator (ENIAC) was developed in 1946 by John Mauchly and Presper Eckert at the University of Pennsylvania. "However, the ENIAC was not a stored

program computer ... Its processing was controlled externally by switches and control panels that had to be changed for each new series of computation" (O'Brien, 1979, p.30). If the ENIAC was a "stored program" computer its instructions would be stored internally and executed without any manual or external intervention. The program is a set of instructions that define and specify the set and sequence of actions to be performed by the computer.

In 1949 the first stored program electronic computer known as the Electronic Delayed Storage Automatic Computer (EDSAC) was developed at Cambridge University.

In "1954 the first computer was installed for a business application: processing of payroll" (Davis, 1974, p.3). Today there are millions of computers in operation in various organisations. The task of payroll processing which in 1954 was a major achievement and a complex process for a computer is now considered a routine process. Today business computers are used by organisations to deal with operations ranging from the routine payroll processing to organisational control and strategic planning tasks.

In the days when the use of a computer in a business organisation was considered a novelty, it was feasible for a single individual to act as a computer specialist possessing all the skill necessary for applying computers to business problems. The computer specialist "analysed problems to be solved by the computer. [He] transformed these problems into a language that machine [computer] could understand ... [He] operated the machines and often main-

tained them" (Friedman and Cornford, 1989, p.38). These individuals (computer specialists) known as the systems analysts were specialists in "computing, not business" (Senn, 1984, p.8). The problems they faced in organisation were "predominantly technical" (Banbury, 1987, p.79). As computer technology became increasingly complex and powerful and the tasks to which computers were applied became sophisticated, it was "no longer feasible for one systems analyst to understand the fine points of the technology and the nuances of the application at the same time" (Sprague and McNurlin, 1986, p.7). There was a need for specialisation of the computer related tasks. The specialisation grouped computer jobs into "three broad categories: operations, programming and systems analysis" (McLeod, 1979, p.408). There is further specialisation and the creation of new roles within each category. The further specialisation and the new roles are discussed in Davis, (1974) and Wetherbe, (1984). For the purpose of this discussion we examine the three broad categories only briefly:

OPERATIONS

The task of the operations staff are routine in nature. The work that they carried out have "little conceptual content. Not only are their tasks spelled out in considerable detail, but the timing of their work is largely paced by the hardware" (Friedman and Cornford, 1989, p.39). They essentially operate or run the various jobs on the computer, distribute its output to the users and maintain con-

trol of the computer equipment and files.

PROGRAMMING

This group of staff known as programmers are essentially "language translators". They learn one or more computer languages and are able to translate human readable instructions into computer readable instructions or language. Traditionally they receive the instructions to be translated into computer language from the systems analyst. The output of the translation process is known as the computer program. The computer programs are given to the operations staff to run as jobs on the computer.

SYSTEMS ANALYSIS

This group of staff known as systems analysts liaise between the organisation (users) and the computer programmers. The analyst is essentially concerned with understanding the problems or requirements of the users and specifying these requirements into a form which the programmer can understand. In specifying user requirements to the programmer the analyst is guided by his knowledge of the limitations and capabilities of the computer. In general "it is the responsibility of the systems analyst to define the approach to a computer solution of a problem" (McLeod, 1979, p.409). In some organisations the task of analysis and programming is performed by the same individual.

There is one thing that the computer operator, programmer and systems analyst have in common: they are in a profession that derived its existence from computer techno-

logy. The computer is seen as central to their profession. They (computer operator, programmer, systems analyst) constitute the personnel in an organisation's information systems department (Wetherbe, 1984, p.93). The above statements lead to the following propositions:

(1) The information systems department exists because of their (computer operator, programmer, systems analyst) profession;

(2) Their profession exists because of computer technology;

(3) Computers are therefore central to the creation and the function of the information systems department.

If computers are seen to play a major role in the function of the information systems department, and the department's main function is the creation of an organisation's MIS then it is natural to perceive computers as very crucial elements in the creation of MIS.

Following this line of argument an MIS is essentially a computer-based system. This perspective of MIS as a computer-based or technical system has traditionally enjoyed strong support in the literature. Mader and Hagin (1974, p.345) state that "the term [MIS] implies a formalised computer-based capability for generating information useful in managing the organisation's major functions". McLeod (1979, p.16) states: "while much written about MIS implies the use of computers, nothing makes it an absolute requirement. A firm need not have a computer to have an MIS". Despite this view about MIS, McLeod's (1979) discussion assumed a computerised MIS. McLeod supports his pre-

ference for a computer-based MIS with the following argument: "the computerised MIS offers the best description of how a formal information system functions. Also the computerised version is the type that represents real career opportunities". This implies that for the MIS practitioner or those wishing to make a career in MIS discipline the concept of a MIS without computer should be discarded as it does not offer any career prospect. Long and Long (1990, p.280-287) argued that the "term information system is a generic reference to a computer-based system that provides the following:

[a] Data processing capabilities for a department, or, perhaps, an entire company.

[b] Information that people need to make better, more informed decisions". Long and Long (1990) identified four type of information systems: MIS, expert systems, decision support systems and data processing system. Long and Long's (1990, p.287) definition of information systems implies that all the four types of information systems (MIS, expert systems, decision support systems and data processing systems) are computer-based systems. They defined MIS as "an integrated structure of data bases and information flow that optimises the collection, transfers and presentation of information throughout a multilevel organisation". Davis (1974, p.5) argued that "one can conceptually discuss management information systems without computers, but it is the power of the computer which makes MIS possible. The question is not whether a computer shall be used in management information systems, but the extent to which various

processes should be computerised". Davis defined MIS as "an integrated, man/machine system providing information to support the operations, management, and decision-making function in an organisation. The system utilises computer hardware, software ... and a data base".

The above discussion indicates that computer technology occupies a central position within the technical systems tradition. The belief that "it is the power of the computer which makes MIS possible" has a major influence and legitimates the "modus operandi" of those MIS practitioners who adopt the technical systems perspective. One must add that the technical systems tradition acknowledges the behavioural and organisational dimension of MIS but gives primacy to the technical dimension of MIS. For the advocates of the technical systems perspective the emphasis is on how to fit the behavioural dimension into the technical system and not the computer system into the social system. The next part of this discussion will examine the social systems perspective of MIS.

THE SOCIAL SYSTEMS PERSPECTIVE

The earlier discussion indicated that the fostering of MIS as a technical system can be traced to the history of computer technology and the profession that developed from the use of computers in organisations. Unlike the technical systems tradition, the social systems perspective of MIS can not be traced to any particular profession and did not develop from actual MIS practice. The fostering of

MIS as a social system was mainly a protest and a form of reaction by its proponents against the advocates of the technical view of MIS. Argyris (1977, p.113) states: "in a recent review of the literature on MIS implementation, I found the major theme to be unmet expectations and disappointments, especially when MIS technology was used to deal with the more complex and ill-structured problems faced by organisations". The unmet expectations and disappointments led to a "considerable amount of research ... [being] undertaken to explore the reasons for the failure" (Land and Hirschheim, 1983, p.91). The research produced various explanations for MIS failure (Dickson and Simmons, 1970; Swanson, 1974; Argyris, 1977; Lucas, 1978a and 1978b; Bailey and Pearson, 1983; Ives and Olson, 1984). The research on MIS implementation brought to prominence the motivation, job satisfaction, and psychological needs of users as areas of particular concern and importance in MIS design. The research findings were essentially saying that MIS has a human and behavioural dimension which the advocates of MIS as a technical system have either neglected or do not possess the skill to handle during MIS design.

The recognition of the human and behavioural side of MIS was an important and a big step forward. From the eighties the advocates of the human side of MIS determined that it was time to give primacy to the social dimension of MIS rather than to the technical dimension. Their argument is best summed up in Land and Hirschheim (1983, p.91). They state that: "although the recognition that information systems have behavioural and social aspects was a big step

forward, it is our contention that this will not be good enough in the future. Information systems are not technical systems which have behavioural and social consequences, rather they are social systems which rely to an increasing extent on information technology for their function. Nevertheless, the technology is never more than a component of the information system. Hence, the emphasis on social systems is of paramount importance".

The advocates of MIS as a social system essentially want the MIS design process to recognise and give greater emphasis to the culture of the organisation, user involvement in the design process, explicit recognition of the users' needs and the organisational context into which the MIS is to be embedded. The next part of this discussion will examine the implications of the arguments of the advocates of the social systems against those of the technical systems perspectives for MIS practice.

THE SOCIAL PERSPECTIVE VS. THE TECHNICAL PERSPECTIVE

The view that MIS has a behavioural dimension is acknowledged by both the advocates of the social and technical systems perspectives. In the discussion on the technical perspective of MIS the definition of MIS by Davis (1974) was stated. The definition no doubt gives prominence to computer technology. Despite the prominence given to computer technology Davis (1974, p.19) acknowledges that "an understanding ... [of] human behaviour ... is as important

as knowledge of [computer] programming" in the design of MIS. The question is not whether social issues are important factors in MIS design but how and to what extent they are to be accommodated in MIS design. The technical perspective of MIS offers to the MIS specialist an operational definition of MIS and a framework for action. This operational definition of MIS and the framework for its development has in no way been fundamentally modified by the recognition that MIS has a human side. What has taken place is that instead of radically redefining the conventional definition of MIS and the framework for its development, the technical perspective has sought to simply accommodate the behavioural issues within the conventional definition and MIS design framework. They (technical perspective advocates) essentially still perceive MIS as "technical systems which have behavioural and social implication" (Land and Hirschheim, 1983, p.91). This view of MIS is still prevalent in much of the MIS practice today. It is suggested that a major reason for this is that despite the vast amount of literature advocating the social systems view of MIS, the proponents of the social systems view have not yet proposed an operational definition of MIS and a detailed framework that can guide MIS practice. To argue that MIS is a social system is not in itself a sufficient guide to MIS practice. One must ask what exactly are the components of a social system within the context of MIS definition and practice. If one accepts that issues such as the culture of an organisation are elements of the social system that must be acknowledged in MIS design, then the

next question is how do we operationalise culture and how does a practitioner explicitly recognise and accommodate culture in MIS practice.

In a "conventional information systems development methodology analysts are expected to follow a particular structure for all cases. This structure is well-defined and the techniques and tools within it are also well-defined" (Avison and Wood-Harper, 1991, p.109). The technical systems perspective, (unlike the social systems perspective), despite its limitations offers the MIS practitioner a realistic and pragmatic base for action. Given the emphasis on action and the pragmatic nature of MIS development one can concur with Banbury's (1987) argument that as an agent of change the MIS designer needs a realistic and not an idealistic philosophy to guide and legitimate his action. Banbury (1987, p.86) states: "the analyst's philosophy needs to contain two components:

(a) a set of soundly based beliefs about the nature of those aspects of reality which are significant in the conduct of systems's analysis; and

(b) a set of soundly based and defensible beliefs about such matters as: the purpose of systems analysis; ... and the way in which his role should be enacted"

The emphasis on technical systems will continue to be of paramount importance in real-life MIS practice unless the proponents of the social systems view can offer to the practitioner a pragmatic philosophical base and a design framework that provides an adequate structure for action. Successful MIS design can not be achieved without giving

adequate importance to all the relevant variables and phases of the MIS development process. Henson and Hughes (1991, p.36) have argued that in MIS design the "discoveries of previously unknown constraints can affect the product of any phase throughout the model. Therefore, one phase cannot be completely extracted as an independent task from the systems life cycle". Henson and Hughes were concerned about the lack of foresight, iterative activities and a framework for evaluation of development problems in the conventional approach to systems development. Their argument can be extended to the relationship between the social and technical components of MIS. The inadequate handling of the MIS technical components will result in MIS failure even if the social dimension has been effectively handled. Producing an elegant technical system will also not bring about MIS success if the social components are poorly handled. My argument is that the debate as to whether the social or technical dimension of MIS is of paramount importance in MIS design is retrogressive, and fails to appreciate the systemic nature of the MIS as an entity.

There are over three hundred methodologies that have been developed for systems development (Fitzgerald, 1990, p.7). This thesis will not add another methodology to the ever growing number of MIS methodologies. Rather the theoretical aims of this thesis are:

1. To derive a conceptualisation of MIS that will accommodate both the social and technical systems perspectives. The MIS definition supports and extends the work of Ackoff (1971), Swanson (1974), Mumford (1983a) and Banbury (1987)

and provides a new perspective of MIS.

2. To identity a unifying MIS framework that can be applied in the development of MISs as defined in 1 above.

3. To provide concepts for identifying relationships among MIS variables in the form of a framework to guide researchers responsible for developing MIS methodologies and to help practitioners translate theory into practice.

4. To provide an alternative concept for assessing MIS success.

As discussed in Chapter One the case examined by this thesis in addressing the above theoretical aims is the design of a MIS known as the ISRAS. The research work comprises the following activities:

(a) Understanding and conceptualising the organisation of NWRHA, with particular reference to the Finance Division.

(b) Understanding the scope, nature and use of the MIS to be designed.

(c) Establishing criteria for its successful implementation.

(d) Detailed development of a methodological framework for the design and implementation of the MIS computer model.

(e) The actual design and implementation of the MIS computer model. The design and implementation framework being modified when appropriate at this stage.

By addressing the stated theoretical aims through the above activities this PhD will contribute to the ongoing debate about the nature of MIS and to the theory of MIS

development. It will also be a further development of the concept of MIS as a purposeful system.

The next section will focus on deriving a new definition for MIS based on the work of Ackoff, Swanson and my ontological view about the nature of organisation discussed in Chapter Two (p.42-58).

3.2 MIS AS A PURPOSEFUL SYSTEM

It was stated in p.60 that a considerable amount of research has been undertaken to explore the reasons for MIS failure. For example Swanson (1974, p.178) argued that "failures in the implementation of Management Information Systems ... can be attributed in part to a lack of managerial involvement [in MIS design] and appreciation [of MIS]". Swanson wanted to assess whether MIS failures can be explained in part by lack of managers' involvement and appreciation of MIS.

Swanson's (1974) research was based on data collected after the design and implementation of the MIS. The MIS known as Activity Reporting Information System (ARIS) was an internally developed system. The "ARIS system gathers data on the planned and actual work activity of the Group [department] members, and makes it available to management on a need to know basis" (Swanson, 1974, p.180). This implies that ARIS is a file interrogation MIS i.e. it stores large volume of data which managers can then have access to as and when required.

Swanson (1974, p.179) perceived MIS as a purposeful system. He states "both a manager and an MIS are regarded to be purposeful systems, i.e. systems which display will through the selection of ends as well as means". Swanson also presented conceptual definitions of MIS involvement and appreciation. The concept of involvement was defined in terms of purposeful activities thus:

"1. A manager and an MIS are cooperatively involved to the extent that the activities of each facilitates (rather than frustrates) the attainment of the ends of the other.
2. The inquiry involvement of a manager consists of his cooperative involvement with the MIS inquiry process.
3. The a priori involvement of a manager consists of his cooperative involvement with MIS design, implementation, and operation processes".

The above concept of involvement implies that a manager and MIS are two separate entities with different ends and activities. And through mutual interaction both will benefit from each other.

Swanson (1974, p.179) defined the concept of appreciation in terms of the managers cognitive state. He states: "The MIS appreciation of a manager consists of his manifold beliefs about the relative value of the MIS as a means of inquiry ... if a manager believes his MIS reports to be timely, informative, easy to understand, and so forth, we might say that he appreciated the system's reports".

Swanson used the above concepts of involvement and appreciation to postulate and test three hypothesis. According to Swanson (1974, p.179) "the result of the [hypothesis] tests indicate that managers who involve themselves with the MIS will appreciate the system, and that managers who are uninvolved will be unappreciative. Neither manager nor researcher is likely to find this too surprising. What should be of interest, however, is the research methodology. For the approach described here can be gener-

ally applied to measuring the acceptance of MISs by their users". Swanson's (1974) research fits what we described in Chapter Two (p.61) as MIS assessment or evaluation research. As stated in Chapter Two this thesis is not about MIS evaluation and has to be approached using research strategy different from those employed in evaluation research. The main interest of this thesis in Swanson's (1974) work is in his concept of MIS i.e. his concept of MIS as a purposeful system.

Swanson (1974) derived the concept of purposeful system from the work of Ackoff (1971). Ackoff (1971, p.666) states: "a purposeful system is one which can produce the same outcome in different ways in the same (internal or external) states. Thus a purposeful system is one which can change its goals under constant conditions; it selects ends as well as means and thus displays will".

The above statements by Swanson indicate that:

1. MIS is an entity;
2. It has a will;
3. It carries out a set of activities and;
4. It has an end or purpose.

Swanson conceives a manager as an entity possessing the above characteristics of MIS. This enabled Swanson (1974, p.179) to examine the relationship between a MIS and a manager in terms of "their entanglement in the pursuit of their respective ends". This thesis supports and extends the above characteristics of MIS so as to provide a new and a richer perspective of MIS.

The argument that "an organisation is a purposeful

system that contains at least two purposeful elements [e.g. two human beings] which have a common purpose" (Ackoff, 1971, p.669) implies that a purposeful system can transcend purposeful entities or elements. From this statement one can argue that MIS as a purposeful system transcends a manager, therefore a manager can be regarded as part of a MIS rather than differentiate between a manager and a MIS in the way that Swanson did. That is, instead of regarding a manager and a MIS as two separate purposeful systems interacting with each other, a manager can be regarded as an element of MIS. Following this line of argument, Ackoff's statements above and Swanson's characteristics of MIS **I propose that MIS is a purposeful system which emerges whenever purposeful entities integrate for a common purpose.** The rest of this section will briefly examine this notion of MIS and outline its characteristics.

In Chapter Two (p.49-58) it was argued that there are three things that can be found both in a human being and an organisation: will, knowledge and existence. It was stated that the difference between an organisation and an individual in terms of the will, being and knowledge is that at an individual level the three things can be described as elementary items while at the organisation level there is a synthesis of the three things (i.e. a fusion of wills, existence and knowledge). Since MIS is a purposeful system which emerges from the aggregation of purposeful entities much like an organisation it is argued that MIS contains the three things: will, existence and knowledge. As in the case of an organisation (Chapter Two, p.54-58) one will

view MIS as a unit that contains a synthesis of will, existence and knowledge.

Following the discussion about the functioning of a person or an organisation (Chapter Two, p.42-58) it is argued that the conduct of the will, being and knowledge of a MIS has to be studied to understand the nature and the mode of functioning of the MIS. As in the case of an organisation they cannot be directly observed but they can be understood by examining the product of their conduct. The product of their conduct constitutes the characteristics (purpose, history, identity, activity and culture) of the MIS. For a discussion on why purpose, history, identity, activity and culture are functions of the will, existence and knowledge see Chapter Two (p.51-54). It was stated earlier that structures (e.g. procedure, role or equipment) are not part of the characteristics of an entity that has a will, being and knowledge. They are seen as devices that facilitate the process of achieving or exercising the characteristics of the entity. Because of their importance in the functioning of an entity they will be included as an element of MIS. The next Chapter will give a detailed theoretical discussion of this concept of MIS as a purposeful system and a framework for its development. The Chapter will demonstrate that this perspective of MIS accommodates both the social and technical perspectives of MIS.

CONCLUSION.

This Chapter started with a discussion about the nature of MIS. The discussion indicated that there are conflicting views about the meaning of MIS and how it should be developed. The reason for the confusion was in part due to the fact that MIS as a discipline emerged from disciplines that contain conflicting philosophies. The disciplines are computer science, organisation science and management science. The Chapter argued that management science and computer science focus more on the technical dimension while organisation science focuses more on the social dimension of MIS.

The debate about the nature of MIS and the strategy for its development is broadly between the advocates of the social systems and technical systems perspectives. The origin and the arguments of these perspectives were examined. The fostering of MIS as a technical system was traced to the history of computer technology and the profession (computer profession) that developed from the use of computer technology in organisations. It was the contention of the Chapter that, unlike the technical systems perspective, the social systems perspective cannot be traced to any particular profession and did not develop from actual MIS practice. The social systems perspective started as a reaction or protest by its proponents against the advocates of MIS as a technical system. The reason for the protest was the reported failures of MIS in organisations due to the neglect of social and behavioural issues

in the design of MIS. The Chapter argued that although the advocates of the social systems view have made strong and convincing arguments about the importance of the social dimension in MIS design, the technical systems perspective still dominates much of MIS practice. One possible reason for this is that the proponents of the social systems perspective have not yet proposed a realistic MIS definition, MIS design framework and adequate philosophical guide for MIS practice.

This Chapter proposed a new definition of MIS. It proposed that MIS is a purposeful system which emerges whenever purposeful entities integrate for a common purpose. This definition derives from and extends the work of Ackoff and Swanson. It was argued that a purposeful system, e.g. a MIS, contains three things: will, knowledge and existence. The Chapter viewed MIS as a unit that contains a synthesis of will, being and knowledge. It was argued that the conduct of the will, existence and knowledge has to be studied to understand the nature and the mode of functioning of a MIS. As in the case of an organisation these three things cannot be directly observed but they can be understood by examining the product of their conduct. The product of their conduct constitutes the characteristics (purpose, history, identity, structure, activity and culture) of an MIS. It is the contention of this Chapter that this perspective of MIS, which will be developed further in the next Chapter, accommodates both the social and technical systems perspectives of MIS and provides a new direction for MIS inquiry.

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CHAPTER FOUR

4. MIS AS A PURPOSEFUL SYSTEM: Its Taxonomy And Framework For Design.

The concept of MIS as a purposeful system was proposed and briefly discussed in Chapter Three. This Chapter provides a more detailed theoretical discussion of this concept of MIS. In section 4.1 the concept of the taxonomy of purposeful systems is proposed and discussed. It provides a framework to alert MIS designers to the different types and levels of contexts in which MIS can be embedded in organisations, and the strategy that can be used to identify and accommodate the special characteristics of the different levels of contexts when designing MIS. A framework to enable the design of MIS as a purposeful system is proposed and discussed in section 4.2. The application of this framework in MIS design is demonstrated in Chapter Five.

4.1 THE TAXONOMY OF PURPOSEFUL SYSTEMS

MIS exists within an organisational context. In MIS literature it is widely acknowledged that the failure to take adequate account of organisational contexts such as culture by MIS designers is a major reason why the introduction of MIS in organisations have frequently not been successful (Mumford, 1981 and 1983b; Land and Hirschheim, 1983; Jayaratna, 1985; Blackler and Brown, 1986 and Ban-

bury, 1987). Whilst one supports this argument it has to be said that in MIS literature the organisation context is treated as if in a given organisation there is one universal context. That is, the MIS literature has not made clear that in a given organisation there are different types and levels of contexts in which MIS can exist or be embedded. For example in an organisation MIS can be designed and implemented at corporate headquarter level, divisional level, departmental level, sectional level, etc. At each of these levels the information requirements of managers and the organisational context within which the managers operate may differ from one level to another. Given the above levels at which MIS can be designed in organisations one may raise the following questions:

(1) Is organisational context (culture, purpose, history, structure, activity, identity) at each level the same? If not:

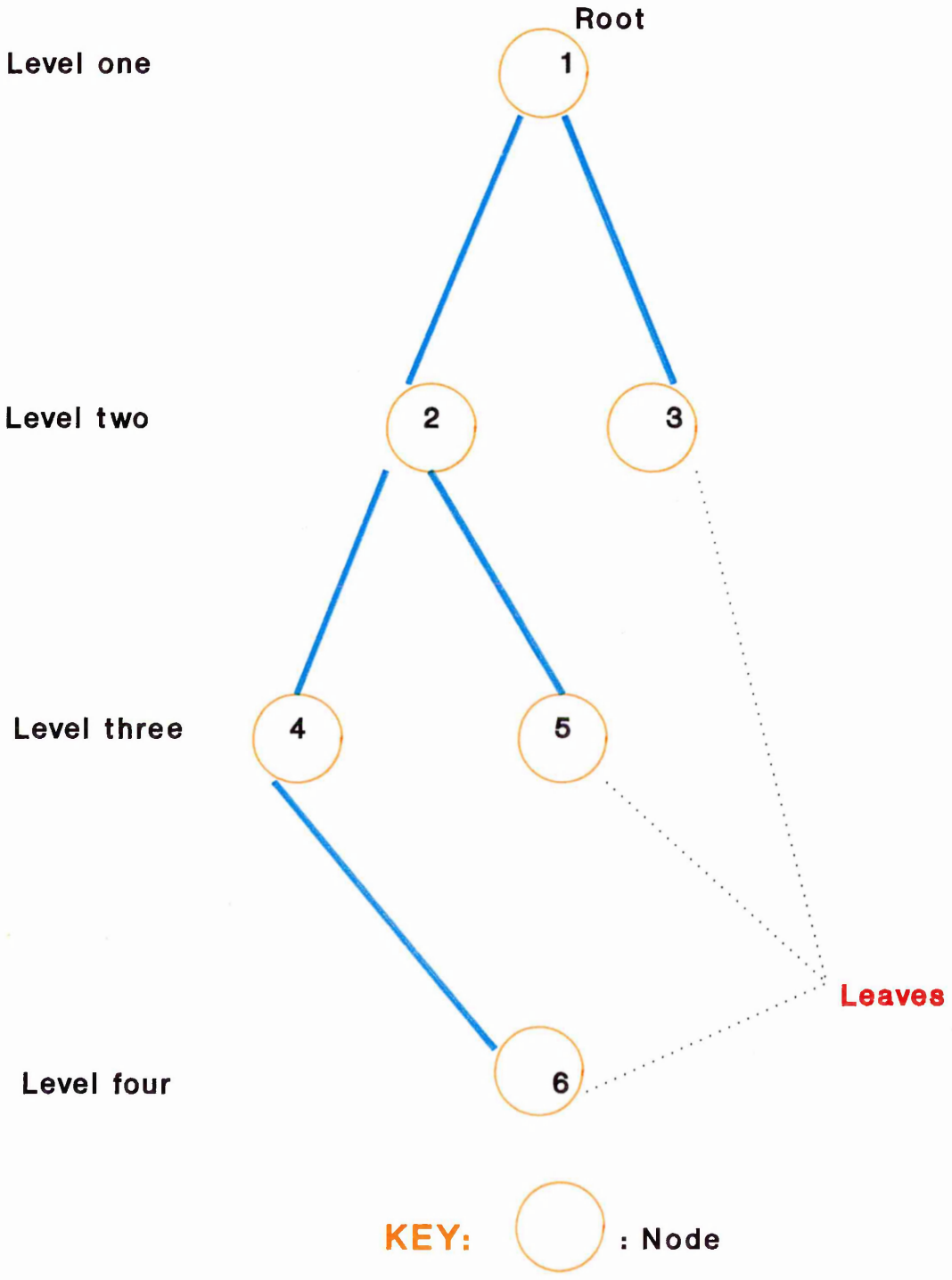
(2) How would MIS designers distinguish and identify the special characteristics of each level during MIS design and implementation?

It will be argued in this section that each level has its unique characteristics as well as having some characteristics that are common to all and the preceding levels. This section will provide a framework to assist MIS designers in identifying the different levels of context and their special characteristics. The framework will be termed the taxonomy of purposeful systems and will be derived from the principles of hierarchical file structure and schema (Martin, 1976; Gane and Sarson, 1979). The principles of

hierarchical file structure and schema are briefly discussed.

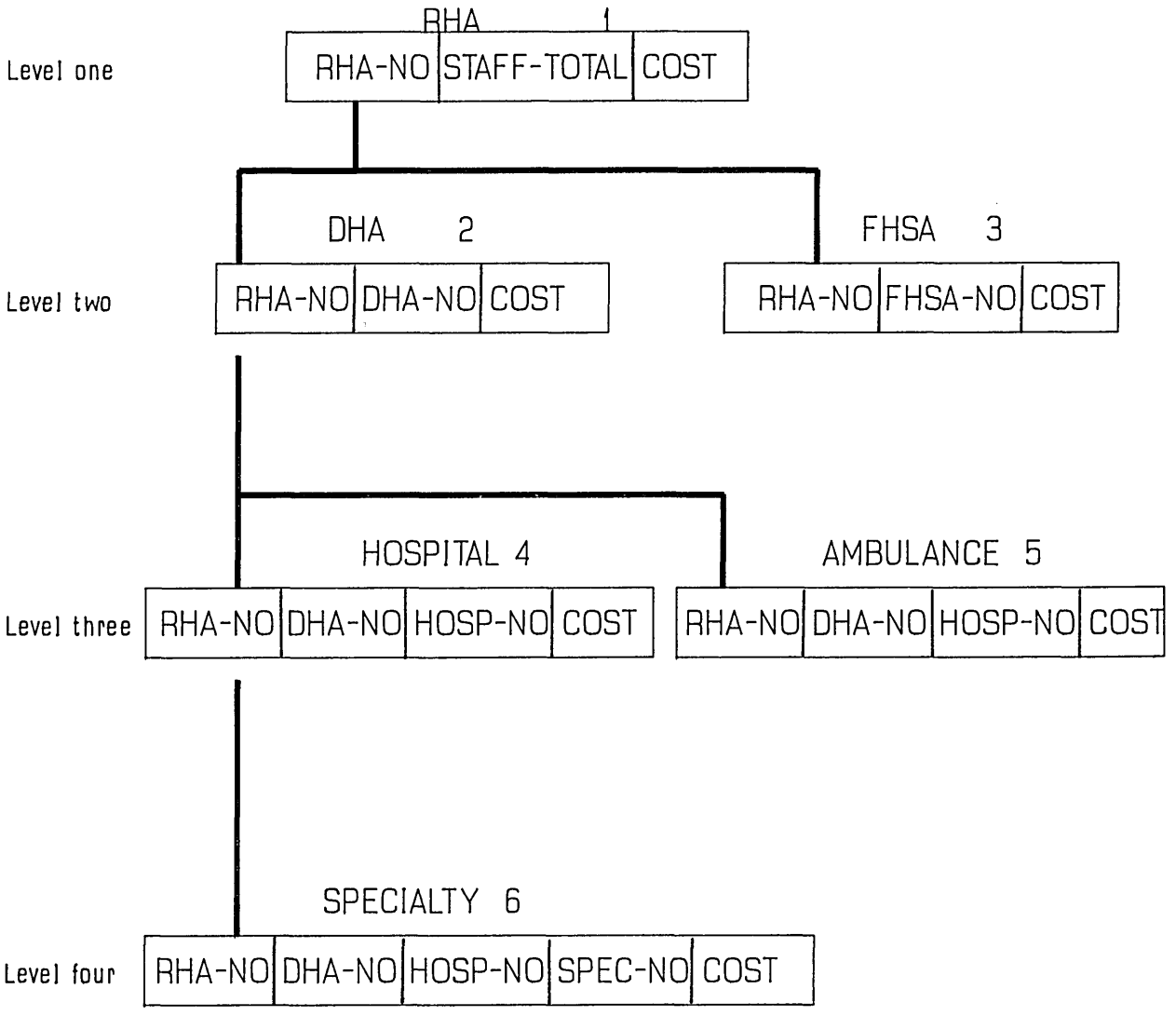
A computer file is a group of related records and a record is a group of related "data items treated as a unit by an application [computer] program" (Teorey and Fry, 1982, p.468). A "data item describes some attribute of an object of data processing" (Davis, 1974, p.287). For example, if a hospital is the object of data processing its three attributes may be described by the following data items: hospital name, total beds and budget. When these three data items (hospital name, total beds and budget) are combined and treated as a unit they form a hospital record type. There are different approaches that can be used to organise records on a file. One approach uses the concept of hierarchy to structure records on the file and such a file is known as a hierarchical file. Gigch, (1978, p.590) defines hierarchy as "a structure of items or events that admits some form of ranking among levels". This is the principle on which the hierarchical file structure is based. Martin (1976, p.87) defines hierarchical files as files with "tree-structure relationship between the records". In a "tree-structure relationship" items are arranged in a hierarchic relation and the position of an item in the hierarchy depends on its attributes and relationship to other items in the hierarchy. The concept of "tree-structure relationship" has to be understood in order to appreciate the principles of hierarchical file structure. Figures 1 and 2 will be used to describe the concept of "tree-structure relationship".

FIGURE 1 (A TREE)



A tree is composed of a hierarchy of items known as nodes. In Figure 1 there are six nodes numbered one to six. The highest node on the tree is called the root. With the exception of the root all nodes have one preceding node i.e. each node has a node relating to it at a higher level. The preceding node is called the parent. No node is allowed to have more than one parent and a node can have more than one item related to it at a lower level. These are called the children. The nodes with no items relating to them at a lower level are called leaves. In Figure 1 there are four levels of nodes. The root is at level one. Nodes two and three are the children of the root. Nodes three, five and six are the leaves. The possible levels of nodes a tree can have are theoretically unlimited. Figure 2 will be used to demonstrate the use of a tree-structure relationship in organising a hierarchical file. Figure 2 has the same hierarchical structure (number of levels and nodes) as Figure 1. The six elements in Figure 1 are known as nodes while the six elements in Figure 2 are known as record types. In Figure 2 the level one has the RHA as its record type, level two has the DHA and Family Health Services Authority (FHSA) as its record type and level four has the Specialty as its record type. The numbering of these record types correspond to the numbering of the nodes in Figure 1. Each record type has a group of data items which describes some attributes of the record type. The record type RHA has RHA-NO, STAFF-TOTAL and COST as data items describing its three attributes. Figure 2 is a hierarchical file contain-

FIGURE 2 (A schema for a hierarchical file)



KEY NO : Number

ing the total administrative cost for each RHA, DHA, FHSA, Hospital, Ambulance and Specialty units in England. All the six record types have the cost data item as their last data item. It is the cost data item that contains the administrative cost of each record stored in the file. In data-base terminology a logical description of record types as depicted in Figure 2 is known as a schema for a tree structure. A schema is a "logical data-base description ... it gives the names of the entities [records] and attributes and specifies the relations among them ... it is a framework into which the values of the data items can be fitted" (Martin, 1976, p.74). A schema remains unchanged while the actual figures fitted into the schema can change from instant to instant. For example the COST data item of any of the record type remains unchanged while the actual amount fitted into it can be changed. The main interest of this section in the concept of hierarchical file structures is in the way the attributes of the elements are constituted and the relationships between the elements. This will be discussed using the following normalised or decomposed form of Figure 2:

1 RHA (RHA-NO, STAFF-TOTAL, COST)

2 DHA (RHA-NO, DHA-NO, COST)

3 FHSA (RHA-NO, FHSA-NO, COST)

4 Hospital (RHA-NO, DHA-NO, HOSP-NO, COST)

5 Ambulance (RHA-NO, DHA-NO, AMB-NO, COST)

6 Specialty (RHA-NO, DHA-NO, HOSP-NO, SPEC-NO, COST)

With the exception of the root (RHA) each element or

record type has its unique attributes as well as inheriting attributes from one or more elements. At level two the DHA has DHA-NO and COST as its natural attributes and inherited RHA-NO attribute from its parent (RHA). The administrative cost of any DHA can be obtained by using the attributes RHA-NO and DHA-NO as record identifiers. At level four the Specialty has SPEC-NO and COST as its natural characteristics and inherited the attributes RHA-NO from RHA, DHA-NO from DHA, and HOSP-NO from hospital. It is the inherited characteristics RHA-NO, DHA-NO, HOSP-NO that provides the context which makes possible adequate identification of a given Specialty unit cost. The administrative cost of any Specialty unit can be obtained by using RHA-NO, DHA-NO, HOSP-NO and SPEC-NO as unique record identifiers.

The advantages of having the schema for a hierarchical file (Figure 2) and decomposed schema are:

(1) It provides an overall chart of an organisation's data item and record types.

(2) It shows the relationship between various data items and record types.

(3) The attributes of any element can be expanded or modified with ease and without the need for major modification of the application programs that use the file.

(4) It is easy to understand and can be used for discussion between the users and MIS designers.

(5) It simplifies the task and cost of future systems developments i.e. a new systems project will build on existing schema rather than reinventing the schema.

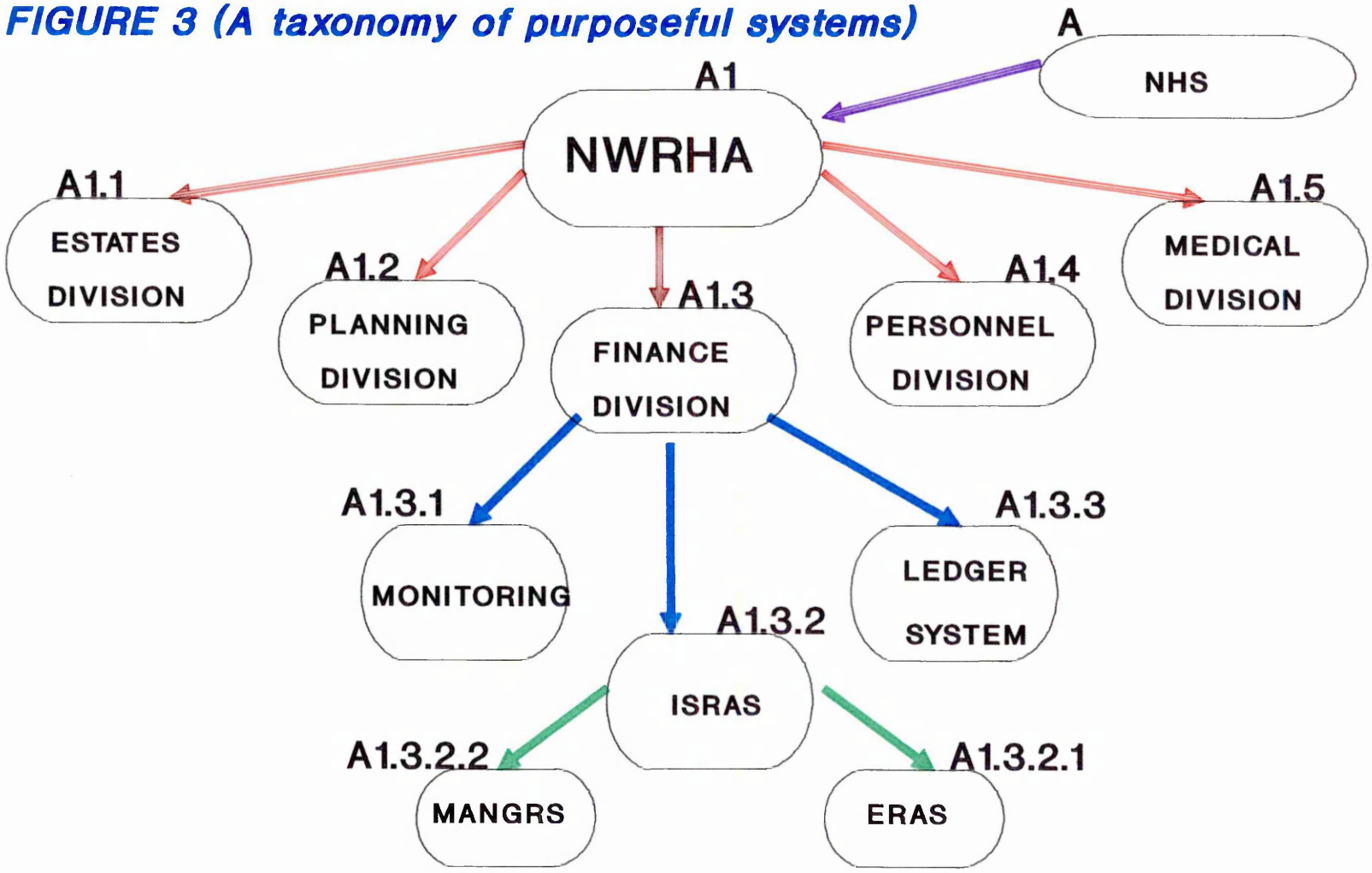
The above discussion indicates that the attributes of

an element (node) can be categorised into two: natural and inherited attributes. The type and number of inherited attributes depend on the position of the element within the tree or file hierarchy.

The remaining part of this section will use the above principles of hierarchical file structure and decomposed schema to derive and discuss a concept to be termed the taxonomy of purposeful systems (Figure 3) and examine its application in MIS design.

Chapter three (p.100-101) proposed that MIS is a purposeful system which emerges whenever purposeful entities integrate for a common purpose. This indicates that a sufficient condition for MIS to emerge is the existence of a purpose and the aggregation of purposeful entities for that purpose. This statement implies that if within a MIS "y" which has a purpose "x" a sub-purpose "x1" is defined and some of the purposeful entities of the MIS "y" are integrated for the sub-purpose "x1" then a sub-purposeful system "y1" can emerge. The sub-purposeful system "y1" that emerged becomes a sub-system of the MIS "y" with its own purpose and purposeful entities. What this argument is saying is that it is possible for MIS to emerge as a sub-system of another MIS. These statements will be clarified using Figure 3. It is a classification of purposeful systems and is derived from the concepts of tree (Figure 1), hierarchical file structure (Figure 2) and decomposed schema p.114. The NHS has purposeful entities (individuals) with a common purpose (free delivery of health care public). Its position in Figure 3 is similar to that of the

FIGURE 3 (A taxonomy of purposeful systems)



root in Figure 1 since it is the highest purposeful system in the hierarchy. The NWRHA is a child of the NHS and consists of purposeful entities (individuals) with a common purpose (providing health care to the North West population), and following our definition of MIS the NWRHA can be viewed as a MIS. The Estates, Planning, Finance, Personnel and Medical Divisions are children of the NWRHA. Each is formed by defining a sub-purpose of NWRHA and the aggregation of purposeful entities for that sub-purpose, and can be described as MIS. Each is a MIS which emerged as a subsystem of the MIS: NWRHA. The Finance Division has three children Monitoring (A1.3.1), ISRAS (A1.3.2) and Ledger system (A1.3.3) and each is a purposeful system or MIS.

It has to be said that MIS as defined in this thesis is not synonymous with the traditional organisational division of labour or function though in certain situations this might be the case. For example in Figure 3 the MISs termed Estates, Planning, Finance, Personnel and Medical Divisions correspond to the five major functions in the organisation. The MANGRS (A1.3.2.2) which is one of the MISs developed by this research is not a function in the sense of being a Department or Section. It emerged because of the existence of a purpose and the aggregation of purposeful entities for that purpose. It is theoretically possible to develop an unlimited number of MISs within a given department. As argued earlier the basic requirement for MIS to emerge is the existence of a purpose and the aggregation of purposeful entities for that purpose. The actual process

of identifying purposeful systems and constructing a taxonomy of purposeful systems (e.g. Figure 3) during MIS inquiry will be demonstrated in Chapter Five.

It was argued at the beginning of this section that there are various levels at which MIS can be designed in organisations. Based on this view the question was raised: is organisational context at each level the same? Organisational context includes the elements identified in Chapter Three (p.100-101) as the characteristics of MIS: purpose, history, culture, structure, identity and activity. The discussion about the attributes of a node on a tree (Figures 1 and 2) provides some answers to the above question. It was argued that the attributes of a node can be categorised into two: natural and inherited attributes. If we apply this concept to MIS in terms of the various levels (e.g. Figure 3) at which MIS can be designed in organisations, it is clear that the characteristics of a given MIS can be categorised in two ways: natural and inherited characteristics. In Figure 3 the characteristics of NHS is represented by the symbol "A". At a lower level to the NHS is the NWRHA. The natural characteristics of the NWRHA is represented by the number "1" while the characteristics it inherited from the NHS is represented by the symbol "A". At a lower level to NWRHA there are five MISs which are the sub-systems of NWRHA. The natural characteristics of each is represented by a number (.1, .2, .3, .4, or .5). They all inherited certain characteristics from the NHS and NWRHA. The characteristics each inherited from the NHS is represented by the symbol "A" while the characteristics

each inherited from the NWRHA is represented by the number "1". The ISRAS (A1.3.2) inherited "A" from the NHS, "1" from NWRHA, ".3" from Finance Division and has ".2" as its natural characteristics. Purpose is an element of MIS and shall be used to give examples of the natural and inherited characteristic of MIS. The NWRHA may have as its purpose: equity and free delivery of health care to its population. Within this purpose a sub-purpose such as efficient resource management may be defined and assigned to the Finance Division. From the Finance Division's purpose a subsidiary purpose such as distribution of resource to the DHAs may be defined and assigned to ISRAS. ISRAS will have the distribution of resources to the DHAs as its natural characteristic. This natural characteristic of ISRAS is represented in Figure 3 by the number ".2". ISRAS carries out this purpose as a sub-system of the Finance Division and must adopt an approach that ensures an effective contribution to the purpose of the Finance Division. For ISRAS to contribute to the Finance Division's purpose of efficient resource management it has to inherit and accept efficiency as a necessary part of its purpose. That is, instead of perceiving its purpose as the distribution of resources to the DHAs it would perceive it as the efficient distribution of resources to the DHAs. The item "efficient" being an inherited attribute from the Finance Division whose purpose is the efficient resource management. This attribute inherited by ISRAS from the Finance Division is represented in Figure 3 as ".3". The Finance Division has to ensure that in managing the resources of the NWRHA its

approach does reflect the NWRHA's purpose i.e. equity and free delivery of health care. To reflect the NWRHA's purpose in its task of managing NWRHA resources the Finance Division has to perceive or inherit the item equity as part of its purpose. This will mean restating its purpose as equitable and efficient resource management. The Finance Division will not be able to fully reflect equity in its resource management task if its sub-systems such as ISRAS do not reflect or perceive equity as part of their purpose. For equity to be part of ISRAS's purpose it has to inherit it as an attribute from the NWRHA through the Finance Division. To effectively achieve its purpose of distributing resources to the DHAs the ISRAS has to perceive or inherit the attributes: equity and efficiency. It inherits efficiency from the Finance Division and equity from the NWRHA. This means that ISRAS purpose has to be restated as the equitable and efficient distribution of resources to the DHAs rather than simply the distribution of resources to the DHAs. The failure by ISRAS to take on board its inherited attributes (equity and efficiency) may create a situation in which it produces a rational and technically elegant system that would be rejected by the DHAs because it did not acknowledge equity in its approach. Reflecting equity in its purpose might mean distributing money to the DHAs on a normative basis to reflect the relative state (health, unemployment, social deprivation, age, etc) of each DHA's population rather employing a rational resource allocation model that will treat all DHA's on an equal basis.

The usefulness of the concept of the taxonomy of purposeful systems in MIS design are:

(1) MIS context.

This section accepts the arguments of the social systems tradition that MIS designers must take account of the organisational context in which MIS is to be embedded. It was argued at the start of this section that in a given organisation there are different levels and types of contexts in which MIS can be embedded. The concepts discussed under the rubric of the taxonomy of purposeful systems provide a framework to alert the MIS designer of the different levels of MIS context. The strategy that can be used to identify and accommodate the different levels of contexts in MIS design will be discussed in section 4.2 and Chapter Five. The discussion above indicates that for a given MIS there are two types of contexts:

(a) Primary context.

This Chapter shall propose and use the label primary context as a term for what has been described in this section as the inherited characteristics of MIS. The primary context is the wider context of a given MIS. It is the primary context that legitimates and conditions the existence of the MIS. This can be illustrated using the concepts in Figures 2 and normalised schema p.114. It was argued on p.115 that to obtain the administrative cost of a given record type one will need to know the inherited

attributes of the record type. For example to obtain the administrative cost of a Hospital, one must know the RHA-NO and DHA-NO attributes inherited by the Hospital of interest. Without the inherited attributes the existence of the Hospital cost on the file will be of little value since it can not be identified when needed. The cost on its own will be of little value if it can not be related to its wider context i.e. the Region (RHA-NO) and District (DHA-NO). On p.120-121 purpose was used to illustrate the inherited characteristics or primary context of a MIS. It showed that ISRAS inherited equity and efficiency as part of its primary context. The approach used to identify ISRAS inherited characteristic (purpose) can be applied in determining other characteristics that constitute the primary context of ISRAS. Section 4.2 will propose and discuss the principles to be used in the actual identification and construction of the taxonomy of purposeful systems, and the primary contexts of a given MIS.

(b) Secondary context.

The label secondary context is proposed and used as a term for what has been described in this section as the natural characteristics of MIS. The secondary context is the basic characteristics (purpose, structure, activity, culture, history and identity) of MIS. They are characteristics that are local or specific to a given MIS. That is, they exist because of the particular MIS and excludes the primary or wider organisational context in which the MIS is to be embedded. In Figure 2 the Hospital record type has

HOSP-NO,and COST as its secondary context. The secondary context of MIS are easier to identify than the primary context. For example without defining a purpose and aggregating purposeful entities for that purpose a MIS will not exist. Thus preliminary purpose and purposeful entities automatically becomes part of the secondary context of the MIS.

The task of MIS design involves the identification of the primary context (inherited characteristics) and secondary context (natural characteristics) of MIS, and organising them to achieve an effective purposeful system. This will be discussed further in section 4.2.

(2) MIS administrator

In data-base terminology the individual responsible for the custody, organisation and control of an organisation's data-base is known as the data-base administrator. The data-base administrator "maintains the overall view of the data ... He encourages standardisation of data items and determines what data structures and layouts will be best for the data users as a whole. He attempts to referee the feuds that develop between departments or divisions about the nature of the data" (Martin, 1976, p.7). The discussion of the taxonomy of purposeful systems suggest that there is a need for a new job title in MIS practice with responsibilities similar to that of the data-base administrator. We propose the new job title to be MIS administrator. The MIS administrator will be responsible for maintaining the taxonomy of an organisation's purpose-

ful systems or MISs. He will define and maintain the inherited and natural characteristics of all MISs in the organisation. This will encourage standardisation, minimise duplication and reduce systems development time. The type of training needed by the MIS administrator is briefly discussed in Chapter Seven.

The next section will develop further the concept of MIS as a purposeful system by proposing and examining a framework for its design.

4.2 THE UNIFYING FRAMEWORK FOR MIS DESIGN.

The concept of MIS proposed in this thesis gives MIS the status of an active unit that has a purpose which it seeks to accomplish. As a unit the MIS might have problems which may hinder it from achieving its purpose. Without adequate knowledge of the characteristics and the mode of functioning of the MIS one will not be able to understand its problem or to solve it. For me the purpose of MIS inquiry is to understand the problems of the MIS and to resolve them so as to enable the MIS achieve its purpose. This will involve the identification of the MIS, understanding the characteristics of the MIS, identifying the deficient characteristics, organising the characteristics, putting the MIS into operation and measuring how well it achieves its purpose. Based on this view of MIS inquiry I propose the following framework for MIS design:

(1) Naming the MIS;

(2) Understanding the MIS elements;

(3) Organising the MIS elements;

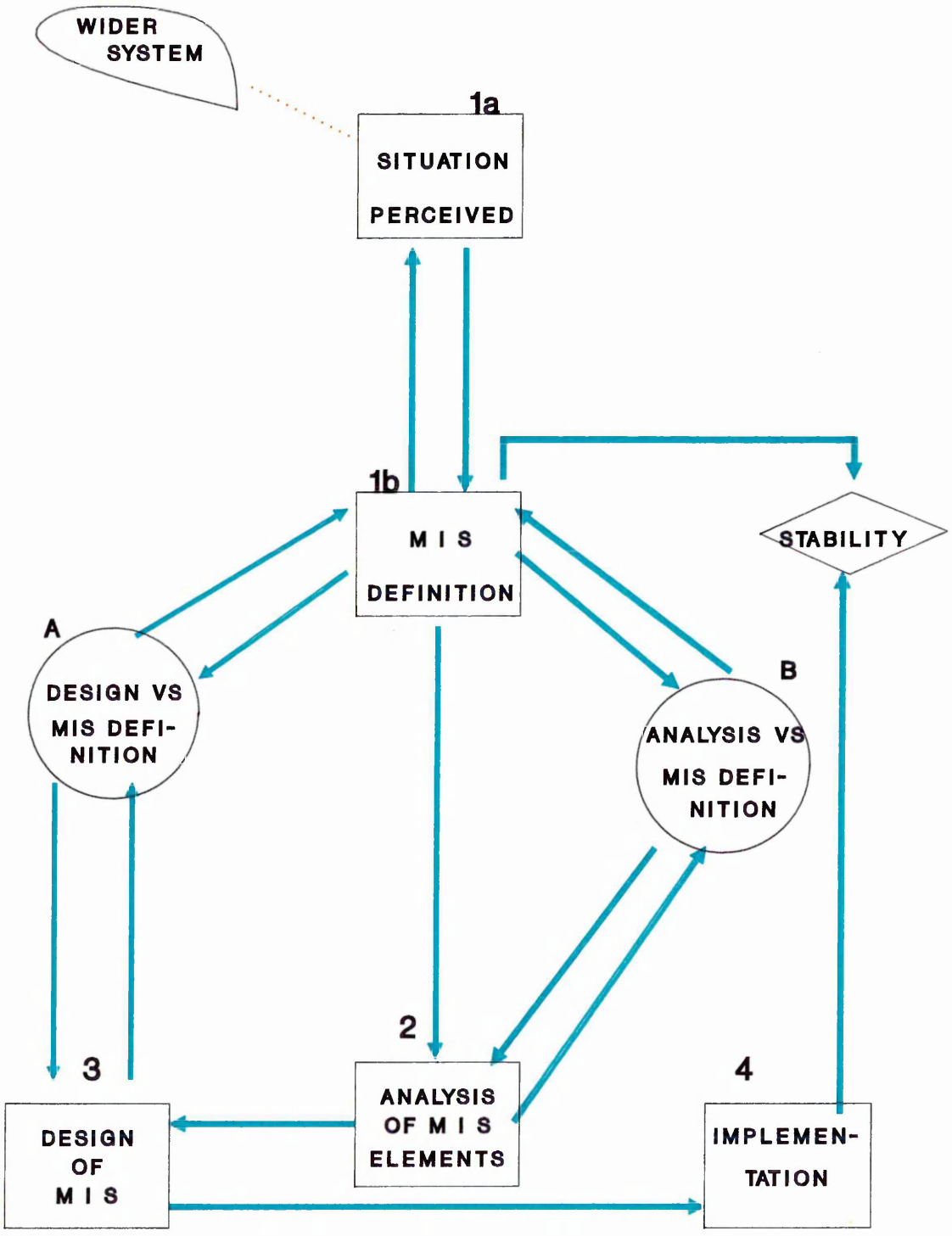
(4) Implementation and monitoring of MIS outcome.

The operational model of this framework is depicted in Figure 4. The rest of this section will discuss the different components of this framework.

STAGE ONE: Naming the MIS.

The task of this stage is to name or identify the MIS that will be designed. This can be a simple or problematic

FIGURE 4 - THE UNIFYING FRAMEWORK



task depending on the role of the MIS designer in the process of identifying the MIS. For example in Chapter Two (p.34-35) it was stated that IRAP was named by the client as the MIS to be introduced into the organisation. In a case like the IRAP where the client claims to know the MIS that has to be designed and insists that the named MIS be developed, the MIS designer either has to accept the MIS as defined by the client or abandon the project. If the MIS designer accepts the MIS as defined by the client one may say that from the designer's perspective the task of naming the MIS was a simple one.

There may be cases in which people are aware that they are in a problematic situation but they are not certain what the problem is or how it should be resolved. An example of such a situation is a sudden increase in the number of people in a hospital's waiting list. Many factors such as lack of funds, a consultant spending more time on his private work and less on the hospital's patients, poor management of available facilities or lack of a proper update of the waiting list may give rise to such a problem. A problem of this nature which is "original ... or has not been solved previously" by the management is known as an "ill-structured" problem (Gigch, 1978, p.377). We refer to a situation in which there is an ill-structured problem as an ill-structured situation. People in an ill-structured situation may have different interpretations and definitions of the problem and how it should be resolved. It is our contention that, for the MIS designer, the first step

towards resolving the ill-structured problem is to define or name the MIS (i.e. purposeful system) which when designed will alleviate the problem. The first part of the MIS design framework (Figure 4) is aimed at providing principles for identifying the MIS that has to be designed to alleviate a problematic situation. The first part of the framework is depicted in Figure 4 as boxes 1a and 1b.

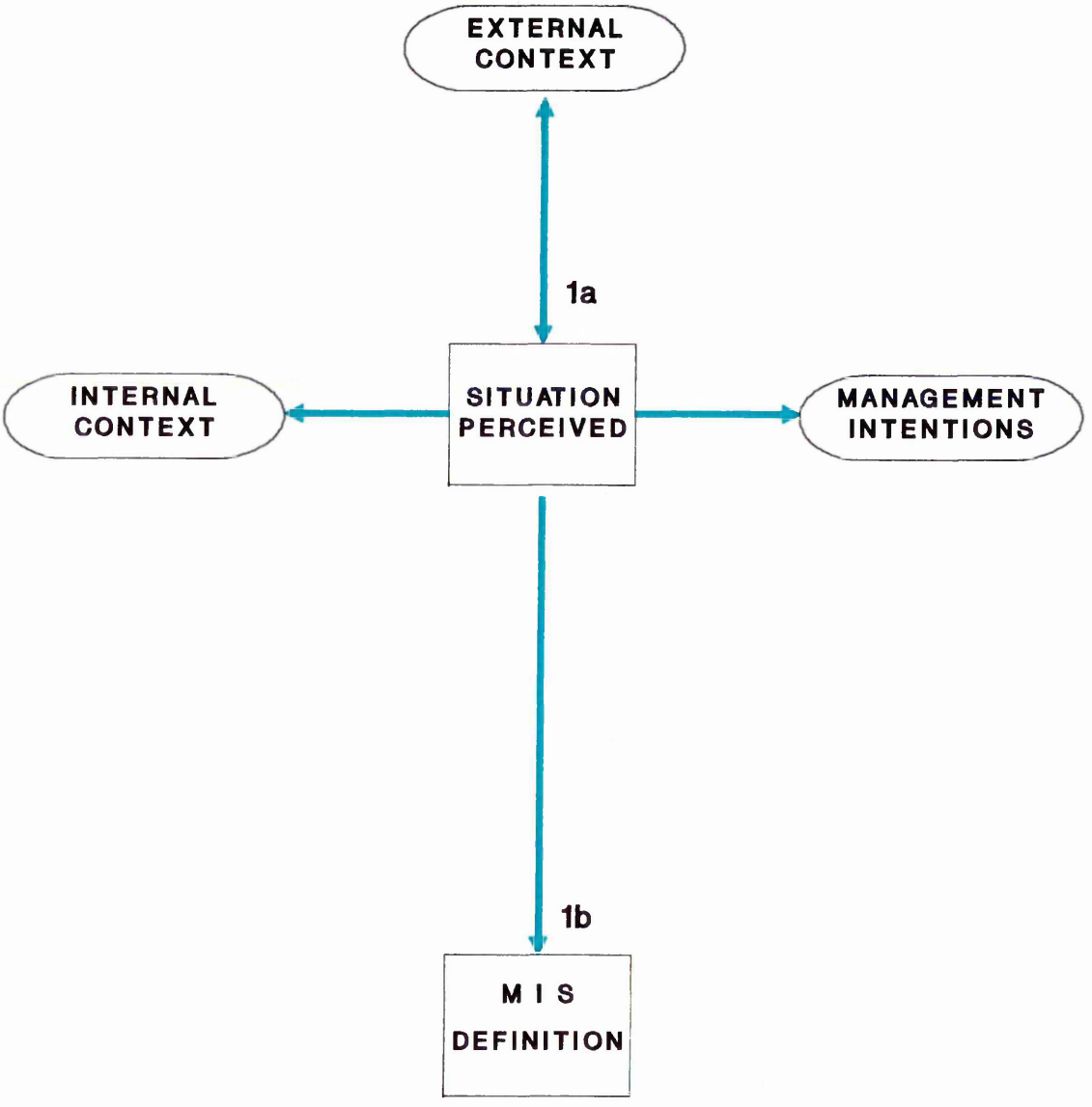
The purpose of the activity represented by box 1a is to understand the problematic situation. Based on this understanding a notional MIS is named and expressed in box 1b. The process of understanding the situation and identifying the MIS to be designed can be very problematic. This is due to the basic problem of epistemology. That is, how are we to ensure that the knowledge acquired about a situation (1a) has been adequate and correct? How are we to guarantee that the MIS definition (1b) is a true representation or expression of the situation (1a)? There is obviously no simple answer to the problem of error in human inquiry.

In an excellent discussion on the problem of error Casserley (1965, p.126-127) states: "the problem of error is always with us ... Error occurs only in a real world. Man may misconceive the real, but he is never capable of perceiving the positively and completely unreal. If I say that I see a pink elephant flying about in front of me, I can say so only because I live in a world in which there really are pink things, there really are elephants, and there really are birds that fly". We accept Casserley's position on the problem of error, and shall proceed with

our discussion on the basis that "the fact that error occurs, ... is not very relevant to the subtleties of epistemological theory".

Figure 5 will be used to discuss the conduct of the first part of the MIS design framework. The perception and description of a problem by the people in a problematic situation is represented in Figure 5 as the management intentions. It is possible that the description of a problem as given by those in the problematic situation is not an adequate description of the problem. Following Casserley it is argued that the description of a problem by those in a problematic situation must have some relevance to the real problem since they are not capable of perceiving the positively and completely unreal problem. Like the case of a "pink flying elephant" stated by Casserley the designer has to accept the client's description of the problem and then seek to understand the type of environment and the things in that environment that must have made the client present a particular picture of the problem. The environment in which the client operates is represented in Figure 5 as the internal and external context of the management intentions. The data gathered from the internal and external context of the management intentions is presented to those in the problem situation with the aim of ascertaining whether they will amend their picture or description of the problem based on this data. For example the management of a hospital may perceive a long waiting list of patients as a major problem. The internal context of this problem include

FIGURE 5 (MIS DEFINITION)



the number of hospital beds, hospital manpower and theatre facilities. The external context include the nature of NHS, funds allocated to the hospital by its DHA and the health status of the population where the hospital is located. A quick examination of the number of patients treated by the hospital over a period of five years may suggest that the number of patients treated by the hospital in the current year is actually less than in the previous years. This information might suggest that the consultants (internal context variable) are not spending as much time as their contract demands on the hospital patients. If this information is presented to the hospital's management it might have the effect of changing the managers perception of the problem from that of waiting list to staff problem i.e. how to control the consultants. Our contention is that the initial problem definition must rest with the client. The responsibility of the MIS designer in the problem definition process is to examine the internal and external context of the problem descriptions given by the client. The data obtained is then fed back to the client. The client might insist that his description of the problem is adequate or may amend his perception about the problem based on the data provided by the MIS designer.

Whatever is agreed between the client and the MIS designer as the problem to be tackled is formally expressed as the purpose of the MIS to be designed. The expression is the MIS definition and is depicted in Figure 5 as box 1b.

STAGE TWO: Understanding the MIS elements (Analysis).

A system is defined as "a set of interrelated elements" (Ackoff, 1971, p.662). The performance of a system is influenced by the state of each element and how well the elements fit and relate to each other. Emery and Trist (1969, p.286) put it this way: in a production system that has two elements (i.e. technological and social elements), the "technological [element] sets certain requirements of its social [element] ... and the effectiveness of the total production system will depend upon the adequacy with which the social [element] ... is able to cope with these requirements". That is, the nature and behaviour of the technological element affects the behaviour of the social element and the behaviours of both elements (technological and social) affect the behaviour and effectiveness of the production system. MIS as defined by this thesis has interrelated elements: purpose, history, identity, structure, activity and culture. The aim of the second part of the MIS design framework is to provide an approach that can be used to examine the elements of MIS and to establish if there is adequate fit between the elements, and how effectively they are contributing to the MIS performance. Figures 6 and 7 will be used to discuss the conduct of the second part of the MIS design framework.

The taxonomy of purposeful systems discussed in the first section of this Chapter arranges MISs within an organisation in a hierarchical order. Based on the notion of tree and hierarchical file structure it was argued that

each MIS in the purposeful systems taxonomy has inherited (primary context) and natural (secondary context) characteristics. The nature and type of the inherited characteristics depend upon the level and position of the MIS within the taxonomy. It was argued that the primary context is the wider context of a given MIS and it is the primary context that legitimates and conditions the MIS.

The term context analysis is proposed in this thesis and is used to mean the process of deriving the primary and secondary context of a given MIS. The process of conducting context analysis is discussed using Figure 6. The taxonomy of purposeful systems (Figure 3) indicates that during the life of a purposeful system such as the NWRHA, other purposeful systems (e.g. ISRAS) emerge as lower level systems or sub-systems. Having identified the MIS to be designed in stage one of the MIS design framework, the task of the second stage starts by adding the identified MIS to the taxonomy of purposeful systems if a taxonomy of purposeful systems already exist in the organisation. If it does not already exist the MIS designer has to construct the taxonomy of purposeful systems. This is done by identifying significant episodes in the life of the organisation which are relevant to the inquiry or the MIS defined in stage one. An episode may be the creation of a new department, structural changes, diversification or new procedures. The identified episodes are arranged in a hierarchical order to form a taxonomy of purposeful systems. This will be discussed further in Chapter Five.

Having constructed the taxonomy of purposeful systems

FIGURE 6 (CONTEXT ANALYSIS)

	EPISODE-1: DHA	EPISODE-2: HOSPITAL BUDGETARY SYSTEM	EPISODE-3: WAITING LIST SYSTEM
PURPOSE	Purpose of the DHA	Purpose of the hospital budgetary system	Purpose of the waiting list system
HISTORY	History of the DHA	History of the hospital budgetary system	History of the waiting list system
IDENTITY	Identity of the DHA	Identity of the hospital budgetary system	Identity of the waiting list system
CULTURE	Culture of the DHA	Culture of the hospital budgetary system	Culture of the waiting list system
ACTIVITY	Activity of the DHA	Activity of the hospital budgetary system	Activity of the waiting list system
STRUCTURE	Structure of the DHA	Structure of the hospital budgetary system	Structure of the waiting list system

the MIS designer starts the context analysis by selecting relevant episodes (i.e. MISs) from the taxonomy and places them on the top row of Figure 6. They are the MISs from which to derive the primary context of the MIS being developed. Any such episode will have the six elements of MIS which are in the first column of Figure 6. The MIS whose primary and secondary context is being derived is placed as the last episode in Figure 6. On the first column are the basic elements of MIS about which information is sought from the MISs at the top row.

Once the episodes are listed on the top row of Figure 6 the designer can proceed to describe each episode in terms of the six characteristics of MIS listed on the first column. In Figure 6 the waiting list system (episode three) is assumed to be the MIS being designed and episodes one and two are the higher level MISs in a taxonomy of purposeful systems from which the waiting list system inherits its primary context. The DHA is identified as the first episode. As a purposeful system the DHA has the responsibility for delivering health care to the population whose length of waiting before receiving treatment is the concern of episode three (waiting list system). The episode three is one of the sub-systems of the DHA and to be an effective sub-system it has to contribute to the overall effectiveness of the DHA. This means that to design the waiting list system (episode three) effectively will require knowledge of the nature and mode of functioning of the DHA or some aspects of the DHA that will affect not

only the functioning of the waiting list system but the way it should be designed. The MIS designer has to describe in the second column of Figure 6 those aspects of the DHA's purpose, history, identity, culture, activity and structure that relates to patient care and the waiting list system (episode three). Figure 6 assumes that the waiting list problem is occurring in a hospital within the DHA. It also assumes that the hospital has a budgetary system and that the way the budgetary system operates is essential to understanding why the waiting list problem exist, and the constraint within which the waiting list system when completed has to function. The MIS designer has to describe in column two those aspects of the hospital budgetary system's purpose, history, identity, culture, activity and structure that relates to the waiting list problem (episode three). The number of episodes at the top row of Figure 6 is dependent on how many episodes are perceived as higher level systems or episodes relevant to the MIS being designed. The data about all the episodes that precede the one being designed constitute the primary context. The data on the last column of Figure 6 constitute the secondary context. The primary and secondary context together make up the total context of the MIS being designed. The task of context analysis is completed when the MIS designer has described in detail the six elements of each MIS on the top row. This information is then summarised and used to conduct what this thesis terms the context evaluation process (Figure 7).

The task of context evaluation is discussed using

FIGURE 7 (CONTEXT EVALUATION)

	PURPOSE	HISTORY	IDENTITY	CULTURE	ACTIVITY	STRUCTURE
PURPOSE	**Description of purpose**	History vs. purpose	Identity vs. purpose	Culture vs. purpose	Activity vs. purpose	Structure vs. purpose
HISTORY	Purpose vs. history	**Description of history**	Identity vs. history	Culture vs. history	Activity vs. history	Structure vs. history
IDENTITY	Purpose vs. identity	History vs. identity	**Description of identity**	Culture vs. identity	Activity vs. identity	Structure vs. identity
CULTURE	Purpose vs. culture	History vs. culture	Identity vs. culture	**Description of culture**	Activity vs. culture	Structure vs. culture
ACTIVITY	Purpose vs. activity	History vs. activity	Identity vs. activity	Culture vs. activity	**Description of activity**	Structure vs. activity
STRUCTURE	Purpose vs. structure	History vs. structure	Identity vs. structure	Culture vs. structure	Activity vs. structure	**Description of structure**

Figure 7. The aim is to examine how each element on the top row fits with the other elements on the first column. Starting with the first element (purpose) on the top row the MIS designer has to place in the purpose and purpose coordinate (i.e. at the coordinate containing the statement: description of purpose) the understanding gained from the context analysis (Figure 6) about the purpose of the MIS being designed. The next MIS element on the top row is the history. The designer places in the history and history coordinate (i.e. at the coordinate containing the statement: description of history) the understanding gained from the context analysis about the history of the MIS being designed. The understanding gained about the identity of the MIS is expressed at the identity and identity coordinate. This process is repeated for each MIS element on the top row. The description of each element at the appropriate coordinate completes the first phase of the context evaluation.

The task of the second phase is to examine the information about each element on the top row against the other elements on the first column. Starting with the first element (purpose) at the top row the designer will examine the MIS purpose (obtained from the purpose and purpose coordinate) against the MIS history (obtained from the history and history coordinate) and the understanding gained is described in the purpose and history coordinate. The aim of this exercise is to determine how compatible the MIS purpose is with the history of the MIS i.e. to ascer-

tain whether history is a major constraint in achieving the stated MIS purpose. The next element on the first column after the MIS history is the MIS identity. The MIS purpose (obtained from the purpose and purpose coordinate) is examined against the identity (obtained from the identity and identity coordinate) and the understanding gained is described in the purpose and identity coordinate. This process is repeated by examining the MIS purpose against the culture, activity and structure elements. Having dealt with the MIS purpose the next element (history) on the top row is examined against the other MIS elements following the same principle used in examining the MIS purpose against other elements. This process is repeated for the rest of the MIS elements on the top row. When this is done the second part of the MIS design framework is completed.

In a situation where the taxonomy of purposeful systems (Figure 3), context evaluation (Figure 7) and context analysis (Figure 6) already exist the process of deriving the primary and secondary context of a new MIS is relatively straightforward. Once Figures 3, 6 and 7 have been prepared they can be documented and updated for future reference. The post of MIS administrator was proposed in p.124 as a possible job title for the individual responsible for the custody and maintenance of Figures 3, 6 and 7.

STAGE THREE: Organising the MIS elements (Design).

At the end of the previous two phases (i.e. naming the MIS and understanding the MIS elements) the MIS designer should have detailed understanding of the current

and preferred state of the MIS elements. In this phase the MIS designer is concerned with:

(a) Identifying, expressing and putting together the logical elements of the notional system (MIS definition) i.e. logical design;

(b) Identifying ways of realising the notional system i.e. physical design.

The task of this stage is very technical and requires special types of tools. The appropriate tool depends upon the type of MIS element one is dealing with. One can in theory start the MIS design process from any of the six elements of MIS. Experience suggests that the MIS activity element (data and processes) should be the first to be designed. This is because it determines the extent to which other elements are effected or should be dealt with in the design process. The activity element can be handled with a set of tools that are "generally referred to as structured techniques" (Wetherbe, 1984, p.103). An example of the structured technique is the structured methodology developed by Gane and Sarson (1979). The structured methodology "provides useful techniques for transforming logical data, processes/flow to a state close to physical computer implementation (i.e. software module, immediate access diagram, dictionary entry etc" (Jayaratna, 1986, p.81). Where the structured methodology is used to handle the activity element (data and processes) its output can be used to deal with part of the MIS structure element (role, computer hardware and software) in the design process. For example the structured methodology's output (such as total number

of files, data volume and access method) can be used to make informed decision about the type of computer hardware and software to be used in the physical design and operation of the MIS.

The structured methodology "is very helpful in ensuring the correctness and communications of systems design specification" (Wetherbe, 1984, p.103). The concepts that underlie the structured methodology is simple and easy to explain to users. Its data flow diagram can be used as a basis for discussion between the users and the MIS designer. The discussion can lead to the modification of certain elements of the MIS. It may be that the purpose elements can not be achieved given the available structure elements (e.g. computer technology or roles) or may require more resources than the organisation can afford. This might lead to an amendment of the purpose or any other element of the MIS.

Both the users and MIS designer can also decide through the output (e.g. data flow diagram) of the structured methodology which activities are to be performed manually or computerised and who (role) should perform them.

When the users are happy with the logical design the MIS designer can proceed to turn the logical design into physical design (i.e. computer software, files and operations manual).

STAGE FOUR: Implementation and MIS success.

This is the phase at which the MIS "goes live" or is put into real life operation. When the MIS is in operation it is expected to alleviate the problems that led to its design and implementation. Vast amounts of research has been conducted with the aim of determining whether the design and introduction of MIS in organisations have been successful or not. Despite the vast amount of research there is no core concept or definition of MIS success in the MIS literature.

Lucas (1978a, p.29) states that "a cost/benefit study is one of the best ways to measure success" but argued that it is extremely difficult to measure MIS "success through cost/benefit study" especially where the MIS supports "sophisticated decisions beyond routine processing of transactions". Ives and Olson, (1984, p.591) argued that "intangible costs and especially benefits of [MIS] are difficult to recognise" and to objectively assess the benefits attributable to MIS used for "disparate, relatively unstructured, ad-hoc decisions ... may be nearly impossible". The difficulty of measuring MIS success through cost/benefit studies has led to other indicators being used.

Some research focusses on system quality as a measure of MIS success (King and Rodriquez, 1978, Lucas, 1978b). System quality is viewed in terms of variables such as how comprehensible the output of MIS are to the users, the difficulty of using the system, the logic of the system and

user confidence in the system. Much attention has also been given to user satisfaction by researchers as a measure of MIS success (Powers and Dickson, 1973, Noland and Seward, 1974, Swanson, 1974, Bailey and Pearson, 1983). Variables such as accuracy, timeliness, relevancy and frequency are used to evaluate the level of users' satisfaction about their MIS. Other researchers have focused on user's attitudes as a measure of MIS success (Swanson, 1974, Lucas, 1978a, Maish, 1979). If users exhibit favourable attitudes such as acceptance and no resistance to their MIS the MIS is judged to be a success. Most of these researches can be said to be based on user oriented criteria in their choice of indicator of MIS success. They are concerned with either factors or process issues that affect the introduction of MIS in organisations. The process researchers "focus on the relationship between the designer and user" while the factors researchers are concerned with "user and situational attributes to see how they relate to the outcome (success)" of MIS introduction in organisations (Franz and Robey, 1987, p.207). Rather than focussing on MIS success from purely user oriented criteria this discussion will focus more on design issues as measures of MIS success. This is aimed at reflecting the iterative and dynamic nature of MIS in measuring MIS success.

The four phases (naming the MIS, understanding the MIS elements, organising the MIS elements and implementation and monitoring of MIS outcome) discussed in this Chapter gives the impression that MIS development is a linear process that proceeds from one phase to another and

that each phase is self-contained and distinct from the other phases. This is rarely a true picture of the MIS development process. MIS development is an iterative process and in principle can proceed from any of the four phases. The concept of MIS proposed and defined by this thesis is a dynamic one. That is, the MIS elements (purpose, identity, history, activity, structure and culture) are time dependent components. For example its history is relative to the length of time the MIS has existed, and the longer is its history the greater the potential to acquire more knowledge that may influence its culture as well as the type or ways in which it performs its activities. If MIS is a dynamic entity the indicators and processes of measuring its outcome (success) must reflect its dynamic nature.

The dynamic nature of MIS will create situations in which the same outcome may be viewed as a success at a given point in time and as unsuccessful at other point in time depending on the state of the MIS. For example users in an organisation that has only five customers might be happy with a report that contains a list of all the five customers. If by the following month the activity of the firm expands and the number of customers increased from five customers to nine hundred customers, the users may view as unsatisfactory a daily report listing all the nine hundred customers. The users are more likely to prefer an exception report that reduces the length of the report to a manageable size. The same users that perceived the MIS as a success when the company had only five customers will

perceive the MIS as unsuccessful when the customers increased to nine hundred. What has changed is not the outcome (nature of report) but the activity element of the MIS which has experienced changes in volume. The same argument can be extended to other elements of MIS.

Given the iterative and dynamic nature of MIS this thesis proposes two perspectives for measuring MIS success: macro and micro perspectives.

(a) Macro perspective.

In Figure 4 the symbol stability links the implementation output to the MIS definition. It was noted earlier that the MIS definition must explicitly state the problem which the MIS is expected to alleviate. The MIS definition can be used as a measure of effectiveness by comparing it with the output from the implementation process. The process of matching the MIS definition against the implementation output is represented in Figure 4 by the stability symbol. It is a pragmatic, simple and general measure of MIS success. It is a process of checking that the MIS definition is still as originally specified and that the implementation output matches the MIS definition. The term macro measure is proposed for this normative process of measuring MIS success.

(b) Micro perspective.

The discussion on p.145-146 indicates that there are situations in which implementation output will not match the MIS definition. When this happens the MIS is said to be

in a failure state. The dynamic nature of MISs means that the stability between the MIS definition and implementation output are temporary in nature. That is, it is subject to change and this change will result in MIS failure. The reason for the mismatch can be traced to any or all the six elements that define MIS. The example in p.145 showed how changes in the activity element of MIS created a MIS failure state.

Another example is a sudden change in identity such as a hospital whose identity is changed from being a DHA managed hospital to a self-governing hospital trust. This change of identity means that the hospital has to earn its money from services provided to patients from any part of the country. This will require a change in purpose. That is, before the change of its identity its purpose might be to ensure that money allocated to it by its DHA is equitably spent on all patients regardless of their place of residence and financial status. The change in identity might change this purpose to one of maximising its income by dispensing with all unprofitable wards, specialties and targeting rich patients. To achieve this new purpose will require a reassessment of its patient care activities so as to maximise its income. Also the change in purpose may be resisted by the doctors as incompatible with the hospital's (NHS) culture and they may oppose the change. The aim of this simple example is to illustrate how a change in one MIS element (identity) can lead to changes in other elements (purpose, activity, culture etc). The changes occur because of the dynamic nature of MISs and will create a

mismatch between implementation output and MIS definition. Such a mismatch will force an iterative process of moving back to examine the MIS definition, analysis (understanding the MIS elements) or design (organising the MIS elements) stage before attempting another implementation run.

The discussion about the macro and micro perspectives of MIS success implies that MIS is an entity which over time experiences "good health" and "bad health". Its period of good health lasts while there is a match between the MIS definition and the implementation output. It experiences "bad health" when there is a mismatch between the MIS definition and implementation output. The cause of the "bad health" can be attributed to a change in any of the six elements of MIS. The macro perspective or measure is proposed as a simple measure that constantly checks the "health" of the MIS while the micro perspective is concerned with the state of the MIS elements.

Wetherbe (1991, p.51) described a case of an aerospace company executive who "became frustrated with the inability of the information systems department to meet his requirements" and the "information systems department in turn became frustrated with his [the executive] inability to make up his mind about the information he needed". The information department, according to Wetherbe, had "to continually revise the systems" because the executive's "requirements were in a constant state of flux". One can argue that this type of frustration that exists between users and MIS designers can be minimised if belief in MIS success is shaped by the dynamic and time dependent nature

of MIS and its elements. This will ensure that changes in user requirements or unmet expectations (mismatch between MIS definition and MIS output or MIS failure indicated by the macro measure) is seen by users and MIS designers as a natural state of "bad health" which MIS experiences over time. It is for the users and the MIS designer to identify the reason for the "bad health" (changes in micro variables or perspective) and to restore the MIS to "good health". This view will also encourage the design of MISs that are easy to modify or adapt to changes in user requirements.

CONCLUSION

The concept of MIS as a purposeful system was proposed and briefly discussed in Chapter Three. This Chapter gave a more detailed discussion of this concept of MIS and proposed a framework for its development.

In MIS literature it is widely acknowledged that organisational context must be taken into account by MIS designers when designing MIS. What is not clear in the MIS literature is that in a given organisation there are different types and levels of contexts in which MIS can exist or be embedded. Organisation context has long been treated as if in a given organisation there is one universal context. This Chapter argues that this view is an insufficient guide for MIS design and contends that in a given organisation there are different types and levels of contexts in which MIS can be embedded. If MIS is to properly reflect the context in which it exists it is essential that one

distinguishes and identifies within the hierarchy of organisational contexts the right context in which a given MIS is to be embedded.

This Chapter has made a start towards providing a framework to assist in identifying the different levels of contexts and their special characteristics. The framework is termed the taxonomy of purposeful systems. It is derived from the principles of hierarchical file structure and schema. Based on these principles it is contended that hierarchic relations exist among the MISs in an organisation and that each MIS has two types of contexts: primary and secondary. The primary context is the inherited characteristics of MIS and constitutes the wider context of a given MIS. The position of a MIS in the hierarchy of MISs influences the type of characteristics inherited by the MIS. The secondary context is the natural or specific characteristics of MIS. They exist because of the particular MIS and exclude the wider organisation context in which the MIS is to be embedded.

It was argued that the task of MIS design involves the identification of the primary context (inherited characteristics) and secondary context (natural characteristics) of MIS and organising them to achieve an effective MIS. The Chapter drew a parallel between the responsibilities of a data-base administrator and the task of maintaining the taxonomy of an organisation's purposeful systems or MISs. MIS administrator was proposed as the job title for the individual responsible for maintaining the taxonomy of an organisation's MISs. She/He will be responsible for

defining and maintaining the primary (inherited) and secondary (natural) characteristics of all MISs in the organisation. It was argued that this will encourage standardisation, minimise duplication and reduce systems development time.

The last section of this Chapter developed further the concept of MIS as a purposeful system by proposing and discussing a framework for its design. The framework has four components: (1) naming the MIS, (2) understanding the MIS elements, (3) organising the MIS elements, (4) implementation and monitoring of MIS outcome.

The Chapter also proposed two perspectives for measuring MIS success: macro and micro. It was argued that these perspective will properly reflect the time dependent and dynamic nature of MIS.

These theoretical ideas are now applied to the practical design of a MIS in Chapter Five.

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5. MIS AS A PURPOSEFUL SYSTEM: Its application in the design of MIS.

This Chapter demonstrates the application of the theoretical concepts developed in Chapters Three and Four to the design of MIS. The structure of the Chapter follows the stages of the MIS design framework discussed in Chapter Four. The stages are: (1) Naming the MIS. In this stage the MIS designed by this thesis is named or identified. (2) Understanding the MIS elements. This stage is about understanding the elements of the MIS identified in stage One. The task of this stage involves the identification of the relevant episodes (purposeful systems) in the organisation, using the identified purposeful systems to construct a taxonomy of purposeful systems and also to conduct context analysis and context evaluation. (3) Organising the MIS elements. The above two stages are concerned with issues of analysis while this stage is concerned with the design of the MIS. (4) Implementation and MIS success. In this stage the discussion is primarily concerned with the implementation of the MIS and examines whether the MIS is a success.

STAGE ONE: NAMING THE MIS

It was stated in Chapter Two that this project was carried out within the Strategic Planning Section (finance). The Section provides the financial input in the

preparation of the strategic plans of NWRHA. It develops systems and methodologies that support and inform the resource allocation process of the NWRHA. Given that the Section has a purpose and that purposeful entities (staff) are integrated to execute the Section's purpose one can define the Section as a purposeful system. In a discussion with the Head of the Strategic Planning Section he said he wanted the Section to develop an Integrated Strategic Resource Allocation System (ISRAS). At that time no one in the Section knew exactly what systems should be developed and his use of the term ISRAS was simply an expression of his desire that the systems developed by the Section should be done in an integrated fashion. This thesis uses the term ISRAS to mean a purposeful system i.e. Strategic Planning Section.

It was argued in Chapter Four (p.126-128) that the task of naming the MIS to be designed can be a simple or problematic task depending on the role of the MIS designer in the process of identifying the MIS. It was stated in Chapter Two (p.33) that during the first meeting with management to discuss this project the management expressed their aims as:

(1) "we want a model to help us plan the health need of the four million people in the North West";

(2) We would "like to see a further development of the existing planning model".

These types of general statements indicate a client who is aware of a need or problem but he is not very clear what the exact problem is or how to resolve it. These types

of statements by those in a problematic situation is represented in Chapter Four Figure 5 as the management intentions. As argued in Chapter Four the MIS designer has to accept the management intentions (i.e. problem owners' description of the problem) and ascertain as much as is possible of what has influenced those in the problematic situation to perceive the problem in a particular way. The designer does this by examining the internal and external contexts of the management intentions. On the basis of the data gathered from the internal and external contexts of the management intentions, the client might insist that his description of the problem is adequate or may modify his perception and description of the problem. Whatever is finally agreed between the client and the MIS designer as the problem to be tackled is expressed as the purpose of the MIS and will form the name of the MIS to be designed. The internal and external contexts of the above two aims (management intentions) of the client were yet to be examined when the client came up with the idea of implementing the IRAP. This meant that what would have been a problematic task from the designer's perspective (i.e. identifying the MIS to be designed based on the client's two aims stated in p. 157) is now a simple task (i.e. the client's insistence that IRAP is the system to be implemented eliminated the need to investigate and identify what MIS should be designed).

The task of naming the MIS changed from a simple to problematic task when IRAP was abandoned and replaced with a new problem. As stated in Chapter Two (p.39-40) the pro-

blem that replaced IRAP was the design of a computer-based strategic planning model for the acute services. It was stated in Chapter Two (p.40) that the task of naming the exact nature of this problem or MIS was still in progress when the Government White Paper "Working for Patients" (1989) was published. The White Paper did provide a sufficient guide to make the naming of the MIS to be used in implementing the White Paper's new direction in resource planning and allocation a relatively simple task. Chapter One (p.20-22) identified two tasks that the NWRHA needed to perform to implement the new funding arrangement required by the White Paper. Two MISs were designed to accomplish the two tasks. The MIS designed to accomplish the activities of the first task (Chapter One p.20) is defined as the Maximum Net Gain of Resource System (MANGRS). The aim of the system is to ensure that the activities of the first task (Chapter One p.20-21) are performed in such a way as to maximise the net income to the NWRHA. The MIS designed to accomplish the activities of the second task (Chapter One p.21-22) is defined as an Equitable Resource Allocation System (ERAS). The aim of the system is to ensure that the activities of the second task is adequately performed to support and inform the NWRHA resource allocation process. The MANGRS and ERAS are sub-systems of ISRAS and are the two MISs upon which this thesis is based.

STAGE TWO: Understanding the MIS elements (Analysis).

The MIS to be designed was identified in stage one of the MIS design framework. The task of stage two starts by adding the identified MIS to the taxonomy of purposeful systems if a taxonomy of purposeful systems already exist in the organisation. It was argued in Chapter Four that in a situation where the taxonomy of purposeful systems, context analysis and context evaluation do not exist the MIS designer has to construct the taxonomy of purposeful systems. This is done by identifying significant episodes in the life of the organisation which are relevant to the inquiry or the MIS defined in stage one. The episodes are the MISs from which to derive the primary context of the MIS defined in stage one. The episodes and the MIS to be developed are used to form the taxonomy of purposeful systems.

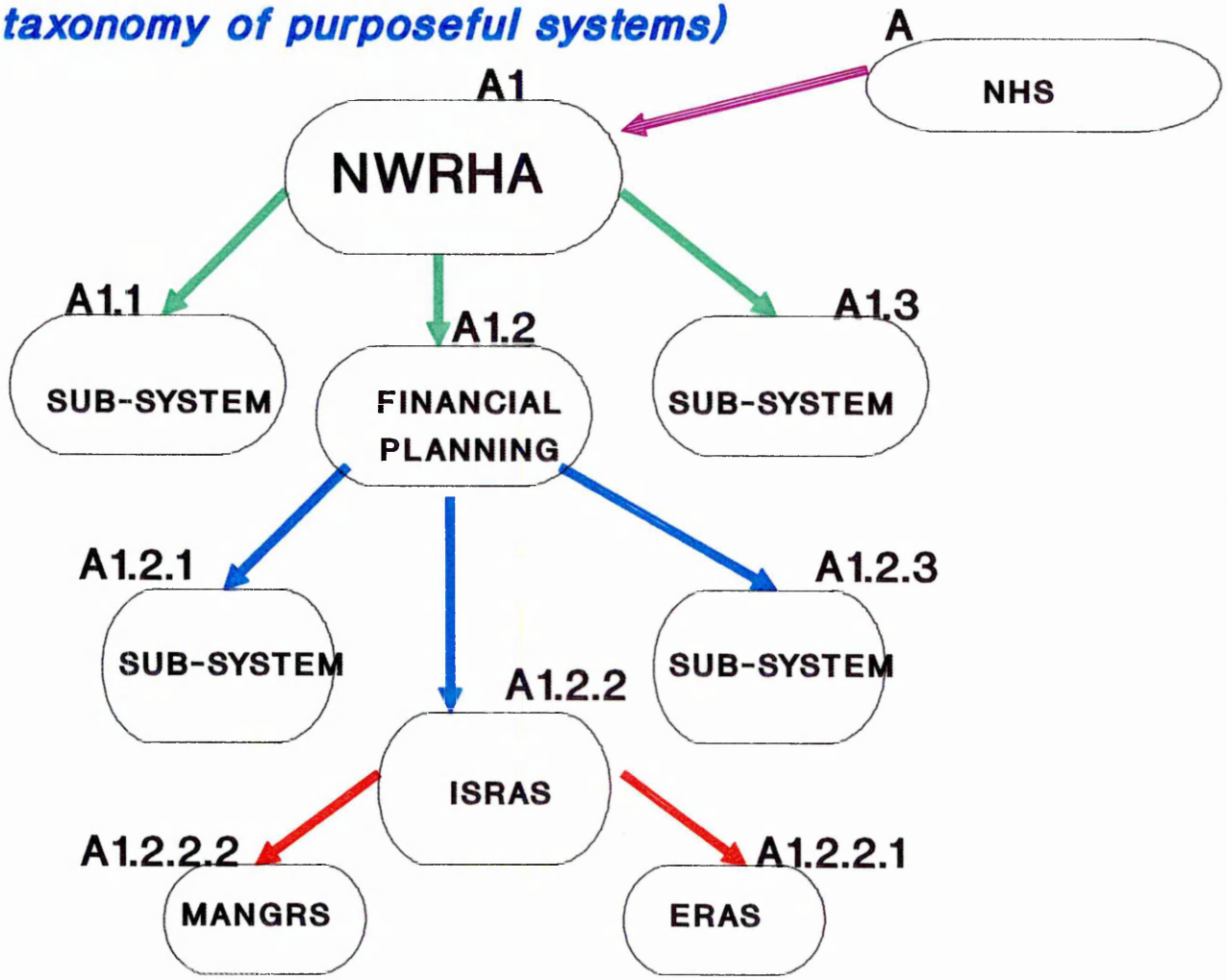
The episodes relevant to ISRAS and its sub-systems (MANGRS and ERAS) are identified and used to construct a taxonomy of purposeful systems. ISRAS and its sub-systems are MISs concerned with the resource allocation process within the organisation. This means that the episodes to be identified and used in the construction of the taxonomy of purposeful systems are those episodes that have or can influence the organisation's resource allocation process. The resources of the organisation come from the NHS and this makes the NHS a significant episode that can provide a wider or primary context of the organisation's resource

allocation process. The resource to be allocated belongs to the NWRHA once it has been received from the NHS and the NWRHA has the potential to influence the way its resources are distributed. This makes NWRHA a possible episode to be included in the taxonomy of purposeful systems. One may also ask whether there are past or current episodes in the life of the organisation that may influence any new resource allocation system. In this organisation there has been a previous planning process capable of influencing any new resource allocation and planning system. This past financial planning process is identified as the financial planning episode and is included as one of the episodes in the taxonomy of purposeful systems.

So far the episodes NHS, NWRHA and financial planning have been identified as episodes from which to derive the primary context of a new resource allocation MIS. The NHS, NWRHA, financial planning together with ISRAS and its subsystem will be used to construct the taxonomy of purposeful systems. The taxonomy is depicted in Figure 8. In Figure 8 the attributes of the NHS is represented by the symbol "A". The NWRHA has the number "1" as its characteristics and inherited "A" from the NHS. The financial planning episode has the number ".2" as its characteristics and inherited "1" from the NWRHA and "A" from the NHS through the NWRHA. ERAS has the number ".1" as its characteristics and inherited "A,1,.2,.2" from the NHS, NWRHA, financial planning and ISRAS respectively.

Having constructed the taxonomy of purposeful system (Figure 8) the next task is to examine the characteristics

FIGURE 8 (A taxonomy of purposeful systems)



of each purposeful system on the taxonomy through context analysis. Figure 9 is the context analysis. The episodes taken from Figure 8 are placed on the top row of Figure 9 and the six MIS elements are placed in the first column. When studying the episodes NHS, NWRHA and financial planning one will be interested only in those characteristics that are relevant to the organisation's resource allocation process. The episodes in Figure 9 are briefly discussed.

THE NHS.

The lengthy historical process of negotiation and polemic out of which the NHS came into being in 1948 is outlined in Pater (1981) and Ham (1982). Before 1948 only the people who could pay their medical expenses and those in areas with wealthier and more generous benefactors had better access to hospital services. The NHS was created to promote and offer free medical service to everyone regardless of their ability to pay for the service and their area of residence. The founders of the NHS saw health care as a universal necessity much like the founders of democracy saw freedom of individuals as a universal need that should be guaranteed to everyone. The original purpose of the NHS was to provide health care which is "comprehensive in scope, ... available to all, ... and free at the time of need" (Pater, 1981, p.1098).

The creation of the NHS changed the perceptions and attitudes of the public to health care from that of "client" to the "ownership" of health care provision.

FIGURE 9 (CONTEXT ANALYSIS)

	EPISODE-1: THE BIRTH OF NHS.	EPISODE-2: THE NWRHA	EPISODE-3: FINANCIAL PLANNING.	EPISODE-4: THE BIRTH OF ISRAS	EPISODE-5: ERAS
PURPOSE	Equity and free delivery of health care →		Efficient and equitable distribution of resources to DHAs	Future development of planning and allocation systems	Distribution of resources to the DHAs on a per capita bases.
HISTORY	Born in 1948 after a lengthy process of polemic. It inherited inequitably districbuted hospital services. Started in 1976 to address the imbalance in resource allocation by the use of RAWP. In 1989 it replaced the RAWP with a per capita based funding system	Born in 1974 and has 19 DHAs. Over the past ten years it has sought ways for ensuring that its resources are equitably distributed to the DHAs through the activities of its Financial Planning Section.	Born in 1983. Developed and implemented the SPM as tool for planning . and allocating resources to the DHAs. It was implemented despite the resistance from the DHAs. Favourable internal and external changes gave its proponents a good chance to implement the SPM. Politic and resistance by the DHAs ended the SPM's use by the organisation.	Born in 1989 and it is overshadowed by ↩	Born in 1989. It a new approach to resource planning and it is over-shadowed by the SPM politics and history.
IDENTITY	Ethical-open system →		A service related approach to resource planning and allocation.	None	Resident population based resource allocation and planning system
CULTURE	A shift in public attitude from that of client to "ownership" of health care system →		A shift from normative to rational mode of planning ↩	Overshadowed by ↩	A combination of rational and normative modes of resource planning and allocation
ACTIVITY	Patient care	Patient care for the North West residents.	Resource determination and allocation	None	Resource determination and allocation
STRUCTURE	Government policies, monies and management.	Regional policies, monies and management	Regional policies and monies. Innovative and autocratic leadership. Computer hardware and Software. →	→	→

Thunhurst (1982, p.8) accepted that the principle upon which the NHS was founded "held out a promise, or series of promises, to the ordinary ... man and woman" but he argued that the principle has been "more of an aspiration than reality". It is argued that this "aspiration", created by the principle on which the NHS was founded, has led to "medical care ... [being] viewed less as a benefit provided by a benevolent government and more as a right demanded by all citizens" (McEwen, 1985, p.1098).

The principle upon which the NHS was founded gives it a characteristic not found in privately owned business or in other public operated enterprises. This characteristic is the feature of the NHS which I shall term ethical open-system. This identity derives from the notion that the NHS is founded on equity and is expected to make its service available and free to the demands of its environment (public). It is a system that does not have the ability to select its target population or the power to exclude sub-groups if it seems desirable. That is, it does not exercise the power to decide which part of the environment (society in general) should benefit from its service. The Royal Commission on the NHS (1979, p.9-10) argued that "one of the most significant achievements of the NHS has been to free people from the fear of being unable to afford treatment for acute or chronic illness". To say that the NHS has freed people from the fear of not being able to afford treatment implies that people have come to perceive the NHS as a system not capable of liquidation or bankruptcy. That

is, people view the NHS as a system which they are sure will always exist to meet their future need i.e. provide treatment for their illness.

Policies and monies are the basic structure by which the NHS meets the needs of its environment. The policies and monies are given to its sub-systems (e.g. NWRHA) for the needs of the population within the sub-systems boundaries.

The resources of the NHS were distributed to its sub-systems in an inequitable manner until 1976 (Chapter one p.2-3). It started to address the imbalance in resource allocation in 1976 through the use of RAWP and as stated in Chapter One the RAWP was abandoned in 1989. It was replaced with a resident based resource allocation method.

The above information about the NHS is summarised in column two of Figure 9. In the episode-1 and purpose coordinate is a summary of the purpose of the NHS i.e. equity and free delivery of health care. At the history and episode-1 coordinate is the summary of the NHS history. It states that the NHS was born in 1948 after a lengthy process of negotiation and polemic and through the RAWP has ensured that its resources are equitably distributed to its sub-systems (RHAs). In 1989 the RAWP was replaced with a resident based resource allocation method. In the culture and episode-1 coordinate is the summary of the NHS culture and it is described as a shift in public attitude from that of "client" to "ownership" of health care provision. The main activity of the NHS is patient care and this is entered in the activity and episode-1 coordinate. The struc-

ture and episode-1 coordinate contains the summary of the NHS structure. The structure is comprised of Government policies, monies and management.

THE NWRHA

The NWRHA is a sub-system of the NHS. Chapter One stated that the NWRHA was created in the 1974 NHS reorganisation and has nineteen DHAs. As a sub-system of the NHS the NWRHA inherits some of the NHS characteristics. The NWRHA sees it purpose as being "to promote the Region's health and secure systems of care for those who need them" in an "effective ... [and] equitable manner" (Caring Today for a Healthy Tomorrow (CTHT), 1991, P.5). The NWRHA inherited the principle of equity and free delivery of health care from the NHS and its population views its service as one to which they have the right of free access. As an ethical-system it does not perceive liquidation as a serious threat nor does it have the power to decide which part of its population should or should not benefit from its service.

The NHS produces broad policies for its sub-system and each of these sub-systems, such as the NWRHA, translates the broad policies into more specific (regional) policies to guide its action. The regional policies and the monies received from the NHS are the main structure through which the NWRHA carries out its activities. The monies and policies are passed to its sub-systems (DHAs) to use in meeting the health needs of the population within their

boundary. In formulating its policies and decisions about the distribution of its resources it is constrained by its inherited characteristics: equity and free delivery of health care to its population. This means the NWRHA has to find ways of planning and allocating its resources so that each sub-system (DHA) will accept the resources allocated to it (DHA) as a fair share of the NWRHA resources. The statement that "over the last 10 years or so, the RHA [NWRHA] has sought to move towards equalisation of resources between all Districts" (Edmundson, 1990, p.1) implies that the NWRHA's resources were allocated inequitably to the DHAs and that the NWRHA is in the process addressing this imbalance in resource distribution.

The characteristics of the NWRHA are summarised in the third column of Figure 9. Where the characteristic of the NWRHA is the same as that of the NHS it is indicated with an arrow.

FINANCIAL PLANNING

In March 1982 the then Regional Treasurer retired. This was after an absence of six months due to health reasons. A temporary Acting Regional Treasurer was appointed on a one year contract. This contract expired in March 1983 when a substantive Regional Treasurer was appointed. After this time, i.e. 1982 - 1983, the Districts' reorganisation occurred. Due to the reorganisation many staff including top managers left the Finance Department to take up posts in the Districts. The main "consequences for these many

moves in such a short period of time is that the staff in the [Finance] Department are extremely unsettled and morale is at a very low ebb" (Reorganisation of the Treasurer Department, (RTD), 1983, P.1). While the Department "ticked over", the Acting Regional Treasurer kept "open as many vacancies as possible to allow the incoming Chief Officer as much flexibility as possible in organising and developing the Department" (RTD, 1983, P.1-2).

The brief scenario given above indicates that the Regional Treasurer appointed in 1983 took over a Finance Department in need of major renewal. It also makes clear that the new Treasurer had wide scope and flexibility to organise the Finance Department as he wished. The situation within the Finance Department was perfect for the type of innovative and autocratic personality of the new Regional Treasurer. During the reorganisation of the Finance Department the Treasurer expressed his view about the finance function thus: "the finance function must ... change its image from one of being "hidebound" by regulations and obstructive to different thinking to one of trying to enable others to achieve their objectives and therefore constructive in its approach. This type of approach ... requires a new way of considering the problems of others".

Pettigrew (1986, p.119) argued that "radical changes require strong commitment and high motivation, and therefore the unequivocal availability of a new ideology which precisely and enthusiastically endorses the change". A new ideology that would "precisely and enthusiastically endorse" the radical change the Treasurer introduced in the

organisation was not in existence by the time the Treasurer arrived in the organisation, and was still not in existence when the change was implemented. He arrived in the organisation with definite views about how resources could best be planned and allocated to the DHAs. These views were conceptualised in what became known as the SPM (a brief description of the principles, development and use of the SPM is contained in Chapter One, p.9-13). The Treasurer created the Financial Planning Section and the main task of the Section was to develop and implement the SPM.

Through the SPM the Financial Planning Section aimed to ensure efficient and equitable distribution of resources to the Districts (SRARA, 1985; Edmundson, 1990). The implementation of the SPM in the organisation was a radical change and challenge to the existing organisational thinking about resource planning. By emphasising a quantitative approach to resource planning and allocation, the Financial Planning Section through the SPM introduced cultural change into the organisation i.e. a change from a normative to a rational mode of financial planning. As stated in Chapter One (p.12-14) the SPM was resented by the Districts. When a senior manager was asked why the SPM was developed and implemented despite the prevailing attitude and resistance the manager reflectively said: the SPM's "principle is difficult to fault". The basic principle of the SPM was that the magnitude of allocation must be related to Districts' relative requirements for services planned i.e. resource allocation must be service led and the relationship between resources and services planned must be made

explicit. The manager also said that within the then Regional Team of Officers (RTO) the Regional Medical Officer commanded a position of high influence and his support for the SPM philosophy provided strong tactical support for the development of the SPM.

Other factors helped to place the SPM and its proponents in an unassailable position in their drive to implement change. In 1984, following the government's acceptance of the Griffiths (1983) report, "General Management" was introduced in the NHS. In October 1984, the Treasurer became the chief executive of the NWRHA on his appointment as the General Manager. In addition to his new strong position of power, other factors in the operating environment facilitated his drive to implement the SPM. There was pressure on the NHS to quantify both service developments and planned cost improvements so that progress could be monitored more closely. There was also general dissatisfaction with the existing planning tool known as the RAWP. The reasons the RAWP was seen as unsatisfactory are contained in Chapter One (p.5-8).

In 1985 a consultancy firm, Cooper and Lybrand, was brought in by the NWRHA to evaluate the SPM as a planning tool. The firm submitted a report in August 1985 and recommended that the SPM should replace the RAWP. The report strongly endorsed the SPM principles.

These factors: a favourable operating environment; the recommendations of external consultants; SPM's novel approach to resource planning; and most importantly the originator of the SPM being in a strong position of power

left the opponents (Districts) no choice but to accept the inevitability of change. In February 1986, the SPM calculations were first put into use in the organisation.

In September 1986, the General Manager left the NWRHA to join a consultancy firm. In 1987 the Head of Financial Planning also left the organisation. With the exit of the two key figures in the SPM saga, the organisation saw an opportunity to end its uncherished co-existence with the SPM. The mood of those who held the old ideology at the sight of an opportunity to remove the SPM could be summarised by a statement in a letter addressed to the Financial Planning Section by a member of the SPM advisory group. In the letter he speculates: "from what I can remember the Service Provision Model was the "brainchild" of the former General Manager who is now departed. I wonder if ... the Service Provision Model should depart with him". The SPM did certainly depart with him. More discussion about financial planning in the organisation and the SPM are contained in Chapter One (p.8-14).

The above discussion about the financial planning episode are summarised in the fourth column of Figure 9. The information is categorised into the six elements of MIS. They provided good indications of what would overshadow any new computer-based planning model. A senior manager was asked how the organisation would react to a new planning model initiative and he said the reaction would be: "not again". He thought the former General Manager had left a legacy which would make people wary of any new model.

The above discussion of the financial planning epi-

sode provides some indication about the culture of the organisation. Before discussing the next episode the culture of the organisation is further examined briefly.

"Appointing the General Manager is seen as one of the most significant decision a Health Authority will make" (National Association of Health Authorities and Trust, (NAHAT), 1991, p.xx). As a chief executive the General Manager's values and beliefs have major influence in shaping the culture of the organisation. Resistance by the organisation members to the General Manager's values will also bring to light the current culture. The main responsibility of the RHA is the overall planning, monitoring and allocation of resources to the DHAs. The reactions of the DHAs to the resource allocation process and the leadership style of the chief executive may indicate the type of culture prevailing in the organisation.

Since the introduction of General Management in the NHS (Griffiths, 1983), the NWRHA has had two General Managers. One determinant of culture in organisations is the influence of the leaders and the people that the leaders bring into the organisation who share their values and beliefs (Sathe, 1985). Schein (1988, p.2) emphasised the central role played by leaders in the creation of organisational culture. He argued that "organisational cultures are created by leaders, and one of the most decisive functions of leadership may well be the creation, the management, and - if and when that may become necessary - the destruction of culture". Starting with the first General Manager the influence of the two General Managers on the culture of the

organisation is examined.

It was stated earlier that the first General Manager rose to Chief Executive from the post of Treasurer. It was also stated that he came into the organisation with definite values and a vision about how strategic change in terms of how financial planning and allocation should be implemented. Strong commitment is seen as an essential mechanism that promotes values and visions in organisations. Pettigrew (1979, p.577) defines commitment as "the willingness of participants to give energy and loyalty to an organisation, to be effectively attached to its goals and values". One of the ways of building commitment is through "personalised" recruitment or recruitment on the basis of "prior acquaintance". This is in part the approach adopted by the General Manager. He recruited the head of Financial Planning on the basis of prior acquaintance. He was quite familiar with the General Manager's vision and was recruited purely to promote, develop and implement the SPM. His position as the head of Financial Planning and his relationship to the General Manager gave him much power and influence in implementing the SPM. The brief discussion that follows will illustrate the cultural climate in the NWRHA during the first General Manager's time of office.

Consensus management (Strong and Robinson, 1990) existed in the NHS before the introduction of General Management in the NHS (Griffiths, 1983). Before the Griffiths (1983) report, there were no "identifiable leaders within management ... [and] it was often difficult to establish who is in charge" (NAHAT, 1991, p.5). The DHAs

were not tightly controlled from the Region in terms of the way they deployed their resources. The DHAs received and deployed their resources in a way that seemed appropriate to them. This freedom in managing resources was threatened by the General Manager's vision expressed through the SPM. Instead of setting minimum targets and service levels for the DHAs and giving them the discretion to manage their resources provided they met the minimum targets, the Region adopted a specific funding policy. That is, the Region was not just allocating resources to the DHAs but was also prescribing where and what services they should be spent on. The DHAs resented the prescriptive guidelines from the Region and perceived it as an interference to their freedom to manage services.

As part of the efficiency drive in the NHS the DHAs were expected to institute Cost Improvement Programs (CIP). The DHAs resented the strategy adopted by the Region in implementing its CIP policy. The SPM was used to influence the amount of money a DHA should save as part of its CIP. This money was then withdrawn from the DHA into Regional fund and later redistributed to all DHAs. The policy of withdrawing the CIP fund from the DHAs was eventually abandoned. The Chief Financial Planner said the withdrawal of the CIP fund from the DHAs was scrapped because of the "bad publicity" it generated.

While the Districts were resenting the General Manager's vision expressed through the SPM, a new culture was being created at the Region. Schein's (1988, p.6) argument that the "basic assumptions and beliefs" which form an

organisation's culture develop from "learned responses to a group's problem of survival" implies that solving problems are major ingredients in the process of creating culture.

In a policy document stating the need and principles behind the SPM approach to resource allocation the Region gave what it perceived as problems which the SPM approach would help to alleviate. The document (SRARA, 1985, p.3-4) states:

[1] The prime reason for developing a service related approach is to create a link between service targets and financial targets ... The Service Provision Model is the means by which this ... is achieved.

[2] A service related approach to resource allocation is a logical consequence of the planning process, and more refined methods and policies are urgently required.

[3] In more recent years the NHS has received some criticism through the Public Accounts Committee for implied lack of management control evidenced by the large variations in unit costs seen in certain services. This has resulted in initiatives such as the publication of National Performance Indicators ... and increased emphasis on the Annual Review process at all levels.

[4] The NHS is increasingly being asked to quantify both service developments and planned cost improvements so that progress can be monitored more closely.

[5] A consequence of this is that changes in service provision must be described explicitly in terms of the effects on service levels, and conversely any development monies identified must be shown to be utilised on service develop-

ments and described in this way. It is no longer considered acceptable by Regional Health Authorities to allocate funds without knowing precisely what those funds are intended to achieve. More and more, the Regional Health Authority expects Districts to submit plans in this way.

[6] Given the necessity for a serviced based approach to the presentation of plans, it is important that the decision-making leading to the formulation of those plans is well informed and related both to Regional policies and resource requirements in broad terms. Both the service targets and the Service Provision Model financial targets are important indicators which will contribute to improved decision-making over resource allocation".

The statements above indicate what the leadership perceived as problems facing the organisation and the type of response the organisation should make to resolve them. In its external environment the leadership identified the criticism and pressure on the NHS to introduce adequate "management control", and to "quantify both service development and planned cost improvement so that progress can be monitored more closely". As implied in 5 above the leadership perceived the current planning approach and accountability within the organisation inadequate for dealing with the perceived problem. The planning and accountability approach had to change. The Districts would have to prepare and submit plans which describes an explicitly planned service, and the Region has to know precisely how and on what services monies were spent.

The submission of explicit plans and the accounting

for how monies were spent on services do not seem to be the leadership's ultimate aim. The leadership's ultimate aim is implied in 6 above which is to create a new decision-making culture within the organisation. As implied in 6 above the service targets and the Service Provision Model would inform and shape this new culture.. In general the leadership wanted the organisation to adopt a quantitative and rational decision-making culture in responding to its resource allocation and planning process.

In a letter contained in the policy document about the SPM the Chairman of the NWRHA states: "This document proposes an approach to resource allocation which is directly linked to health service planning ... I believe that it represents a decisive step forward in implementing policy changes and will help us put our resources where they are most needed".

Producing policy documents or pronouncing new values and beliefs does not mean that those beliefs and values would automatically become part of the culture of the organisation. The beliefs must be shared by members of the organisation and should inform the organisation's response to problems (Schein, 1988).

Given the belief and vision of the General manager expressed though the SPM the question may be asked: did the General Manager bring about cultural change in the organisation?

When asked what would be the eventual fate of the SPM, the Chief Financial Planner responded that the SPM concept was "well entrenched within the building [Region]"

and would continue to guide resource planning. This was after the General Manager who introduced the SPM had left the organisation. He was in effect saying that the values and visions embodied in the SPM were accepted by the Region. This implies that there were two types of culture operating within the NWRHA. One (the new culture) was operating at the centre (Region) while the second (old culture) was operating at the grassroots (DHAs). The Region embraced the SPM approach to resource allocation, advocated the need for explicitly stated plans and management control through specific funding while the Districts resented the SPM and the values emanating from the Region.

Effective communication is one means of spreading values and visions within an organisation (Pettigrew, 1979). A mechanism such as the SPM advisory group was an ideal vehicle for spreading the Regional values and vision on resources planning. Though the SPM advisory group members were drawn from the DHAs, an informant said the group existed purely for political reasons. The group had no power and the statement in p.172 indicates that some of the members resented the SPM principles. The Financial Planner and the Chief Financial Planner were once sent to hold consultation with each DHA General Manager so as to secure agreement on the Regional finance policy. When asked what he expected the outcome of the consultation to be, the Financial Planner responded that he did not expect much agreement to come out of the consultation process. He saw the consultation process as a publicity exercise. This was not surprising given the differences in the values existing

at the Region and DHAs. The outcome of the consultation process would not alter the Regional plans, but would portray the Region as having a consultative approach in its dealing with the DHAs. As discussed earlier the SPM values and its objectives were discarded after the General Manager and the Head of Financial Planning left the organisation. The leadership of the current General Manager is now examined.

The current General Manager was a former Air Vice Marshal. "He came to the health service after a career in the Royal Air Force in which he rose from Aircraft Apprentice to Air Vice Marshal" (CTHT, 1991, p.4). Just as there is a difference in the professional background of the two General Managers so also there is a major difference in the type of NHS environment they experienced as General Managers. The fundamental changes introduced in the NHS by the White Paper "Working for Patients" (1989) has created an NHS environment that was totally different from what existed in the time of the previous General Manager. The argument by Sathe (1985, p.14) that one of the important factors affecting differences in culture is "the influence of the business environment in general, and industry in particular" implies that the two General Managers may operate in different cultural climates - since they experienced different NHS environments brought about by the White Paper "Working for Patients" (1989). Because the new changes in the NHS are so fundamental and some of them are still at the initial stages of implementation one may not be able to strictly compare the leadership style of the two General

Managers. The leadership style of the current General Manager and the type of culture he is introducing into the organisation may be illustrated by the following two incidents.

(1) THE CIP

Despite the fact that the CIP fund was no longer withdrawn from the DHAs, the DHAs were still expected to achieve a certain amount of efficiency savings. The DHAs have to state in their annual plans submitted to the Region the amount of money they expect to save and identify the schemes from which the savings would be made. The schemes may be something like manpower, staff accommodation or energy. The Region monitors the DHAs performance throughout the plan period to ensure that the stated savings are achieved. I was instructed to design computer software to facilitate the control and monitoring of the DHAs CIP performance. Unfortunately the software was never used by the Region. The week the software was ready for use by the Region, the General Manager gave instruction that the Region should no longer control and monitor the DHAs CIP performance. He believed that the Region should delegate such responsibility to the DHAs. The DHAs are still expected to make the efficiency savings but the control and monitoring of the CIP is now the responsibility of the DHAs' General Managers.

This is a very different scenario from that which existed in the time of the previous General Manager. By then the CIP fund was not only withdrawn from the DHAs but also the control and monitoring of the CIP came from the

Region.

(2) Elderly Services Working Group

The Regional Elderly Services Working Group produced a document setting out guidelines for the management of elderly services by the DHAs. According to the Regional Health Economist this "document was blocked [rejected] by the General Manger". The General Manager viewed this document as being "too prescriptive". He stated that the "role of the Region was advisory not prescriptive or telling the DHAs what to do", and that the "practical day to day affairs should be left to the DHAs". This example illustrates the General Manager's belief in the values of delegation, grassroots management, and his dislike for central and bureaucratic control.

The earlier discussion indicated that two types of culture exist in the NWRHA: the grassroots (DHAs) and the centre (Region). Whether the two cultures would eventually evolve into a single corporate culture and when it would happen is open to debate. However, one may speculate that given the current General Manager's style of leadership the march toward evolving that single corporate culture that would be embraced both by the centre (Region) and grassroots (DHAs) has begun. Given that the recommendations of the White Paper are at the early stages of implementation, it is too early to say what type of culture will eventually emerge in the organisation. The shape the culture takes may depend on how the new changes such as the internal market (introduced by the White Paper "Working for Patient", 1989) affects the NHS environment and the leadership's response

to such environment.

THE ISRAS

By the end of 1988, most of the staff (especially the senior officers) in the Financial Planning Section had left the organisation and obtaining suitable replacements proved difficult. With very few staff left in the Section, there was no major initiative in terms of systems development. The Section simply "ticked over". As stated in Chapter Two (p.37-38) the reorganisation of the Finance Division in 1989 created a new Section known as the Strategic Planning Section which effectively replaced the Financial Planning Section. The staff is composed of a multi-disciplinary team. Their mission is to facilitate the implementation of the organisation's resource allocation policy through the development of planning and allocation systems. The origin of the term ISRAS and its use by this thesis to mean the Strategic Planning Section is stated in the first part of this section.

In the case of SPM discussed under the financial planning episode (p.169-170) the Financial Planning Section was created specifically to develop and implement the SPM. In the case of the Strategic Planning Section there was no specific problem such as the SPM defined for the Section as its task. When the Head of the Strategic Planning Section was asked what are the precise responsibilities of the Strategic Planning Section his response was: "there is nothing written down. Some of us have job description,

others don't. Even those that have [job description their job descriptions] have changed. You've got to play it by ear". These statements by the Head of the Strategic Planning Section indicate that the Section was created not in response to any immediate or specific problem but as a Section to tackle problems that may arise in the future. The fifth column in Figure 9 shows that ISRAS has no activity and identity at the time of its creation because it has no specific problem to address. ISRAS as a purposeful system, in principle, replaced the Financial Planning Section that developed SPM. The ISRAS is expected to broadly solve the type of problem which the Financial Planning Section sought to solve for the organisation i.e. to design systems to support the resource allocation process of the organisation. Because ISRAS was a replacement of the Financial Planning Section the ISRAS is overshadowed by the legacy left by the Financial Planning Section. The history and culture of the ISRAS is shown in Figure 9 to be overshadowed by that of the financial planning episode.

The MANGRS and ERAS were identified earlier as the two MISs designed by this thesis. The two MISs are briefly examined.

MANGRS(A1.2.2.2)

This is the MIS that was used to accomplished the first task stated in Chapter One (p.20-21). It is used to recoup the money spent on the residents of other RHAs and as stated in the introduction of Appendix A, the MANGRS

aimed "to maximise the net income to the Region" through proper identification and costing of patients from other RHAs.

Given that one can identify and classify the patients through the hospital Korner Episodes System (KES), the more problematic aspect of designing the system is how to determine the total cost of treating a patient. It raises issues such as whether the salaries of the staff at the Regional and District headquarters, cost of land and other administrative costs should be charged to patients in a hospital. It was decided that these costs exist directly or indirectly from the need to provide care for patients, and that a means should be found to allocate all cost relating to patient care to individual patients.

MANGRS derived average regional specialty costs from the available costs and activity data. It produced two sets of results using the regional and national average specialty costs for each patient treated in the NWRHA. It was found that the national average costs produced higher figures (i.e. treatment cost) than the regional average costs. A decision was taken to use the treatment costs derived by the national average costs except for cases where no national average cost exist.

The MANGRS has now been refined and more realistic average costs can be derived at hospital level instead of at the regional level. The cost derived at hospital level produced from the MANGRS is to be used instead of the national average costs in subsequent calculations. MANGRS was successfully implemented and Appendix B contains the

management's appreciation for MANGRS's success.

MANGRS is not the type of MIS whose design and implementation can produce organisational consequences such as resistance to its use by members of the organisation. It was not a system used for the actual management of the organisation. Its output was purely used to assist managers in their negotiation with other RHAs about the cost of treating their (other RHAs) residents in the NWRHA. In the future the regional officers will not need to conduct this type of negotiation because hospitals will have to invoice directly any RHA whose resident they treated.

MANGRS has no internal organisational impact such as cultural change or resistance to its use, and it is a tentative system to be replaced when the DHAs start to invoice other RHAs directly. For these reasons it is decided that the discussion in this thesis will concentrate mainly on the second MIS, ERAS. This is why MANGRS has not been included in Figure 9.

ERAS(A1.2.2.1)

ERAS is the MIS designed to assist the managers in implementing the per capita funding process introduced by the White Paper. The activities which the funding of the DHAs on a per capita basis involves are contained in Chapter One (p.21-22). Following the introduction of the per capita funding system by the White Paper, a group known as the Resource Allocation Working Party Group (RAWG) was set up by the NWRHA. The main purpose for setting up the RAWG

were:

"(1) To interpret national guidance for the RHA,... etc.

(2) To prepare a draft resource allocation policy for consideration by the RHA based upon the principles outlined in the White Paper.

(3) To examine all factors involved in drawing up such policy and advising on the way forward.

(4) To identify a practical time table for implementation of the policy, pointing out the likely implications for service delivery.

(5) To prepare advice for the preparation of the 1991/92 planning guidelines" (Edmundson, 1990, p.1). These responsibilities of the RAWG were aimed at ensuring the successful implementation of the per capita funding process within the organisation.

The concept of the per capita funding suggests a very uncomplicated resource allocation mechanism. In principle it is simply a case of allocating on a pro-rata basis a given sum of money to the Districts based on their resident population. This seemingly simple process becomes complex when the following factors are taken into consideration:

(a). FUNDING IS CURRENTLY PROVIDER BASED.

The Districts are currently funded on the basis of their catchment population or the services they provide. ERAS estimated that a given District's spending for 1990/91 is £114,282m. The estimated spend on its resident population is £64,544m. Based on its resident population ERAS estimated that the District would get £57,301m as its

projected 1990/91 allocation. Given the figure of £57,301m (its target allocation) instead of £114,282m (its estimated spend) the District will have to rationalise services (closure of hospitals) in order to stay within budget.

(2) DETERMINATION OF RESIDENT SPEND.

It was stated above that a particular District's spend is £114,282m. How much of this is actually spent on its own residents? Whose residents other than its own was part of the money spent on? How much was spent by other Health Authorities on its own residents, and how does one identify these other Health Authorities? These are some of the questions that must be answered to inform the resource allocation process.

(3) WEIGHTING FACTORS.

The DOH uses the age weight and under 75 standard mortality ratio as weighting factors in determining Regional allocations. The DOH accepted that the national methodology may not be sensitive enough to be applied at sub-regional level without taking into account factors such as social deprivation, accident and emergency department, old long stay mental illness/handicap, poor primary care and high level of homelessness. Determining acceptable weighting factors for these issues are very problematic given the current level of data on quality of care and social disadvantage. The application of certain weights will shift resources from one District to another, creating winners and losers.

The national age weights and the under 75 standard mortality ratio were the basic weighting factors used in the initial versions of ERAS. There was much debate among the RAWG members on the appropriate weighting factors to be used in ERAS and work was commissioned aimed at obtaining the deprivation factors and regional age weights to be used as input variables for the subsequent versions of ERAS.

(4) TRANSITION.

The DOH guidance (EL90MB/22, P.5) states "the pace of change towards weighted capitation based funding at District level - calculated on whatever basis - will depend upon:

(a). The overall level of resources in future years;

(b). The extent of disparities between Districts in a Region;

(c). The rate at which strategic shifts can be brought about in those Districts which are further from their eventual share of resources". This means that the NWRHA has to decide on the appropriate strategy for moving the Districts from the present funding system to the per capita based funding system.

In Figure 9 columns two to five constitutes ERAS's primary context while column six constitute ERAS's secondary context. The primary and secondary contexts make up ERAS total context. Starting with ERAS's first element, purpose, a summary of ERAS's total context is presented.

(A) Purpose.

In Figure 9 column six the purpose of ERAS is the distribution of resources to the DHAs on a per capita basis. Columns two to five indicate that the organisation has long been interested in ensuring that its resources are equitably distributed. To achieve effective distribution of resources to the DHAs one has to perceive ERAS purpose as the equitable distribution of resources to the DHAs on a per capita basis.

(B) History.

In Figure 9 column six the history of ERAS shows that ERAS was born in 1989. It is a new approach to planning and replaced the organisation's previous allocation and planning system. Columns two to five indicate that there has been much politics and resistance to previous methods of resource allocation and planning within the organisation. To be effective the ERAS has to be designed with an awareness of its history as a new approach to resource planning which is overshadowed by past resistance to previous planning systems. There is a need to be aware of the past organisational attitude to its predecessor (SPM).

(C) Identity.

Column six states ERAS identity as a resident based resource allocation system. The awareness of its identity is essential for whatever is perceived to be outside the identity constitutes its environment. The environment is

the entities it interacts with in terms of input and output. In deciding what and how to interact with its environment it is important that ERAS acknowledges its inherited ethical-systems identity. This would ensure that it does not behave like a business oriented system. One can restate ERAS identity as an ethical, resident population based, resource allocation system.

(D) Culture.

The culture before the creation of ERAS has been either a normative or rational mode of planning. ERAS culture is described as a combination of rational and normative modes of planning. If ERAS decides to emphasise only the rational mode of planning, it has to treat each District equally by allocating resources purely on the basis of each DHA's resident population. The type of problem this might create is highlighted in p.187-188 under the sub-heading: funding is currently provider based. To move the DHAs from the current funding system to the per capita system in a way that minimises disruption to the current level of hospital services will require a combination of the normative and rational mode of resource planning and allocation system. The normative aspect of the resource planning system will ensure that the level of services currently provided by each District is protected even if it means giving a District more money that it would get if resources were distributed on a purely per capita basis.

(E) Activity.

ERAS and all previous systems have basically the same type of activity. As indicated in Figure 9 their activities has been about the determination and allocation of resources.

(F) Structure.

Column six gives the structure of ERAS as consisting of new regional policies, managers, computer hardware and software. The policies are defined by the RAWP. Computer hardware and software were inherited from previous systems. The discussion about the SPM indicates that SPM was implemented despite resistance from the Districts. This was possible because of the strong power base of those that implemented the SPM. This suggests that a manager with a strong position of power is needed to implement ERAS if there is strong opposition to ERAS implementation by the DHAs.

The investigation of the relevant episodes (purposeful systems), entering a summary of the data gathered in Figure 9, and producing a summary of the six MIS elements from Figure 9 as done in a - f above, completes the context analysis phase. The next phase is to carry out the context evaluation process.

As stated in Chapter Four the task of context evaluation is to examine the data about each MIS element obtained from the context analysis phase against the other MIS elements. The context evaluation of ERAS is contained in

FIGURE 10 (CONTEXT EVALUATION)

	PURPOSE	HISTORY	IDENTITY	CULTURE	ACTIVITY	STRUCTURE
PURPOSE	A of page 190	X	X	X	X	X
HISTORY	History indicates that purpose may be achieved but not without strong resistance from the Districts	B of page 190	X	X	X	X
IDENTITY	No conflict is expected between the purpose and identity	A fit exists between history and identity	C of page 190	X	X	X
CULTURE	Provided a proper balance is achieved between the rational and normative approaches no major conflict will emerge	History indicates that resistance is inevitable if the culture emphasizes rationality	No conflict is expected between identity and culture	D of page 191	X	X
ACTIVITY	No conflict is expected between purpose and activity	No conflict is expected between history and activity	Identity might be a hinderance to activity because entities from which to obtain inputs are not clearly defined	No conflict is expected provided that activity does not emphasize rationality in its approach	E of page 192	X
STRUCTURE	Available structure is sufficient to achieve the purpose	Structure is sufficient to overcome the attitude created by past history	Available structure is compatible with identity	Structure is compatible with culture	There is a fit between activity and structure	F of page 192

Figure 10 and is briefly examined.

In the purpose and purpose coordinate is the information "A of page 190". This means that this coordinate ought to contain the summary of ERAS's purpose which is contained in page 190 number A. The reason for placing "A of page 190" in the coordinate instead of the actual summary of ERAS's purpose is because of the lack of adequate space to contain it. At the history and history coordinate is the information "B of page 190". This means that the history of ERAS on page 190 number B is to be placed in this coordinate. The same principle applies to the identity (C of page 190), culture (D of page 191), activity (E of page 192) and structure (F of page 192) elements of ERAS. They are information from the context analysis phase.

There are fifteen coordinates in Figure 10 that contain the "x" symbol. The "x" indicates that the coordinate containing it ("x") should be left blank because it has a duplicate elsewhere within Figure 10. For example on the second row there is the "x" symbol at the history and purpose coordinate. This is because at the third row there is the purpose and history coordinate and since the aim of the context evaluation is to determine the fit between purpose and history the two coordinates (history and purpose at row two, and purpose and history coordinate at row three) will contain the same information. Entering the same information in both coordinates will be an unnecessary duplication. It is therefore decided to eliminate all duplicate coordinates by placing the "x" symbol on them.

Having entered the summaries of each MIS element from the context analysis phase in the appropriate coordinate in Figure 10 one may start the context evaluation process from any of the MIS elements on the top row of Figure 10. In this example we start from the first element, purpose, on the top row and examine the fit between ERAS's purpose and the other elements on the first column. The next element to purpose on the first column is the history. One examines purpose against history by determining the fit between the information placed in the purpose and purpose coordinate (A of page 190) against the information in the history and history coordinate (B of page 190) and the result is placed in the purpose and history coordinate. In this example it is found that history indicates that purpose may be achieved but not without strong resistance from the Districts. The previous effort by the organisation to ensure that its resources are equitably distributed among the Districts created losers and gainers. Those DHAs that traditionally received a bigger share of the organisations resources resisted any attempt to move resources away from them to the less fortunate Districts. The information in the history and purpose coordinate means that either one proceeds with the ERAS's design quite aware of the potential resistance or undertakes further investigation aimed at finding ways to minimise the resistance.

The next element to history on the first column is the identity. As in the case of history, the purpose (i.e. the information in "A of page 190") is examined against the information placed in the identity and identity coordinate

(C of page 190) and the result is placed in the purpose and identity coordinate. In this example it is found that there is no conflict between purpose and identity. That is, its purpose of equitable distribution of resources on a per capita basis is compatible with its identity i.e an ethical resident based resource allocation system. They would not be compatible if its identity is that of a business oriented system which will mean that ERAS has to seek its purpose purely by the most efficient manner rather that in an equitable manner. The compatibility between the ERAS's purpose and identity means that no further inquiry may be necessary to examine the fit between its purpose and identity. This process is repeated for other elements culture, activity and structure in the first column. Having examined purpose one moves to the next element, history, on the top row. At the history and history coordinate (B of page 190) is placed the information about ERAS's history. The next element to history of the first column is identity. The history (B of page 190) is examined against identity (C of page 190) and the result is placed in the history and identity coordinate. In this example it is found that there is no conflict between the history and identity. By basing its identity on the number of residents in each DHA the ERAS is in a better position to be accepted by the DHAs than the financial planning (i.e. SPM) episode whose identity was based on the service levels provided by each DHA. It is easier to justify an output based on the actual population of a DHA than an output based on the level of services a DHA is expected to provide. Unlike the previous

episodes one expects ERAS's identity to be more acceptable to the DHAs.

History is used to repeat the same process by examining it against culture, activity and structure. The same process used to examine history is applied to the rest of the elements on the top row.

Any of the information in Figure 10 may force further investigation to remove a hindrance before proceeding with the MIS design. When one has entered the necessary information into Figure 10 and it is thought that no further investigation about the issues in Figure 10 is necessary the design process can proceed to the next phase of Figure 4 i.e. organising the MIS elements.

STAGE THREE: ORGANISING THE MIS ELEMENTS (Design).

It was suggested in Chapter Four that MIS design is best approached from the MIS activity element and this thesis started its design process from the activity element. The main tool used in this thesis in the logical design process is the Sheffield Business School's adaptation of the Gane and Sarson's (1979) structured methodology. The difference between the Gane and Sarson (1979) methodology and its Sheffield Business School adaptation is briefly discussed.

Figure 11 shows the basic symbols and convention used in the Gane and Sarson's methodology. A box or square is used to represent the destination or origin of data. In Figure 11 the square is labelled "District". A rounded

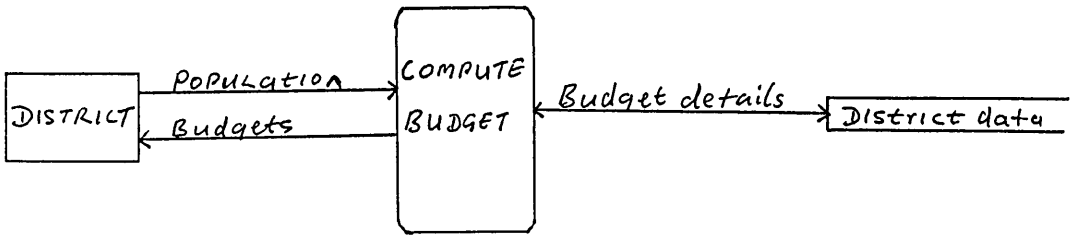
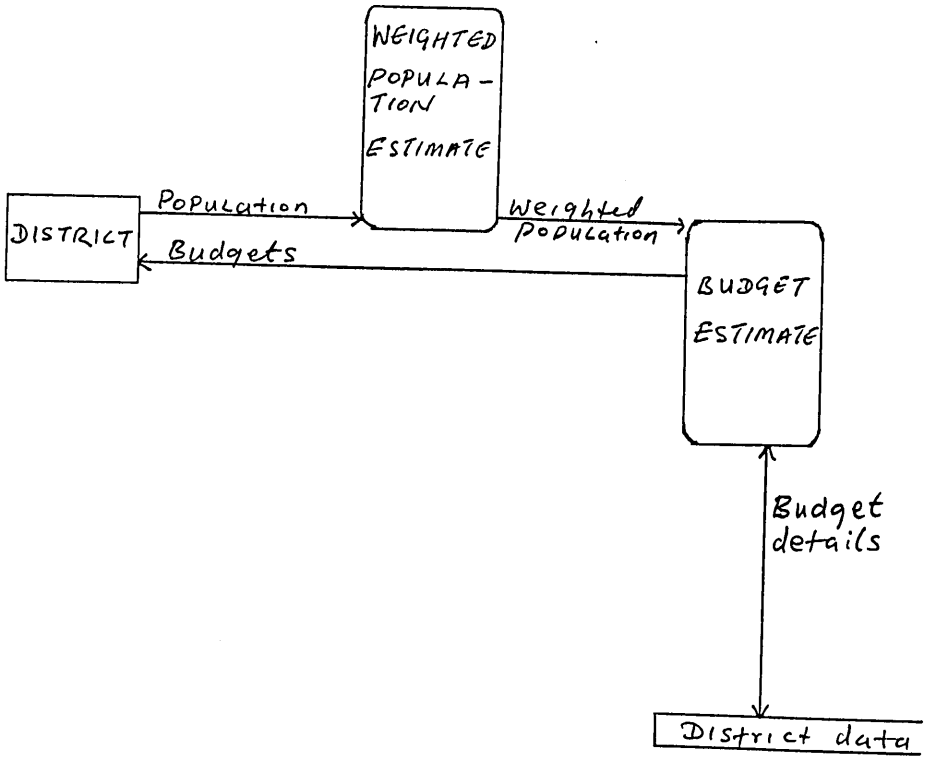

DISTRICT
Population
Budgets
COMPUTE
BUDGET
Budget details
District data

FIGURE 11B


WEIGHTED
POPULA-
TION
ESTIMATE
DISTRICT
Population
Budgets
Weighted
Population
BUDGET
ESTIMATE
Budget
details
District data

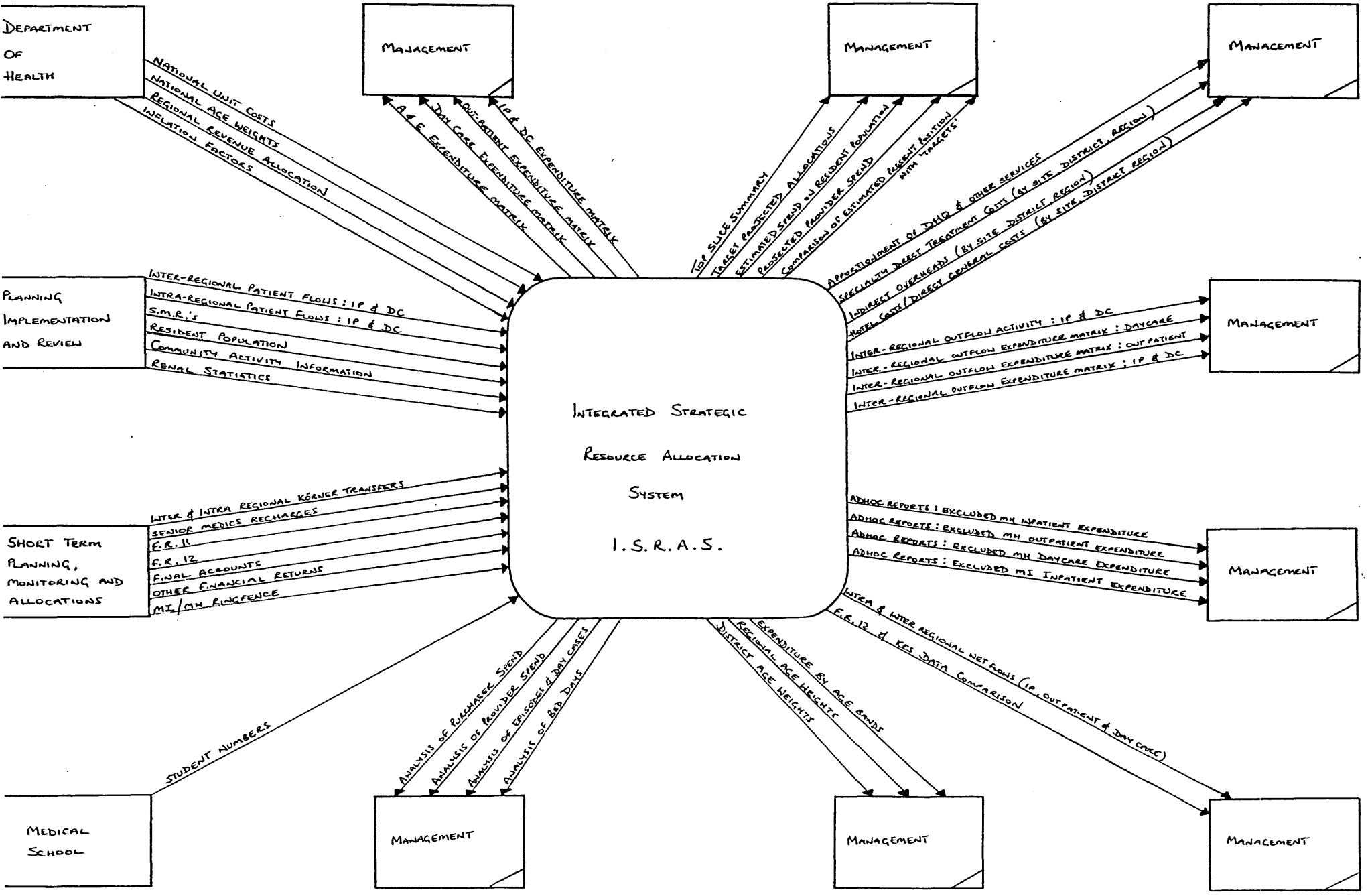
rectangle is used to represent a data transformation process. In Figure 11 the rounded rectangle is labelled "compute budget". It indicates a process of transforming input data into Districts' budgets. An open-ended rectangle is used to represent a file or store for data. In Figure 11 the file is labelled "District data". An arrow is used to represent data flow. In Figure 11 the arrows labelled "population", "budget" and "budget details" are data flows. When the four symbols - square, arrow, rounded rectangle and open-ended rectangle - are used to diagrammatically represent an operation as shown in Figure 11 the diagram is known as a Data Flow Diagram (DFD). A process such as the one labelled "compute budget" in Figure 11 can be decomposed into lower level processes. For example the "compute budget" process is decomposed into a two-stage process of calculating the Districts weighted population and using the weighted population to determine Districts budgets. The decomposed version of Figure 11 is shown in Figure 11B. Each of the two processes (weighted population estimate and budget estimate) can be decomposed into lower level processes.

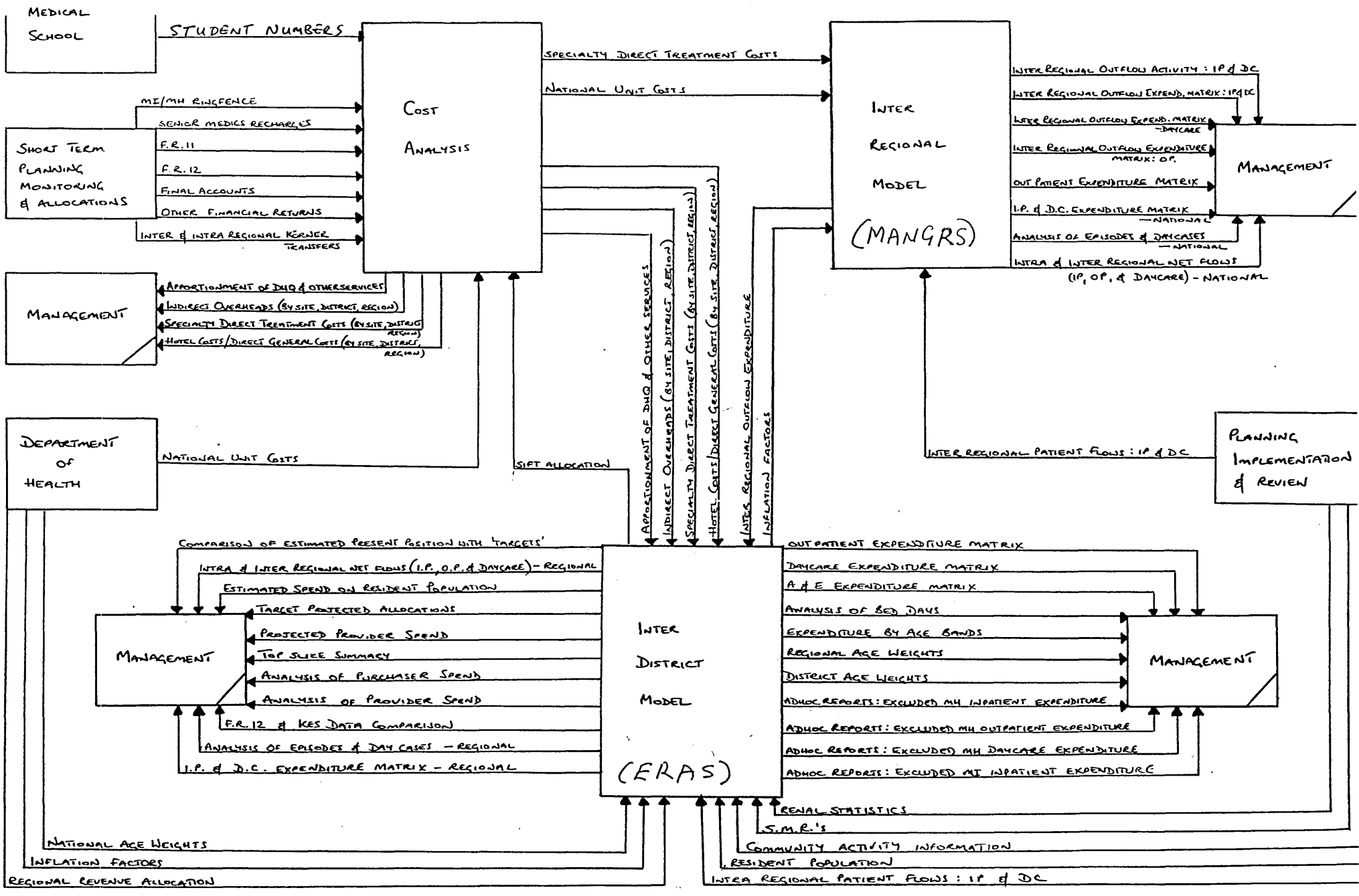
The Sheffield Business School perceives the Gane and Sarson's DFD as an operational level DFD and added to it two higher level diagrams known as the contextual and functional diagrams. The contextual and functional diagrams are the Sheffield Business School's addition to the Gane and Sarson's methodology. This thesis applied the contextual, functional and operation DFD's in its MIS design

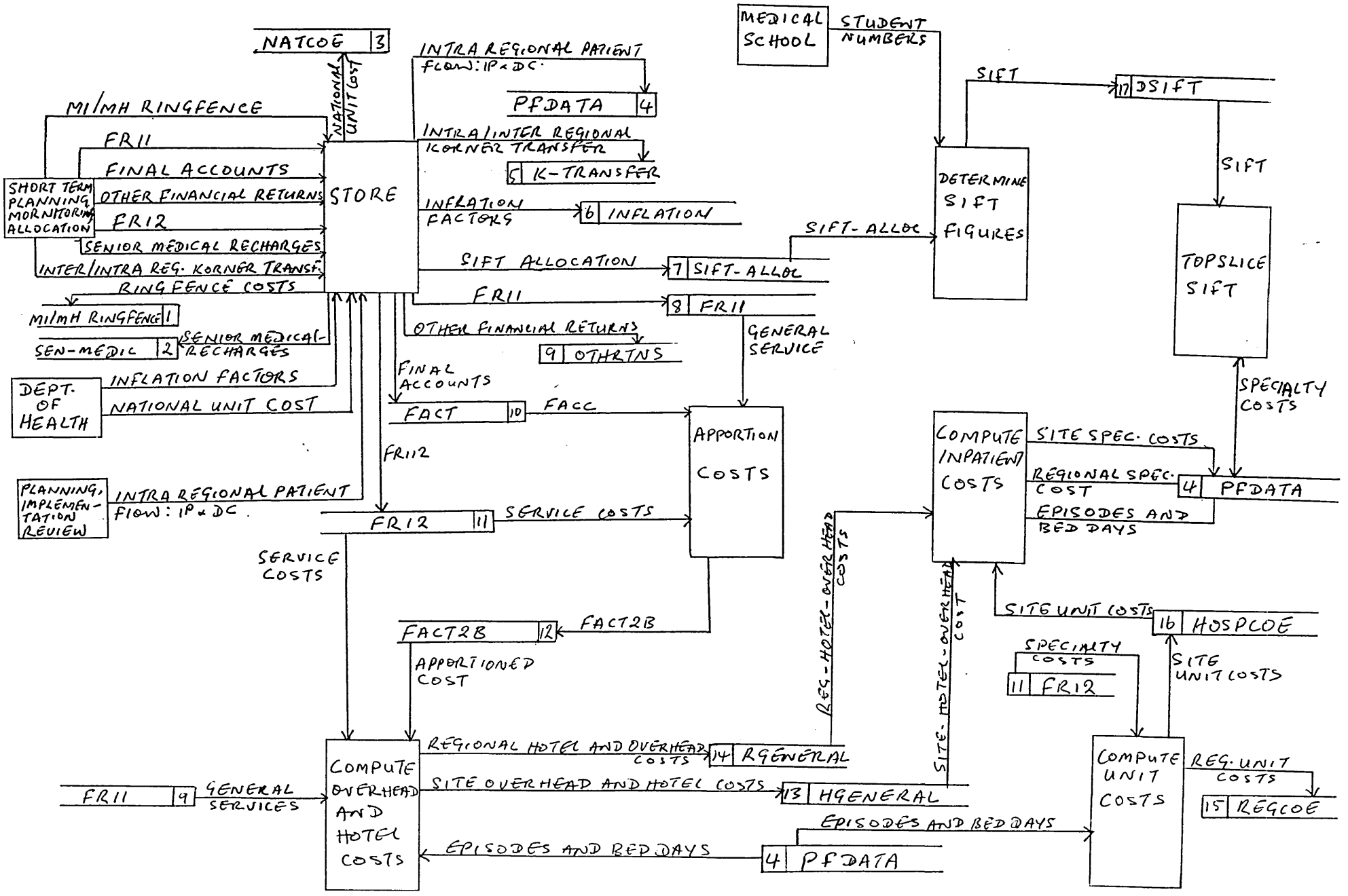
process.

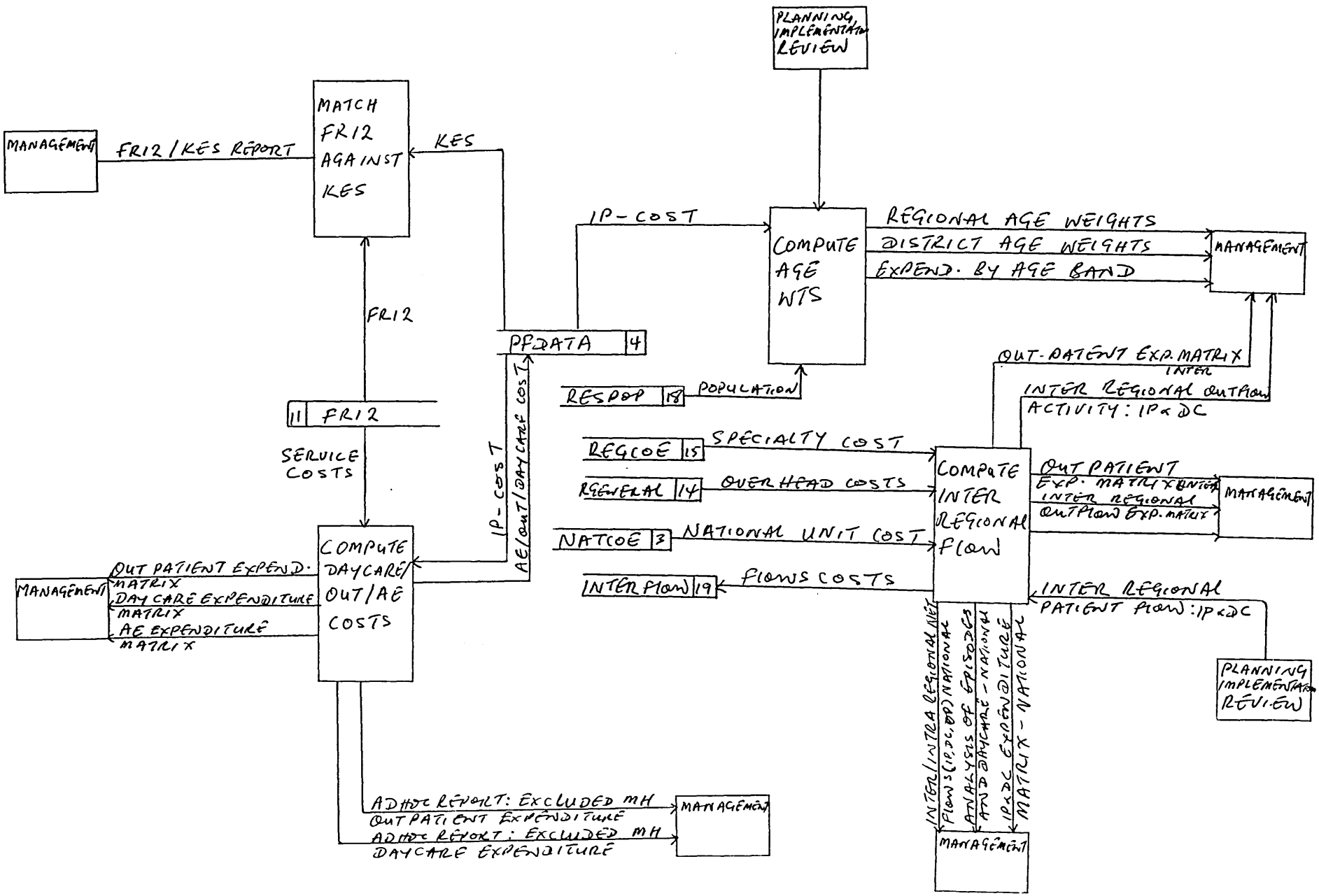
The contextual diagram is the highest level of resolution. It broadly defines the systems boundary and specifies the entities that interacts with the system in terms of input and output. It was decided to view ISRAS as the contextual level of resolution since the two MISs designed by this thesis are sub-systems of ISRAS. Figure 12 is a contextual diagram showing ISRAS and the entities that interact with it. ISRAS and its boundary is represented by the big rectangle while the entities that interact with ISRAS are represented by the small rectangles. The arrows show the data flow between ISRAS and the entities. When one removes the boundary of ISRAS its sub-systems are revealed. A diagram of the sub-systems is what the Sheffield Business School defines as the functional diagram. Figure 13 is a functional diagram showing ERAS and MANGRS as the sub-systems of ISRAS. It specifies the boundary of each sub-system, the interaction between the sub-systems and the entities they interact with in terms of information flow.

The specialty unit costs and overhead costs attracted by each patient are essential data needed by ERAS and MANGRS. The process of deriving the specialty unit costs and overhead costs is very complex in terms of the volume of data, classification of costs and levels of computation. Because the process is complex and is common to both ERAS and MANGRS in terms of input and some output, it was decided that for design convenience it would be better to logically group and treat the process as if it is a separate function. It is represented in Figure 13 by the rectan-


DEPARTMENT OF HEALTH
NATIONAL UNIT COSTS
NATIONAL AGE WEIGHTS
REGIONAL REVENUE ALLOCATION
INFLATION FACTORS
MANAGEMENT
A & E EXPENDITURE MATRIX
DAY CASE EXPENDITURE MATRIX
OUT-PATIENT EXPENDITURE MATRIX
IP & DC EXPENDITURE MATRIX
MANAGEMENT
TOP SLICE SUMMARY
TARGET PROJECTED ALLOCATIONS
ESTIMATED SPEND ON RESIDENT POPULATION
PROJECTED PROVIDER SPEND
COMPARISON OF ESTIMATED PERCENT POSITION WITH TARGETS
MANAGEMENT
APPORTIONMENT OF DHSS & OTHER SERVICES
SPECIALITY DIRECT TREATMENT COSTS (BY SITE, DISTRICT, REGION)
INDIRECT OVERHEADS (BY SITE, DISTRICT, REGION)
HOTEL COSTS/DIRECT GENERAL COSTS (BY SITE, DISTRICT, REGION)
PLANNING IMPLEMENTATION AND REVIEW
INTER-REGIONAL PATIENT FLOWS : IP & DC
INTRA-REGIONAL PATIENT FLOWS : IP & DC
S.M.R.'s
RESIDENT POPULATION
COMMUNITY ACTIVITY INFORMATION
RENAL STATISTICS
INTEGRATED STRATEGIC RESOURCE ALLOCATION SYSTEM
I.S.R.A.S.
MANAGEMENT
INTER-REGIONAL OUTFLOW ACTIVITY : IP & DC
INTER-REGIONAL OUTFLOW EXPENDITURE MATRIX : DAYCARE
INTER-REGIONAL OUTFLOW EXPENDITURE MATRIX : OUTPATIENT
INTER-REGIONAL OUTFLOW EXPENDITURE MATRIX : IP & DC
SHORT TERM PLANNING, MONITORING AND ALLOCATIONS
INTER & INTRA REGIONAL KÖRNER TRANSFERS
SENIOR MEDICS RECHARGES
F.R. 11
F.R. 12
FINAL ACCOUNTS
OTHER FINANCIAL RETURNS
MI/MH RINGFENCE
ADHOC REPORTS : EXCLUDED MH INPATIENT EXPENDITURE
ADHOC REPORTS : EXCLUDED MH OUTPATIENT EXPENDITURE
ADHOC REPORTS : EXCLUDED MH DAYCARE EXPENDITURE
ADHOC REPORTS : EXCLUDED MI INPATIENT EXPENDITURE
MANAGEMENT
MEDICAL SCHOOL
STUDENT NUMBERS
ANALYSIS OF PURCHASER SPEND
ANALYSIS OF PROVIDER SPEND
ANALYSIS OF EPISODES & DAY CASES
ANALYSIS OF BED DAYS
MANAGEMENT
EXPENDITURE BY AGE BANDS
REGIONAL AGE HEIGHTS
DISTRICT AGE WEIGHTS
MANAGEMENT
INTRA & INTER REGIONAL NET FLOWS (IP, OUTPATIENT & DAY CARE)
F.R.12 & KES DATA COMPARISON
MANAGEMENT


MEDICAL SCHOOL
STUDENT NUMBERS
MI/MH RINGFENCE
SENIOR MEDICS RECHARGES
SHORT TERM PLANNING MONITORING & ALLOCATIONS
F.R.11
F.R.12
FINAL ACCOUNTS
OTHER FINANCIAL RETURNS
INTER & INTRA REGIONAL KERNER TRANSFERS
COST ANALYSIS
SPECIALTY DIRECT TREATMENT COSTS
NATIONAL UNIT COSTS
INTER REGIONAL MODEL (MANGRS)
INTER REGIONAL OUTFLOW ACTIVITY : IP & DC
INTER REGIONAL OUTFLOW EXPEND. MATRIX : IP & DC
INTER REGIONAL OUTFLOW EXPEND. MATRIX - DAYCARE
INTER REGIONAL OUTFLOW EXPENDITURE MATRIX: OP.
OUT PATIENT EXPENDITURE MATRIX
I.P. & D.C. EXPENDITURE MATRIX - NATIONAL
ANALYSIS OF EPISODES & DAYCASES - NATIONAL
INTRA & INTER REGIONAL NET FLOWS (IP, OP, & DAYCARE) - NATIONAL
MANAGEMENT
MANAGEMENT
APPORTIONMENT OF DHQ & OTHER SERVICES
INDIRECT OVERHEADS (BY SITE, DISTRICT, REGION)
SPECIALTY DIRECT TREATMENT COSTS (BY SITE, DISTRICT, REGION)
HOTEL COSTS/DIRECT GENERAL COSTS (BY SITE, DISTRICT, REGION)
DEPARTMENT OF HEALTH
NATIONAL UNIT COSTS
SIFT ALLOCATION
APPORTIONMENT OF DHQ & OTHER SERVICES
INDIRECT OVERHEADS (BY SITE, DISTRICT, REGION)
SPECIALTY DIRECT TREATMENT COSTS (BY SITE, DISTRICT, REGION)
HOTEL COSTS/DIRECT GENERAL COSTS (BY SITE, DISTRICT, REGION)
INTER REGIONAL OUTFLOW EXPENDITURE
INFLATION FACTORS
INTER REGIONAL PATIENT FLOWS : IP & DC
PLANNING IMPLEMENTATION & REVIEW
COMPARISON OF ESTIMATED PRESENT POSITION WITH 'TARGETS'
INTRA & INTER REGIONAL NET FLOWS (I.P., O.P. & DAYCARE) - REGIONAL
ESTIMATED SPEND ON RESIDENT POPULATION
TARGET PROJECTED ALLOCATIONS
PROJECTED PROVIDER SPEND
TOP SLICE SUMMARY
ANALYSIS OF PURCHASER SPEND
ANALYSIS OF PROVIDER SPEND
F.R.12 & KES DATA COMPARISON
ANALYSIS OF EPISODES & DAY CASES - REGIONAL
I.P. & D.C. EXPENDITURE MATRIX - REGIONAL
MANAGEMENT
INTER DISTRICT MODEL (ERAS)
OUTPATIENT EXPENDITURE MATRIX
DAYCARE EXPENDITURE MATRIX
A & E EXPENDITURE MATRIX
ANALYSIS OF BED DAYS
EXPENDITURE BY AGE BANDS
REGIONAL AGE WEIGHTS
DISTRICT AGE WEIGHTS
ADHOC REPORTS: EXCLUDED MH INPATIENT EXPENDITURE
ADHOC REPORTS: EXCLUDED MH OUTPATIENT EXPENDITURE
ADHOC REPORTS: EXCLUDED MH DAYCARE EXPENDITURE
ADHOC REPORTS: EXCLUDED MI INPATIENT EXPENDITURE
MANAGEMENT
RENAL STATISTICS
S.M.R.'s
COMMUNITY ACTIVITY INFORMATION
RESIDENT POPULATION
INTRA REGIONAL PATIENT FLOWS : IP & DC
NATIONAL AGE WEIGHTS
INFLATION FACTORS
REGIONAL REVENUE ALLOCATION


NATCOE 3
NATIONAL UNIT COST
INTRA REGIONAL PATIENT FLOW: IP & DC
PFDATA 4
MI/MH RINGFENCE
FR11
FINAL ACCOUNTS
OTHER FINANCIAL RETURNS
FR12
SENIOR MEDICAL RECHARGES
INTER/INTRA REG. KORNER TRANSF.
RINGFENCE COSTS
SHORT TERM PLANNING MONITORING ALLOCATION
STORE
INTRA/INTER REGIONAL ICORNER TRANSFER
5 K-TRANSFER
INFLATION FACTORS
6 INFLATION
SIFT ALLOCATION
7 SIFT-ALLOC
FR11
8 FR11
OTHER FINANCIAL RETURNS
9 OTHRTNS
MI/MH RINGFENCE 1
SEN-MEDIC 2
SENIOR MEDICAL-RECHARGES
DEPT. OF HEALTH
INFLATION FACTORS
NATIONAL UNIT COST
FINAL ACCOUNTS
FACT 10
FACC
APPORTION COSTS
FR12
PLANNING, IMPLEMENTATION REVIEW
INTRA REGIONAL PATIENT FLOW: IP & DC
FR12 11
SERVICE COSTS
SERVICE COSTS
FACT2B 12
FACT2B
APPORTIONED COST
MEDICAL SCHOOL
STUDENT NUMBERS
SIFT
17 DSIFT
SIFT
DETERMINE SIFT FIGURES
SIFT-ALLOC
TOPSLICE SIFT
SPECIALTY COSTS
COMPUTE INPATIENT COSTS
SITE SPEC. COSTS
REGIONAL SPEC. COST
4 PFDATA
EPISODES AND BED DAYS
REG-HOTEL-OVERHEAD COSTS
SITE-HOTEL-OVERHEAD COST
SITE UNIT COSTS
16 HOSPCOE
SPECIALTY COSTS
11 FR12
SITE UNIT COSTS
COMPUTE UNIT COSTS
REG. UNIT COSTS
15 REGCOE
REGIONAL HOTEL AND OVERHEAD COSTS
14 RGENERAL
FR11 9
GENERAL SERVICES
COMPUTE OVERHEAD AND HOTEL COSTS
SITE OVERHEAD AND HOTEL COSTS
13 HGENERAL
EPISODES AND BED DAYS
EPISODES AND BED DAYS
4 PFDATA


PLANNING, IMPLEMENTATION REVIEW
MANAGEMENT
FR12/KES REPORT
MATCH FR12 AGAINST KES
KES
IP-COST
COMPUTE AGE WTS
REGIONAL AGE WEIGHTS
DISTRICT AGE WEIGHTS
EXPEND. BY AGE BAND
MANAGEMENT
FR12
PFDATA 4
RESPOP 18
POPULATION
OUT-PATIENT EXP. MATRIX
INTER REGIONAL OUTFLOW ACTIVITY: IP & DC
11 FR12
SERVICE COSTS
IP-COST
AE/OUT/DAYCARE COST
REGCOE 15
SPECIALTY COST
REGGENERAL 14
OVERHEAD COSTS
NATCOE 3
NATIONAL UNIT COST
INTERFLOW 19
FLOWS COSTS
COMPUTE INTER REGIONAL FLOW
OUT PATIENT EXP. MATRIX
INTER REGIONAL OUTFLOW EXP. MATRIX
MANAGEMENT
INTER REGIONAL PATIENT FLOW: IP & DC
PLANNING IMPLEMENTATION REVIEW
COMPUTE DAYCARE/OUT/AE COSTS
MANAGEMENT
OUT PATIENT EXPEND. MATRIX
DAY CARE EXPENDITURE MATRIX
AE EXPENDITURE MATRIX
ADHOC REPORT: EXCLUDED MH OUTPATIENT EXPENDITURE
ADHOC REPORT: EXCLUDED MH DAYCARE EXPENDITURE
MANAGEMENT
INTER/INTRA REGIONAL NETFLOWS (IP, DC, OP) NATIONAL
ANALYSIS OF EPISODES AND DAYCARE - NATIONAL
IP & DC EXPENDITURE MATRIX - NATIONAL
MANAGEMENT

MANAGE-MENT
ANALYSIS OF PURCHASED SPELL
ANALYSIS OF PROVIDED SPELL
ANALYSIS OF EPISODES AND DAYCARE REFERRALS
IP&DC EXPENDITURE MATRIX REGIONAL
INTER/INTRA REGIONAL NET FLOWS (IP,DC,OP) - REGIONAL
DAYCARE EXPENDITURE MATRIX
GENERATE REPORTS
AE EXPENDITURE MATRIX
ANALYSIS OF BEDDAYS
ADHOC REPORT: EXCLUDED IP MH EXPENDITURE
ADHOC REPORT: EXCLUDE MI INPATIENT EXPENDITURE
MANAGE-MENT
NETFLOWS
20 NETFLOW
INFLATION 6
SMR 19
RESOP 18
POPULATION
INFLATION FACTORS
SMR
DETERMI-NG ALLOCA-TIONS
PLANNING IMPLEMENTATION REGION
SMR
ESTIMATED SPEND ON RESIDENT POPULATION
COMPARISON OF ESTIMATED RESIDENT POSITION WITH TARGET
TARGET PROJECTED ALLOCATION PROJECTED RESOURCE SPEND
TOPSLICE SUMMARY
MANAGE-MENT
MANAGE-MENT

gle labelled "cost analysis".

To derive the operational level diagram one has to remove the boundaries of ERAS and MANGRS. The operational diagram is the lowest level of resolution and specifies the logical activities of each sub-system. The operational diagram for ERAS and MANGRS are contained in Figures 14A, 14B and 14C. Figure 13 indicates that none of the sub-systems (ERAS and MANGRS) is self contained or functions independently. The relationship between them is depicted by the flow of information or arrows connecting them. At the operational level (Figures 14A, 14B, 14C) the relationship between the sub-systems is maintained through the sharing of files, and the output of one sub-system's process being an input to another sub-system's process. This means that Figures 14A, 14B and 14C is a single diagram split into three pages for ease of handling and documentation.

When the contextual, functional and operational diagrams have been completed, discussed and agreed with the users the next task is to produce a data dictionary and make decisions about the type of hardware and software suitable for the physical design and implementation of the system. These tasks were not performed by this thesis because of the following reasons:

(a) Producing a data dictionary is a time consuming task. Given the size of ERAS and MANGRS, past experience suggests that, it will take an individual about two months to produce the data dictionary. With the exception of me, there was no one involved in the MIS design who had the technical

knowledge necessary for building a data dictionary. The speed at which the White Paper was to be implemented meant it was not feasible for me to complete the data dictionary before proceeding to the physical design. Inadequate resources (i.e. a design assistant with technical knowledge) and time constraints were responsible for not producing the formal data dictionary prior to the physical design of ERAS.

(b) The output of the data dictionary helps to inform decisions about the type of hardware and software necessary for the physical design and implementation. The organisation already has extensive hardware facilities (e.g. a computer network based on the Apricot VX FT server) and software (e.g. dBase IV) on which any MIS developed in the organisation has to be implemented. This meant that there was no need to go through the process of deciding which computer facility to purchase by estimating data volumes and program size from the data dictionary. A data dictionary would have been necessary if a decision was to be made about purchasing a computer facility for the MIS.

(c) Producing a data dictionary and a diagram of the overall logical and physical design serves as part of the systems documentation and is very useful for future modification of the system. The client is aware of this and said new staff will be appointed to assist in producing the documentation. Pending the appointment of new staff I moved into the physical (software) design process. A formal detailed documentation of the system will be produced when the resources become available.

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CHAPTER SIX

6. THE VALIDITY OF MIS RESEARCH OUTCOME

The aim of section 6.1 is to discuss and relate some of the findings of this thesis to the work of other authors. The works examined are that of Mumford (1983a and 1983b), Banbury (1987), and Davies and Wood-Harper (1989). These works were chosen because they were the most relevant to the findings of this thesis. This research is action research based on a single case. Most of the criticisms directed against action research and case studies are voiced from the perspective of the natural science method of inquiry. The natural science method of inquiry and the problem of acquiring human knowledge are briefly examined in section 6.2. The discussion about the natural science method of inquiry is used in section 6.3 to briefly examine the validity of the research.

6.1 RELATED WORK

Mumford (1983a, p.9) developed an information "systems design methodology called ETHICS - standing for Effective Technical and Human Implementation of Computer-based Systems". Mumford (1983b, p.47) states: "the traditional approach to the design of computer systems is coming under attack. Many early computer systems encountered resistance, were expensive to operate because of unanticipated human

cost and did not meet management expectations ... There is increasing awareness that treating people as adjuncts to machines does not work". To ensure that people are not treated as adjuncts to computers the ETHICS methodology offers an approach which encourages active users' participation in the design of information systems. The ETHICS methodology advocates that "all groups with an interest in design outcomes will be involved in the [design] process, and their interests will be represented in any design team that is created" (Mumford, 1983b, p.47).

There are fifteen steps or stages in the ETHICS methodology. The ninth step of the ETHICS methodology is known as "future analysis" and the task involves "a broad assessment of the required amount and focus of system flexibility ... [through] an identification and analysis of future changes likely to affect the system within the next five years" (Mumford, 1983a, p.85). The findings of this thesis suggest that another step whose task is a reverse of the task of the "future analysis" step should be included amongst the steps of ETHICS methodology. "Past analysis" is suggested as the title of the step and the task would involve a broad assessment of the required amount and focus of systems flexibility through an identification and analysis of past changes likely to affect the new system.

Mumford (1983b, p.47) states: "instead of design practice being related to a set of predominantly technical objectives with little thought being given to the design of the organisational context into which the technical system is to be embedded, there is increasing recognition that sys-

tems design must take a wider approach. The stage we are moving towards is participative". This statement while advocating a participative approach to systems design also acknowledges the importance of the organisational context in systems design. An examination of the steps of the ETHICS methodology suggests that the ETHICS concept of organisational context does not specifically include past conditions internal to the organisation. The past conditions are the events that constitute the historical context of the organisation. These past events overshadow the present and are capable of encouraging resistance and hindering learning and adaptation. It is argued that a participative process that does not fit naturally with the historical context of a situation is likely to be unsuccessful. If an analysis of the historical context of the situation is undertaken prior to the participative process one may be able to identify the extent to which the users are able to participate, the events that determine and influence users' attitudes towards participation, and the appropriateness of participative approach in the given situation. Based on the output of the historical analysis one may either seek to eliminate the identified conditions capable of limiting the value and level of participation or design a participative strategy suitable to the situation.

The concepts of context analysis and context evaluation presented in this thesis provides useful guidelines for conducting historical context analysis. It is suggested that the principles of these concepts be included in the steps of the ETHICS methodology and may possibly be termed

past analysis. The past analysis will complement the ETHICS "future analysis" step and may enhance ETHICS effectiveness by ensuring that its participative process fits naturally with the context of the situation. The work of Davies and Wood-Harper (1989) is examined next.

The aim of Davies and Wood-Harper's (1989, p.71-72) work was "to explicate the concept of information system so that we may better understand how information systems are developed". They argued that "without making attempts at conceptual clarification, the field of information systems development is in danger of proliferating practice without reflective learning". This is a view shared by this thesis. Much of the work presented in this thesis aimed to explicate the concept of MIS and the framework for MIS development. Davies and Wood-Harper (1989, p.62-64) presented three "theoretical paradigms in information systems development":

(a) The sociological view

This "view is found to dominate the writers on information systems" and its main concern is with the notion of information. Within the sociological view "computers are a conceptually redundant element" and may not be "required for an information system to be enacted". What is taken as the central issue or concern in the task of information systems development is the "effect of information as a phenomenon on human social action and the reciprocal effect of a social action creating such a phenomenon".

(b) The datalogical view

In this view the "notion of information is taken for

granted". The Information system is seen as a technical system and little attention is given to the political and sociological aspects of information systems. The datalogical view of the concept of information systems is "most widely accepted amongst practitioners of information systems design".

(c) The computational view

This view of information system is "most commonly found in writers who are chiefly concerned with computer programming ... In relation to the pragmatics of analysis, design, and development, the computational model of information system is chiefly concerned with structuring the concept of the problem in such a way that it may be capable of representation and manipulation through the technology of the computer".

Davies and Wood-Harper (1989) also identified three presuppositions that may be found in methodologies for information systems development. The presuppositions which they called "worldviews" relate to the rationality of modelling, the empirical process of intervention and change, and the cultural metaphor of situation that are implicit in methodologies for information systems development.

Davies and Wood-Harper (1989), having identified the three theoretical paradigms in information systems development and the three worldviews implicit in methodologies for information systems development, used the Mutiview methodology to examine the theoretical paradigms and worldviews of different information systems methodologies. The Multiview

methodology (Wood-Harper, Antill and Avison, 1985) is a methodology that bring together different information systems methodologies to form a single methodology. It assumes that there are five stages in an information systems development cycle and shows how different information systems methodologies can be used at the different stages of the development cycle. Davies and Wood-Harper's main argument may be summarised as follows:

(1) There are five stages in an information systems development cycle. The stages are as presented in the Multiview methodology. Each stage can operate within one or more paradigms of information system.

(2) There are different methodologies for information systems development. Some of these methodologies are more suitable to the task of a given stage of the information systems development cycle. The user of the methodologies should be aware of their limitations. The limitations are due to the nature of their underlying theoretical paradigms and worldviews.

Davies and Wood-Harper (1989) provide an excellent scrutiny of the principles of methodologies. The main weakness in their attempt to "explicate the concept of information system" is now examined.

Davies and Wood-Harper argued that the writers on information systems, the practitioners of information systems design and the writers on computer programming all have different and distinct views of what an information system is and also on how to improve or develop it. The implication of these distinct views will not only mean

confusion for those entering the field of information systems but may also have an effect on the advancement of the field of information systems. One way to resolve the conflict is to conceptualise the notion of information systems to a level that adequately accommodates the different views and at the same time provides a sound basis for action. Davies and Wood-Harper provided what seemed to be a resolution or a framework to accommodate the divergent views when designing information systems. The problem with their effort was that they attempted to clarify and resolve the conflict not at a conceptual level of what an information system is, but at the level of information systems methodologies. The problem of resolving the different views of information systems at a methodological level are:

(1) The "concept of information system is in its infancy" (Davies and Wood-Harper, 1989, p.71). As a relatively new discipline the field of information systems will fail to make substantial progress if the concept of information systems is conditioned and understood mainly through information systems methodologies. Once developed the methodologies as tools become "static" in the sense that they have fixed and particular assumptions about information systems. By separating the concept of information systems from the methodologies the onus will be on those responsible for the development of methodologies to come up with methodologies that match whatever is the current state of the concept of information systems. The benefit will be the development of better methodologies and unconstrained advances in the concept of information systems.

(2) Davies and Wood-Harper (1989, p.65) argued that "Methodologies have an implied notion of that situation in their development protocols [i.e. they provide a particular point of reference for the analyst]. [The] point of reference may or may not accommodate the views of people in the situation. This can lead to a fundamental mismatch. For example, to view the situation as that of functional task design when it is, for the actors, fundamentally a political situation may mean the adoption of both an inappropriate notion of information systems and an inappropriate methodology for tackling that situation". These statements in effect mean that the concept of information system is both information methodology and problem content bound. That is, what an analyst takes as information system depends on the notion of information system implied by the problem situation and also by the methodology employed by the analyst. This would suggest that there are about three hundred notions of what an information system is, given that there are about three hundred methodologies (Fitzgerald, 1990). Davies and Wood-Harper indicated that the information systems designer may face conflict if the notion of information system implied by his methodology does not match the notion of information system implied by the problem situation. This type of conflict will continue to exist or be perceived to exist unless the information systems practitioner is able to derive his theoretical model of information system not from the methodologies or problem content. The information designer should derive his

concept of information system from a given comprehensive concept of an information system which is not information systems methodologies or problem content bound.

Part of the aim of this thesis is to contribute to the debate about a general and pragmatic concept of MIS which is both information systems methodologies and problem content free. It is suggested that the concept of MIS as a purposeful system presented in this thesis has made such contribution. The concept of MIS as a purposeful system provides a generic notion of MIS that may be applicable in any MIS problem situation. It is not information systems methodologies or problem content bound. At the present level of development one may say that the concepts presented in this thesis has identified the necessary but not sufficient characteristics of MIS. To define the sufficient characteristics are the ultimate aim of MIS research, and it is suggested that further research and development of the concept of MIS as a purposeful system may lead to the achievement of such an aim. The work of Banbury (1987) is examined next.

Banbury (1987) discussed a possible framework for systems analysis practice. He raised a number of important issues that are relevant to information systems analysis and design. This discussion will examine aspects of Banbury's (1987) discussion that are relevant to the focus of this thesis.

Banbury (1987) argued for a shift in emphasis within systems analysis practice from the narrow preoccupation with technical to more general social aspects of informa-

tion systems. Such a shift would entail adequate recognition and modelling of the user system by the analyst. Banbury (1987, p.86-87) argued that the analyst cannot properly model the user system if the analyst does not have a sound philosophy or beliefs about the user system. He argued that "in general the analyst's philosophy needs to be realistically rather than idealistically based to be a suitable source of prior understanding for the model of the user system in its final form. This would suggest that the focus of this component should be the decision maker, and the structure of constraints within which he operates". Banbury is in effect arguing that to effectively model the user system the analyst needs a philosophy or "set of beliefs about the nature of man as decision maker which owes more to the action reference frame, than to more behaviour-oriented models of man". This frame of reference would view and explain the individual's action "in terms of the meanings he assigns to the relevant aspects of the situation he sees himself facing, as well as to the action he chooses to take (and its outcome). This assignment of meanings is seen to take place against the background of the individual's current weighing of his own interests, values and concerns within the constraints of his social context". This implies that the user system is characterised by organisational constraints within which the users operate. These constraints (e.g. organisational policies, groups that share particular interests, organisational environment or roles within the organisation) are to be recognised and incorporated into the model of the user

system.

There are concepts developed in this thesis that agree with Banbury's (1987) position about recognising the complexity of organisational context or user system and incorporating the complexities in the design of MIS. The concepts of the taxonomy of purposeful systems, context analysis and context evaluation recognise that there are varying degrees of constraints that condition and determine the effectiveness of a MIS. The organisational constraints constitute part of the MIS primary and secondary contexts and exist in hierarchical order as demonstrated in this thesis. This thesis has provided useful constructs and framework that gives the MIS designer pragmatic principles for recognising, analysing and incorporating the complexity of the user system in the design of MIS.

6.2 HUMAN INQUIRY

"Placed in the context of society, man is threatened by the complexity of his own organisations" (Gigch, 1978, p.1). The study of these organisations provide man with the necessary understanding to enable him manage the complexities of the organisations. Inquiry is an intellectual activity which may provide understanding about man and his organisations. The everyday use of the word inquiry implies the notion of a particular form of knowing, researching and discovery activity to obtain knowledge about a phenomenon.

There is a world in which we live and perceive, and a world of ideas in which we think, imagine and devise theories (Casserley, 1965). This implies there are two perspectives of how we can come to grips with knowledge. It distinguishes between knowledge as a product of perception given to us in our immediate experience of the world in which we live, and knowledge as a product of intellectual abstraction and construction. The knowledge obtained through the process of intellectual abstraction is termed "scholarly knowledge" by Boulding (1987, p.111). He dichotomised human knowledge into "folk knowledge" and "scholarly knowledge". The "scholarly knowledge" differs from "folk knowledge" not in the underlying process of acquiring the knowledge, for both are acquired through the "process of mutation and selection". The main difference between them is that "scholarly knowledge" benefits from mechanisms which intellectually allow for more elaborate

enhancement and expansion of both the formation and testing of new images. A deliberate act of inquiry is required to gain "scholarly knowledge".

Inquiry, as an intellectual activity can take many forms and can be undertaken for a variety of reasons. To embark on any inquiry, the inquirer presupposes the existence of that which can be known. Susman and Evered (1978) noted that in hermeneutics such a presupposition is known as the hermeneutical circle. The "idea of the circle is that no knowledge is possible without presuppositions" (Susman and Evered, 1978, p.595). There is also the presupposition that the knowledge acquired from the inquiry process would be of benefit to the understanding of the past, managing the present and predicting the future.

Having made the above presuppositions, the critical issue facing the inquirer is epistemological; a methodology capable of yielding accurate and valuable results. Boulding (1987, p.115) noted that the real world that we are trying to understand exists in great variety. He argued that "if we are to increase our understanding of them and if our images of them in our mind are to contain a larger proportion of truth and a smaller proportion of error, then for each system we are investigating we have to search for an appropriate methodology". The question of what constitutes an appropriate methodology is a thorny issue of debate among scholars. Casserley (1965, p.241) argued that "methodology ... is modern man's substitute for genius". He doubted whether "in the long run there is any substitutes for genius, either in history, or natural science, or

anywhere else ... there is no methodology which will enable mediocre men to produce the same result as great ones". His argument centred on the problem of "subject value" which he noted is always implicit even in the most objective results. Churchman (1974, p.461) was more provocative. He asserted that "until we can arrive at a more satisfactory idea of mankind and progress, we must admit we do not have a sound basis ... for evaluating social studies aimed at improving sectors of our society. No University faculty can claim an ability to judge the real value of a SD [Systems Design] research by students or themselves".

What is regarded as valid knowledge and the method for acquiring the knowledge is influenced by the inquirer's view of knowledge and the type of phenomena being investigated. One method of obtaining knowledge which is relevant to this discussion is the scientific method of inquiry. The scientific method and view of knowledge is examined briefly.

SCIENCE AND KNOWLEDGE

There are various reasons one may seek an explanation about a phenomenon. A person may ask for an explanation about the slump in the house market. His reason for wanting such explanation might stem from the need to know when to buy or sell a house; how the fall in the house market may affect the building industry; or he may seek the explanation just out of curiosity. Whatever the reason might be for seeking an explanation an inquirer is satisfied only if what he considers as an adequate explanation of the

phenomenon is given. There are various theories about what constitutes an adequate explanation of an event or phenomenon. Some argue that an explanation of an event cannot be taken as satisfactory unless the explanation is given in terms of the posterior causes of the event. Those who are of the view that an explanation of an event must state the purpose or posterior causes of the event are known as the advocates of the teleological model of explanation. Teleology is "the philosophical doctrine that seeks to explain and justify the states of the world [events] in terms of posterior causes which may be relegated to far-off futures in time and space" (Gigch, 1978, p.43). The teleological concept of explanation claims that the behaviour of things are determined by the future. This means that any satisfactory explanation of an event must be given in terms of the future causes or determinants of the events. The teleological concept of explanation was discredited by "Newton's physics" (Checkland, 1981, p.75). Teleology has again became respectable by the reintroduction of the teleological concept of explanation in science by general systems theory, "albeit in a more limited sense than that which had been known before ... Newton" (Gigch, 1978, p.44).

For some a detailed description of an event constitutes an adequate explanation. There are those who hold the view that a valid explanation of an event must be an explanation given in terms of laws of nature which govern the behaviour of matter. Those who are of this view of explanation are known as the advocates of the scientific model of explanation. It is the scientific model of explanation

which is examined in this discussion. What is meant by the scientific method of explanation depends on what one means by science. We have to point out what we mean by science within the context of this discussion before examining the scientific model of explanation. Philosophers "of science - the scholars who make it their job to observe scientists and to explain what it is that scientists do - have not yet settled, among themselves, on a single model of what science is" (Lee, 1989, p.33-34). The model of science used in this discussion is what is called the "natural science" model (Checkland, 1981, p.66-67). The natural science model is selected for the following reason.

This research is management research based on a single case study. Among "management researchers, the natural science model is well-known and ... many of the criticisms directed against case studies are voiced from the perspective of the natural science model" (Lee, 1989, p.34). We will use the criticisms as the basis for discussing the validity of the research findings in section 6.3.

The scientific method and view of knowledge are now examined briefly. Scheffler (1967, p.8) states that the "standard view of science ... affirms the objectivity of science ... it understands science to be a systematic public enterprise, controlled by logic and by empirical fact, whose purpose it is to formulate the truth about the natural world. The truth primarily sought is general, expressed in laws of nature, which tell us always and everywhere the case". From Scheffler's assertion it is clear that science advocates and makes claim to objective

knowledge. The view that science is a "public enterprise, controlled by logic and by empirical fact" suggests that scientific knowledge is independent of an individual, undisturbed by emotion, undistorted by personal bias or the unobservable behaviour of the phenomena under investigation. The claim of science that its knowledge is objective is based on the following reasons:

(a) Science is assumed to be a public enterprise. This means that all scientific assertions are subject "to the test of independent and impartial criteria, ... [which recognises] no authority of persons in the realm of cognition" (Scheffler, 1967, p.1). It is believed that by removing the authority for establishing the legitimacy of an assertion from the source of the assertion (individual) and conceding the authority to the public, science would remain objective. Popper (1965, p.27-29) states "there are no ultimate sources of knowledge. Every source, every suggestion, is welcome; and every source, every suggestion, is open to critical examination". Popper argued that those who reject the idea that "truth is above human authority ... [are] endanger[ing] the idea of the objectivity of knowledge, and of common standards of criticism or rationality". It seems that in science the idea of the objectivity of knowledge is more of an aspiration; an expression of hope rather than reality. This is apparent from scientific attitude to objective knowledge and the means to the knowledge. Science believes that there is an objective knowledge and the way to that knowledge consist of: the making of assertions or conjectures by the individ-

ual; the destruction of the assertions by public effort (refutation); an assertion which is yet unrefuted despite severe tests is taken as truth until it is refuted by other scientists. This means that all knowledge is temporal and there is no way of permanently establishing given knowledge as truth. Despite this comment one would agree that the subjection of scientific assertions to public test is a great strength of science and has contributed to the respectability and advancement of science.

(b) Science is assumed to be controlled by logic. This means that scientific assertions or knowledge are established as valid assertions by deductive reasoning only. That is scientific assertions are refuted or confirmed by "deductive argument [rather than by inductive argument] (Checkland, 1981, p.56). Popper (1965, p.51-53) states "the role of ... deductive logical reasoning, remains all-important for the critical approach; not because it allows us to prove our theories, or to infer them from observation statement, but because only by purely deductive reasoning is it possible for us to discover what our theories imply. ... the success of science is not based upon rules of induction". Popper argued that "induction, i.e. inference based on many observations, is a myth. It is ... [not] one of scientific procedure". The scientific argument against induction presents no problem when it is seen as a defence and clarification of one (scientific method) of the many ways of acquiring human knowledge. Science is a "particular pattern of human activity ... [by which] we may reduce the complexity of the variety of the real world in experiments

whose results are validated by their repeatability, and we may build knowledge by the refutation of hypothesis" (Checkland, 1981, p51). Clearly this pattern of human activity called science is made possible because of its subject matter (the physical and natural world) which exhibits some regularity and whose complexity can be reduced and controlled in experiments.

The problems of carrying the scientific argument against induction into other patterns of human activities whose subject matter is different from that of natural science will be discussed in section 6.3.

The steps of the scientific method are described in Checkland (1981) and Gigch (1987). Generally the scientific method involves:

(1) The selection of the phenomenon to be investigated.

The researcher decides on the phenomenon to investigate. The origin of the researcher's interest and his presuppositions about the phenomenon are not seen an crucial aspects of the scientific method. What is important is the logic of his investigation.

(2) The postulation of an hypothesis.

In studying a phenomenon the researcher is interested in discovering and explaining how events are connected. Generally the researcher wants to explain why an event of type "y" occurs whenever the event of type "x" occurs. To do this the researcher identifies the aspects (variables) of the phenomena he wants to explain. He proposes abstract concepts to represent these variables. He then makes statements using the abstract concepts in the form of hypothesis

which establishes and explains the relationship between the variables.

(3) Hypothesis testing.

The researcher designs an experiment to test his hypothesis. This involves "designing an artificial situation within which he [researcher] can examine the workings of a few variables while others are held constant" (Checkland, 1981, p.56). If the hypothesis holds as postulated by the researcher, the hypothesis is accepted as a valid explanation of the observed events.

(4) Repeatability and refutation.

The researcher has to submit his hypothesis and experiment to public tests. He must describe his hypothesis and experiment in a way which allows other researchers to repeat the experiment in different settings in similar conditions. The hypothesis is accepted as valid theory if the same conclusion is reached by other researchers. The hypothesis is rejected if the experiment cannot be replicated in other settings or if other researchers did not reach the same conclusion as the original experiment.

The discussion above is a brief account of what constitutes explanation in the natural sciences. Natural science has a clearly defined criteria (public test) for establishing satisfactory explanation and a procedure (scientific method) which a researcher should follow in arriving at a satisfactory explanation of a phenomena. The "scientific method and its paradigm have been successful when applied to fields of organised simplicity or ... the so-called restricted sciences" (Gigch, 1987, p.20). Scien-

tific method is unsatisfactory and fails to provide adequate explanation when applied to fields of the unrestricted sciences such as social science. A major reason for this, is the fundamental difference between the subject matter of natural science (natural world) and social science (human beings and their social organisations). Human beings and their social organisations exhibit a high degree of indeterminism, unquantifiable variables and unlike the subject matter of the natural science they need to be studied in their natural settings. The recognition that the subject matter of the unrestricted sciences are different from that of the natural sciences and cannot be explained using the natural science method have led to the emergence of other approaches such as action research and ethnography as methods of explanation. MIS is a social phenomena which has to be studied in its natural setting and cannot be adequately explained using the natural science mode of explanation. This research is action research based on a single case study. Most of the criticisms directed against action research and case studies are voiced from the perspective of the natural science model (Susman and Evered, 1978; Lee, 1989). In section 6.3 the validity of this research approach is examined within the context of these criticisms.

6.3 THE VALIDITY OF THE RESEARCH APPROACH

Ives, Hamilton and Davis (1980, p.910) defines MIS research as "the systematic investigation of the development, operation, use and/or impact of an information (sub)system in an organisational environment". This definition identifies four areas: development, operation, use and impact of information systems as the focus of MIS research. Clearly these are issues relevant to human activity systems rather than the natural world which is the domain of natural science. A human activity system is "generally described by human beings undertaking purposeful activity such as man-machine systems" (Wilson, 1984, p.22). A central element in such a system is the human being. Checkland's (1981) classification of systems clearly showed that natural systems are fundamentally different in kind from human activity systems. "The origin of this difference is the special characteristics [e.g. self-consciousness and irreducible freedom or free will] which distinguish the human being from other natural systems" (Checkland, 1981, p.115). Wilson (1984, p.25) provided a very useful decomposition of a human activity system. The decomposition identifies what we take to be the subject matter of MIS research. Wilson (1984, p.24-25) decomposed "a human activity system into two other systems: a system of activities and, ... a social system whose boundary is coincident with the ... [human activity systems] boundary". The elements of the social system are "people doing the activities" and the relation-

ships that exist between the elements are "interpersonal". The elements of the "system of activities" are "activities" while the relationships existing between the elements are "logical dependencies". Placed within the context of MIS research the MIS is a "system of activities" (such as its development, operation and use) and a "social system" (people who carry out the activities). This implies that in MIS research one is essentially dealing with human beings and their set of activities. The special characteristics that distinguish human beings from other natural systems dictate that "there can never be accounts of human activity systems similar to, and having the same logical status as accounts of natural systems" (Checkland, 1981, p.118).

One would expect MIS research to be conducted using approaches that are compatible and suitable for understanding human activity systems. Unfortunately some MIS researchers believe that the way to respectability and legitimisation of MIS research is to adopt the natural science method in MIS research. Probably also because they have been earlier socialised in that tradition.

Lee (1989) presented a methodology for conducting MIS case studies. The methodology presented by Lee was an excellent defence and response to the criticisms and problems involved in the study of a single case. The problem with Lee's (1989) methodology is that it is based on the natural science model. According to Lee (1989, p.32) the methodology "satisfies the standards of the natural science model of scientific research". This statement implies that Lee was interested in proposing a MIS research methodology

which satisfies the natural science model of scientific research. The fact that "the study of a real-world MIS in its real-world setting precludes, by its very nature, the laboratory controls of laboratory experiments" (Lee, 1989, p.35) calls into question any claim that a pure application of the scientific method is possible in a real-world MIS inquiry.

The increasing number of experimental MIS studies demonstrates the influence of the scientific method of inquiry on MIS research. Kaplan and Duchon (1988, p.573) state that "the dominant approach to information technology studies has been based on a positivistic experimental ideal of research". Jarvenpaa, Dickson and DeSanctis (1985, p.141) argued that "experimental research has become one of the most popular forms of information system (IS) research". They argued that "despite the surge of interest in experimentation during the past ten years, the research suffers from methodological weakness". They used the study of information presentation format to illustrate the confusion and conflicting results emerging from experimental MIS research. Jarvenpaa, Dickson and DeSanctis (1985, p.141) state "several researchers have generated results that suggest that graphs are no better than tables in presenting information ... On the other hand, several experiments have provided evidence that graphics are not only preferred by managers but also lead to better decision performance in some situations ... As a further illustration, three studies using interpretation accuracy as a dependent variable were in disagreement. Feliciano ... concluded that graphs

are easier to interpret than tables. Lusk and Kersnick ... found the reverse, and later Tullis ... demonstrated that there was no difference in interpretation accuracy between graphs and tables". Despite these confusions and conflicting results Jarvenpaa, Dickson and DeSanctis still believe that the problem of experimental research in MIS is mainly a methodological one which can be solved through adequate research design and the development of relevant and valid measurements.

Experimental and other MIS research that use quantitative methods often concentrate on basic and less complex aspects of MIS. They focus on selected technical, economic, user and organisational attributes which they treat as "static, independent, and objective rather than as dynamic, interacting constructs; i.e., as concepts with attributes and meanings that may change over time and that may be defined differently according to how individual participants view and experience the relationship between them" (Kaplan and Duchon, 1988, p.573). The more problematic and complex issues such as identity, culture, history, "social interaction and negotiation that could affect not only the outcomes ... but also the constructs under study" are not generally dealt with by experimental and quantitative research. If MIS is to advance as a discipline it has to move out of the shadow of the positivist research orientation of the natural sciences to a research orientation suitable to MIS subject matter. To be seen as scientific, and to avoid complex MIS issues such as social interaction, identity, history and culture that constitute and shape the

nature of MIS is the main luxury of operating within the hypothetico-deductive framework. Boulding (1987, p.110) has rightly argued that "it is a mistake to transfer methods appropriate in one field [of knowledge] to another, where they may be inappropriate". Boulding noted that "each field of knowledge has to find its appropriate method, depending on the nature of the system about which knowledge is sought".

The appropriateness of the case study and action research approach for tackling complex and important research problems of MIS are recognised by some authors (Mumford, 1981; Benbasat, Goldstein and Mead, 1987; Miles, 1987; Wilson, 1989 and Avison and Wood-Harper, 1991). Important developments and advances in MIS discipline such as the ETHICS (Mumford, 1983), Systems Methodology for Information Requirements Analysis (Wilson, 1989) and Multiview (Avison and Wood-Harper, 1991) were achieved through action research. This research accepts the appropriateness of action research for MIS research and follows the tradition of these authors by using action research as its research strategy.

MIS is a relatively new discipline and may benefit from discovery and exploratory research aimed at clarifying the nature and structure of MIS. Through exploratory study this research aimed to increase our knowledge about the nature of MIS by building on the work of other researchers. The next part of this discussion examines the validity of this research approach by responding to major criticisms of action research. The validity of action research especially

when based on a single case is criticised on the basis that its findings cannot be generalised. The issue of generalisability is now considered.

GENERALISABILITY OF THE RESEARCH OUTCOMES.

In section 6.2 the discussion of the natural science model noted that one way in which the legitimacy of a scientific assertion is established is through public test. This will involve replicating the original experiment not just in the original setting but in different settings of similar condition. If the results from the different setting are the same as the original experiment the original assertion is said to be a generalisable assertion i.e., the assertion is applicable "to a range of settings" (Lee, 1989, p.35). A major criticism of action research is that its results cannot be replicated and are not generalisable. Unfortunately those who question the replicability and generalisability of action research outcome do so in the spirit of the natural science model. Natural science has developed a concept of replicability and objective knowledge suitable for its subject matter (natural world). To insist that such a concept should be applicable to other areas of human activity (e.g. action research) whose subject matter (man and his organisation) is very different from that of the natural science seems quite unrealistic and dogmatic.

"No two real-world problems are exactly the same, not in the sense in which two reactions between copper and

nitric acid are exactly the same when carried out under similar situations" (Checkland, 1981, p.241-242). That no two organisations are exactly the same in terms of its members, problems and context is a fact which one cannot disagree with. Despite this uniqueness of every human organisation the replicability of action research from one organisation to another is possible. This can be achieved only in the sense made possible by its subject matter (man and his organisation) and not in the sense made possible by the subject matter of natural science. Action research "has its own legitimate epistemological and methodological base [and] ... it can contribute to the growth of knowledge differently from what positivist science can contribute" (Susman and Evered, 1978, p.599). The knowledge that emerges from action research is not a prescription of rational rules of operation but "action principles or guides for dealing with different situations" (Susman and Evered, 1978, p.599). The findings of this thesis are to be viewed within the context of action principles and not as a prescription of rational rules.

A brief examination at the way humans perceive objects suggest that they already possess mechanisms to resolve the issue of the uniqueness of every human organisation, and are able to transfer theoretical concepts from one organisation to another. Casserley (1965, p.135-136) states that in a "human being, equipped with self-consciousness and memory, perception is never merely the perception of this or that but also the perception of this kind of thing and that kind of thing ... never merely this

thing in itself, but also of its obvious analogies to other things". Casserley also noted that human perception "always arranges things in categories or significant classes in the very act of perceiving". Placing Casserley's assertions within the context of this discussion, it is argued that systems and social theories are forms of invented categories or significant classes into which an inquirer can arrange variables (i.e. give meaning to the variables) in the very act of perceiving them. By providing a unified concept of MIS, its elements and framework for MIS design, this thesis has provided significant classes into which the relevant variables in MIS inquiry can be arranged and understood.

Espejo and Watt (1979, p.259) described how the basic approach to most MIS design work evolved. They state: "By the early 1960s ... [computer] applications were sufficiently numerous and complex to make it obvious that some systematisation of the design process was necessary and these rapidly grew, starting in external consultancies, a variety of systems approaches. The basis of these approaches is a methodical checklist of project steps or phases ... Add to this the data base approach of the late 1960s and you have the basics of most MIS design work being carried out in practice". This account implies that a "systemic approach" or knowledge for MIS design work emerged not from a laboratory type setting but within the natural setting of human organisation. It also indicates that the systematic approach grew not out of experimental tests but from the action, logic and experience of design-

ing MIS. The main interest of this discussion in Espejo and Watt's (1979) account of the emergence of the traditional approach to MIS design is that the approach is a set of principles that grew out of actual intervention in organisations and that these principles are being applied by others in different organisations.

Espejo and Watt (1979) argued that this traditional approach to MIS design is limited and has failed to guide the design of effective MIS. This view implies the concept of generalisability. "Generalisability is a quality describing a theory that has been tested and confirmed in a variety of situations, whether such testing is conducted through case research, laboratory experiments ... or natural experiments" (Lee, 1989, p.41). This means that what Espejo and Watt (1979) suggest is that the traditional theory of MIS no longer holds true when tested or applied to the design of MIS in organisations. That is, the testing or application of the traditional MIS theory in a variety of situations (organisations) has produced results which indicate that the traditional approach to MIS design is limited and unsatisfactory.

"No theory concerning MIS would be generalisable on the basis of a single case study, since the single case study would have tested the theory against the empirical circumstances of just a single setting" (Lee, 1989, p.41). As old and emerging concepts of MISs are tested and applied in MIS design within different organisations the learning arising from them will continue to enhance our understanding of the theory and practice of MIS. Some of the MIS

concepts presented in this thesis were based on previous research. Section 6.2 also related some of the findings of this research to other theories about the nature of MIS and its development. Our knowledge of MIS would be enriched when other researchers have tested and applied the concepts developed in this research in other organisational settings.

CONCLUSION

The work of Mumford (1983a and 1983b), Banbury (1987), and Davies and Wood-Harper (1989) were examined in the first section of this Chapter. The discussion related some of the findings of this thesis to their work. Davies and Wood-Harper suggest that the concept of information system is information systems methodologies and problem content bound. It was suggested that such notions are not good enough for the future of MIS methodologies and the conceptual development of MIS. This Chapter argued that a way toward the development of better MIS methodologies and unconstrained advances in the concept of information system is in developing a generic and pragmatic concept of MIS. This generic concept would not be information systems methodologies and problem content bound, and would serve as frame of reference from which the MIS designer can derive his theoretical model of information system during MIS practice. It is hoped that the concept of MIS as a purposeful system presented in this thesis has made a useful

contribution towards such a generic and pragmatic concept of MIS.

Mumford (1983b) while advocating participative approaches to systems design also acknowledges the importance of the organisational context in systems design. An examination of the steps of the ETHICS methodology suggests that the ETHICS concept of organisational context does not specifically include past conditions internal to the organisation. The past conditions are the events that constitute the historical context of the organisation. These past events overshadow the present and are capable of encouraging resistance and hindering learning and adaptation. This Chapter argued that a participative process that does not fit naturally with the historical context of a situation is likely to be unsuccessful. If an analysis of the historical context of the situation is undertaken prior to the participative process one may be able to identify the extent to which the users are able to participate, the events that determine and influence users' attitudes toward participation, and the appropriateness of participative approach in the given situation. Based on the output of the historical analysis one may either seek to eliminate the identified conditions capable of limiting the value and level of participation or design a participative strategy suitable to the situation.

The concepts of context analysis and context evaluation presented in this thesis provide useful guidelines for conducting historical context analysis. It is suggested that the principles of the concepts may be included in the

steps of the ETHICS methodology and may possibly be termed past analysis. In general the past analysis task would involve a broad assessment of the required amount and focus of systems flexibility through an identification and analysis of past changes likely to affect the new system. This may enhance ETHICS effectiveness by ensuring that its participative process fits naturally with the context of the situation.

Among the issues raised by Banbury (1987) was the need for adequate recognition and modelling of the user system by the analyst. This Chapter argued that there are concepts developed by this thesis that confirm Banbury's (1987) position that user system and its complexity should be incorporated in the design of MIS. The concepts of the taxonomy of purposeful systems, context analysis and context evaluation recognise that there are varying degrees of constraints that condition and determine the effectiveness of MIS. The constraints constitute the MIS primary and secondary contexts and exist in hierarchical order as demonstrated in this thesis. It is hoped that this thesis has provided useful constructs and framework that gives the MIS designer pragmatic principles for recognising, analysing and incorporating the complexity of the user system in the design of MIS.

The second section of this Chapter discussed the problem of acquiring human knowledge. It was argued that what is regarded as valid knowledge and the method for acquiring the knowledge is influenced by the inquirer's view of knowledge and the type of phenomenon being invest-

igated. The natural science method of inquiry was briefly examined. The reason for examining the natural science method of inquiry was that most criticisms directed against action research and case studies are voiced from the perspective of the natural science method of inquiry. The validity of this research outcome was examined within the context of these criticisms in section 6.3. Following Boulding (1987) this Chapter argued that it was a mistake and unrealistic to transfer methods suitable in the natural science to human activity systems. This is because their subject matter are different and require different inquiry methods.

The issue of the generalisability of action research was also discussed. It was argued that generalisability can be achieved only in the sense made possible by the action research subject matter (man and his organisation) and not in the sense made possible by the subject matter of the natural science. Following Casserley (1965) it was argued that despite the uniqueness of every human organisation, man already possess mechanism that make possible the transference of research outcomes from one organisation to another. It was argued that systems and social theories are forms of invented categories or significant classes into which an inquirer can arrange variables (i.e. give meaning to the variables) in the very act of perceiving them. This implies that by providing a unified concept of MIS, its elements and framework for MIS design, this thesis has provided significant classes into which the relevant variables in MIS inquiry can be arranged and understood.

Following Susman and Evered (1987) it was argued that the knowledge that emerges from action research is not a prescription of rational rules of operation but action principles for dealing with different situations. The outcome of this thesis is to be viewed within the context of action principles and not as a prescription of rational rules. As old and emerging action principles of MIS are tested and applied in MIS design within different organisations the learning arising from them will continue to enhance our understanding of the theory and practice of MIS.

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CHAPTER SEVEN

7. CONCLUSION.

What is a MIS? This was one of the questions I had to ask myself at the early part of this research project. The discussion in Chapter Three suggest that anyone hoping to find a generally agreed meaning of MIS from the MIS literature is likely to be disappointed. The lack of consensus in the literature about the meaning of MIS would naturally lead to a lack of agreement on how to develop MIS. By using what the literature has to say about MIS as a starting point, this research has sought through real-life experience and development of MIS to explicate the concept of MIS and how it should be developed.

Now that this research has come to an end one is in a position to reflect on the learning and to assess if the research has answered the question: what is an MIS? The view of this thesis is that MIS is a complex phenomenon and the argument and effort to explicate its meaning and how it should be developed has not been exhausted by this research. This thesis has made some contributions and it is hoped that other researchers and practitioners will enhance and develop the findings of this thesis. When that is done our knowledge of MIS will continue to be enriched. The main contribution of this thesis to our knowledge of MIS is examined in this Chapter.

In Chapter Three the theoretical aims of this thesis

were stated as follows:

1. To derive a conceptualisation of MIS that will accommodate both the social and technical systems perspectives. The MIS definition supports and extends the work of Ackoff (1971), Swanson (1974), Mumford (1983a) and Banbury (1987) and provides a new perspective of MIS.

2. To identity a unifying MIS design framework that can be applied in the development of MISs as defined in 1 above.

3. To provide concepts for identifying relationships among MIS variables in the form of a framework to guide researchers responsible for developing MIS methodologies and to help practitioners translate theory into practice.

4. To provide alternative concepts for assessing MIS success.

Each of the four aims above have been accomplished in this thesis. The first section of this Chapter provides a summary of the main themes and concepts that emerged from this thesis. The four aims above will be used as the structure for the discussion in this section i.e. the discussion will be in four parts using the four aims above as the headings for the discussion. The section will also discuss additional findings to the four main aims. The second section of this Chapter will discuss areas for further research based on some emergent issues.

understood by examining the product of their conduct. The product of their conduct constitutes the characteristics (purpose, history, identity, activity, structure and culture) of the MIS. For a discussion on why purpose, history, identity, activity and culture are functions of the will, existence and knowledge see Chapter Two (p.50-54).

The above discussion can be summarised as follows:

(1). Based on the work of Ackoff (1971) and Swanson (1974) I derived a definition of MIS. The definition is that MIS is a purposeful system which emerges whenever purposeful entities integrate for a common purpose.

(2). Based on the work of Ackoff (1971) and my ontological assumptions about human beings and organisations discussed in Chapter Two, I derived and outlined the characteristics of the MIS as defined in (1) above. The characteristics are purpose, history, identity, culture, structure and activity.

(3). This concept of MIS and its characteristics accommodates the arguments of both the social and technical systems perspectives of MIS. The characteristics such as structure (e.g. computer hardware), activities (e.g. computer software and operation) and purpose (e.g. computer systems objective) accommodate the perspective of MIS advocated by the technical systems proponents. The characteristics history (e.g. past events that overshadowed the present), culture (e.g. belief and images that guide action) and purpose (e.g. social objective) accommodate the perspective of MIS advocated by the social systems proponents.

Having discussed above how the first aim of this thesis have been fulfilled, the second aim is examined briefly.

The second aim of this thesis was:

To identity a unifying MIS framework that can be applied in the development of the MIS as defined by the task outlined as the first aim of this thesis.

This thesis proposed an MIS design framework which can be applied in the development of MIS as a purposeful system. The nature of the design framework is influenced by my ontological assumptions discussed in Chapter Two.

The concept of MIS proposed in this thesis gives MIS the status of an active unit that has a purpose which it seeks to accomplish. As a unit the MIS might exhibit problems which may hinder it from achieving its purpose. Without adequate knowledge of the characteristics and the mode of functioning of the MIS one will not be able to understand the problem or to solve it. Most practitioners would not be interested to know about the characteristics of the MIS or how it functions if such knowledge does not lead to action. This means that in MIS inquiry the emphasis has to be about acquiring knowledge that leads to action. The purpose of MIS inquiry is to understand the problems of the MIS and to resolve it so as to enable the MIS achieve its purpose. This will involve the identification of the MIS, understanding the characteristics of the MIS, identifying the deficient characteristics, organising the characteristics, putting the MIS into operation and measuring how

well it achieves its purpose. Based on this view of MIS inquiry the following framework for MIS design is proposed:

Stage one: Naming the MIS.

The task of this stage is to identify the MIS to be designed. The output of this stage is known as the MIS definition. It is a formal expression of the problem and nature of the MIS to be designed.

Stage two: Understanding the MIS elements.

This stage is about understanding the elements or characteristics of the MIS identified in stage one of the MIS design framework. The task of this stage involves the identification of the relevant episodes (purposeful systems) in the organisation, using the identified purposeful systems to construct a taxonomy of purposeful systems and also to conduct context analysis and context evaluation.

Stage three: Organising the MIS elements.

The two stages above are concerned with issues of analysis while the task of this stage is concerned with design issues. In this stage the MIS designer is concerned with: (a) identifying and putting together the logical elements of the notional system (MIS definition) i.e. logical design, (b) identifying how and ways of realising the notional system i.e. physical design.

Stage four: Implementation and monitoring of MIS outcome.

This is the phase at which the MIS "goes live" or is put into real life operation. When the MIS is in operation it is expected to alleviate the problems that led to its design and implementation. Part of the task of this stage is to monitor or measure whether the design and introduc-

tion of the MIS in the organisation has been a success or not.

The operational model of this MIS design framework is depicted in Chapter Four Figure 4. The four stages above are the main components of the MIS design framework. There are sub-stages within each of the four main stages. A detailed theoretical discussion of this MIS design framework is given in Chapter Four. In Chapter Five the application of the design framework in the design of a real life MIS as a purposeful system is demonstrated. Some concepts that are part of the design framework are discussed under the third aim this thesis.

The third aim of this thesis was:

To provide concepts for identifying relationships among MIS variables in the form of a framework to guide researchers responsible for developing MIS methodologies and to help practitioners translate theory into practice.

The concepts that fulfilled this third aim of the thesis are: the taxonomy of purposeful systems, primary context, secondary context, context analysis and context evaluation. The concepts are examined briefly.

The taxonomy of purposeful systems.

In MIS literature it is widely acknowledged that the failure to take adequate account of organisational contexts such as culture by MIS designers is a major reason why the introduction of MIS in organisations have frequently not been successful (Mumford, 1981 and 1983a; Land and Hirsch-

heim, 1983; Jayaratna, 1985; Blackler and Brown, 1986; Banbury, 1987). Whilst one supports this argument it has to be said that in MIS literature organisation context is treated as if in a given organisation there is one universal context. That is, the MIS literature has not made clear that in a given organisation there are different types and levels of contexts in which MIS can exist or be embedded. For example in an organisation MIS can be designed and implemented at the corporate headquarter's level, divisional level, departmental level, sectional level, etc. At each of these levels the information requirements of managers and the organisational context within which the managers operate may differ from one level to another. Given the above levels at which MIS can be designed in organisations Chapter Four raised the following questions:

(1) Is organisational context (culture, purpose, history, structure, activity, identity) at each level the same? If not:

(2) How would MIS designers distinguish and identify the special characteristics of each level during MIS design and implementation?

It was argued in Chapter Four that each level has its unique characteristics as well as having some characteristics that are common to all and the preceding levels. Following this line of argument a framework is proposed to guide those responsible for developing MIS methodologies and to assist MIS designers in identifying the different levels of contexts and their special characteristics. I termed the framework the taxonomy of purposeful systems. It

was derived from the principles of hierarchical file structure and schema (Martin, 1976; Gane and Sarson 1979). The development and structure of the taxonomy of purposeful systems is discussed in Chapter Four. The actual process of constructing and applying this concept when designing MIS is demonstrated in Chapter Five. The discussion about the taxonomy of purposeful systems indicate that for a given MIS there are two types of contexts: primary context and secondary context.

Primary context

The discussion about the taxonomy of purposeful systems indicate that one can identify within the total context of a given MIS those characteristics which are inherited by the MIS from higher level purposeful systems. The inherited characteristics constitute the wider context of a given MIS. The inherited characteristics of MIS is what I termed the primary context. It was demonstrated in Chapters Four and Five that it is the primary context that legitimates and conditions the existence of a given MIS.

Secondary context

Based on the concept of the taxonomy of purposeful systems it was argued that any MIS has natural characteristics. The natural characteristics are the characteristics that are local or specific to a given MIS and excludes the wider organisational context in which the MIS is embedded. I have used the term secondary context to mean the natural characteristics of a MIS. The primary context and secondary

context together make up the total context of a given MIS.

Context analysis

The taxonomy of purposeful systems arranges MISs within an organisation in a hierarchical order. Based on the notion of a tree and hierarchical file structure it was argued that each MIS on the purposeful systems taxonomy has inherited (primary context) and natural (secondary context) characteristics. The nature and type of the inherited characteristics depend upon the level and position of the MIS within the taxonomy. I proposed the term context analysis and it refers to the process of deriving the primary and secondary context of a given MIS.

Having constructed the taxonomy of purposeful systems the MIS designer starts the context analysis by selecting relevant episodes (i.e. MISs) from the taxonomy and places them on the top row of a context analysis matrix (e.g. Figure 9 of Chapter Five). They are the MISs from which to derive the primary context of the MIS being developed. Any such episode will have the six elements (purpose, history, identity, culture, structure and activity) of MIS which are placed in the first column of a context analysis matrix (e.g Figure 9 of Chapter Five). The MIS whose primary and secondary context is being derived is placed as the last episode in the context analysis matrix (e.g. the ERAS in Chapter Five Figure 9). On the first column of the context analysis matrix are the six elements of MIS about which information is sought from the MISs at the top row of the context analysis matrix.

Once the episodes are listed on the top row of the context analysis matrix the designer can proceed to describe each episode in terms of the six characteristics of MIS listed on the first column. That is, for each episode on the top row the MIS designer has to describe in the appropriate coordinate its purpose, identity, culture, activity, history and culture. The data about all the episodes that precede the one being designed constitute the primary context. The data on the last column of the context analysis matrix (i.e. data about the MIS being designed) constitute the secondary context. The primary and secondary context together make up the total context of the MIS being designed. The task of context analysis is completed when the MIS designer has described in detail the six elements of each MIS on the top row of the context analysis matrix. This information is then summarised and used to conduct what I have termed context evaluation.

Context evaluation

Having conducted the context analysis the next task is to critically examine the data about each of the MIS elements (the data is obtained from the context analysis output). I have termed this critical examination process a context evaluation process. The aim of the context evaluation is to identify the deficient element and to ensure that no element is a major constraint to achieving an effective MIS. The process basically involves the matching of each MIS element against the other elements to determine

the fit between them. The principle and process of conducting the context evaluation process (e.g. Figure 10) is covered in Chapters Four and Five.

These concepts: the taxonomy of purposeful systems, primary context, secondary context, context analysis and context evaluation would be useful to both MIS designers (in identifying, understanding and analysing MIS variables or elements when designing MIS) and those responsible for developing MIS methodologies (by using them to enhance current and new MIS methodologies). They are the concepts that satisfy the third aim of this thesis.

The fourth aim of this thesis was:

To provide alternative concepts for assessing MIS success.

A vast amount of research has been conducted with the aim of determining whether the design and introduction of MIS in organisations have been successful or not. Despite the vast amount of research there is no core concept or definition of MIS success in the MIS literature. Some of these studies and the indicators which they employ to measure MIS success are discussed in Chapter Four. It was argued in Chapter Four that most of the research about MIS success focus mainly on user oriented criteria as measures of MIS success. This thesis focused more on design issues as measures of MIS success. This is aimed at reflecting the dynamic nature of MIS in measuring MIS success. The concept of MIS proposed and defined by this thesis is a dynamic one. That is, the MIS elements (purpose, identity, history, activity, structure and culture) are time dependent compo-

nents. For example its history is relative to the length of time the MIS has existed, and the longer is its history the more the potential to acquire more knowledge that may influence its culture as well as the type or ways in which it performs its activities. If MIS is a dynamic entity the indicators and processes of measuring its outcome (success) must reflect its dynamic nature.

The dynamic nature of MIS will create situations in which the same outcome may be viewed as a success at a given point in time and as unsuccessful at other point in time depending on the state of the MIS. For example users in an organisation that has only five customers might be happy with a daily report that contains a list of all the five customers. If by the following month the activity of the firm expands and the number of customers increased from five customers to nine hundred customers, the users may view as unsatisfactory a daily report listing all the nine hundred customers. The users are more likely to prefer an exception report that reduces the length of the report to a manageable size. The same users that perceived the MIS as a success when the company had only five customers will perceive the MIS as unsuccessful when the customers increased to nine hundred. What has changed is not the outcome (nature of report) but the activity element of the MIS which has experienced changes in volume. A research that used user satisfaction as indicator of MIS success would pronounce a verdict of "success" when the organisation had five customers. Based on the same criteria the research would pronounce a verdict of MIS "failure" when the MIS

activity (customers) increased to nine hundred.

Given the iterative and dynamic nature of MIS this thesis proposes two perspectives for measuring MIS success: macro and micro perspectives.

Macro perspective

The process of matching the MIS definition against the implementation output is represented in Chapter Four Figure 4 by the stability symbol. It is a pragmatic, simple and general measure of MIS success. It is a process of checking that the MIS definition is still as originally specified and that the implementation output matches the MIS definition. The term macro measure is proposed for this normative process of measuring MIS success. In the example above, the implementation output will match the MIS definition when the organisation had five customers. The implementation output will not match the MIS definition (user requirement) when the customers increased to nine hundred. The task of the macro measure is to monitor or measure this type of changes between the MIS definition and implementation output.

Micro perspective

The discussion in Chapter Five indicates that there are situations in which implementation output will not match the MIS definition. When this happens the MIS is said to be in a failure state. The dynamic nature of MIS means that the stability between the MIS definition and implementation output are temporary in nature. That is, it is

subject to change and this change will result in MIS failure. The reason for the mismatch can be traced to any or all the six elements that define MIS. The changes occur because of the dynamic nature of MIS and will create a mismatch between implementation output and MIS definition. Such a mismatch will force an iterative process of moving back to examine the MIS definition, analysis (understanding the MIS elements) or design (organising the MIS elements) stage before attempting another implementation run. The micro measure is concerned with monitoring the changes that occur in each of the six MIS elements during the life of the MIS.

The discussion about the macro and micro perspectives of MIS success implies that MIS is an entity which over time experiences "good health" and "bad health". Its period of good health lasts while there is a match between the MIS definition and the implementation output. It experiences "bad health" when there is a mismatch between the MIS definition and implementation output. The cause of the "bad health" can be attributed to a change in any of the six elements of MIS. The macro perspective or measure is proposed as a simple measure that constantly checks the "health" of the MIS while the micro perspective is concerned with the state of the MIS elements.

The four aims of this thesis were stated at the beginning of this Chapter. Each aim was briefly examined in this section to show how it has been fulfilled by this

thesis. The concept of MIS as a purposeful system derived from the work of Ackoff (1971) and Swanson (1974); the taxonomy of purposeful systems; the unifying MIS design framework; primary context; secondary context; context analysis; context evaluation; macro and micro measures are all original contributions made by this thesis to the theory and practice of MIS.

ADDITIONAL FINDINGS

The work of Mumford (1983a and 1983b), Banbury (1987), and Davies and Wood-Harper (1989) were examined in the first section of Chapter Six. The discussion related some of the findings of this thesis to their work. A brief summary of that discussion is presented in this section.

Mumford (1983b) while advocating a participative approach to systems design also acknowledges the importance of the organisational context. An examination of the steps of the ETHICS methodology suggests that the ETHICS concept of organisational context does not specifically include past conditions internal to the organisation. The past conditions are the events that constitute the historical context of the organisation. These past events overshadow the present and are capable of encouraging resistance and hindering learning and adaptation. This thesis argued that a participative process that does not fit naturally with the historical context of a situation is likely to be unsuccessful. If an analysis of the historical context of the situation is undertaken prior to the participative

process one may be able to identify the extent to which the users are able to participate, the events that determine and influence users attitude towards participation, and the appropriateness of participative approach in the given situation. Based on the output of the historical analysis one may either seek to eliminate the identified conditions capable of limiting the value and level of participation or design a participative strategy suitable to the situation.

The concepts of context analysis and context evaluation presented in this thesis provides useful guidelines for conducting historical context analysis. It is hoped that the principles of these concepts may be included in the steps of the ETHICS methodology and may possibly be termed past analysis. In general the past analysis task would involve a broad assessment of the required amount and focus of systems flexibility through an identification and analysis of past changes likely to affect the new system. This may enhance ETHICS effectiveness by ensuring that its participative process fits naturally with the context of the situation.

Davies and Wood-Harper (1989) suggest that the concept of information system is information systems methodologies and problem content bound. They gave an excellent scrutiny of the principles of methodologies and argued that the writers on information systems, the practitioners of information systems design and the writers on computer programming all have different and distinct views of what an information system is and also on how to improve or develop it. Davies and Wood-Harper provided what seemed to

be a resolution or a framework to accommodate the divergent views when designing information systems. The problem with their effort was that they attempted to clarify and resolve this conflict not at a conceptual level of what an information system is, but at the level of information systems methodologies. Their approach may not be good enough for the future of MIS methodologies and the conceptual development of MIS. Once developed the methodologies as tools become "static" in the sense that they have fixed and particular assumptions about information systems. In this thesis it is argued that a way towards resolving this conflict and ensuring the development of better MIS methodologies and unconstrained advances in the concept of information system is in developing a generic and pragmatic concept of MIS. This generic concept would not be information systems methodologies and problem content bound, and would serve as a frame of reference from which the MIS designer can derive his theoretical model of information system during MIS practice. The onus will be on those responsible for developing MIS methodologies to come up with methodologies that match whatever is the current state of the concept of MIS. It is suggested that the concept of MIS as a purposeful system presented in this thesis has made a useful contribution towards such a generic and pragmatic concept of MIS.

Among the issues raised by Banbury (1987) was the need for adequate recognition and modelling of the user system by the analyst. There are concepts developed by this thesis that agreed with Banbury's (1987) position that user

system and its complexity should be incorporated in the design of MIS. The concepts of the taxonomy of purposeful systems, context analysis and context evaluation presented in this thesis recognise that there are varying degrees of constraints that condition and determine the effectiveness of MIS. The constraints constitute the MIS primary and secondary contexts and exist in hierarchical order as demonstrated in this thesis. It is suggested that this thesis has provided useful constructs and framework that gives the MIS designer pragmatic principles for recognising, analysing and incorporating the complexity of the user system in the design of MIS.

7.2 FURTHER RESEARCH

This section briefly examines areas of further research.

The use of metaphors as a way of thinking about a phenomenon can provide useful insights about the phenomenon under investigation (Morgan, 1987; Sternberg, 1990). The nature and the characteristics of MIS as presented in this thesis may be constrained in the level of understanding they offer about MIS because of the concept of purposeful systems employed in this research. Also the concepts were developed within the setting of a public organisation. If the concepts are tested in the setting of a private organisation the limitations of the concepts may be highlighted or the test may provide new insights about MIS by enhancing the concepts.

One may say that the concept of MIS developed by this thesis is a major extension of the concept employed by Swanson (1974) in his treatment of MIS. It is hoped that further research aimed at extending and testing the concepts presented in this thesis is undertaken by others. The research may test the concepts presented in this thesis by applying them either in a public organisation or in a private organisation. This may either lead to a confirmation or modification of some of the concepts. One may hypothesize that the six characteristics of MIS identified in the thesis are necessary but not sufficient characteristics. Research may identify other characteristics or con-

firm the six as sufficient characteristics. One may also test some of the concepts by including them in current MIS methodologies. For example it was suggested that aspects of the context analysis and context evaluation may be included as a step in Mumford's (1983a) ETHICS methodology. It was noted that this may be termed past analysis to complement the ETHICS "future analysis" step.

Two other areas that may be considered for further research are examined.

(a) **MIS administrator**

In data-base terminology the individual responsible for the custody, organisation and control of an organisation's data-base is known as the data-base administrator. The data-base administrator "maintains the overall view of the data ... He encourages standardisation of data items and determines what data structures and layouts will be best for the data users as a whole. He attempts to referee the feuds that develop between departments or divisions about the nature of the data" (Martin, 1976, p.7). It was argued in Chapter Four that there is a need for a new job title in MIS practice with responsibilities similar to that of the data-base administrator. Chapter Four proposed the new job title to be the MIS administrator.

The need for the role of MIS administrator came from the discussion of the taxonomy of purposeful systems. It was suggested in Chapter Four that the MIS administrator would be responsible for maintaining the taxonomy of an organisation's MISs. She/He will also be responsible for

defining and maintaining the primary and secondary contexts of all MISs in the organisation. It was argued that this will encourage standardisation, minimise duplication and reduce MIS development time.

Research could be conducted with the aim of establishing the role of MIS administrator within MIS practice. The research could start by examining the similarities between the responsibilities of a data-base administrator and that of MIS administrator. The research could expand on the responsibilities of the MIS administrator mentioned in this thesis and also examine the type of training needed by the MIS administrator.

The concepts presented in the thesis suggest that the curriculum intended as academic preparation for MIS administrators must be multidisciplinary based. For example one will need adequate knowledge of systems concepts such as the concept of hierarchy (Gigch, 1978) in order to appreciate and maintain the taxonomy of an organisation's MISs. The responsibility for encouraging standardisation, minimise duplication and reduce MIS development time will require considerable technical skill about MIS development such as data structure and software development concepts (Davis, 1974; Martin, 1976; Gane and Sarson, 1979 and Wetherbe, 1984). The responsibility for defining and maintaining the primary and secondary contexts of all MISs in the organisation will require knowledge of organisational theory such as the concept culture (Schein, 1988).

(b) Policies in the NHS

It was stated in Chapter Five that the principle upon which the NHS was founded gives it a characteristic not found in privately owned business or in other public operated enterprises. This characteristic is the identity of the NHS which I gave the term ethical open-system. This identity derives from the notion that the NHS is founded on equity and is expected to make its service available and free to the demands of its environment (public). It is a system that does not have the ability to select its target population (the power to exclude sub-groups where desirable). That is, it does not exercise the power to decide which part of the environment (society in general) should benefit from its service. The NHS does not perceive liquidation or bankruptcy as a serious threat. For example no hospital has been declared bankrupt for failing to provide the quantity, quality and type of service demanded by the customer. Hospitals have been closed and services "rationalised" but the reasons underlying such decision would appear to have little to do with consumer preferences.

Research aimed at securing policy changes in the Health Authorities could proceed by examining the impact of changing any of these NHS attributes. For example one could examine what the behaviour of managers would be if the NHS is exposed to the type of threat (e.g. possible liquidation) faced by the "business oriented systems". This might provide insight into ways of making the implementation of

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m R L DALE To M PYE, AJK BINNS, J SCAMPION

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Date 08/12/89 Ref. V17/RLD/PC Your ref.

At the meeting of the RHA on the 28th November the Chairman and General Manager together with the RHA expressed considerable satisfaction at the outcome of the Cross Boundary Flow negotiations with other Regions. I would like to place on record the thanks expressed to all staff involved in this exercise.

R L DALE
ACTING AGM (F&MS)

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CROSS BOUNDARY FLOWS - COSTING METHODOLOGY

INTRODUCTION

From April 1990, allocations to Regional Health Authorities will be based on each Region's resident population, as outlined in the White Paper. For 1990-91, inter-Regional payments will be made by means of cash limit adjustments. All Regions will therefore need to reach agreement on the extent and cost of services provided to authorities in other Regions. In charging for inter-regional cross boundary patients, the aim will be to maximise the net income to the Region. This paper considers the exercise in two stages:

(a) Identification of the elements of cost

(b) Identification of an appropriate costing methodology to be used, that ensures maximum cost recoupment.

COST ELEMENTS

The cost elements can be classified into two broad categories:

1. Hospital services

(i) Direct patient treatment costs
(ii) General Services (Hotel) costs

Hospital services accounted for over 76% of total Regional Expenditure in 1988/89. As this will form the major part of the cross-boundary recharge, the costing work should concentrate more in this area.

2. Non-Hospital Services

(i) District/Regional Headquarters
(ii) Blood Transfusion Service
(iii) Other Services (as defined in Note 7 Annual Accounts)
(iv) Patient Transport Services
(v) Community Health Services
(vi) Community Health Councils

Patient Transport Services and Community Health Services are provided for residents in the Region only. These costs therefore can be ignored for cross-boundary flow purposes. The DoH have also confined the exercise to in-patients and day cases only. Supra-regional services (Heart Transplants at Wythenshawe Hospital and Psychiatric Services for the Deaf at Whittingham) are also to be excluded.

COSTING METHODOLOGY

There are 3 possible bases for costing:

-actual cost
-marginal cost
-average cost

Current information systems do not allow identification of the actual cost of individual patients, although this

would give the most accurate results. Marginal costing would be more appropriate when dealing with inter-hospital recharges where the flow of patients is much greater. Given the current cost information available from the FR returns and the timescale for completing the cross-boundary flow exercise, the average cost approach has been pursued.
The methodology to be adopted for each of the cost areas is considered below:

1. Hospital Services

4 options are available:

(i) Regional average costs

(a) Specialty cost/episodes =

$$\frac{\text{Total Regional specialty expenditure}}{\text{Total Regional Consultant/GP episodes}}$$

(b) Direct Hotel cost/patient day =

$$\frac{\text{Total Regional direct hotel cost}}{\text{Total Regional patient days}}$$

(c) Other site on-costs/episodes =

$$\frac{\text{Total site on-costs (excl. (b))}}{\text{Total Regional consultant/GP episodes}}$$

(d) Total cost =
[(a) x episode] + [(b) x patient days] + [(c) x episodes]

Source: 1988/89 FR11, FR12

(ii) District average costs
Calculations as per (i) but using individual district data

(iii) Site average costs
Calculations as per (i) but using hospital site specific data

(iv) National average costs
Calculations as per (i) but using DoH 1987/88 Korner cost data

In deciding between the 4 options, the following factors need to be taken into consideration:

Aim of maximising net income - this is likely to be the most important consideration

Accuracy - use of site average costs would give results closest to actual cost, with national average costs furthest from actual.

Work involved - the national average costs would be the easiest to apply as no work would be required in calculating specialty costs; these would be supplied by the Department.

The percentage variation of specialty costs between the 4 options will need to be examined. The selective use of more than one option would be a possibilty.

2. Non-Hospital Services

These elements will only form a small proportion of the recharge and therefore it is proposed that a simple approach be adopted.

(i) District/Regional Headquarters
The Headquarters function arises solely from the need to provide patient treatment services and thus any cross-boundary recharge should include an element for this service. It is not possible to relate spending on the HQ function directly to patient workload. However, given the low percentage expenditure on this service (4.5% of total Regional expenditure in 1988/89), it is proposed to use a simple apportionment methodology as follows:

Apportion HQ expenditure over all other services on the basis of expenditure, to obtain the Hospital Services element

Apportion the HQ (hospital services element) over all patient groups on the basis of expenditure, to obtain the element for Patients using a bed.

Derive an HQ cost/episode by dividing HQ(patients using a bed element) by total number of episodes.

Source: Annual Accounts

(ii) Blood Transfusion Service
Assuming all BTS expenditure is incurred on Hospital Services and on the patient groups of Patients using a bed and A&E only, an apportionment methodology can be adopted similar to (i), i.e

Apportion BTS expenditure to between Patients using a bed and A&E on the basis of relative expenditure

Derive a BTS cost/episode by dividing BTS(patients using a bed element) by the total number of episodes.

(iii) Other Services
This heading comprises a large mix of services, with the majority of expenditure incurred on Contractual Hospitals, Projects financed with Local Authorities, and Care in the Community. It also includes, however, expenditure on areas such as Occupational Health, Research and Development and Staff Accomodation. Again, due to the relatively small proportion of expenditure on this service (2.6% of total Regional expenditure in 1988/89), an apportionment methodology as outlined in (i) is proposed.

(iv) Community Health Councils
CHCs accounted for only 0.07% of total Regional expenditure in 1988/89. An apportionment methodolgy as outlined in (i) is proposed.

SUMMARY
In aiming to achieve total cost recovery as far as possible for cross-boundary flow patients, the various cost areas have been considered, together with the costing methodology options. The way forward to maximising net income to the Region will become clearer once the activity and costing data become available and the various options are tested.

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