THE UNIVERSITY OF HULL

COMPUTER DEPLOYMENT IN THE HEALTH SERVICES OF DEVELOPED AND DEVELOPING COUNTRIES: A COMPARATIVE CASE STUDY OF THE UK AND OMAN

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BY:

ABDULLAH AHMED WARIDAN AL-NAHDI

B.Sc. Computer Science & Information System (Fontbonne College, USA)

Supervisor: Dr. Paul Keys

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ABSTRACT

Organisations are increasingly deploying and using computer technology in various ways, involving the allocation of large amounts of capital and human resources. However, in many cases, computer deployment has been accompanied by failure, particularly in health care services. Therefore, information technology has raised grave questions, misunderstanding, fears, and hostility.

This study emphasises the importance of computer deployment and development in developed and developing countries' health care services with examples from advanced and less advanced nations. It describes strategy development for IT/ISs using information system methodologies and explores the development of ISs strategy in the NHS in the light of fundholding and the internal market. A number of problems that commonly influence the success or failure of computer deployment and development are identified. These issues are explained through two case studies: the Omani health system and General Practices (GPRs) in the UK, which have introduced computers.

The research focuses on five main sets of issues related to computer deployment and utilisation in health care: strategic planning; computer utilisation; computer fears; computer impact; and computer technical problems and performance. Users' overall satisfaction with systems in use is also considered.

Data collection was carried out using two surveys. One survey was conducted in GPRs in Humberside and the other conducted in Royal Hospital and Sultan Qaboos University Hospital in Oman. Data sources included observations, review of relevant documents, such as reports, research papers and manuals, structured and non-structured interviews with selected users and a questionnaire.

A number of conclusions can been drawn from this study: firstly, computer deployment, utilisation and development still faces problems in both the systems studied, more especially the Omani system. Secondly, GPRs have carried out strategic planning for computer deployment and utilisation and are prepared to use information system methodology for IT/IS strategy and there is

a plan to use this for competitive advantage but Omani hospitals did not set a constructive strategic plan for their systems. Thirdly, the main problems of computer failure are related to human issues rather technical issues. The most important of these human issues are the style of the leadership planning, poor utilisation of computer applications, lack of skills and poor training. Finally, the results of the survey suggested that though the respondents were aware of the potential of computer technology, the problems of computer fears, training and lack of skills were experienced, and often, few individuals possessed computing knowledge.

The author suggests several points to be considered: 1) that any thinking about computer deployment and development should employ appropriate information system development methodologies; 2) the decisions on computer deployment, use and development should be made by a special committee that has expertise in IT matters; 3) good strategic planning for computer deployment, use and development; should be connected to the organisation's overall strategy and 4) there is a need of mandate review for such development and planning. With these points in mind the researcher presents a diagram to help improving strategic planning and development of IT/IS methods with particular emphasis on the Omani environment.

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LIST OF ABBREVIATIONS

BAA	Business Area Analysis
CBS	Common Basic Specification
C & C	Construction & Cutover
CIDA	Canadian International Development Agency
CMDS	Contracting Minimum Data Sets
CISP	Community Information Systems Providers
CMMSs	Case Mix Management Systems
CSFs	Critical Success Factors
DHAs	District Health Authorities
DHSS	Department of Health System Support
DISP	Development Information Systems for Purchases
DP	Data Processing
DSSs	Decision Support Systems
EMIS	Egton Medical Information System
ERHA	East Riding Health Authority
ES	Expert System
ETHICS	Effective Technical and Human Implementation of Computer-based Systems
FHSAs	Family Health Services Authorities
FPC	Family Practitioner Committee
GII	Global International Infrastructure
GNP	Gross National Product
GPRs	General Practices
GPs	General Practitioners
GSM	Global System for Mobile
GUI	Graphical User Interface
HARMS	Human Resources Management Systems
HCUG	Humberside Computer Users' Groups
HIS	Health Information System
HISSs	Hospital Information support Systems
HIW	Health Information Workstation

IE	Information Engineering
IDRS	International development Research Centre
IMGME	Information Management Group Managing Executive
IM & T	Information management & Technology
IMTAC	Industrial Management Technology and Contracting
IS	Information System
ISAC	Information systems Work and analysis of Change
ISD	Information Systems Development
ISP	Information System Planning
IT	Information Technology
ITU	International Telecommunications Union
IT/ISs	Information Technology / Information Systems
JSD	Jackson Systems Development
JSP	Jackson Structured Programming
LAN	Local Area Network
LDCs	Less Developing Countries
Merise	A widely-used methodology for developing information systems in France.
MIS	Management Information System
MoD	Ministry of Defence
MoH	Ministry of Health
MPs	Member of Parliament
MPI	Master Patient Index
MRE	Medical Records Envelope
MSS	Management Systems & Science (Dept in the Univ. of Hull)
NAHAT	National Association Health Authorities & Trusts
NHS	National Health Services
NHSME	National Health Services Management Executive
OAUTHC	Obafemi Awolowo University Teaching Hospital Complex
OCS	Oman Computer Services
OECD	Organisation for Economic Co-operation and Development
OHS	Omani Health System
OOA	Object Oriented Analysis

OR	Operational Research
PASs	Patient Administration Systems
PDO	Petroleum Development Oman
PHC	Primary Health Care
PHIS	Public Health Information Strategy
PI	Process Innovation
RCGP	Royal Computing General Practitioner
RH	Royal Hospital in Oman
ROP	Royal Oman Police
SIS	Strategic Information System(s)
SPD	System Planning & Design
SPSS	Statistical Package for Social Science
SQU	Sultan Qaboos University
SQUH	Sultan Qaboos University Hospital
SSADM	Structured Systems Analysis and Design Method
SSM	Soft Systems Methodology
STRADIS	Structured Analysis, Design and Implementation of Information Systems
TWCs	Third World Countries
WHO	World Health Organisation
YSM	Yourdon Systems Method

1. Chapter One: Introduction

1.1. General Introduction

The Sultanate of Oman is a developing country that has made great strides in its development, over the past twenty seven years. Oman now needs to optimise its use of information by the effective deployment of IT. Therefore, the Omani Government has become interested in the use of computers in various fields that have been subject to very rapid modernisation, especially in the health care systems, taking into account that in developing countries, Oman in particular, there is need for knowledge about the health status of the population as whole, or of groups within it, while at the same time, at the international level, well-established data are needed to achieve the World Health Organisation's (WHO) goal of "Health For All By The Year-2000" (White, *et al.,* 1977).

Information Technology (IT) might be the key tool which will assist developing countries to pursue their development through the availability and use of the information necessary for national strategic planning. However, their practical utilisation of IT for the benefit of the population at large is still very limited. Although IT has been deployed and used in the developing countries, it has often been done but without specific strategy or methodology for its development. In this context, many writers such as Ouma-Onyango, 1997; Sosa-Iudicissa *et al.,* 1995; Walsham, 1993; Burton, 1992; Walsham, *et al.*, 1988; Barker, *et al.*, 1987; Stover, 1984; Rada, 1983; Patel, 1983 have indicated that IT deployment and use in such countries is very expensive and risky, and can result in management, economic, political and social problems, whether resulting from the external or internal environment.

Therefore, the important factors that may optimise the benefits from deployment and the development of IS/IT, are the use of a specific methodology and careful strategic planning. Regarding the importance of strategy to the new technology, Department of Health in the CASPE report (1990) expressed it thus:

> "Making effective use of existing data and information systems should have the highest priority in information and IT strategies, and is the foundation for success of any future management development ." (P. 5)

With respect to the use of methodology, the developers of IT/IS in the developing counties frequently use rule-of-thumb and rely on experience. Estimating the date on which the system will be operational is difficult, and applications are frequently behind schedule (Avison and Fitzerald, 1995). Computer programmers and technicians are usually overworked, and frequently spend a very large portion of their time correcting and enhancing the applications which are operational. Therefore, methodology is important for the development of information systems. This innovation of methodology encompasses the following elements according to Utterback and Abernathy, 1975):

> "Improve process, in this context better information systems development methodologies; improve product, in this context better information systems; and improved organisation, in this context better support for decision making." (P. 10)

However, IT strategic planning and methodology in the developing countries such as Oman is not yet well developed, perhaps because they do not yet realise its importance. Patel (1983) expressed this view, pointing out that IT deployment in the developing countries is constrained by lack of a long-term strategy and appropriate structures for implementation.

There are several reasons motivating the study of computer deployment and its effect on the Omani Health System (OHS). First, as indicated earlier, with the enormous development taking place within the country, Oman needs to optimise its use of information by the effective deployment of IT, and the Omani government has shown interest in the use of computers in various fields. In health care, in particular, computerisation has been introduced on the expectation that it will benefit health care delivery, research and management control (see Chapter Four). No one visiting any of Oman's hospitals could fail to be impressed by the high level of idealism, shown by the elected representatives and staff, and the high level of technology installed. However, the practical utilisation of IT for the benefit of the population at large is still very limited. Second, the rapid advancements in information technology have made this technology more affordable and more relevant to the development of health services. Third, the rapid changes in IT hardware and software have increased the costs of acquiring and operating the new technology, which gives rise to financial constraints. Fourth, there has been a rapid growth in the direct use of information technology by non-data processing experts. This may show a different trend in utilisation and its strategy. Fifth, there is a need to study deployment of IT in relation to proper strategic information system planning with the use of specific recognised methodologies and not depend on using '*ad-hoc* and best deal' methods. Finally, experiences in other countries showed the success and failure of the impact of this technology on health systems. All these factors led the researcher to investigate the new technology's deployment and use in Oman.

1.2. Statement of the Problem

This thesis is concerned with the deployment and use of computer systems by General Practice (GPRs) within the UK National Health Service (NHS) and in hospitals within OHS. A description of the computer based health information systems of GPRs and two Omani hospitals is contained in Appendixes A, B and C (EMIS for the GPRs, WANG system for Royal Hospital (RH) and Gerber Alley System for Sultan Qaboos University Hospital (SQUH) respectively.

Since computer systems have been deployed and used in the Omani Health System they have not yet produced the expected benefits, while imposing a heavy financial burden on the organisations which have installed them. For example, RH and SQUH have installed powerful systems. However, manual records are still much used in the computerised hospitals; many of the system applications are on hold; response time is unacceptably long; some of these systems have become obsolete, and the expense of computer hardware and systems has greatly increased with little tangible benefit. Moreover, there is no complete patient record, because computers have still not been introduced into other Omani hospitals, except that recently, some hospitals have begun to use computers for word processing. In the primary health care and the private health care sectors, the use of computers is still unthinkable. In addition, no information systems methodology is applied to these systems to solve these problems.

Such unfortunate experiences are not restricted to developing countries such as Oman, where rapid infrastructure development is taking place. Similar disasters also occur in countries like the UK on a variety of scales. The attempted computerisation of General Practices (GPRs) in the UK provide well publicised examples of very costly failures.

Therefore, the problems and issues concerning the deployment and the use of computers in health care are numerous, but the interest of this research can be grouped into the following categories or questions:

1- Is the use and development of the computer system strategically deployed into the health system?
2- Is the problem of systems being deployed but not properly or fully used common in developing countries (Oman)?
3- Do computer fears still exist?
4- Is there any impact of computer on the quality and detail of health information and decision makers' planning?
5- If the computer has not fulfilled expectations, is this failure the result of human related issues or technical issues?
6- What is the users' overall satisfaction toward the computer system information, performance and management handling computer deployment?

The above list represents some, but by no means all, issues which may constitute obstacles to computer use and deployment. Theoretical discussion and more detailed information about these problems/ issues is presented in the coming chapters.

1.3. Overall Aims and Objectives

The primary objective of this study is to study computer system deployment and utilisation in the Omani Health System (OHS) vs. General Practice (GPRs). It appears important to highlight the problems and to explore the constraints, which have affected computer deployment and utilisation in Oman health system by identifying and analysing the reasons for lack of success of computerisation.

With this in mind, this study looks at the deployment of computers in GPRs within the British National Health Services (NHS) as a guideline to OHS investigation. It includes an examination of the difficulties faced, computer deployment and utilisation, and the impact of IT deployment and utilisation on their health activities and planning. It also attempts to investigate whether proper Strategic Information Systems planning or methodology has been undertaken as part of the deployment and the utilisation of this technology in the OHS, given that the literature on the problems of computer deployment in the developed countries suggests that the use of strategy planning and specific methodology for IT/IS provide the key to solving both technical and human related problems.

To achieve these objectives, two surveys were undertaken which will be referred to as the qualitative survey (interviews) and quantitative survey (questionnaire) to cover the following topics:

(1) to study the process of computer deployment in a developed country, identifying the problems and whether computers were introduced within a strategic information framework;

(2) similarly, to study the process of computer deployment in a developing country, identifying the problems and whether computers were introduced within a strategic information framework;

More specifically, it is aimed to achieve the following:

(1) to investigate the deployment and the utilisation of computers in UK general practice and their satisfaction with them;

(2) to show the progress in deploying computers in NHS/GP in Humberside since 1986;

(3) to exploit the experience, and the progress of the NHS in using IT to benefit developing countries such as Oman;

(4) to identify problems facing the deployment and use of computers in health care;

(5) to assess management, doctors' and other staff attitudes and satisfaction towards IT in health care;

(6) to suggest a strategic methodology planning for deployment, utilisation and development of this new technology to be in harmony with the values and expectations of Oman.

The methodology used in this work included mainly interviews and questionnaires as means of data gathering. Data were collected from two different environments, namely, GPRs/ Humberside health system in NHS and Royal Hospital and Sultan Qaboos University Hospital in Oman. Therefore, two case studies were carried out. One examined the computer deployment and use in GPRs in the UK and the other examined the computer deployment in RH and SQUH in Oman. These issues are explored statistically in terms of users' responses to the questionnaires. Since this research consists of exploratory investigations (which do not require hypotheses) as well as relationships between variables, hypotheses and null hypotheses are presented only when required (Kerlinger, 1964).

1.4. Background to the Study

1.4.1. Health Care and Computer

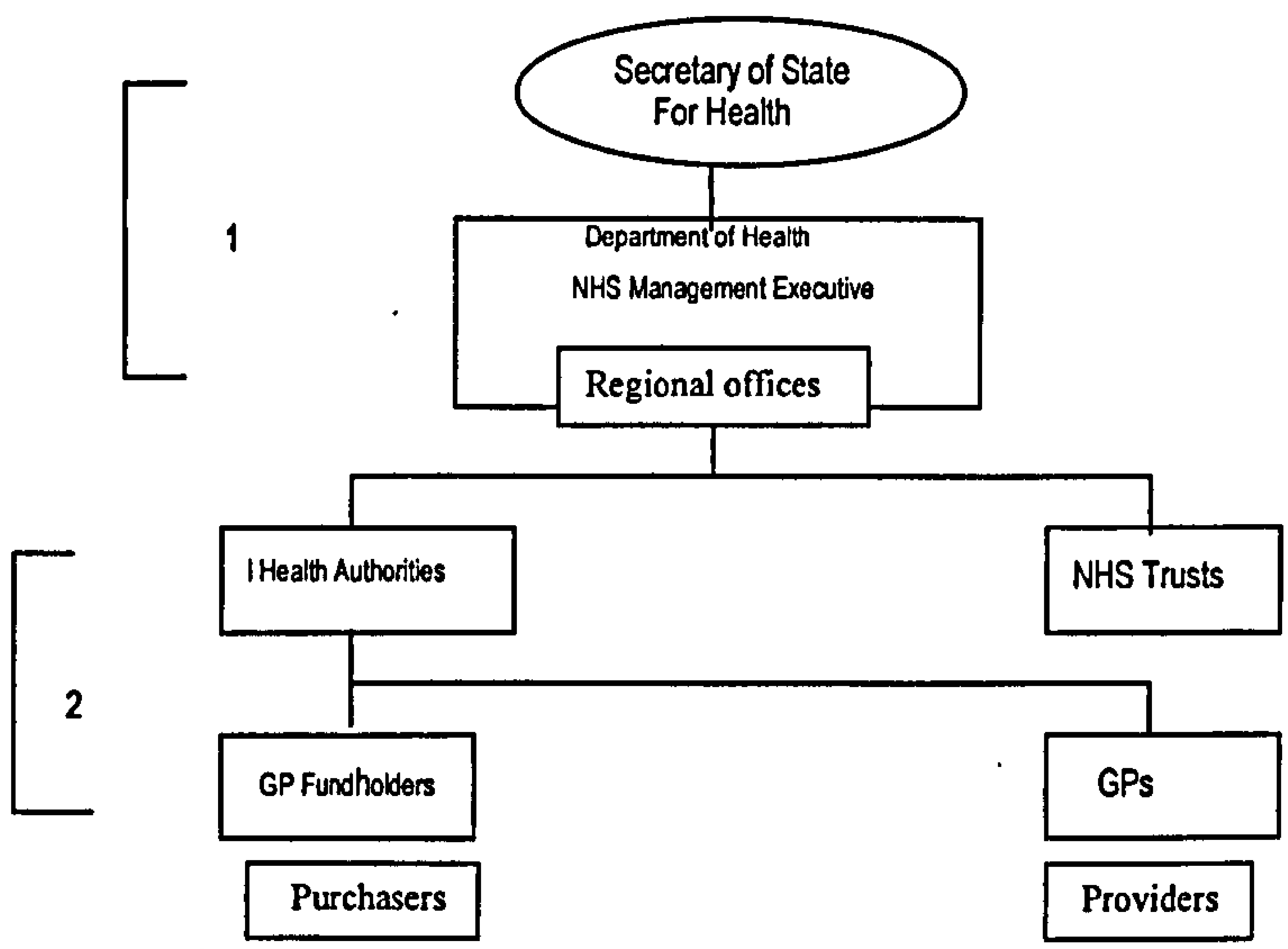
Given the importance of health to human beings, there has been a race and struggle to research and develop means to prevent and cure symptoms and diseases, so people may live healthily and for as long as possible. The developed countries are witnessing huge developments in health provision and related technologies. However, the huge demand, the vast quantity of data involved, and the pressure to provide quality health care while being as economical as possible with resources, have led to a search for tools to help achieve the goals of effective and efficient health care, without undue financial burden. The new technologies of computerised systems are expected to contribute significantly in this regard achieving effective and efficient health care. Engelbrecht and Rothemund, (1987) expressed this objective as follows:

> "The basis for all these systems is, in general, a managerial, task to be fulfilled, e.g. patient details, drug supply or statistics, where the use of computer power speeds up to these tasks and makes them more cost effective. Another approach is to extend the quality of medical care with different assistance techniques." (P. 3)

1.4.2. Health Care in UK

The NHS, which came into being in July 1948, retains the features, which make it unique. Britain was the first country to introduce such a scheme, offering free health care to its entire population. It is the only social service that everyone resident in Britain is free to use whether they pay National Insurance contributions or not. It is also the only national health care system centrally financed and directed. It is regarded as the largest employer in Europe, with a work force of approximately 800,000 (Jarrold,1997). In 1997-98 NHS estimated to spend around £44 billion providing health care for around 58 million people in United Kingdom, equivalent to £750 per person (Appleby, 1997). It is estimated now that NHS is spending daily over £110 millions in providing health care services for the population of the UK (Merry, 1997; Robertson, 1994; Cannah and Pearson, 1991).

Figure 1.1: Organisation of the NHS in England



Source: adopted from 1997/98 NHS Handbook Twelfth Edition.

The organisation of the NHS is currently going through a period of significant changes. Figure 1.1 illustrates the structure of the NHS. At the top of the structure is the Secretary of State for Health in the Department of Health. The Secretary of State is responsible to Parliament for the provision of health services. Individual MPs (Members of Parliament) are able to raise issues in correspondence and through parliamentary questions and debates, and the Secretary of State is expected to be able to respond to these questions. Within the Department, the policy board, chaired by the Secretary of State, sets the board strategic direction for the NHS. The NHS management executive (NHSME) deals with all operational matters within the strategy and directives set by the policy board. One of the most important functions of the Department of Health is to establish the policy framework for the NHS, to negotiate with the Treasury on the level of funding to be provided for the NHS and allocate resources to NHS authorities and also, monitoring the performance of NHS authorities and trusts and to assess the way in which they use their resources (Ham, 1997).

NHS Trusts were first established in 1991 under the NHS reforms. The number of trust has increased over 400 by 1996. These are self-governing units, with their own boards of directors and with freedom to organise their affairs. They cover a range of services including hospitals and community services, which are provided for patient groups on behalf of the Secretary of State (Ham, 1997).

Regional Health Authorities (RHAs) act as an agent for the Secretary of State in the administration of health services. There are fourteen in the United Kingdom. One of the main functions of RHAs is to act as a vehicle for implementation of national policies in their area. They are also responsible for holding District Health Authorities (DHAs) and Family Health Services Authorities (FHSAs) to account through the accountability review process.

District Health Authorities (DHAs) are the purchasers of hospital and community health services for the people who live within their area. There are around 145 DHAs, with population ranging from 100,000 to over 800,000. DHAs responsible for assessing the population's need for health care. This they do by drawing up a picture of health in each community and by consulting with local people. DHAs also liase with FHSAs, GPs, local authorities and other agencies to build up an assessment of the health status of their residents.

Family Health Services Authorities (FHSAs) exist to manage the services provided by GPs, dentists, community pharmacists and opticians; pay practitioners in accordance with their contracts; provide information to the public; deal with complaints from the public; and allocate funds for GP practice developments. FHSAs are responsible for implementing the national contracts in their areas. The boundaries of FHSAs differ from those DHAs. There are 90 FHSAs in United Kingdom serving populations, which range from 130,00 to 1,600,000. Almost one half of FHSAs relate to one DHA, with the balance relating to between two and seven districts.

However, in 1 April 1996 a merger of family health authorities and district health authorities, resulted in reducing the number from 200 into 100.

Fundholders: General practices that are accepted as fundholders are responsible for purchasing a defined range of services for their patients. By the 1994 there was a total of 6,098 fundholders. Family Health Service Authorities (FHSAs) are gradually assuming responsibility on behalf of Regional Health Authorities (RHAs) for administrating fundholding and monitoring the use of resources by fundholders.

General Practitioner: For the majority of the population the GP is the first, the continuing and perhaps the only contract with the NHS. GPs attend their patients in their consulting rooms and at home, and sometimes in a clinic or hospital. Over 90 per cent of all episodes of illness are managed wholly in general practice (Jarrold, 1997). GPs work in primary health care teams with practice nurses, district nurses, health visitors, community midwives, practice receptionists and managers. Increasingly, other health professionals are associated with GP practices.

The main purposes of NHS organisations are to bring together all the managing bodies of the NHS in a partnership to work in common purpose for the benefit of patients and the public; to investigate and give voice to specific problems of concern to its membership; to educate and inform the public about the achievements and needs of the NHS; to promote research, education and the exchange of information within the NHS; to advise government and professional on issues relating to the NHS.

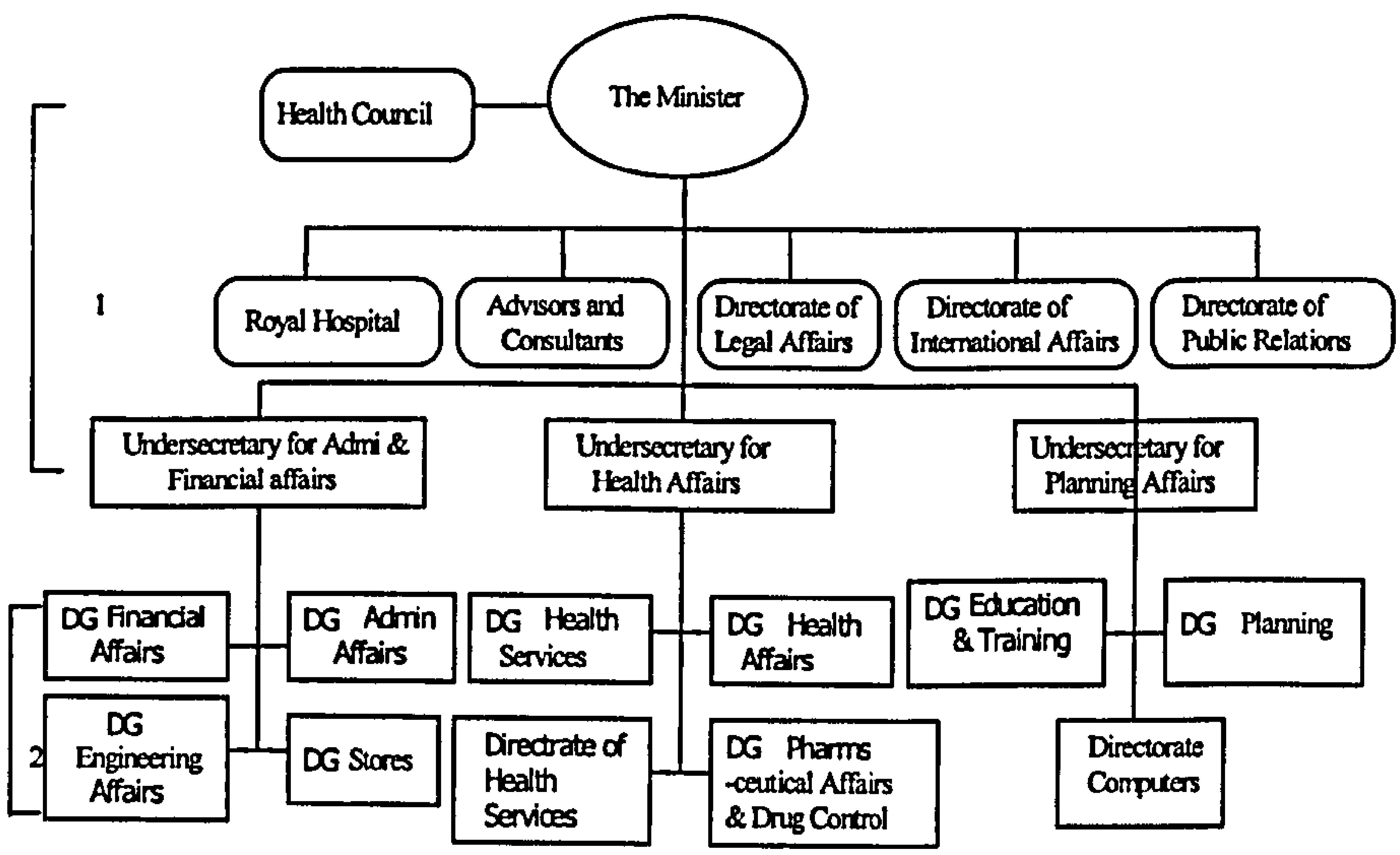
1.4.3. Health Care in Oman

Health systems in Oman are managed by the Omani government, where they operate within a system involving some form of bureaucratic authority. This is primarily for reasons of efficiency and accountability. The Ministry of Health (MoH) is the main provider of health care in the country, though three other government organisations, the Ministry of Defence (MoD), the Royal Oman Police (ROP) and Petroleum Development Oman (PDO), provide medical care for their employees and their dependants. For more information on these health institutions please see Chapter Four. There has also, recently, been an increase in private clinics and hospitals. The MoH provides both curative and preventive health services, each administered by its own Directorate (Please see Figure: 2). To achieve better co-ordination and utilisation of resources, the basic curative and preventive services are being integrated in a regionalised health care system, which, however, has no computerised link.

1.4.4. Organisation of MoH

Referring to the organisation chart of the MoH in figure 1.2 in Chapter One, the Minister of Health is assisted by three Under-secretaries; for Planning Affairs, for Health Affairs and for Administrative and Financial Affairs. A number of Directorates-General and Directorates come under each of the Offices of Under-secretaries. The Health Council, which comes directly under the Minister, is responsible for setting and approving the objectives and health plans. The Minister is also assisted by a number of advisors and consultants, and in addition there are Directorates of Legal Affairs, Public Relations and International Affairs.

Figure 1.2: Organisation Chart of the Ministry of Health in Oman



Source: Adopted from Annual Statistical Report, 1997, Omani Ministry of Health.

* DG = Directorate General.

* Directorate General Health Services includes several regional directorate; see Chapter 4 for more detailed information on those.

The establishment of the office of Under-secretary for Planning Affairs with a number of Directorates General and Directorates has emphasised the important of strategic planning to deliver health services and care. The Directorate of Computers has been added to the structure. The importance of computer systems was expressed by the director when he stated that 'no one can deny the definitive role of the computer in building the health care information system'. The computer collects, analyses and presents health data which contribute, without doubt, to establishing the basis for planning, developing and promoting health services.

The Under-secretary for Health Affairs ensures that all forms of health services are provided to the people of Oman. The Directorate-General of Health Affairs supervises the delivery of preventive, curative and primitive health care through a network of hospitals, health centres and mobile medical units. It also supervises all primary health care programmes. Also there are the Directorates-General of Health Services at the regions which supervise the delivery of comprehensive health care through health centres and hospitals.

The Under-secretary for Administrative and Financial Affairs is followed by four Directorates-General: for Financial Affairs, Administrative Affairs, Stores and Engineering Affairs. All interact to implement the policy of Civil Service for the benefit of the work and employees.

Since 1970 and after the Omani Renaissance, His Majesty Sultan Qaboos Bin Saeed has always emphasised the importance of health in social and economic development. Therefore, a Royal Decree was issued to established the Ministry of Health (MoH) in August 1970. The MoH made a commitment to develop a modern welfare state, including promotion of health of the Omani people free of charge. An improvement in the nation's health would contribute to economic growth by reducing production losses because of workers' illness, increase enrolment and achievements of school children who form the basis of the developing population and free for alternative uses, resources that would otherwise have to be spent on treating patients. Such developments would only be possible through proper health planning and accurate information; therefore, the MoH introduced a series of Five -Year plans, the first of which started in 1976.

The first five-year plan (1976-80) of the MoH aimed mainly to restructure and develop already available health resources. The second and third five-year plans were concerned mainly to increase the coverage of health services and at the same time improve the quality of care. This period showed an increase in the number of health centres and hospitals. It ended in 1990 with the establishment of the most highly specialised and equipped hospital in the Sultanate, the Royal hospital. The focus of the fourth five-year plan (1991-1995) was to identify and establish the priority health problems and needs and plan for health programmes to meet such needs. By the end of 1995, the MoH had developed its "Fifth Five -Year" plan (1996-2000). The most recent approaches in health planning were used to identify health needs as well as solutions to overcome future challenges during the next five years.

Therefore, the present health development plan aims to provide primary, secondary and tertiary care to all the people of the Sultanate in an attempt to reduce morbidity and mortality rates to the levels seen in the most developed countries. It is intended to adopt the most recent techniques for early diagnosis and treatment of chronic and non-communicable diseases to reduce their incidence and prevent their complications.

The status of health services in the Sultanate of Oman has developed tremendously over the past twenty-five years. During 1970, there were only 2 hospitals with 12 beds and 9 clinics and by the end of 1997, the MoH was operating 47 hospitals with a total of 4374 beds and 114 health centres. These hospitals and centres served a total of about 12 million outpatients and an average of 2,550 inpatients were managed daily in MoH hospitals. This success was the result of proper planning and fruitful collaboration with the decision makers to provide high quality of health care. Statistical reports play an important role in the identification of health needs.

The developments in health care are clearly evident from improvements in the health of the people in Oman. The international community has admired Oman's success in dramatically reducing the Infant Mortality Rate to 18 per 1000 live births in 1997. Oman is witnessing an epidemiological transition, where there is a shift from communicable diseases and health problems common in developing countries to non-communicable diseases and health problems related to modern lifestyle.

1.5. Rationale for Examining the NHS

It is thought that in attempting to deploy computers to enhance the efficiency and effectiveness of health care, Oman may benefit from the experience of other countries, which have already introduced computerisation. The NHS was found, in its centralised authority structure, functions and attention to health service delivery, to be close to the OHS (Please see previous Figures 1 and 2). Britain was the first country to introduce such a scheme, offering free health care to its entire population. The NHS is currently undergoing a programme of reforms more fundamental than any experienced since its inception in 1948. These reforms are being introduced in a short space of time to avoid unnecessary delay, and the production and use of information has received top priority on the NHS management agenda. The NHS has a unique bank of data going back to 1948, and this rich source of data could help to improve management information and health delivery in Oman. It would be helpful for Oman to benefit from the NHS's experiences, by studying the errors in system introduction, how data are dealt with (processing, storing and retrieving) and how they are being used. It will also be instructive to see how computer use has improved management information, with a view to developing the delivery of health care. Lastly, the NHS has recently begun to use microcomputers. These, with their ability to analyse and store large amounts of data, could play a significant role in providing accurate and timely information. Further information on the NHS is provided in Chapter Four.

1.6. The Expected Value of the Study

In recent years, the Omani government has become interested in the use of computers in various fields, but until now, no research related to IT strategy deployment and the use of information system methodology in health system has been undertaken in Oman and very little has been undertaken elsewhere.

Therefore, the importance of this study will be derived from the following elements: first, the initial research and description of the systems and their problems in the Royal Hospital and Sultan Qaboos University Hospital in Oman and general practice in the UK; second, the review of literature and collating of up-to-date information in the field; third, the results of the exploratory questionnaire and the interviews; fourth, the measurement of computer progress in Humberside; and finally, the presentation of conclusions derived from the research, regarding the deployment and the use of computers, and recommendation for the introduction of the use the principle of information system methodology into the Omani Health System environment (see Chapter Eight).

The initial research, the description of computer-based systems in different environments and the discussions of the computer deployment in health care in two different environments and present the implications of the findings for the framework of information systems development methodologies (see Chapter Eight). These are the study's main contributions to the literature. In addition, the results of the study will have an important role in the following:

1- expansion of the use of computers to other hospitals in Oman;

2- the introduction of the use of computers in PHC (clinics) and the private sector in Oman where such facilities are as yet unavailable;

3- health data network for government and public;

4- increasing awareness of IT's benefits and risks;

5- as a first step to thinking of implementing specific information systems development methodology and using IT strategy in health systems for competitive advantage.

6- implementation of the results to set up a Department of IT in Oman, to help health management authorities with IT implementation projects.

1.7. Summary of new developments reflected in amended chapters

Since the original work of this study was completed, significant developments have taken place in both the UK and Omani health care systems, and some chapters have been updated to reflect the current situation. This section, therefore, highlights the main developments of recent years, and indicates the parts of the thesis, which have been amended to reflect them.

In the UK, because of the widespread political support for the NHS, the Government recognised that outright privatisation was not feasible, and so from 1991 introduced a massive restructuring process based on the idea of an 'internal market' (Flynn *et al.,* 1996) (see section 2.2.3). In 1994 the NHS Executive issued HSG/94/55 on the operation of the NHS internal market local freedoms and national responsibilities (Ham, 1997). This led to the establishment of 57 Trusts and 306 GP Fundholders (see Chapters 2 & 4).

The 1996 White Paper *'A service with ambitions'* outlines the UK government vision for the NHS. It emphasises that both future health service policy and performance will rely heavily on better data, new communications and information technologies (Peel, 1997) (see section 2.2.5).

However, in the UK, the developments of computer use have been fraught with problems (see section 4.2.7). Similarly, in Oman, in spite of the change of systems and the money spent on the new systems there is a tendency for future planning to shop around for better or new systems (see sections 2.5 and 4.4).

Therefore, in Chapter Two we describe and discuss the information system methodologies that could be used for the development of IT/IS; the researcher believes that computer deployment and development have not always been accompanied by such a methodology. Section 2.2.7 presents one of the information systems methodologies that is believed to be more suitable to the Omani environment and in Chapter Three the chosen methodological framework for information systems is mapped onto the experiences of UK/NHS and Oman (see section 3.5). This forms a basis for further critiques in Chapter Eight, with the findings of the empirical results.

1.8. Thesis Organisation

The thesis covers the main aspects of the deployment and the use of IT and its strategy in health care. Also it covers the use of methodologies for such information system developments. It comprises eight chapters, including this introductory chapter, which has highlighted the importance of the study, and presented the rationale and objectives of this study, as well as highlighting the background of health system in the UK and Oman. The remaining chapters are organised as follows: Chapter 2 explores the information system development and the use of methodologies. It explores information technology in NHS and less developed countries including Oman. It introduces the internal market in NHS and the new developments of computer use by NHS and Oman. Chapter 3 is devoted to a detailed discussion of the use of IT/IS strategic planning and exploring the associate problems that accompany such strategic planning, deployment and development of IT/IS. Chapter 4 provides the background to the two case studies[(1)] and the process of their computer deployment. The first case study explores the NHS creation, its support for the use of computers, and General Practice involvement with computerisation. The second case study provides background information on the Omani Health System and its computers.

Chapters 5 and 6 present the research methodology and statistical analysis of the two field studies.[(2)] Chapter 5 describes the research methodology, questionnaire development and the results of exploratory interviews. Chapter 6 presents a detailed statistical analysis of the two sets of findings.

Chapter 7 discusses the various issues raised by the study, analyses the chosen methodology framework in relation to the empirical findings and presents a summary. Then in Chapter 8 the researcher presents a conclusion, and recommendations regarding the deployment of computers, their uses and training requirements, as well as suggestions for future research.

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(1) The first case study was conducted at a general practice called Old Fire Station Surgery, in Beverley, Humberside, UK, while the other one case study was conducted in Oman.

(2) These two field studies referred to the different environments where the two case studies had been conducted (GPR in the UK and RH & SQUH in Oman).

1.9. Conclusion

This chapter has highlighted the objectives and the importance of this study, providing some background information on health care and the computer, health care in the UK and health care in Oman, and certain problems that we have assumed are related to computer deployment and use. In the next three chapters we will draw on relevant literature to present the theoretical basis for the study, in terms of computer deployment, utilisation and the use of information system methodologies.

2. CHAPTER TWO: INFORMATION TECHNOLOGY (IT) IN HEALTH CARE

2.1. General Introduction

Before the spread of computers, human activities and production systems were largely manual, the workers using only adding machines, typewriters, mechanical or electronic aids to help their systems to run as efficiently as possible. The increase of workloads, the expense of staff and frequent errors have caused over the years, considerable changes in approaches to the use of computers in business administration, reflected in the terms used to describe the activity, from 'data processing' through 'management information' to 'information processing'. These changes have been brought about by technological advantages, experience of technology use, increasing awareness of information needs, and economic needs. However, the realisation of how best to plan and use the technology to its full potential was gradual and in many cases has not been realised (see section 2.1).

IT deployment in developed countries' health care was mainly started as an aid to the care of the environment and efficiency of organisation. It was viewed as an improved business office tool that would enable the health institution to collect bills and other receivables, pay bills and prepare the payroll more quickly, and control inventory more accurately. Recently, however, there has been a greater awareness of the strategic needs of management, and the use of IT for strategic competitiveness (see section 2.2).

With respect to LDCs' health systems, the amount of published work addressing the issue of IT development and deployment is relatively slight, although an increasing interest is being shown in the area. The public health and the organisation of health care services, being in most parts of the world a public sector business, lagged behind in terms of using modern technology, just as other state run activities not considered to be priority. Unfortunately, public health and the provision of equal and high quality medical services are not one of the main priorities of governments, despite touching so closely the life and well being of citizens (Sosa-Ludicissa and Levett, 1995) (see section 2.3).

In addition, health care investment world-wide at just over 1.5 trillion dollars now accounts for 7.5% of world-wide GDP (USA 14%, Europe 8%, Eastern Europe 5%, Japan 6.5%, rest of the world 4%) (Pinto, 1995).

This chapter explores the role of IT in health care. It begins with the development of information system and the use of development methodologies. It then discusses the development of IT/IS in the UK NHS and Omani health systems. Finally, it highlights technology transfer and deployment in the Less Developed Countries (LDCs), drawing attention to some of the problems encountered in this process.

2.2. Information Systems Development (ISD)

2.2.1. Introduction

Information System Development (ISD) continues to cause many problems. Systems often fail to meet their potential, with some resulting in large scale catastrophic failures (Hirschheim and Newman 1988). The main approach for ISD is to focus on the technical issues while relatively ignoring the social and political processes and this inhibits understanding the complexity of ISD.

This section will describe the history of information systems and then highlight several methodologies that support their development for use in organisations. It also takes into consideration the framework of comparison introduced by Avision and Fitzgerald (1995). In addition, consideration will be given to issues arising in developing countries such as top down decision making, poor skills, less participation for end-users, poor strategic planning for ISs and difficulties of implementing such systems. Finally, the choice of one of these methodologies to use in this particular study will be made, bearing in mind theoretical, philosophical as well as practical issues.

2.2.2. The History of Information Systems Development

2.2.2.1. Early Days of Data Processing

When computers first became available in the 1950s, they were seen as being useful only to scientists and code-breakers. At this time, computer applications were implemented without the aid of an explicit information systems methodology, the emphasis being towards programming and required the skills of programmers (Avison and Fitzgerald, 1995). Therefore, the system developers were more technically trained than good communicators. The information systems in this period were oriented towards operational levels systems and often included a system to produce reports and documents (Somogyi and Galliers, 1994; K. Laudon and J. Laudon, 1996). Typical examples of these would be reports on bank deposits, sales, keeping customer records, and producing invoices etc.. When large-scale commercial computing arrived with the second and third generation computers, it was used mainly to achieve economies of scale by automating the routine clerical work of large administrative departments. The systems developed in this era were typically payroll and general ledger systems. However, the cost of early computers, and the high cost of system development turned the focus towards making the computer work, rather than rationalising the processes being automated. The people implementing these systems were programmers who were not good communicators, making it difficult for users to communicate their requirements or needs, which caused frequent dissatisfaction (Avison and Fitzgerald, 1995). In addition, the documentation was usually out of date. Further, the development of applications was frequently more costly and arrived later than expected. Projects to introduce computers were seen more as short term or a solution to current problems than for the long term, with planned implementation strategies for future or new applications. In this period few courses existed giving the education and training necessary for the analysis and design work associated with the development of data processing systems. Most courses that were available were designed to enable people to use and program the computer (Avison and Fitzgerald, 1995).

As a reaction to this, there was growing concern about the development of the systems in terms of analysis and design, as well as the appearance of methodologies to develop computer applications (Avison and Fitzgerald, 1995).

Gradually, with the increasing application of operational research (OR) and management science (MS) to industry and commerce, together with developments in the theoretical base of data processing, system analysis emerged as a key activity, bringing together OR, MS and organisation and management activities in the context of system development.

During this period, two important developments resulted from the focus on operation efficiency: the emergence of new programming languages (e.g. COBOL, FORTRAN) which made programming less cumbersome; and development of special operating software to make better use of computer power. As computer use became easier, further applications were attempted, requiring more processing power (Somogyi and Galliers, 1994).

By the late 1960s, most large corporations had acquired big mainframe computers, and further concerns emerged. First, business started scrutinising the costs and benefits of computerisation, in view of the rising cost of computer system professionals, high maintenance costs, inflexibility of systems and slow response time, and the apparent inability of the computer departments to satisfy users need. Second, it became apparent that computerisation necessitated substantial organisational and job changes. Third, the majority of systems were flawed and fragmentation and duplication of data across systems was a problem, and centralised, remote, batch-processing systems based on historical information did not adequately reflect the real business situation (Somogyi and Galliers, 1994).

The need to rethink the provision of computer support led to more formalised and analytical development methodologies, and the emergence of the new discipline of 'software engineering.'

Theoretical and practical advances were helped by the advent of the versatile mini-computer, whose cheapness, flexibility and relative ease of operation opened up the possibility using computing power in smaller companies, increasing the demand for more and better systems.

A parallel but separate area of development was that of project management. Initially, large computer projects were managed on production-line principles, with the various disciplines compartmentalised. When this approach proved unsatisfactory, with time and budget overruns attracting adverse publicity, the focus turned to controlling the intermediate and final results of development activity, rather than the activity itself.

The large and complex computer programmes fashionable at the time gave rise to problems of program maintenance. As the causes of the maintenance problems began to be recognised, work started on reducing programme complexity, including breaking down the logic control structure, the concept of 'Go To- less' programming and the development of languages such as PASCAL.

From the 1970s onward, modularity and structure (not only of systems, but also of projects and terms) in programming became major concerns of practitioners and academics. IBM's pioneer use of structured project teams using structured programming methods in the early 70s, was one of the first successful approaches to developing large projects (Baker, 1972).

2.2.3. Database and Management Information Systems

Whereas early development methods concentrated on perfecting the processes performed by computers, management's need for cross-relating and cross-referencing data brought a shift in focus, by the end of 1960s, to the actual data and awareness of the desirability of data being independent of basic process, so they could be used in new kinds of systems with practical methods of describing, analysing and storing data. Independent data management systems became available by the late 1960s. During the 1970s, most companies changed to on-line processing to provide better access to data. By the end of the 1970s, information was recognised as a fundamental resource of business.

With this new direction, database and database management systems started to appear. Consideration was given to how best to represent data structures, including hierarchical representation and network- type representation based on entity-attribute relations, while the work of Codd (1970) culminated in development of the relational database.

The context of databases and more sophisticated and powerful mainframe computers gave rise to the idea of developing corporate databases to supply management with information about the business, and some database professionals developed the idea of totally integrated management information systems (MIS) resting on a corporate database (Somogyi and Galliers, 1987). This idea, however, faced certain practical difficulties, e.g. deciding what to put in the data-base, the difficulty of keeping up with changes in management requirements, the need for particular views of internal data that could not be specified in advance, and the need for data external to the organisation's transaction processing systems. Moreover, unrealistic expectations were held of the computer; many companies failed to realise that, while technology can solve technical problems, it is not the answer to management shortcomings (Somogyi and Galliers, 1994).

Although the MIS era contributed a new level of information to serve management needs, it was, as Sprague and Carlson (1982) note, 'very much oriented towards, and built upon, information flows and data files.' (P 19)

2.2.4. The emergence of Information Technology

In the late 1970s, microprocessors using 'silicon chips' hit the headlines and unprecedented changes to personal and business life were predicted. Small, cheap, reliable micros, by the early 1980s, greatly extended the accessibility of computing facilities. Users started by-passing data processing departments and buying their own computers; the low cost of the small machines highlighted the cost of human effort in developing and maintaining large computer systems; and telecommunications came to the fore with recognition of the need to interconnect small, dispersed machines, to maximise their utility. Hitherto separate technologies converged to make up a new complex technology, termed information technology. With these developments, it became clear that the specialist manual activity of system development was needed, for full benefit to be gained from the new computers and information technology. Ready-made application systems emerged in large numbers, and ultra-high-level languages (fourth generation languages) emerged to support system development efforts.

2.2.5. New approaches to system development

The emergence in the late 1960s of the 'life-cycle' view of systems formed the basis of many methods for system development, though the initial linear view of the lifecycle proved counterproductive. The linear approach, which allowed no recursive actions, meant that misconception, errors and omissions made at one stage in the development process would be magnified in subsequent stages. Second, the linear view took no account of the possibility that specifications may need to be adjusted in the light of the system's interaction with its environment. Third, maintenance tends to increase as the number of systems grows.

In response to the alarming backlog of system requests that was evident by the early 1980s, quality assurance, quality control and quality management of system development appeared, and 'user-friendly' systems emerged (Somogyi and Galliers, 1994).

By this time, it was evident that computer systems had wide-ranging organisational effects, and methods for including organisational considerations in system design started to emerge. Nonetheless, official projects lagged behind (Land, 1983); during the major development programmes of the 1980s, too much attention was paid to technology per se, and too little to its application (Somogyi and Galliers, 1994).

2.2.6. New types of systems

In the 1980s, with the recognition that sophisticated hardware and software together can be aimed at different types of application areas, new generic systems emerged. "Expert" and "Intelligent Knowledge-based" systems which imitated the rules and procedures followed by particular areas of expertise attracted attention. It was assumed that computers would have a major role in supporting decision-making processes at the strategic management level and the concept of Decision Support Systems (DSS) evolved.

Meanwhile, manufacturers were providing advanced facilities that contained office systems, computers and networks and made use of television and telecommunications. Electronic mail systems, teleconferencing and videotext came to the fore. The emphasis shifted from the provision of data, to the provision of information and to speeding up information flows (Somogyi and Galliers, 1994). The interest in telecommunications seems likely to increase as more people gain access to computer power.

Technological developments and changes in attitudes have brought rapid changes in the rise of data processing professionals and users, with the latter more involved in development and the former assuming a more advisory role.

However, the most important result of using computer technology has been the realisation that technology per se does not solve problems, and that the introduction of technology results in change. With the recognition that technological choices can and should be evaluated in the context of business choices, the expression, "strategic system planning" has become familiar. There is also increasing recognition of how technology can bring competitive advantage to enterprises by building barriers against new entrants, changing the basis of competition, tying-in customers, switching costs and creating new products and services. By the mid of 1980s, the role of IS in business emerged as a strategic one and IS professionals gained in status accordingly. Information systems are leaving behind their former low-level support position to emerge as the nerve-centres of business, and as the focus has moved from tactical to strategic use of information, the nature of systems and the system portfolio has changed. This makes the development of information systems a strategic concern for organisations.

In the coming section we will look at various methodologies to support the strategic development of information systems.

2.2.7. Methodologies for the ISD Strategy.

2.2.7.1. Introduction:

How have methodologies to support the strategic development of information systems come about? In terms of background, methodologies can be divided into two main categories: 1) Theory methodologies: which developed in the universities and/ or research institutes. These are less well known. However, their influence is often greater than their user base. Multiview and Soft System Methodology are examples of methodologies that combine the data and process techniques. 2) Practice methodologies: which evolve from usage in an organisation, and are then developed into commercial products. These are the most widely used. The development of these methodologies is regarded as an aid to the development of information systems.

2.2.7.2. *What is methodology?*

There are many interpretations that have been applied to the way that methodologies are used. However, we will quote here the definition presented by Avision and Fitzgerald (1995) because it appears as most relevant to the situation in the developing countries. It is that: 'a methodology is regarded as a recommended series of steps and procedures to be followed in the course of developing an information system.' (P. 418)

2.2.7.3. *Reasons for Adopting a Methodology*

Rationales for the choice of a particular methodology vary from one organisation or individual to another, but three main categories of rationale can be identified (Avison and Fitzgerald, 1995). One is a better end product, i.e. better information systems, by emphasising those criteria that are particularly important in the problem situation. A second rationale could be a better development process, in terms of improved management and project control. The third main category of rationale is standardisation - the benefit of having a common approach throughout an organisation.

In the Omani context it seems likely that the first rationale, i.e. improvement of the information system itself, would be the major consideration in adopting a methodology. In this respect, criteria of particular concern would be acceptability to users, availability, ease of learning, and benefits in efficiency and effectiveness, flexibility, maintainability, reliability, security and timeliness of information.

2.2.7.4. *Framework for Comparison*

A number of systems development methodologies exist, and in order to choose among them, it is necessary to have some framework for comparison. Avison and Fitzgerald (1995) provide a useful framework consisting of seven elements as follows:

1) Philosophy: the philosophy of methodology is the principle or set of principles that underlie it. It encompasses a number of elements, namely:

a) Paradigm, i.e. whether the methodology is rooted in the 'hard', reductionist science paradigm, or in the 'soft' holistic systematic paradigm, which is concerned with human activity systems;

b) Objectives: some methodologies, for example, aim to develop a computerised information system, while others, such as ISAC, have as an objective, to discover if there is a need for an information system.

c) Domain: the third factor is the domain of situations that the methodology addresses, i.e. whether they seek to address particular problems, or whether they aim to analyse the organisation as a whole, devise an overall IS strategy, etc.

d) Applicability: Some methodologies are targeted at particular types of problem, environment or organisation, while others are said to be general purpose.

2) Model: The second element of the framework concerns the model to which the methodology adheres. Most IS methodologies are of an iconic, pictorial or schematic type, though some are analytic or mathematical.

3) Technologies and Tools: A key element of the framework is the identification of the techniques and tools used in the methodology.

4) Scope: An indication of the stages of the life cycle of systems development, which the methodology covers. It is also useful to consider the level of detail at which each stage is addressed.

5) Outputs: It is important to know what deliverables are produced by the methodology at each stage and, in particular, the nature of the final deliverable.

6) Practice: Practice encompasses the user base, required skill levels, difficulties and problems encountered with the methodology and perceptions of

success and failure. This should be examined by investigating the experience of prior users of the methodology.

7) Product: The product of the methodology is what purchasers actually get for their money: software, documentation, training, consultancy etc.

2.2.7.5. The Comparison

In this section I do not intend to create a new set of elements for comparison but to use the framework included above in order to present an overview of several existing development methodologies and determine which is likely to be most appropriate to the Omani development. The seven elements that constitute the framework gave rise to several issues, which are related to the Omani environment. Since these issues are not divided equally among the seven elements, there are cases in which one element has been selected more than once, whereas there are others which have never been chosen. Then, I have assigned a value to each one of these issues according to the importance they hold in the Omani environment. In many cases, these values are based on the methodological characteristics identified by Avison and Fitzgerald (1995), though information and assessments from other sources are also taken into account. The Scope element and its issues have been treated differently (see Scope section). An important point to be explained is that the values are only decided by the researcher based on sound judgement and experience of his country's problems. For example, strategy and planning is assigned a value of 5; less participation is given 4; focus on developing the computer system and not attempting to develop the whole of the organisation system scores 3; and so on. Issues or characteristics that are considered to be of less concern in the Omani system are given a value of 2. In this respect it is hoped we have not fallen into the trap highlighted by Avison and Fitzgerald (1995), whereby the owner of a methodology produces a comparison showing its own methodology as best and underrating others.

Like Avison and Fitzgerald, we have made a selection to compare several methodologies:

- Structured Analysis, Design and Implementation of Information Systems (STRADIS), which reflects the process modelling theme and was proposed by Chris Gane and Trish Sarson.
- Yourdon Systems Method (YSM), which was designed by Ed Yourdon and it was originally similar to STRADIS. However, more recent versions of YSM suggest a 'middle up' rather than a top-down approach.
- Information Engineering (IE), designed by James Martin and Clive Finkelstein. It has more emphasis on data.
- Structured Systems Analysis and Design Method (SSADM), which was originally developed by Learmonth and Burchett, and is now standard in most UK Government applications.
- Merise is a widely-used methodology for developing information systems in France.
- Jackson Systems Development (JSD), which was designed by Michael Jackson and is a development of Jackson Structured Programming (JSP) into systems development as whole.
- Object Oriented Analysis (OOA) is a new approach; however, there are a number of object-oriented methodologies. The best known is Coad and Yourdon's Object Oriented Analysis methodology.
- Information Systems Work and Analysis of Change (ISAC), a methodology developed in Scandinavia by Mats Lundeberg and Colleagues.
- Effective Technical and Human Implementation of Computer-based Systems (ETHICS) is a methodology proposed by Enid Mumford. It is a people oriented approach.
- Soft Systems Methodology (SSM), a methodology proposed by Peter Checkland, is influenced by system approach.
  (٢١)
- Process Innovation, which is the design of Tom Davenport, is a business re-engineering methodology.

However, we do not include certain methodologies: Multiview because it combines aspects of other methodologies; Rapid Application Development because it is associated with IE; and KADS because of its narrow application domain and because it is a framework for methodology standards, rather than a methodology as such.

The first element of the framework for comparison is the philosophy of the methodology, which includes four sub-elements:

a) *Paradigm*: Examples of methodologies belonging to the systems paradigm are SSM and ETHICS, both highly participative methodologies which take a socio-technical approach to organisations and which adopt a holistic view of the problem situation, rather than trying to break it down into its constituent parts. In contrast, such methodologies as STRADIS, YSM, IE, SSADM, JSD, OOA, ISAC and Merise adopt clearly reductionist approaches, rooted in the realist position, and can be identified as belonging to the science paradigm. This implies that the break up of a complex situation into its constituent parts will help understand the nature of systems.

In the Omani case, the system-paradigm methodologies that emphasise high levels of participation would be difficult to apply, as the Omani system is authoritarian and strictly hierarchical. Moreover, poor skills characterise the management and end-users in respect to technology. ISAC, although belonging to the science paradigm, also calls for all people to participate in the development. Therefore, the choice of ETHICS, SSM and ISAC would be difficult in Oman.

b) *Objectives*: Some methodologies, e.g. ISAC, decide on IS development only if the change analysis indicates problems and needs in that specific area and in other situations, other development measures are chosen. In ETHICS, the objective is improving the quality of working life. Methodologies which are specifically intended to develop computerised information systems include STRADIS, YSM, IE, SSADM, JSD, OOA and Merise. However, PI has objectives wider than the development of computer systems.

We could stress here that PI is most likely to be accepted as a methodology in a developed organisation or one, which has a new and well educated staff. However, this will not be the case in Oman. Moreover, in Oman for the time being at least, the requirement is specifically for a way of developing computer systems; methodologies, which aim at wider organisational changes are unlikely to be accepted.

c) *Domain*: IE, Process Innovation and SSM are methodologies of the planning, organisation and strategy type. IE, for example, begins by taking an overview of the organisation's objectives and related information needs. An overall IS plan is then devised for the organisation. In contrast, methodologies such as STRADIS, YSM, SSADM, Merise, JSD, OOA, ISAC and ETHICS are specific problem-solving methodologies which do not focus on identifying the systems required by the organisation, but begin by assessing that a specific problem is to be addressed.

The strategic planning element of a methodology is an important issue in the Omani situation where up to now, much deployment and development of information systems has occurred by way of '*ad-hoc* decisions' or 'best deal'. Such approaches have led to frequent computer system failure or changes of system and, hence, increased costs.

d) *Target system*: Most methodologies claim to be general purpose, though it is generally assumed that the application context is a large organisation with an in-house data processing department. Moreover, it is often assumed that tailor-made systems are going to be developed. An exception in this respect, is IE, which envisages alternative approaches. However, STRADIS's main technique is data flow diagramming, which is not particularly suitable for all types of application, such as development of management information systems. In addition, STRADIS and YSM emphasise process while IE emphasises data.

It is important here that the methodology selected be a general purpose one, and that it be prepared to produce the alternative approaches that may fit Omani organisations. Unfortunately, only IE appears to satisfy this requirement.

The second element in the framework of comparison is the Model: It is a means of communication, which seeks to capture the essence of a problem. The model is a representation of a problem or area of concern. The primary process model used is the data flow diagram, which is the primary model of the STRADIS methodology, is important in SSADM, YSM and ISAC, and also features in IE. JSD, ETHICS, PI and SSM are process-oriented but they do not use data flow diagrams. JSD uses the structure diagram; SSM uses the rich picture, to depict processes, structures, and their relationships. ETHICS, interestingly, is one of the few examples of a 'verbal' or narrative model.

In relation to the model, it is difficult to say what feature is preferred. In the case of Oman, this issue is not yet seen as a problem. It is likely that any model that will make the ISD easy and flexible to understand and to use, would be welcomed. Therefore, we will not give this element any weighting score.

The third element in the framework of comparison is Technologies and Tools: SSM unusually, does not recommend or even mention any tools. Most other methodologies such as IE, YSM, SSADM, Merise, JSD, OOA and PI, however, recommend the use of tools to some degree. In this respect, IE suggests that the process should not be contemplated without the use of tools, because the process is too complicated and time consuming. This fact that a methodology recommends the use of tools does not, however, mean that specific, brand name (and often expensive) tools have to be used. Some methodologies, such as ISAC, do not rely on particular techniques and it is relatively easy to envisage similar but alternative techniques being used without affecting the essence of the methodology. Similarly, with IE, it is explicitly suggested that the recommended techniques are not a fundamental part of the methodology and can be replaced or substituted as better ones become available. This gives flexibility.

Flexibility would be a valuable characteristic in a methodology to be used in a developing country, where some tools and techniques may be unavailable or too expensive, or where the skills required for their use may be lacking. In this respect, ISAC and IE are assigned high scores, while the other methodologies mentioned are given lower scores.

The fourth element in the framework of comparison is the Scope: Methodologies vary considerably in the extent to which they address the various stages of the life-cycle, from strategy to maintenance. Strategy is covered in detail by IE, SSM and Process Innovation, but in less depth by Merise, for example, and not at all by STRADIS, ISAC and ETHICS. The next stage of the scope is the feasibility study which evaluates the economic, social and technical costs and benefits of the system under consideration. STRADIS, YSM, SSADM and Merise cover this stage in detail. while IE, ISAC, ETHICS, SSM and PI address feasibility less comprehensively. However, the way most of these methodologies deal with feasibility differs considerably (see Avision and Fitzgerald, 1995). The third stage of the scope is the analysis stage, which includes determining user requirements. All methodologies cover this phase in detail except JSD, which does not specifically address user requirements. The fourth stage is the logical design which is covered by most methodologies except SSM and PI which do not cover this stage. Similarly, the physical design stage is covered in detail by STRADIS, YSM, IE, SSADM, Merise and JSD. However, OOA, ISAC and ETHICS are less explicit. The PI and SSM do not cover this stage. Several methodologies (e. g. YSM, SSADM, Merise) stop at the physical design. Programming and testing are considered to various degrees, however, by STRADIS, IE and JSD. JSD addresses programming in detail and IE addresses testing in detail. Implementation, which includes the planning and implementation of technical, social and organisation aspects, is covered by IE, SSADM, Merise and ETHICS, although not in as much detail as the earlier stages. STRADIS, JSD and PI merely mention it, without providing specific tools or procedures. IE, SSADM and Merise make brief mention of maintenance. Although they provide no formal procedures or rules for addressing this issue, they do at least recognise that it should be addressed.

We could note from this argument that the main focus of the methodologies is on the analysis and design stages. In the Omani context, however, it is desirable that the methodology selected should have the widest scope possible. It should certainly address the planning stage, which has so far been deficient in Oman, and it should provide as much guidance as possible on other stages, since Omani personnel generally lack the skills and experience on which developers must draw when a large margin of discretion is left by a methodology. To assign scores for scope, the method adopted here is to give a value of 3 to each shaded box in Avison and Fitzgerald's diagram (see figure 2.1 below), a value of 2 to each unshaded box, and a value of 1 to each box outlined with a broken line. Then the outcome is shown in the following table.

Figure 2. 1: Scope of Methodologies

Methodology / Phase	STRADIS	YSM	IE	SSADM	Merise	JSD	OOA	ISAC	ETHICS	SSM	PI
Strategy		⬚	■	⬚	□					■	■
Feasibility	■	■	□	■	■			□	□	□	□
Analysis	■	■	■	■	■	□	■	■	■	■	■
Logical Design	■	■	■	■	■	■	■	■	■		
Physical Design	■	■	■	■	■	■	□	□	□		
Programming	□		□			■					
Testing	□		■			□					
Implementation	⬚		□	□	□	⬚			□		⬚
Maintenance			⬚	⬚	⬚						

Adopted from figure 7.3 in Avison and Fitzgerald (1995: P465)
Notice:

■ **: This box = 3 and means that the methodology covers the stage in some detail.**
□ **: This box = 2 and means that the methodology address the area, but in less detail.**
⬚ **: This box = 1 and means that the methodology briefly mention the stage.**

Table 2. 1: Evaluating the Scope of methodologies

Methodologies	Shaded boxes	Unshaded boxes	broken boxes	Totals
STRADIS	4 x3 = 12	2 x 2 = 4	1 x 1 = 2	17
YSM	4 x3 =12	0	1 x 1 = 1	13
IE	5 x3 = 15	3 x 2 = 6	1 x 1 = 1	22
SSADM	4 x3 = 12	1 x 2 = 2	2x 1 = 2	16
Merise	4 x3 = 12	2 x 2 = 4	1 x 1 = 1	17
JSD	3 x3 = 9	2 x 2 = 4	1 x 1 = 1	14
OOA	2 x3 = 6	1 x 2 = 2	0	8
ISAC	2 x3 = 6	2 x 2 = 4	0	10
ETHICS	2 x3 = 6	3x 2 = 6	0	12
SSM	2 x3 = 6	1 x 2 = 2	0	8
PI	2 x3 = 6	1 x 2 = 2	1 x 1 = 1	9

From the results of the above table, the methodologies can be ranked in order in terms of scope. This order is: 1) IE; 2) STRADIS and Merise; 3) SSADM 4) JSD; 5) YSM 6) ETHICS; 7) ISAC; 8) PI, and 9) OOA and SSM. It is clear that IE offers the widest coverage of the various stages of development. It is also noticeable that several methodologies related to the science paradigm come in high positions. The science paradigm has a long and successful history and is responsible for much of our current world (Avison and Fitzgerald, 1995).

The fifth element in the framework of comparison is the Outputs: Methodologies differ, not only in terms of what outputs are produced, but also in terms of the level of detail specified. This is closely related to the level of detail of the rules about how to proceed and the extent of discretion left to the analyst. ISAC specifies in some detail the output of the change analysis stage, but the process of generating alternatives is not described in any detail. However, in the case of IE, the output is a deliverable in each of its major stages.

This way of delivering such output will give confidence to those involved in importing this methodology to their premises, such as the users and the management.

The sixth element in the framework of comparison is the Practice: The traditional view of IS development is that a specialist team of professional systems analysts and designers perform the analysis and design, professional programmers design the programs and write the code, and analysts then implement the system. This is the view taken by STRADIS, YSM, IE, SSADM, Merise, OOA and JSD. In SSM, ISAC, PI and, especially, ETHICS, however, a more proactive role is taken. This has implications for skill requirements. ETHICS, for example, makes heavy demands on the users.

The more participative methods, as indicated earlier, are less suitable to the Omani context, where the organisational culture is strongly hierarchical, and where, also, most managers and users lack the knowledge and skills required for informed participation.

The seventh element in the framework of comparison is the Product: A methodology may provide a large and copious set of manuals as is the case, for example, with SSADM. Some methodologies require consultants, facilitators and/or training courses to be used as part of the product. However, there is no hint given by Avision and Fitzgerald to compare these methodologies.

In general, in the Omani context, the need is for a methodology that covers the entire systems development cycle from strategy to cutover and maintenance. The strategic planning of the information system and the organisation should be at the highest level of the organisation. User participation and high user interaction such as are found with ETHICS, are not necessarily appropriate, given the Omani culture and current level of skills in the technology area. The problem has already been defined as being to develop a better Information System, so methodologies such as ISAC and SSM, which focus more on defining the problem situation and deciding what course of action to take (e.g. whether to computerise or not), appear less suitable to the Omani situation. Table 2.2 shows the scores assigned to each of the development methodologies, in relation to the criteria discussed above.

Table 2. 2: Evaluation of methodologies by predetermined criteria

Methodologies / Issues and their value	STRA DIS	YSM	IE	SSA DM	Meris e	JSD	ISAC	ETHI CS	SSM	PI	OOA
Less Participation (4)	4	4	4	4	4	4	x	x	x	x	4
Break up situation (3)	3	3	3	3	3	3	3	x	x	x	3
To develop Computer IS (3)	3	3	3	3	3	3	x	x	x	x	3
Planning (5)	X	x	5	x	x	x	x	x	5	5	x
General purposes with the use of alternative approaches (3)	X	x	3	x	x	x	x	x	x	x	x
Models:	X	x	x	x	x	x	x	x	x	x	x
Use of variety of technique and tools (4)	2	2	4	2	2	2	4	x	x	2	2
Scope values	17	13	22	16	17	14	8	10	12	8	9
A deliverable output in each stage (3)	X	x	3	x	x	x	x	x	x	x	x
Specialist team for methodology design & implementation (4)	4	4	4	4	4	4	x	x	x	x	4
Purchaser gets: Large & rich of manuals; Consultants; facilitators; and/or Training course	X	x	x	x	x	x	x	x	x	x	x
Total	29	29	51	32	33	30	15	10	17	15	25

From the above table and in the light of these considerations, it has been decided for the purpose of this study, to focus on IE, as the type of IS development methodology which seems to be more applicable in the context of the Omani health care system. Therefore, we will highlight this methodology's main aspects.

2.2.8. Information Engineering (IE)

The term information engineering was first used by Clive Finkelstein to describe a data modelling methodology that was developed in Australia in the late 1970s, then he collaborated with James Martin (1989) who is later credited with popularising the methodology. Since the early days, a number of versions have evolved. The version described here is the 'classical' version described by Avison and Fitzgerald (1995).

IE is claimed to be a comprehensive methodology covering all aspects of the life-cycle. It is viewed as a framework within which a variety of techniques are used to develop good quality ISs.

One of the beliefs underpinning IE is that data is at the heart of an information system and that types of data are more stable than the processes acting upon the data. Thus, identification of the nature and structure of the organisation's data provides a stable basis from which to build information systems

A key feature of IE is communication through the use of diagrams. Each IE technique is oriented towards diagramming, using standard symbols and colour codes.

The primary IE model consists of three components: data, activity, and the interaction of the data and activities. The support of case tools is a basic requirement. IE methodology is top-down, beginning with a top management overview of the enterprise as whole. In this context separate systems are related and co-ordinated which enables an overall strategic approach to be adopted. The methodology is divided into four levels, as follows:

2.2.8.1. Information Strategy Planning (ISP).

The objective here is to construct an information architecture and strategy which supports the overall objectives and needs of the organisation. It involves analysis of the current situation in terms of business strategy, information systems organisation, and definition of data subject areas, such as customer or product, and major business functions. Managers are given an opportunity to state their objectives and needs. Critical success factors (CSFs) are identified for the organisation, and decomposed into CSFs for individual parts of it. An information architecture is produced, which includes a statement of the ideal systems required in the organisation, the technology required to support the systems, and a proposal for the organisation of the IS function to support strategy. The resulting information strategy plan (ISP) identifies business areas for analysis and allocates priorities for development.

Recently IE has adopted the above approach to ISP to include elements of business process re-engineering.

2.2.8.2. Business area analysis

In this stage, a detailed data and function analysis is performed for each of the business areas identified in the information strategy plan. At this stage maximum involvement of end users is recommended. The major task of the stage is the analysis and diagrammatic representation of entities and relationships, processes and dependencies. Interaction analysis is carried out to examine the relationship and interaction between the data and functions, analyse entity life-cycles where the function/entity type interaction is shown in the form of an entity relationship model, analyse process logic and prepare process action diagrams. The existing systems are modelled and the outcome cross-checked for completeness, correctness and stability. The parts of the model to be developed are identified, implementation/transaction sequences evaluated and design objects planned. The output from this phase is the business area description, containing much greater detail than that arrived at during the ISP stage. This information provides the basis for the broad identification of business processes requiring computer support.

2.2.8.3. System Planning and design

This level is divided into business system design and technical design (sometimes called external and internal design). In the area of business systems design, for each design area identified, the facts gathered are used to design a system to fulfil the identified business requirements. This involves several steps: preliminary data structure design (a first attempt at converting the entity model to the structure of the chosen database management system); system structure design (mapping of business processes to procedures) and the interactions are highlighted by the use of data flow diagrams; procedures design, involving the development of data navigation diagrams, preparation of dialogue flows and the drawing of action diagrams; confirmation of completeness, correctness and usability; and planning for technical design that involves the definition of implementation. The output of the technical design phase is the technical specification, which includes the hardware and software environment, its use, standards and conventions, and the plan and resources for subsequent construction and cutover.

2.2.8.4. Construction and cutover

This level indicates the stages of construction, cutover and production. Construction is the creation of each defined implementation unit. It includes system generation and verification. Cutover is the controlled changeover from the existing systems and procedures to the new system. Its tasks involve preparation of schedules, installation of software, and making final acceptance. It is regarded as complete when the system operates for a period at defined tolerances and standards, and passes its post-implementation review. Production is the continued successful operation of the system, involving system evaluation which includes performance measurement, comparing benefits and costs and user acceptance, tuning which includes monitoring performance, software and reorganising databases, and maintenance which includes correcting bugs and modifying the system.

In practice, much of the development after the ISP can be performed in parallel by means of a co-ordinating model.

2.3. Information Technology in NHS

2.3.1. Introduction

It would be catastrophic if the medical profession and other health decision-makers were to ignore the effect of IT deployment on health organisation. The feasibility studies in the literature suggest that the use of computers produces better health information, that actually leads to better management, and in turn, better health care for the population. This point has been well expressed by Strickland-Hodge, *et al.*, (1988):

> "Within Primary Care data are amassed every day on patients. This data needs to be treated as the essential corporate commodity of health services. Without it no true picture of the country's health care needs can be produced. ... The findings of Korner lead to the conclusion that data must be gathered together simply but efficiently and the most appropriate method for this is Technology." (P.17)

Ritchie (1986) also stresses this issue and illustrates the significance of computers in coping with general practice patient information:

> "Each day, GPs make hundreds of thousands of entries in patients' notes, thereby generating valuable information on the health of the nation. Sadly, the overwhelming bulk of this information is lost to posterity: traditional methods of data retrieval are cumbersome and unequal to the magnitude of the task, and the epidemiological potential remains untapped ... An adequate information system which is both effective and efficient is therefore of paramount importance." (P.9)

We will discuss elsewhere (Chapter Four) the introduction of the computer into NHS General Practice (GPR) in the UK and the Omani health system. In this section we will discuss in general IT/IS deployment in NHS and developing countries, highlighting the main processes, obstacles/ or factors that might hinder their deployment, development and use.

2.3.2. The Developments of Information Systems in NHS

In the 1980s, many hospitals in the NHS had implemented patient administration systems, computerised personnel, payroll and financial accounting systems, and had developed stand-alone computer systems to support hospital departments such as pathology and radiology. These systems did not, however, meet all of the hospitals' needs and had significant limitations. For the most part, they were intended to improve hospital administration; little information technology was available to staff on hospital wards to help with care and treatment of patients, the ward staff relied on manual records to manage their work.

It appears that the hospitals had implemented their computer on a departmental basis and these systems were not linked. As result, hospital staff could not pass information easily from one system to another and often had to spend time entering the same information into separate systems. The resorting of information was therefore, slow and inefficient. It also open to error and omission which affected the reliability of the information used by clinicians and hospital managers.

Though the NHS is committed to considerable investments in IT, especially since the NHS Review of 1989, at the same time, questions have been raised about the value of existing IT investment.

In order to be implemented, an IT strategy for the NHS, like any other strategy, must be communicated from the centre to the periphery. This can be done by passing it down through successive administrative levels, or by negotiating directly with professional groups. In the field of IT policy. The latter route can be expected to assume increasing importance, given the amount of power concentrated at the periphery (in the hands of doctors) and the likelihood that, in relation to IT, the priorities of hospital staff will often differ from those of the centre (see Chapter 3 for more detail on IT strategy).

IT-related policies in the NHS encompass three main strands: the national data collection infrastructure, IT implementation policies and policies which combine IT and management issues.

Although there has always been some form of data collection in the NHS, important developments in the formulation of an explicit information policy were the Royal Commission on the NHS (1979) which led to studies on a national data collection system and on budgeting mechanisms, and the Griffiths report (1983) which built on the budgeting work. The National Data collection system is still in existence and forms the basis of the national performance indicators which have been criticised for focusing on input and process measures at the expense of outcomes. Moreover, the centralised view they reflect led in practice to the expenditure of much effort on the collection of data which had little local relevance. In this context Gleave (1982) citing Pfeffer (1982) argued that the problem of data collection is more difficult than its seems to be as it is collected by different groups or different departments and will probably be subject to different interpretations.

The need for a formal, rational information policy for the NHS was expressed by the IT Division of the NHS in the mid-1980s (DHSS 1986). One outcome was the development of the Common Basic Specification (CBS), a set of common data structures, which could be used throughout the service to facilitate design. The CBS reflected the centre-led and data/IT -driven approach, which was prevalent at the time, but has been rendered obsolete by the advent of open systems and the changed information flows resulting from the NHS Review. Moreover, no attention was given to problems that might occur in system implementation and use.

A striking characteristic of the NHS is the degree to which managers and service providers have always tended to generate their own information (e.g. finance systems and patient records) which were totally distinct. The new hospital finance systems developed in the light of the Griffiths report did not succeed in involving doctors in financial decisions, so in 1986, the Finance Division of the DHSS piloted a new Resource Management initiative, based on collaboration between doctors and managers; new information systems to support decision-making; and the capacity for planned change (Buxton *et al.*, 1989). Whilst the initiative did result in efforts to link management processes to information systems, it also raised problems, such as difficulty in implementing databases containing patient-based data.

In 1988, the NHS Executive concluded that NHS trusts would need new computers to support the NHS reforms. They considered that such systems would help to improve information for the costing and pricing of services, and assist hospital managers to use their resources more effectively. Therefore, they launched the Hospital Information Support Systems (HISS) Initiative to investigate how systems could be developed. Since its launch of the Initiative, the NHS Executive has spent some £56 million including £48 million in financial support to 16 projects at 25 hospitals (Window, 1996).

Further developments in Health Service IT policies occurred after 1989, as a consequence of the NHS Review, which introduced an internal market for health services and formal involvement of service providers in management.

Believing that the changes brought by the Review would necessitate a new infrastructure for data collection and more attention would have to be paid to the collection of qualitative data, the government made available considerable sums for the purchase of new computer systems. However, there was no explicit, integrated IT policy. IT was endorsed on a piecemeal basis and it was not clear how the system should be co-ordinated.

Hospital data collection activities have also been influenced by the Patient Charter, leading to a concern with measurable standards of performance. And hospitals' individual initiatives to attain British standard 5750, for example, NHS information policy is the outcome of a variety of different policies, each with their own objectives and explicit or implicit effects and lacking internal consistency.

Something of the a departure from previous policies was marked by the publication in 1992 of the NHS Management Executive's Information Management and Technology strategy, which offers a five point vision for the future:

a) Information will be person-based; b) Systems may be integrated; c) Information will be derived from operational systems; d) Information will be secure and confidential and e) Information will be shared across the NHS (Connolly and Huckerby, 1998).

Points b) – e), above, which suggest that local and national networks will be the focus of central initiatives, represent a continuation of previous policies. The endorsement of person-based systems is, however, a radical departure for the NHS, though such systems have been used for some years by private sector institutions such as banks, which see them as an aid to tailoring services to individuals. Implementation of a such a system in the NHS raises several important problems however: the tension between systems designed for command and control and those for supporting operational service delivery; patient access to information; the need for security, and the possibility of local political factors impeding successful implementation.

The IM & T strategy has set some clear priorities, which should help both the NHS and suppliers to formulate their own strategies. Moreover, despite the continued focus on data and technology rather than information, there is an indication of recognition of the relationship between information and management processes. A number of issues, however, still give cause for concern: tension inherent in the state policies; the vagueness of the framework; the task of bridging old and new; the failure to consider political issues, and the central control of local investments (see Chapter 3).

The new developments in health information arose as a result of the establishment of the internal market and contract (see next section).

2.3.3. Internal Market and Contract Developments in NHS

After over 40 years of central planning, in 1991, the NHS underwent a radical transformation, whereby power and authority for decision-making were allocated to district health authorities, individual hospitals, community units and selected GPs. The mechanism for achieving this devolution is the internal market (McGuire and Anand, 1996).

In this concept, the majority of hospitals and general practices have now established their own management structures through hospital trust or GP Fundholding practices. This is regarded as a major achievement of the NHS reforms and can be interpreted as an extension of the desire to establish effective management structures within the NHS which began with *The Griffiths Report* (HMSO, 1983). These proposals stressed the need for a clearer delegation of responsibility and accountability in the process of allocating health sector resources.

Therefore, the internal market separates the responsibility for purchasing services from the responsibility for providing them. The main purchasers are district health authorities, which receive annual budgets from which they purchase services on behalf of their residents (McGuire and Anand, 1997). Those GPs who apply for and are granted fundholder status also have budgets with which to buy a designated range of diagnostic and minor surgical treatments directly from providers, on behalf of their (Glennerster *et al*, 1992). These practices represent an extremely important concentration of purchasing power in some areas.

On the supply side, there are three main types of providers: NHS trusts, directly managed units and independent providers. Competition between providers for services commissioned by districts and GP fundholders is seen as a mechanism for promoting efficiency.

The financial separation of supply and demand and the encouragement of supply-side competition represent a totally new environment for the NHS.

Set against increased managerial freedom is the removal of certainty over levels of funding.

The ability of hospitals to adjust to these changes will depend on their management systems. Hospitals are complex institutions with multiple objectives, not all of which are financial. Moreover, while managers have overall responsibility for financial performance, doctors make clinical decisions which determine the way money is actually spent. Recognition of their key role in this respect has led to attempts to include them formally in management decision-making about the use of resources.

The other area of uncertainty facing hospitals concerns the nature of the external environment in which they must operate. One source of uncertainty is the degree of competition. Hospital markets often display elements of monopoly, for various reasons, such as heavy investment costs and patients' reluctance to travel for treatment. In the light of restriction in the contestability of hospital markets, some commentators have suggested that contestability could be applied to hospital managements. However, such arrangements would pose problems if doctors were involved in management, as it would be more difficult to replace them than non-medical managers.

Another aspect of the external environment about which there is uncertainty is the extent to which hospitals' activities will be regulated or managed. Restrictions can be justified on the ground that planned change is more likely to meet the multiple objectives of the health care system than a purely market-led approach. However, the tendency to introduce additional regulation on an ad hoc basis makes it difficult to predict how the market will perform. Moreover, over-rigid regulation could pose a threat to efficiency if it stifles local freedom.

The formal link between purchasers and providers of health care is the contract, through which providers make clear the services they intend to supply and the terms and conditions on which they will be supplied. In the NHS internal market, contracts are 'the subject of agreement between purchaser and provider (Department of Health 1989c). There are three main categories of contract: block, cost and volume, and cost per case (McGuire and Anand, 1997).

Under a block contract, access to a defined range of services and facilities, is provided in return for annual fee. In negotiating such contracts, it has usually been necessary to forecast expected levels of activity. One of the main problems with block contracts may be variations in activity around indicative volumes (e.g. failure to use capacity to the full, or treating more cases than have been agreed and funded). This problem can be overcome by specifying ceilings and floors, outside which cost and volume arrangements come into operation.

A cost and volume contract specifies that a provider will supply a given number of treatments or cases at an agreed price. The emphasis is on outpatients, i.e. patients treated, than inputs, i.e. facilities provided. If the number of cases exceeds the cost and volume agreement, extra cases have usually been funded on a cost per case basis.

Costs per case contracts are defined at the level of the individual patient. Such contracts obviously involve considerable transaction costs.

Statistics for 1991/92 reveal that the great majority of contracts taken out were block contracts, which represented 94% of the total value of contracted services (NAHAT, 1994). Large, block contracts with NHS providers accounted for nearly 80% of the total value of contracted services, through they represented only about 18% of the total number of contracts. The dominance of block contracts reflected the steady-state contracting requirements imposed to avoid dramatic changes of activity, which would disrupt patient services. However, these requirements are gradually being lifted and in the long term, as costing and pricing systems become more sophisticated, less reliance on block contracts can be expected, though regulation is likely to remain a permanent feature of this market.

The contracting process has incurred substantial costs. In particular, setting up systems for recording, costing and billing has involved large investments in information systems.

There have been many criticisms of the creation of internal markets. It has been claimed that they lead to various inefficiencies or inequities of their own and that they may be the forerunner or prototype of complete privatisation (Deakin 1993a; Cutler and Waine 1994). However, those who favour the internal market argue that it should be evaluated according to its impact on efficiency, responsiveness, choice, equity and quality (Bartlett and LeGrand

1993).

LeGrand (1994), attempting to evaluate the impact of the NHS internal market, could not attribute undoubted improvement in cost-efficiency to the market reforms *per se*. Further, evidence about choice and responsiveness was also mixed, with GP fundholders perceiving increased choice of hospitals for referrals but other studies including no increase in patient choice. One of the main improvements claimed for internal markets is that they give consumers much more influence over resource allocation, and thereby reduce bureaucratic and professional paternalism. For Saltman and von Otter (1992), consumer empowerment and patient choice was the central feature of planned markets and public competition.

In relation to indicators of quality, while there are some signs of improvements in waiting times and reduced waiting lists for hospital treatment, there is no evidence of improvements in clinical care or outcomes, which can be directly linked with internal market changes.

Another attempt to examine the impact of the internal market on NHS trusts has been undertaken by Csaba (1995) and Soderlund *et al.* (1996). Csaba tested a number of hypotheses concerning the determination of average costs of over 200 provider units over three financial years. The explanatory variables included measures of output based on finished consultant episodes, case mix, technology, factor input prices and a number of market structure control variables. Generally the findings were mixed. The higher the concentration of purchaser power in the internal market, the lower was provider unit cost, implying that purchasers can influence the efficiency of provider units. There was weak support consistent with competitive behaviour of provider units being linked to market structure - i.e. the more competitive the structure the lower the unit cost. This is in accordance with the results of the work by Soderlund *et al.* (1996), who found that the considerable variation in hospital costs could be explained through the variation in outputs products and wage and property costs. They also found that trust status and increased purchaser power were associated with lower hospital costs, although hospital market share had no impact on cost. Csaba (1997), in a different specification, found some support for hypothesis that competition did lower costs. However, according to Flynn *et al.*, (1996), in practice, the health care market is not competitive.

The kind of strategy adopted by NHS authorities to develop their health service was mainly to create competition that was intended to reduce the huge expenses and increase the quality of health services for patients. However, it remains to be seen whether the internal market could help to pursue this direction or creates more disputes and conflicts.

In the coming section we will introduce the most common computer systems in use within the NHS today.

2.3.4. The Most Common Applications Software in use within the NHS

The current best estimate is that NHS trusts spend about £220 million a year on their information systems. The NHS has spent between £3 billion and £4 billion on information over the past ten years (Ham, 1997). This includes the costs of centrally funded initiatives programmes such as the resource management programme, clinical audit, the hospital information support systems (HISS) programme as well as the costs of Information Management Group (IMG) and its substantial and strategically important national infrastructure projects. We will describe here several of most common applications running in the NHS.

a) Patient Administration System (PAS):

A PAS holds patient-based records dealing with demographic data, hospital activity data (e.g. waiting list), administration and discharge data, and a small amount of clinical information. PAS usually consist of a suite of integrated modules. These are:

- a patient registration module, which maintains the patient's personal and administrative details - held in a master patient index (MPI);
- an inpatient management module which provides information to assist the effective use of hospital resources (e.g. patient ward and supervising clinician); and
- an outpatient module-essentially an appointment system for scheduling clinics (Ambage, 1995).

Order Communications and Results Reporting modules do not form part of the portfolio of traditional PAS models, but are a key element in fully integrated patient care systems. Integrated system require change in the working practices of the health professionals (Rae and Dewhurst, 1995), but bring benefits in terms of increasing productivity of medical records, nursing and clerical staff.

b) Case Mix Management Systems (CMMSs)

CMMSs, which were introduced as part of the national Resource Management Initiative, allow analysis of the services provided to patients and the resources used, to support the planning and monitoring of business plans, for individual clinical directorates and for the hospital as a whole.

c) Medical audit systems

These systems, which are mainly microcomputer based, contain a data base of patients and individual care events, designed to support individual clinicians in recording and analysing patient treatment. Problems may arise from discrepancies between the information collected in these standalone systems and that available in corporate systems. Integration is, therefore, a key issue.

d) GP systems:

Numerous suppliers offer applications packages designed to support GPs in managing both the clinical and financial systems of their practices, including maintaining patient records, generating prescriptions and monitoring fundholding budgets. Systems must comply with a national specification for certain functions (Mackintosh and Shakespeare, 1995).

e) FHSA computer systems:

FHSA systems provide information about the volume and type of work carried out by general medical practices in their area and to process contracted claims for payment made by GPs in connection with the services they provide (Mackintosh and Shakespeare, 1995). All FHSAs use the same standard national applications software.

f) Hospital Information Support System (HISS)

HISS is integrated systems, which supply computerised information support facilities for most hospital functions, using a common MPI as the focal point. Data need by entered only once and information can be supplied from a common data source to all levels of organisation. The NHS Information Management Committee promulgates an incremental route to HISS, making as much use as possible of existing systems (Ambage, 1995). The IM and T strategy has set a target of the 2000 for all large acute hospitals to have an integrated system. HISS systems are the subject of recent central guidance on procurement (Rae and Dewhurst, 1995).

Besides the above types of application software, building the application will require supporting software, e.g. database management software relational database software, and reporting and analysis software. Increasingly, the same application is available on a range of different hardware manufactures' products.

2.3.5. Other recent IT/IS development in the NHS

The statement '*Today the NHS is in a state of change*' has been applied to the procurement system in the NHS more than almost any other structure, but this change has left the system in more disarray than ever before, according to Connolly and Huckerby (1998), who indicate that the cost of new technology introduction and the advantage of possible management economies is unknown. The introduction of these new technologies is taking a fast pace and many of them are major cost and economic savers if the management system into which they are applied to can take advantage of them.

According to Connolly and Huckerby, (1998), in 1995 the estimated output of the UK medical systems manufacturing industries was £2.7bn excluding drugs, representing 0.8% of the total UK manufacturing output. Of this output total exports were over £1.5bn. The UK industry is interested in co-operating with NHS procurement organisations to develop new and cost-effective healthcare technologies, which will be beneficial to both the NHS and worldwide healthcare economies increasing UK exports (Connolly and

Huckerby, 1998).

From this pace we could see that there is a number of centrally supported information management and technology projects, which are involved with collection, analysis and presentation of data, related to HoN monitoring. These projects are undertaken within the framework of the national Information Management and Technology Strategy (IM&T) by the NHSME's Information Management Group (IMG), and in particular the Development Information Systems for Purchases project (DISP). The project focuses on understanding purchaser issues and requirements for IM&T and stimulating the development, implementation and use of IM&T support to meet the requirements.

In supporting this project there are other projects such as: national pilot sites to specify, develop and implement information systems in support of the role of health care purchasing. These sites develop systems to manage contracts, and to support health needs assessment and the other key functions of purchases. Within these pilot projects, much use has been made of the Contract Minimum Data Sets (CMDS) passed between health care providers and purchasers to support the contracting process.

Another development is the concept of Health Information Workstation (HIW) to support a number of key processes including health needs assessment and planning.

We can summarise the development of DISP in 1994 into the following: 1) developing of event linkage; 2) improving the use of information to monitor performance; 3) extending the HIV concept into multi-agency environments; 4) examining the ways in which information can be collected, stored, analysed and presented to monitor progress towards HoN targets; 5) ensuring that health care purchasers have access to data sources which help them to developed their local strategic for achieving HoN improvements.

Other projects include: 1) a review of capabilities and methods of current GP systems; 2) consideration of alternative approaches to setting up a national scheme; 3) recommendations including anticipated costs, benefits and implementation plans; 4) involvement in the Community Information Systems for Providers projects (CISP), a project which examines the nature of information and the information systems used by the organisations involved with the provision of care in the community; 5) development by Department of Health of Information Strategies to ensure that it collects the information required to support its objectives in the most effective and cost-effective way. The Public Health Information Strategy (PHIS) has the lead in Health of the Nation matters and its currently examining how best to improve public health information.

Other new development seen in the introduction of Registration links system under the name of items of Service - Going to Live! (Greetham, 1996). The aim of the system to process the claims through using audit trails procedure. This Links project greatly speeds up the process of submission of claims by GPs to the HA, bringing benefits to the practice in terms of administrative staff time and potential financial gain (Greetham, 1996).

According to Connolly and Huckerby (1998), positron emission tomography is one of the latest technologies incorporated in the UK market. Only four systems have been purchased -three in teaching hospitals for research purposes and one in a charitable trust, but all doing routine NHS work. The use of PET in pre-screening patients requiring cancer treatment has been shown to give major cost benefit within the treatment chain, Studies:

2.4. IT in Less Developed Countries (LDCs)' Health care

2.4.1. Introduction

Approaches to economic transactions and technology transfer must take into account the changes in the international scene attributable to the information economy. Technological improvements have altered input/output ratios and introduced cheaper substitute products and process, marginalising commodity economics and weakening traditional development plans. Traditional comparative advantages based on labour, raw material, energy and transportation no longer suffice.

Enos and Park (1988) define technology transfer as the acquisition of the entire body of knowledge necessary to fulfil a specific task. Such knowledge covers design, construction, operation, training and improvements, they use the term technology adoption to refer to the 'entire sequence of decisions ... determining how, where, when and with what consequences technology is employed' (p26).

All society is underpinned by 'complex information systems at work' (Sturges and Neill, 1990). The improvement of information flows has often been advocated as a recipe for weakening geographical isolation and advancing national integration and economic activity. In other words, information is seen as a key to development.

Access to reliable health information is crucial for progress toward health for all. However, health workers in countries with few resources do not have access to basic information they require for training and clinical decision-making. This lack of information inevitability limits professional development and the quality of health care, contributing to unnecessary suffering and death in these countries (Pakenham-Walsh and Priestley, 1997).

Pakenham-Walsh and Priestley (1997) report that James Grant, former Executive Director of UNICEF as saying, 'the most urgent task before us is to get medical and health knowledge to those most in need of that knowledge. Of the approximately 50 million people who were dying each year in the late 1980s, fully two-thirds could have been saved through the application of that knowledge.' (p.18)

The researcher will highlight some of the developments and conferences surrounding IT in developing countries. In so doing, we will consider the broader issue of availability and use of computers in Less Developed Countries (LDCs) to understand what can be expected in terms of benefits and obstacles, and how planning and solutions to the deployment and use of this technology have been pursued.

2.4.2. IT transfer in LDCs

Due to the low price of PCs data processing has spread in all developing countries, but this does not mean that the technology is mastered everywhere. Research and development laboratories are the very first users of networks and software-banks in the public domain have been constituted by some scientific organisations in order to allow a wide diffusion of new tools and techniques. The free diffusion of such software and the possibility of getting advice from their developers play an important part in the spreading of knowledge in the field of data processing. The access that the scientific and technical community is given to these tools is an asset for technological control of data processing (Renaud and Gazin 1995).

Pakenham-Walsh and Priestley (1997) pointed out the lack of health information on shortage of health library information and staff, trainees and training programmes, multimedia procedures, and information technology and related skills. In addition they have indicated other issues related to the help that should be offered by developed counties, such as promoting coordination; analysis and advocacy.

Technology can be conceived as information and knowledge condensed into artefact, process or service in order to satisfy a need (Ouma-Onyango, 1997). Developing countries, when considering importing Western technology, need to analyse and modify it, to fit their own needs. With respect to IT transfer there are many initiatives have been taken by international organisations like the International Telecommunications Union (ITU) or the OECD, industrialised countries (the United States, Japan, Canada, G-7), as well as by the European Community in the field of information society. These initiatives were presented in the form of conferences and health information systems and were supplied to the LDCs.

Among these initiatives are the Maitland Commission's report entitled *The Missing Link,* that was published by the ITU in Dec. 1984. The report drew the attention of governments, operators and manufacturers, and international agencies to the North-South telecommunications gap. The publication of the Maitland report marked the beginning of an intensification of international actions in telecommunications and development which led to the World Telecommunications Conference in Buenos Aires, held by ITU on 21-29th March 1994. The Conference adopted an action plan for telecommunications development with a special programme for the less developed countries. Their final declaration expressed the need for encouraging telecommunications development in an open and competitive economy.

Then the American initiative on the Global Information Infrastructure (GII) was outlined in Buenos Aires. The GII vision rests on the following five principles: encouraging private investment; promoting competition; creating a flexible regulatory environment that can keep pace with rapid telecommunications and market change; providing open access to the network for all information providers and users and finally, ensuring universal service so that the GII is available to all members of our society. This was followed in 1995 by delivering an agenda for co-operation that identifies the USA relationship with other nations with respect to making the GII a reality.

In Japan, the Telecommunications Council, the advisory board of the Ministry of Post and Telecommunications published in May 1994 a major policy document on these issues (Telecommunications Council, 1994). The document encouraged an administrative dialogue with Europe, the United States and Asian countries, stressed the promotion of international co-operation in bodies like ITU, and finally pointed out the need to support the less developed countries.

Canada has convened through its International Development Research Centre (IDRC) and the Canadian International Development Agency (CIDA), a small interdisciplinary group of specialists to 'brainstorm' on the potential development impact of new information and communication technologies in developing countries. The G7 convened a Ministerial Conference in Brussels on Feb. 25-26th to discuss these topics, which conclusions 'Our action must contribute to the integration of all countries into a global effort. Country in transition an developing countries must be provide with the chance to fully participate in this process as it will open opportunities for them to leapfrog stages of technology development and to stimulate social and economic development' (Ministerial Conference, 1995). (P. 6)

The European Community has contributed to the development of telecommunication and information society in the developing countries by means of several instruments: dialogues, initiatives by European investment banks, economic and development co-operation, and scientific and technological co-operation.

Dialogues have been launched with developing countries (Cyprus, Malta) or groups of them (League of Arab States, MERCOSUR) in view of the growing rolls of telecommunications for economic and social development, and restructuring of the sector in these countries.

In the late 1993, a seminar on mobile digital communications was hosted by the League of Arab States and by MODARABTEL (MODARABTEL, 1995, see Servantie *et al.*, 1995). Following this seminar, the League of Arab States communicated to the Commission its adoption of the GSM (Global System for Mobile - digital cellular mobile telephony) standard;

With Latin America and Mediterranean, two programmes (AL-INVEST and MED-INVEST) were launched to promote industrial co-operation and investment with a view to increase trade, technology transfer. know-how and European capital inflow.

In the past five years we have witnessed enormous strides in the use of computer-based information systems (or informatics) and computer-based networking and communications (or telematics) in the health sector in the industrially developed countries (Mandil, 1995). Consequently, it will have some effects on the developing countries health systems. Therefore, the transfer and the development of IT applications in LDCs' health care was important to these countries to capture health information and provide high quality health services.

In this respect, the medical profession faces, as never before, one of the greatest challenges in its history, to achieve an acceptable level of health. The awareness of epidemiology, nowadays, finds new tools that contribute to narrow the gap between both the possibilities afforded by knowledge and the relative achievements of its applications in vast development regions. However, the possibility of introducing new technologies to support the medical field needs a number of requirements to be fulfilled (Mazzafero *et al.*, 1995). The main requirements are changing the situations and the condition of health care in the immediate future and using technology efficiently, in which Informatics and telematics will play an important role, provided they are integrated within more ample and adequate policies and programmes (Mazzafero *et al.*, 1995).

The EpiAim study is an initiative of the European Commission that was carried out in 1994 to analyse the use of health Informatics and telematics in two regions in the developing world, Africa and Latin America. This study has addressed health and medicine information and communication technologies and socio-economic development issues (Sosa-Iudicissa and Levett, 1995).

In Latin America, health Informatics has become an important part of their health care activities. However, still many resources are allocated to hospitals and only few to health system management and primary care (Rienhoff, 1995).

Two international conferences were hosted by Mexico City in 1981 and 1982. The first dealt with cybernetic systems; the second was an IMIA working conference on 'Health Informatics in developing Countries'. In addition, Brazil hosted an international seminar of IMIA on Informatics in Health Services Management on November 1984.

Havana was the most active location for health informatic seminars. In 1988, the International Congress INFOMATICS 88 was held in Havana, Cuba on Medical Informatics. The two main topics on Medical Informatics focused on 1) how Medical Informatics may help in the administration of health and 2) how the Informatics resources should be managed in health care. The second International Informatics Conference INFORMATICS 90 was held in Havana, Cuba in February 1990 Several hundred participants from all over the world attended the conference. Spanish, English and Russian were the languages employed. Another Latin-American Congress on Health Informatics, IMIA-LAC '92, was held in Havana with great success and attendance of 52 participants from 13 countries representing Latin-American and Caribbean countries, PAHO, USA, France, Germany and Spain. And in 1994, the international Congress on Medical Informatics Havana 94 was held at the Cuba Convention Palace. The conference brought together care services administrations, physicians, nurses, researchers and informatics specialists.

The first International Working Conference on Health Informatics in Africa, HELINA 93 was held at the Obafemi Awolowo University, Ile-Ife, Nigeria, in 19-23 April 1993. In the closing session of HELINA 93, it was proposed that this successful conference should be periodically organised and along the lines of HELINA 93. It was also decided that an electronic bulletin board should be established for the African health informatics community. In addition, there has been a conference, the AFRICA TELECOM 94 Conference, organised in Cairo by the international Telecommunication Union, Geneva.

According to Jørn Braa and Aurthur Heywood (1995), in Africa, there is a resource pool of experiences, methodologies and approaches to dealing with problems facing the reconstruction of the health services in Africa. Therefore, the development of an action-oriented, people centred information system is an essential aspect in the restructuring of a health system if correctly done.

According to Ricky Richardson (1995), another development in technology in the field of medicine, is telemedicine. Telemedicine can be defined as the transfer of medical data between care providers, be they institutionally based as in hospitals or personally between consulting physicians. This process allows for specialist experience, naturally concentrated in centres of medical excellence, to be come available to physicians (and thus their patients) in hospitals that are less well supplied with such expertise. A practical example of telemedicine is the link-up of Saudi Arabia to the USA.

Another development that may help to make communication links among physicians and allied health workers in the developing world is the use of Satelife through its electronic network, HealthNet. Satelife has developed the technology to provide inexpensive e-mail messaging services to the developing world. This allows health workers to correspond and share information with colleagues in their own regions, as well as abroad. In addition to e-mail services, Satelife provides off-line access to a range of current health information including articles from respected medical journals and databases (Mullaney, 1995). This development is registered as a not-for-profit organisation in USA. The HealthNet operates in 15 countries in Africa, 5 countries in Asia and operates a ground station in Cuba and Brazil. The HealthNet services are designed to address serious shortages of health information in the developing countries, and to overcome an array of technological barriers and high costs that impede communications.

In the coming section we will present exemplars of two cases in the developing countries to show how far they conduct and use this technology.

2.4.3. Two Cases of IT deployment and use in LDCs

2.4.3.1. The Belgrano Hospital in Argentina

Rodas *et al.*, (1995) report on the introduction of a computerised system in the Belgrano Hospital, a public hospital serving a low-income population in Buenos Aires, Argentina. The hospital is medium-sized, serving a population of some 120,000, has 176 beds, plus maternity and intensive care facilities and is staffed by 146 medical professionals, 119 nurses and 81 administrative, technical and maintenance personnel.

The objective of computerisation was to provide timely, necessary and relevant health information, comprehensive and clearly presented, in order to provide better services to the community. It was expected that computerisation would facilitate standardisation and unification of data, identification of the population and categorisation of problems; improve communications; and support training and research.

It was decided to introduce PCs, work with distributed systems, develop individual areas and integrate those areas. Several low-cost workstations were installed in different areas of the hospital. Each area developed programmes that best suited their needs. Training was provided for personnel, according to a plan of priorities decided by the hospital management. Programmes developed covered preventive medicine, maternity and neo-natal care, pathology, laboratory, accounts, procurement, pharmacy, personnel, emergency services, admissions and discharches, reception, invoicing, an Electronic Data-Processing Department, and the collection of general-purpose data for executive direction. All this is achieved by means of 25 compatible PCs including old and more recent models, which constitute a local area network. In-house trained personnel are operate the systems. Rodas *et al.* (1995) emphasise that creation of the network was a very slow, step-by-step process, as it was done without any special budget or grant.

The users report favourably on the outcome. Benefits reported include increased productivity, improved error-detection, time-saving, accuracy of information and easier training. The income of the hospital has been increased by improved efficiency in identifying patients covered by sickness schemes and billing the social security offices. Overall, the users feel computerisation has improved the quality of services provided for the community. No one feared the reduction of work-load by the computer and higher working morale is reported in the areas that are incorporated into the LAN.

The Belgrano's experience of computerisation is interesting, in that it was achieved piece-meal, at very low cost, but obviously with careful management and a high level of commitment. Another important feature is the high level of participation and self-direction; the self-development capacities of different areas have been encouraged. This policy has evidently been instrumental in ensuring that the system meets users' needs, securing commitment and maintaining morale. Finally, attention should be drawn to the Belgrano's provision of permanent in-house training. This will obviously facilitate the optimal use of the system, but it is acknowledged that a hospital's ability to provide such training will depend on the existence of at least a few personnel with the necessary technical skills, and on a willingness to commit time and resources for this purpose.

2.4.3.2. Obafemi Awolowo University Teaching Hospital Complex OAUTHC) in Nigeria.

Makanjuola *et al.* (1995) note that Informatics and telematics technologies are today being successfully implemented in health care in Nigeria, but that use is largely based on standard packages. There is a shortage of appropriate systems for management and planning, and little experience on how to benefit from such systems. They offer some suggestions based on the experience of operating a basic Health Information System (HIS) in the Obafemi Awolowo University Teaching Hospital Complex (OAUTHC), comprising two hospitals and three health centres, in Ue-Ife, Nigeria. The system, which has been operating in one of the hospitals since 1991, was developed jointly by the hospital, the Computer Science Department of the OAU, and the Computing Centre of a Finnish University. It is based on a standard microcomputer with three terminals and, by Western standards, is very low cost, although a significant investment for an African hospital (Daini *et al.,* 1992,3).

The system collects almost the same information as the existing manual system, as the management wanted to adopt a gradual, incremental approach, learning from experience before expanding the system. After four years of operation, the management was convinced of the viability of the system in the Nigerian context and was anxious to get more benefit from the information in the database. It was also planning to expand the system to other units and departments.

An interesting outcome of computerisation was that it highlighted a problem of deficient record-keeping practice that had existed under the manual system. Physicians were sometimes failing to write patient discharge notes, because they did not see this as important, compared to their other tasks. When the arrival of a computer system made it easy to access summarised reports, it became apparent just how much data was missing. To overcome the problem, feedback reports were developed for the Consultants, based on the discharge summaries. These not only showed where data was missing (e.g. diagnosis codes not entered) but also helped the physicians to realise the benefit that could be derived from complete patient records. Similarly, feedback was provided to nurses responsible for reporting patient transfers to the medical records department. It began with a simple daily list of patients on the ward: soon, the nurses came to see that the patient list could contain other information that was useful to them, such as diagnosis, treatment, hospital fees paid, etc. It was hoped that gradually, health care and administrative personnel would find more ways of benefiting from the system.

Computerisation also improved communication between the hospital and the Primary Care Units (Health Centres) from which it took referrals. Moreover, Makarjuola *et al.* (1995) gave examples of how geographical analysis of in-patient data could be used to provide information to local government regarding the effective catchment distance of a hospital, as an aid to planning service requirements. Also, by collecting information on cases seen in different health care facilities but originating in the same place of residence, it may be possible to pinpoint areas where, for example, cases of malaria are originating. Reporting of geographic patterns to community representatives would enable them to participate in preventive health care initiatives in their areas.

As the OAUTHC (Obafemi Awolowo University Teaching Hospital Complex) experience shows, if deficiencies in manual record-keeping exist due to individual's attitudes or organisational culture, computerisation, per se, will not improve matters. However, the slow incremental approach adopted by OAUTHC allowed staff gradually to appreciate the benefits of the system and identify for themselves how they could benefit from it. As Maknjuola *et al.* (1995) emphasised, conscious effort, reflection, experimentation and professional collaboration are needed to expand the use of, and benefit from an information system.

2.5. The New developments in Oman HIS

2.5.1. The Strategic policy and development for HIS in OMAN

Information Technology (IT) has been acknowledged by the Ministry of Health in Oman as an essential service in the health care delivery system. In fact, IT service has been included in the list of essential services being planned at a project level for all new health institutions, whether hospitals or health centres. The New Sohar Hospital, the New Nazwa hospital and numerous new health centres projects came with the complete IT infrastructure, namely the structured wiring, the necessary services, clients and printers. The Central IT Department developed the necessary hospital and health centre information systems.

Another important IT policy decision in the health services is the 'paperless' direction taken for the health centre information system.

There is also a proposal under study to replace by the year 2000 all the paper based outpatient notes with electronic records.

Recently the Council of Ministers took a decision to create a body that will manage the Civil Registration Services. The organisation will start operating very soon. Once this service starts, every citizen and expatriate living in the sultanate will be given a unique identification number that will be used also for health services. With the introduction of this new service, the Ministry of Health will plan to have a unique registration per patient across the Sultanate.

2.5.2. Development in Royal Hospital's HIS

a) Development in 1997:

OCS Medicom Package: In April 1995, the Ministry entered into a contract with Oman Computer Services (OCS) for modernisation of computer hardware and supply of the Medicom hospital information system. Several modules have already been implemented including Master Patient Index, Outpatient Booking and Registration, Inpatient Management, Medical Records, Radiology. Statistics, Pharmacy and Medical Stores, Medical Purchase, Microbiology and Histopathology. The Computer Liaison Committee was mainly concerned with facilitating and monitoring implementation of these modules.

However, since the modules were being implemented without proper testing, since problems were being faced by the users and these were not being rectified in a timely manner, and since there was inordinate delay on the part of OCS in implementing other modules, intervention was required by H. E. the Under-secretary and by the Director General. OCS subsequently took action to change the Project Manager, rectify some of the user problems and the Ministry accepted the proposal of OCS to convert the modules from character base to graphic user interface. The implementation schedule was further revised to provide for GUIsation (Graphic User Interface), rectification of errors and installation of additional modules, like Biochemistry, Haematology, general Stores, Engineering, Pharmacy Management, Discharge Summary and Operating Theatre, though not all of these could be implemented immediately.

OCS has recently implemented the following additional modules, though user feedback is required before confirming acceptance: Work order monitoring, General Stores, Echo, Holter, Treadmill, Blood Transfusion, Billing.

The obvious achievements compared with the earlier activities are 1) the discontinuation of manual registers kept by nurses in the wards. The nurses have been trained to use the system for any inquiry. 2) Additional Computer Points: The computer plan was to have structured cabling all over the Hospital to cover the future expansion. The plan was to have a total of 625 points but because there was not enough budget to cover all 625, only 300 points were installed in 1995 and 1996. The remaining 325 points (now increased to 341) were approved and for double outlets. This should have been completed by the end of January, 1998. However, the work is still going on. 3) The Surgical Clinical system was redesigned in a new computer language to make it user friendly. The program 'talks' with the main SUN system to check for registration and administration details to avoid duplication of data. Lab reports can be viewed and printed without going to the main system. The system also generates discharge reports, operation notes and statistics without shutting down the users from LAN system, whereas in the old LAN system the users are logged off to generate any type of statistics. 4) The Endoscopy Program was also redesigned and rewritten in a new computer language that is faster, user friendly, and also linked to the main system to check for the patient registration details. Laboratory results can be viewed and printed without the need of going to the main system. The program has been in operation since 1996. 5) The Anaesthesia Program is ready for use. It was tested by the Anaesthesia Doctors and was also linked to the main system to check for admission details. The entire above is under Windows NT (Net Work).

b) Plans for 1998

1) Completion of remaining modules:

In keeping with the revised schedule, OCS is expected to rectify the errors and complete GUIsation of all implemented modules by July 1998. After that, the additional software requirements related to these modules, as also implementation of other pending modules (Cardiology, SCBU, ICU, etc.) are to be effected so that the project is completed in 1999. However, up to now, the July 1998 schedule has not been completed.

2) Clinical System:

So far there are three clinical LAN Systems (Surgical, Endoscopy and Anaesthesia) running in the hospital. During 1998 it is hoped that OCS will develop a clinical system for various departments so as to make it possible to process clinical data and finally generate a discharge Summary specific to the needs of the respective departments.

3) Laboratory Analysers:

On the intervention of H. E. the Under-secretary for Planning, OCS finally agreed to do the required programming to link eight analysers to the SUN system.

4) Graphical User Interface (GUI):

As compared to the earlier WANG system which was quite user friendly and simple to use, various departments had complained of the need to use keys to perform any function on the SUN system. There seemed no way out except to accept the OCS proposal for a GUI system which necessitated change of Kanz 486 diskless terminals for Pentium PCs.

5) Linking Secretaries' PCs to the SUN system:

Although it had been decided that all secretaries' PCs should be linked to the main system so they can be used as network computers and also work in stand-alone mode, this work has still not been done by OCS. It was also decided that all the PCs which are in the network should have Microsoft Office installed in them so that the user will have only one computer with all the facilities as a network computer or a stand-alone for doing office work. OCS is required to expedite this work to avoid the present situation where certain users have three computers on their desk, one for WANG, one for SUN and another for office work, none of them compatible with the others.

The main developments in the Royal Hospital's HIS were the following: 1) at the end of 1995, the introduction of a new computer system called SUN system, which has already been mentioned earlier on In this chapter. (See Chapter 4 for the specification of this system). This has influenced the decision to provide state-of-the-art tertiary care services, i. e. to serve as an apex referral centre for Ministry of Health institutions, as was planned for the Royal hospital. Therefore, in this respect, 2) the government has established the 'Bousher clinic' just across the road to help covering the primary and secondary health care services. 3) MEDICOM Modules: Medical stores, Purchasing, Histology Cytology and Microbiology, has been implemented, using the new SUN system. There is a plan to continue the implementation of the Medicom Modules.

In addition to the above developments there are other activities such as: 1) supervision of contractor in terms of the day to day operation and maintenance of the software and hardware and ensuring the smooth operation of the system. 2) management of Royal Hospital staff including the contractor staff, involving scheduling of operators; 3) supervising, monitoring and co-ordinating all activities of the Project for modernisation of the Hospital Information System and reporting progress to the concerned management; 4) managing the Clinical Information systems on Local Area Network (LAN) in the Surgical, Anaesthesia and Endoscopy departments; 5) supervising the implementation and smooth operation of the Human Resource Management System (HRMS) in the finance and personnel departments.

2.5.3. Development in SQU Hospital's HIS

The initial purchase price of the Gerber Alley system was RO 300,000. Currently, the Hospital spends money directly and indirectly on maintaining this system. The direct cost in terms of maintenance money paid is around RO 9,000 per month. However, details of indirect expenses including maintenance of HIS department and 24 hours coverage on the help desk have not been released.

a) Computer deployment has had the following advantages

1) All entries to hospital are being recorded on computer

2) The doctors are ordering for Biochemistry, Radiology, Pharmacy and Microbiology requests directly on the computer, which transmits this information to the particular service areas.

3) The results of the tests conducted in the service areas are automatically instantly available on the computer at the ordering areas instantly.

4) The Radiology department is using the system for result recording.

5) Biochemistry and Microbiology labs use computers for all their activities.

6) The Pharmacy department is using the computer to analyse the consumption of drugs.

7) All Administrative departments use the computer for all practical purposes.

b) Government Policy for the ISs

a) Government policies on health service information systems is to formulate a uniform policy on Health information. This policy is reviewed periodically and amended as when required.

b) Future strategic information system planning for SQU Hospital is to upgrade the present system to a state of the art system based on client server technology. The Hospital is on the look out for any ready made system, which can match the requirements of the Hospital. The system is expected to have teleconferencing facilities.

HIS is engaged in a study of the current requirements and the system study is expected to start in August, 1998 and the analysis is expected to be completed by the end of November, 1998.

c) The Important use of computer information

a) Information used for management uses. The details of bed occupancy, consumption of drugs, etc. are used by management to formulate future policies.

b) Information used by decision-makers to monitor the experiences and efficiency of usage. Procurement of new equipment decision of hiring on additional staff is arrived at after using the information obtained from computer.

c) Information use for diagnosis and treatment, where all the tests on the patients and the drugs administered are available on line on computer. It is possible to see on computer the results of a particular test for a period of time. In addition, system provides for drug interaction checking and indexes on poison and similar recorded cases.

2.6. Conclusion

The researcher has discussed Information System Development and the methodologies that could be used as a framework for such development. It has been shown that IE, of all the methodologies reviewed, would be best suited to the Omani environment.

Then presenting the local and national computing policies and strategies deployment in the UK NHS has been presented, with emphasis on the internal market and contracting for health care as well as the IT/IS which was mainly developed for these purposes. It does appears that NHS has its hands full with attempts to make the health system efficient and effective but there is a feeling of a vague strategy and unclear methodology.

Technology transfer and deployment in the developing countries' health systems were also described. Similarly, there are attempts to increase the awareness of the technology and its importance for the developing countries' health systems. However, these LDCs still fail to produce the right strategy and policy for why and how they could use this technology.

In the coming chapter we will emphasise more on the strategic development of information systems use in health care, as exemplified by the UK/NHS and Oman, then mapping the Omani and the UK experiences into the framework that was described in section 2.1 to see how far their procedures are consistent with the IE methodology that is chosen as a framework for such development. In addition we will highlight farther issues and difficulties encountered during the transfer and the deployment of IT/IS into developed counties (UK/NHS) and developing countries (Oman).

3. CHAPTER THREE: INFORMATION TECHNOLOGY STRATEGY

3.1. Introduction

The increased importance of information systems and technology to NHS management has been manifested in the past two decades, as health care organisations have moved towards a greater use of computerised information systems as their work has grown increasingly complex and management need to make more effective decisions more quickly (Ferlie and McKee, 1988; Weinerm *et al.,* 1986). Additional pressures come from a competitive environment and the fast development of IT. Thorne (1988) believes that IT strategies, the information produced by IT and the type of management that use this information and plan business, will cause information to play a large part in altering the relationships among the elements of this environment.

Therefore, interest has grown in the development of strategy for IT/IS to help in making information a strategic resource, reducing expenditure, and using information technology as a competitive weapon. Earl (1993) highlighted four areas of IT/IS strategy, namely 1) aligning investment in IS/IT with business goals; 2) exploiting IT for competitive advantage; 3) directing efficient and effective management of IS/IT resources; and 4) developing technology policies and architecture of which he claimed the first two are dominate (Mowles *et al.,* 1994).

In the case of developing countries, where technology is developing and changing very fast, with political and economic consequences, there should be a specific strategy for its deployment and development. Patel (1983) has indicated that such a policy should constitute an integral part of national development policy, plan and strategy.

In the case of public services, especially in the NHS in the UK and in developing countries, there are two main aims for IT strategy and deployment: firstly, to minimise government spending on services offered and secondly, to provide a good quality of services to the nation whilst preserving their status. Government agencies face external and internal pressures to provide an acceptable quality of care at the lowest possible cost.

In Chapter Two we saw that the developed countries have applied computer technology in their health systems for a number of years and it has more recently been introduced to developing countries, so it has become essential to health information systems. However, both developed and developing countries have faced enormous difficulties in planning, implementing, utilising and maintaining this technology, not only technically but also in human factors such as management competence, strategic planning, skills, funding, social and political issues, etc.. (See Chapter 2).

Therefore, this chapter discusses the strategic development process of IT/IS in health care, as exemplified by the UK NHS and developing countries. Then, we will map the NHS and Omani experience onto the framework of IE methodology (see Chapter 2).

3.2. IT Strategy in Health care

3.2.1. What do we mean by IT Strategy?

Firstly, what do we mean by 'strategy'? Duncan *et al.* (1995) have indicated that the term, strategy, has three related meanings, usage of which is common in health care management. A 'strategy' may be viewed as a sequence of decisions, an organisation's behaviour, or a plan. Consistency is the central theme that ties together the three usages of strategy. First, 'a strategy may be viewed as a pattern that emerges in a stream of decisions concerning the positioning of the organisation within its environment'. Also, the strategy may be viewed as the 'behaviour' of the organisation. This behaviour is influenced by external and internal forces that suggest what the organisation should do. These result in a set of common organisational values and goals that are eventually presented by top management as a plan to lead the organisation to where it wants to go.

IT strategy is a strategy for both information systems and information technology. It is a formal plan for introducing, maintaining and supporting information systems and information technology in an organisation (Peel, 1995). IT strategy is above all a strategy and a plan for addressing information gaps through new or modified information systems and information technology applications.

Therefore, Lederer and Sethi (1991) have concluded that strategy for IT refers to the process of identifying a portfolio of computer-based applications that will assist an organisation in executing its business plans and consequently realising its business goals or the process of deciding the objectives for organisational computing and identifying potential computer applications which the organisation should implement. The same authors, in 1988, said that strategy for IT includes the research for applications with a high impact and the ability to create an advantage over competitors. In this context, Austin (1992) gives a similar definition of strategy for IT as 'any combination of computers, workstations, software systems, and communications technology used to gain competitive advantage.' (P. 361)

3.2.2. The Concept of IT Strategy

The concept of IT strategy has evolved over the last two decades and has been directed or interpreted in different ways. In the late 1970s, according to McLean and Soden (1977), the primary objectives of system planning were to improve communication with users and to increase top management support. This will give a better ability to forecast resources requirements and allocate resources, to determine more opportunities for improving the Management Information Systems (MIS) department, and to identify new and higher payback computer applications. According to Vacca (1984), IT strategy has been used to identify strategic applications of information technology.

In this respect, there are several authors (Wiseman, 1988; Earl, 1989; Ward *et al.*, 1990,1) and researchers (Vitale *et al.*, 1986; Johnston and Carrico, 1988; King *et al.*, 1989) who have discussed the conceptual issues surrounding IT strategic applications. They also identified the factors that determine whether a particular IT application is strategic and the factors that facilitate or inhibit such applications.

From the literature, there seems to be a general consensus among those authors that strategic IT applications meet two essential criteria. Firstly, they have a direct link with business strategy, because strategic IT applications influence the business strategy by creating new strategic options (Galliers, 1987b; Wiseman, 1988; Earl, 1989). IT supports the business strategy by playing a direct role in its implementation (Vitale *et al.*,1986; Pegels and

Rogers, 1988; Sabherwal and King, 1991). Secondly, strategic IT applications significantly affect organisational performance, either by providing the organisation with competitive advantage, or by reducing advantage enjoyed by its competitors (Porter, 1985; Porter and Millar, 1985; McFarlan, 1984; Wiseman, 1988; Perlitz, 1993). Therefore, IT should provide a competitive advantage or offset competitors' advantage. If it fails to do so, it can not be considered strategic, despite its link with the business strategy (Sabherwal and Tsoumpas, 1993).

The above comments all imply the basic 'golden rule' that the strategy for IT should be part of the overall organisation strategy, if it is to be a success. In addition, Ciborra (1994) emphases the willingness to invest in the technology to lead the innovation of IT strategy. These points have been emphasised by many of the writers and authors in this field such as Thorne (1988); Kovacevic and Majluf (1993); Galliers (1994); Peel (1995) and Duncan *et al.* (1995).

3.3. IT Strategy in NHS

3.3.1. Introduction

Health services have to cope with society's demands in terms of quantity and quality of provision, while balancing internal and external factors such as economics, development, education and competitors. Usually, the most important objective of any business is to gain profit, or at least to survive and run without losses. In the case of public health services, Levitt (1986) and Jones (1986) have indicated that there may be no profit-making intention, but such services have to be able to sustain themselves and carry out their mission. To achieve this objective, they have to seek a variety of approaches, techniques and opportunities that will be cost effective, develop their image and satisfy founders and customers.

Sheaff (1995) has pointed out that information is a resource as necessary for the effective provision of health care as trained staff, adequate buildings and equipment. This is reflected in the strategy of managerialism, which attempts to professionalise health services management and to model it increasingly overtly on private sector commercial management.

Commercialisation of healthcare is a policy objective in much of Europe, comprehending both public expenditure containment and managerialism strategies. This has happened now in Britain, France, Sweden and parts of eastern Europe (e.g. Romania, Poland and Russia) where more radical health reforms are leading towards various forms of 'internal market' (Ministry of Health, Education and Welfare 1992).

Therefore, Hardman (1991) noted that the emphasis now in the UK hospital environment is on greater control and the efficient use of resources. The next step, he believed, would be that the outcomes of health information, would be used to generate competition and political and administration pressure. As he pointed out:

> "Effectiveness in health care is not simply a technical issue but about social judgement. Unless technology or type of treatment is superior in all dimensions, statements about its relative effectiveness will involve making value judgements about trade-offs between accessibility and quality of care, of risk and benefit, of survival and quality of life." (P. 16)

3.3.2. The Reasons for pursuing strategy for IT in NHS

The main thinking underlying IT Strategy deployment in the NHS or other health services has been directed to efficient use of IT as an aid to the management process. Another concern has been to cut costs or reduce the total cost of the technology. Kropf and Greenberg (1984) have indicated that threats to traditional sources of hospital revenue and new forms of hospital organisation have increased competition among hospitals, introducing further threats that utilisation, market share, and revenues will decrease. These opportunities and threats have resulted in increased interest by the hospital industry in IT strategy planning, which has been seen by Palvia *et al.* (1990) and Keen (1994) as a radical departure from the past.

According to Greer *et al.* (1983), organisational technology strategies emerged to be of use in medical equipment decisions. Coddington *et al.* (1985) indicated several reasons why the hospital industry has to set strategies, related to the new environment such as deregulation, competition and new technology and they indicated that strategies developed a year or two year ago may now be outdated. However, the most important reason for IT strategy is to reduce administrative costs (Duncan *et al.* 1995). Shortell *et al.* (1985) indicated that the main reasons for initiating strategies and changing them over time resulted from: 1) the perception of performance gaps; 2) the perception of chaos gaps, which Shortell (1985b) expressed as arising when the organisation viewed itself as challenged or its identity as threatened; 3) changes in the external environment, which may result from the financial, legal, technological, competitive, regulatory, and other environment of health care organisations; and 4) changes in organisational leadership, since new leaders frequently have different views of the organisation, its strengths and weaknesses, its environment, and its competition.

3.3.3. The Process of Developing IT Strategy in the NHS

Sheaff (1995) has indicated that the NHS's behaviour is governed by the facts that since cutting health budgets is unpopular and demand for health care services is increasing, governments have tried to increase health system activity through administrative reform and resource reallocation, rather than budget increase. The use of IT strategy in the NHS was seen firstly as the result of the Korner Reports (DHSS 1982) and the Griffiths/Department of Health (1983) report, emphasising the importance of data collection and its use for effective and efficient health care delivery. However, there have been difficulties and slow progress in the use of IT and its strategies. Peel (1995) has expressed this point:

> "Developing a supportive, affordable and achievable information and technology strategy for any large and complex organisation, particularly in health care, is exceptionally difficult." (P.21)

Peel (1995) also pointed out that the use of technology to support the Korner and Griffiths reports involved huge expenditure, which led to further thinking on IT strategy:

> "The technology implications of the Korner Reports (DHSS 1982) and the information implications of the Griffiths/Department of Health 1983) led to the first DHSS commitment to recurrent annual investment in hospital information systems, of several hundred millions pounds. By 1986 there was increasingly urgent need to

integrate the planning of investment in such systems with the information requirements of clinical, administrative and managerial staff, if only to prevent considerable duplication of effort. The Department of Health hoped to minimise this waste by so defining the goals of such a strategy, its guiding principles and the specific actions to be taken at national, regional and local levels, as to produce a national information framework for local investment decisions on IT systems." (P.22)

Thomas (1988) indicated that in 1986 the NHS Training Authority established the IMT (Information Management and Technology) Project Group with wide representation from the NHS to recommend a strategy for training and staff development in IMT, with particular reference to priority learning needs and target groups, and to indicate responsibilities for the implementation of the strategy. The focus was on the need for IMT training in three areas: 1) information awareness and usage; 2) information management; and 3) information technology.

According to Peel (1995), it was not until 1988 that an actual systematic attempt by the Department of Health in England to require formal written strategies for regional district and health authorities appeared. These strategies had to state explicitly what benefits were to be obtained from investment in information management and technology and, in particular, what personnel and organisational development would be necessary to achieve this. Quality and value for money were to be demonstrable at all times.

Peel (1995) expressed the view that the establishment of the NHS Training Directorate (NHSTD), which was developed and financed by the NHSME in 1991 would help the implementation of programmes for training, education and technology to give momentum to the idea of strategy. According to Keen (1994), the idea was enhanced when the NHS Management Executive published its Post-Review Information Management and Technology (IM&T) strategy at the end of 1992. This strategy offered a five-point vision of future developments: 1) Personal-based Information. This was new to the NHS, though the idea had been used for several years in other organisations. Peel (1995) pointed out that strategic personal data would be communicated more quickly and widely, and a national policy and framework was necessary to ensure confidentiality and security of personal information. 2) The possibility of systems integration, which needed collaboration between professionals in delivering services. 3) Operational system as the source of information. 4) Information security and confidentiality. 5) Sharing of information across the NHS (that would acknowledge the impact of contracting on data flow).

The NHSME attempted to develop healthcare information and systems more quickly by following a nation-wide but decentralised strategy rather than by leaving these decisions to the market or by having all investment controlled centrally. Its essential minimum requirements are that the principles underlying an information management and technology policy should be consistent with the wider UK health policy and strategy (see Chapter 2). All information and IT projects over a threshold amount (in 1994, £1 million) should be subject to Treasury approval and each NHS organisation should have an information management and technology strategy explicitly related to its goals (Connolly and Huckerby, 1998).

The Information Management and Technology (IM&T) strategy, which was established in December 1992 (NHSME, 1992) aimed to define a national infrastructure from information sharing and support for the development of local skills. It also aims to assist local choice in end-user systems through nationally funded development and exemplar projects; and to ensure value for money for local purchasers by minimising reinvention.

In this context, the IM&T strategy advocates a set of linked policies. All information systems should be person-based, because care must be focused on the needs of individuals and integrated across the healthcare organisations with which they come into contact. If information is person-based, data need only be entered once and can be shared easily between organisation, minimising the data entry required.

In addition, there will be a strategy and system for NHS-wide data exchange, and consequently a networking policy to cover both voice and data communication, and national standards for machine-to-machine communications. Since personal data will be communicated more quickly and widely, a national policy and framework is necessary to ensure confidentiality and security of personal-based information.

As we saw in Chapter 2, the NHS is attempting to use the internal market and contracting for more efficient and quality of health services. Therefore, the national IM&T strategy will focus on maximising purchasing power, minimising reinvention, and providing guidance to the supplier community. Increasing sophistication of systems will support a move to more complex and specific contracting, bringing about more effective monitoring of contracts and health interventions, or health gain. According to Frank Burns (1998) who has been given the key task of reviewing the IM&T strategy for the NHS, he has received four key messages from his discussions with personnel from the NHS: 1) The new strategy must be seen to support the real work of the NHS. This relates to real patient care and the development of information to help the professionals improve their abilities with this task. 2) The technology should be used to create an environment such that when a patient moves from one area to another, their healthcare records follow them. 3) There should be a national information strategy, which responds to the need of NHS workers. 4) The final message was that if a strategy is put together to accomplish all this, then it must happen.

All these principles are intended to provide for an integrated approach to the management of information and the development of the computer systems and work processes. In this respect all specialists should have systems to support medical audit, and all hospitals should have links with general practices.

An organisation's strategy for IT is aimed at ensuring that its information systems and information technology are linked to and support its objectives. Examples of systems that seek to fulfil this aim were presented in Chapter two. The overall strategy of the NHS includes facilitating the operation of the internal market, such as monitoring NHS performance and management to achieve better resource use; improving the quality of patient care; encouraging the analysis of clinical activity; improving information on the health status of the population's and monitoring it; and planning or providing healthcare to meet the population needs. These requirements are best addressed by using information systems methodology (see Chapter 2).

In the context of these attempts to develop a strategy for IT/IS in health systems in the UK, the following two examples may give some idea of the planning processes and the difficulties that the strategy may face.

3.3.4. Two examples of Strategy for IT/IS in the UK's Health System

3.3.4. *Wirral Hospital's project*

Spours (1993) described several important points to be considered, arising out of an investigation of Wirral Hospital's project for introducing computer strategy. He reported that Wirral Hospital initially had no information strategy and little in the way of operational information technology support. It had been selected as a pilot site for a Resource Management initiative. This provided the incentive for an ambitious programme, which led to the implementation of hospital-wide systems designed to support clinical as well as administrative requirements. Spours highlighted the following features of the project: 1) Managers recognised that data should be collected as a by-product of operational systems and not as an end in itself. 2) The fundamental strategy adopted at the Wirral was to change staff attitudes and organisational structures, then put in place the IT infrastructure required to support them. This approach helped to secure the 'buying in' and co-operation of senior staff and reduce the feeling of remoteness which, he argued, characterises so many NHS hospital systems. 3) The choice of system for implementation was the result of an extensive research and evaluation process. Although the chosen TDS system was perceived not to be up-to-date in technical approach, it was demonstrably effective in operation, and well liked by doctors.

3.3.4.2. Ashworth Hospital's project

The next example, described by Spencer-Jones (1993), is that of the Ashworth Hospital, where he is the IT manager. The hospital was in the process of changes such as moving from an old style of management to a much more effective management structure aligned with the NHS, and becoming a centre of excellence, setting new standards for the treatment and care to those who most need it, e.g. those with mental disorders, and those changes were aided by IT strategy. Before the new strategy, the hospital had some computers and systems in place, but it had been an *ad hoc* process, and did not meet the information needs of different groups in the hospital. By 1990-1991, an IT department had been established to create an IT strategy to help in solving these problems. This strategy addressed the issues of patient and staff education, training facilities and administration and highlighted what changes needed to be made to get an IT infrastructure in place. Consequently, this was easily and successfully managed. Furthermore, it was necessary to deal with the disarray of maintenance contracts and different PCs involving 17 different personal computer dealers. An open tender to appoint a sole PC supplier was issued by the IT manager. The CompuAdd manufacturer won the tender for reasons of optimum mix of price, performance and maintenance. This resulted in cost savings of approximately £45000 of resources. The installation of over 300 PCs on site, all linked in a network spread over 22 buildings, provided the IT infrastructure 18 months into the programme. The next step was to have networked PCs on all 30 wards. Training and educational facilities for both patients and staff have improved as a result of hospital-wide access to PCs, and staff development has been enhanced. Thus, the implementation of a hospital-wide PC network at Ashworth is making an impact. It is not the only solution, but it is certainly part of the solution which, through the greater access to and faster flow of information, is helping bring about management and cultural changes within the hospital. Spencer-Jones (1993) indicated that although a successful information strategy will not be a cure-all, it can be a major facilitator to bringing about management and cultural change.

We may realise several points about the attempt of NHS to adopt the use of IT strategy. Firstly, the adoption of IT strategy came gradually and not at once. Secondly, the attempts were not free of difficulties as well as high expenditure (see next section). Thirdly, determination was shown to solve these difficulties; these developments were not constrained by requirements such as waiting until the next five-year plan, as is the case in Oman.

3.3.5. The Challenges for making IT strategy in Health Systems

Considerable concern has been expressed over the expenditure on IT in the NHS in recent years (Galliers, 1994). For example, Angell and Smithson (1991) have indicated that it was revealed in a study in 1984 that 20 per cent of UK IT expenditure was wasted, a total of 800 million pounds. This problem is far from being solved. Wessex Regional Health Authority's Regional

Information Systems Plan (RISP) was abandoned in 1990 with major write-offs of between £20 and £40 million. Similar figures apply to other countries, e.g. USA (Martino 1983) and Australia (Galliers 1987a).

In 1993 public sector IT represented over 1.7% of government expenditure, that is more than £2 billion (KEW Associates 1992; Margetts 1991a). Within this total picture the DSS is spending £1,749 million between 1982 and 1999 on its Operational Strategy, though this figure has a history of being revised upward (National Audit Office 1989a). The NHS spent £609 million on IT in 1992, while Education (private and public sector) spent £975 million (Willcocks, 1994).

The current best estimate is that the NHS spends about £220 million a year on its information systems. Also, the NHS has spent £3 billion and £4 billion on information systems over the past ten years.

This failure is blamed on the lack of applied IT strategy, inadequate IT project management skills, inadequate evaluation and control mechanisms, training and staffing in major projects (National Audit Office 1987, 1989ab).

According to Connolly and Huckerby (1998), the implementation of new technologies on cash cost grounds without consideration of the economic consequences of such actions and without a management control for technology is extremely risky and is a major reason for incremental growth in real expenditure. However, Connolly and Huckerby (1998) have indicated that it is not the cost of the technology, which leads to the incremental cost in developed countries. Rather, the failure of general management to demand the savings implied by new technology is triggered off by not demanding that the case for procurement should be Health Technology Assessed.

Potentially, the impact of computers on health institutions is considerable. According to Collen (1991), the trend for computers in health will be of great value to improve patient care by: 1) improving efficiency and reducing costs; 2) providing better clinical decision support; 3) enhancing the process of monitoring the quality of care and services; 4) supporting health services research through better computer-stored databases; and 5) facilitating electronic claims and forms processing. However, Ball (1991) believed that by the end of the 1980s, these important benefits had been only partially achieved. And Young (1991) confirmed this point when he pointed out that although these technologies hold such promise, few finally do what was promised.

Ferrara (1991) believed the IT tools initially adopted with enthusiastic expectations, are under-utilised, and may even face complete rejection in the operating environment. Young (1991) evaluated the clinical use of computers as poor, because the vast majority of clinicians do not use the computers directly for patient care. Experience is slow to accumulate, and the same mistaken attitudes and errors continue to be repeated. Burch (1990) attributed such problems to the fact that system projects are often built piecemeal, which may result in incompatible, redundant and inflexible information systems.

In 1977, 32 computer applications to clinical problems were identified by review of major journals. It was discovered that 51% were not working and in only 19% was the system still used (Friedman and Gustafson, (1977)). Another major study of the use of imaging equipment has shown that the utilisation of expensive technologies in the NHS is poor (South East Thames Management Services Report, 1984).

Burch argued that management policy too often makes blind stabs at quick-fix solutions, and tries to fit jobs to technology without proper planning. As he pointed out, throwing technology at problems without proper strategic planning always ends in failure. One of these failures in NHS authorities purchasing new technologies is in identifying how quickly savings on the health of the nation using those new technologies can be achieved. According to the Chief Executive of the Institute of BioMedical Science, because of this mentality, all governments fail to plan effectively for the future (Potter, 1998). Therefore, Connolly and Huckerby (1998) emphasise that the IT procurement process needs to be managed before, during and after acquisition of the technology concerned. In practice, the picture emerging in the procurement of high-technology shows that the process is poorly managed and the consequence of poor management is creeping growth and incremental costs (Connolly and Huckerby (1998).

A report by the Kobler Unit at the University of London's Imperial College (Hochstrasser and Griffiths, 1990) lists findings from a range of studies which show negative results of the use of IT in health care and one of these is that IT seldom leads to sustainable competitive advantage. However, this situation may occur particularly when the IT was not implemented initially for competitive advantage or the system in the organisation is not planned to help achieve this aim. To support this point Galliers (1986b) has pointed out that many companies and non-profit organisations do not formulate strategy according to the competitive rational/ analytic model, nor do they adequately plan for their information systems, let alone incorporate competitive considerations into their strategy process. Therefore, competition should be considered during the IT strategy.

Farmer (1988) warned that too frequently in the past, decisions have started to be taken at the IT strategy and selection level without a more appropriate strategic setting. He emphasised that controlling the efficiency of a technical implementation is less important than ensuring that the 'right' systems are computerised in the first place. Similarly, Connolly and Huckerby (1998) indicated that the implementation of the wrong technology would carry direct patient consequences.

According to Farmer (1988) and Shortell *et al.* (1985), IT strategy could influence change and the shape or profile of the services and power. The health care organisation is unlike those of most other industries; in particular, it has a divergent and loosely linked set of stakeholders composed primarily of the board of trustees, administration, the medical staff, other health professionals, employees, third-party payers, and patients. Particular challenges are posed by physicians who, through their clinical decision making, may generate upwards of 70% of the organisation activities and costs, with implications for internal or cultural aspects such as management style and philosophy.

Denis *et al.* (1991) drew attention to the complex (and often highly political) decision making environment faced by hospital administrators (and by managers of the professional service organisations and social service agencies). Keen (1994) pointed out the tension between systems designed for command and control and those for supporting operation services delivery. While the need for better training and development is recognised, the focus of the IM&T strategy is still pursued casually, focusing largely on IT and data collection (see Chapter 2). However, in the hospital environment, especially in institutions depending on public funds, decision-making is often highly political, with doctors having a kind of autonomy in service provision, where the physicians control the level of hospital usage. This activity has been seen by Coddington *et al.* (1985) as a new competitive environment, where physicians control markets for hospital services. This leads, as one might expect, to fragmented, loosely integrated strategies. Different actors' interests need to be realised when planning for such a strategy (Champagne *et al.,* 1987). Professionals may resist any technology that might undermine their skills or professional status. They may also believe no technology can take place of the human senses. They may see technology only as an aid to ancillary tasks, e. g. telephone, or for fast calculation and reporting. They may fear that technology will be used as a monitoring device.

Rathwell *et al.* (1983a) expressed that the lack of finance and skills in programming were seen as the major limitations in using microcomputers. Hewett (1986), citing Pfeffer *et al.* (1982), commented that information technology increases the power attributed to some groups, while reducing that of others. This may result in resistance to IT deployment and utilisation. The idea of physician resistance was expressed, suggesting that it was not the computers, the programs or their implementation, but the doctors themselves who were the problems (Kaplan, 1965 and Willcocks and Mark 1988). They indicated also that powerful groups (particularly doctors) could hinder the implementation of a system they do not support.

Another important issue is the integration of patient record or computer health systems, which has to some extent hindered the development and deployment of the computer in health systems. Gleave (1982); Hughes (1992); Peterson (1991) and Yamamoto *et al.* (1991) have expressed the importance and the benefits of the integration of medical information systems as well as expressing concern about the difficulties that may arise from this process.

In this context Gleave (1982), citing Pfeffer (1982), argued that the problem of data collection is more difficult than it seems to be, as it is collected by different groups or different departments and will probably be subject to different interpretations. Lippeveld *et al.,* (1997) pointed out that health workers receive little or no training in data collection methods. Hughes (1992) indicated that the lack of comprehensive integration, at even the most basic level, may lead to the situation where systems developed in isolation cannot communicate, data is duplicated and inefficiency and ineffectiveness are the presenting characteristics. Furthermore, the take-up of integrated systems is constrained by several factors, including the capital costs, lack of awareness amongst hospital staff and senior managers, and long timescale before, benefits are achieved, the complexity and risks of implementation, and the fear and uncertainty associated with these factors. In addition, Yamamoto *et al.* (1991) admitted that the shortage of staff in medical information, is the largest bottleneck for the integration and the development of HIS in Japan.

Sheaff (1995) has pointed out problems such as poor knowledge of the technology and fear. He claimed that health service managers (including health professionals in their managerial capacities) find themselves having to operate or introduce information systems without knowing what sort of information system to order; nor how to install and operate it; nor what sort of information to demand of the system; nor how to use it for decision support. Also, Protti and Haskell (1991) realised that the health care industry has been relatively slow to accept the inevitable conclusion that it is information, and not just computer systems, which must be managed.

Margetts and Willcocks (1992) in their article, "Information Systems and Risk: Public Sector Studies", indicated that risk could occur when those responsible for deployment and development are unaware or unfamiliar with, suspicious or even frightened of the technology itself.

The lack of information on computer applications in the NHS, coupled with the desire to develop more client-orientated training packages culminated in a decision by Rathwell *et al.* (1983a) to elicit data on the use of microcomputer in the NHS. They found there was a current lack of knowledge of existing computing facilities and their usage. Many districts did not have the skills to develop their own computer program. The training and education needs of the NHS were in a state of crisis. 72% of NHS districts were of the view that a more co-ordinated programme of training was required for NHS personnel. This problem had been raised earlier by Gleave (1982), who found that the training conducted for health information systems was poor; the only in-service training made available was annual seminars for coding clerks. Utilisation was poor, the highest rates of application being clinical 39%, finance 37%, works 30%, personnel 25%, word processing 22%, general management

19% and statistics/ research 19%. 85% of districts were limited in their use of microcomputing facilities. Changes were foreseen, in terms of increase in the future use of microcomputers for patient administration, general management, supplies and catering, and less emphasis in their use for work activity, word processing and statistics/research.

McCullough and Boyce (1990) in their article, "Taking IT on trust" indicated that technology remains a taxing managerial challenge and is often complicated and costly; sometimes all its unlimited potential seems to offer are new, expensive ways of getting things wrong. Moreover, they pointed out that in the public sector IT problems are compounded by staff shortages, poor funding, disordered acquisition and legislative pressure. They pointed out the importance of involvement of users, as 'people make or break the system.' Willcocks and Mark (1988) also drew attention to lack of expertise in the implementation of IT in the NHS, causing underestimation of the time taken to get a new installation off the ground (Kearney, 1987).

Furthermore, the key actors in these health institutions have to cooperate; successful operation of such a system and its strategy depends on commitment on the part of management, medical and nursing staff (Spours, 1993; Peel, 1995). It is of vital importance that clinical staff are made to realise the full implications of the system, particularly in respect of training and how the system impacts on the practice of medicine. Duncan *et al.* (1995) point out that IT strategy and strategic management may fail if there is less than full commitment and involvement from top management, too little emphasis on building the information systems for decision making, failure to integrate overall objectives with IT strategy planning and lack of attention to implementation strategies.

Therefore, we can realise that the difference between success and failure depends mainly on management competence and the ability to set strategy, that is, to develop and implement plans to position the organisation so as to take advantage of the rapidly changing market, product, technology, and social environments relative to its competitors and its environments.

To sum up, the literature identifies a number of problems: 1) poor information strategic planning; 2) management competence; 3) political implications; 4) the challenges of integration; 5) resisting and fears of this technology; 6) lack of funding; 7) lack of knowledge of the availability, to operate and to use this technology; 8) poor training and education in this technology; 9) poor utilisation and 10) a variety of technical problems and many others obstacles.

3.3.6. The use of IT strategy as a Competitive Weapon in NHS

Schultz and Johnson (1990), who pointed out that health care services compete with each other at least for resources, have indicated the role of competition in health care systems. Similarly, Jones and Worsdale (1993) have argued that strategic use of information technology is an essential element in 'Working for Patients' where they believed that NHS hospitals are competing with private health organisations as well as with each other. Therefore, a key aspect of strategic thinking and managing is competitive position. And to be competitive, it is necessary to obtain and analyse information or data. Also, the activities an organisation performs can contribute to an organisation's relative cost position and create a basis for differentiation. A cost advantage may stem from such disparate sources as a low-cost purchasing system, a highly efficient record-keeping system or superior utilisation of staff, technology and hospital equipment.

Farmer (1988) has indicated that the private sector has increasingly recognised the need to exploit IT for competitive advantage, and he believed that in the NHS context, this might be translated into ensuring that the investment in computing information supports the overall work-direction of the health authority. According to Duncan *et al.* (1995), decision support systems and improvements in customer service levels and facilities, as well as lower costs, are other ways of seeking strategic competitiveness.

Jones and Worsdale (1993) pointed out that the use of IT as a strategic weapon may be achieved in three ways: 1) to improve productivity and performance, 2) to enable new ways of managing and organising, and 3) to develop new business. However, a major focus of the use of IT in the health service has been to identify, more clearly, resource use and to examine how resources may be used more efficiently, thereby improving the productivity and performance which has been seen as an approach of pursuing competitive advantage.

The implementation of the NHS reforms and the introduction of the market in April 1991 place emphasis upon the need to introduce competition into the NHS in order to improve provider performance (Robinson, 1997). However, The White Paper *The National Health Service. A service with ambitions,* which sets out the government's strategic vision and emphasises that both future health service policy and performance will rely heavily on better information technology for the NHS, makes no mention of competition and markets (Peel, 1997).

3.4. IT Strategy in the LDCs

3.4.1. Introduction

It is an advantage, and in some cases could be a pre-requisite, to have a national policy and strategy for health informatics and telematics, which should spell out, as a minimum, the national priorities and short term targets, and the national standards for health data, procedures and applications software (Mandil, 1995). The rationale for this and the elements of a national policy and strategy are specifically discussed in a WHO publication (WHO, 1988), which states that 'The policy and strategy for health informatics must reflect the environment in which they will operate. They must be appropriate to the technological status of the country, reflect the financial and human resources available, and meet the timing constraints often imposed from elsewhere.' (P. 8). In this respect, a policy for IT sets down the rules and a strategy for IT will describe what will be done within IT and how, in the context of those rules (WHO,1988).

IT transfer and development in the developing world, as indicated in Chapter Two, often does not involve a specific method or strategic plan for the future or even for their present context. Therefore, in this section we will review the literature on IT strategy in LDCs, and explore the challenges of IT deployment and planning which LDCs need to be aware of.

3.4.2. The Reasons for pursuing IT Strategy in LDCs

The main rationale for IT strategy is to implement the policy set by the WHO (1988) for a national health informatics. This will ensure that development and use of IT will proceed in a co-ordinated manner, in consonance with an overall health information policy (WHO, 1988). This will necessitate the sharing and exchange of information, as indicated in Chapter 2, the relative priority of different projects, the education and training of health professionals, and the evaluation of IT impact on health services.

In addition, there is a need for IT strategy to improve the communication and collaboration among managers, informatics professionals, and end-users of information; major decisions to be made regarding future needs, allocation of informatics resources, the type of systems to be adopted (specification) and its integration. Furthermore, periodic strategy development is needed to respond to new and increased requirements of users, to reflect changes in the country's health environment, and to take advantage of the continued improvements and cost reductions offered by technology.

Yanez (1995) has gathered several points on the strategies and the actions that are involved in the transfer and the development of IT. These are:

1) obtaining the necessary assistance in financing and running health care systems;
2) creating a new investment policy, which requires the LDCs Member States to focus on improving health facilities, with reinforcement of the primary care network, maintenance and rehabilitation of existing facilities and equipment;
3) improving the capability of administrations; decentralisation should be encouraged, and non-governmental initiatives promoted. The communication advocates a less compartmentalised and fragmented implementation of projects and programmes, and a joint combination of external technical assistance with the developing local manpower and know how;
4) creating a higher co-ordination of the community and its Member States together with international agencies like WHO, the World Bank and UNICEF. The initial point of such links is the exchange of information and

sharing of experiences.

3.4.3. IT Strategic Transfer in LDCs

The main strategic aims of LDCs in acquiring and using information technology are to probe the environment, identify new threats and challenges, and respond in a creative way to new circumstances (Dedijer and Jequier, 1987). Therefore, in technology transfer, strategic national information management involves monitoring technological developments in developed countries, evaluating their probable impact, making optimal decisions on the basis of information which is often incomplete, and dealing with future events (Dedijer and Jequier, 1987).

With respect to the aims and strategies there are many examples of projects such as the EpiAim project, which addresses broad fields like health and medicine, information and communication technologies and socio-economic development issues. It has three main strategic objectives Sosa-Iudicissa and Levett, 1995): 1) to produce an 'instant picture' or blueprint of the conditions and situations within the health sector; 2) to establish the methodology that could or should be used, to investigate the diffusion and utilisation of telematics systems in the health care sector; 3) to provide some key case-studies resulting from easily accessible information.

EpiAim also proposed a common political strategy between all Member States of the European Union for integration of interests for the Latin American region, according to three areas: 1) Developing of the health services infrastructure with emphasis on health care information systems; 2) Focus on priority health problems of the most vulnerable groups, with specific programmes implemented under the health services system; 3) Management of information necessary to carry out the preceding two activities according to the management strategy or the best possible use of resources.

The use of Electronic Data Processing Centre in the developing countries' hospitals, is a strategy to provide better services by obtaining timely, necessary, and relevant information in the area of health care, complete in content and clear in presentation, to the community as well as the professionals in health activities.

African libraries are prime victims of the tightness of hard currencies.

Many university and medical libraries have had to dramatically reduce their acquisitions of scientific journals and the publication of foreign medical societies. Their use of E-mail and CD-ROMs, whereby foreign libraries holdings are listed, has alleviated part of the problems. In addition, HealthNet services are designed to address serious shortages of health information in the developing world, and to overcome an array of technical barriers and high costs that impede communications (Mullaney and Xavier, 1995) (see Chapter 2 for SatelLife).

Another aspect of strategic planning of IT transfer is computer-based training (CBT), which deserves to be given a high consideration, since the health care sector, with its large manpower pool is an ideal target for the use of CBT.

Ouma-Onyango (1997) indicates that strategy of IT may come through the information used to plan and advance the future and to cope with the attendant uncertainties, which is the case in most of the developing countries.

In spite of all these attempts to plan for IT strategy, the process of transferring IT into the developing countries is attended by many difficulties, as we will explore in the next section. However, many authors and writers such as Burton, (1992); Stover, (1984); Su, (1988); Rada, (1983); Barker, *et. al,* (1987); Walsham, *et al.,* (1988) and Patel, (1983) suggest policies or approaches that should be considered in this regard. Su (1988) has offered two approaches for the developing countries to pursue. The first one is to build their own internal industrial and technological revolution and the second one is based on the absorption and efficient application of new technologies from abroad. However, he recognised that these approaches would need personnel with a background of an adequate educational and scientific level, which means there is a need for the advancement of the general educational and cultural level, quantitatively and qualitatively. Emphasis should be placed on supporting technological development by substantial funding, training of personnel, systematic research and policy design, and an understanding management, sympathetic to the application of new technologies.

Similarly, Rada (1983) called on developing countries to pursue policies heavily based on human resources, information, and knowledge-intensive activities, with a more active policy in terms of training and education, and well developed strategy. Furthermore, and more specifically, Stover (1984) stressed the importance of the political context of an organisation in influencing decisions on computer adoption, the selection of technologies, development of systems and the choice of system users.

In this context, Patel (1983) cited the examples of Russia and Japan. These two countries built their own autonomous decision-making capacity and it was only through the reduction of external technological dependence and the development of national technological capacity that each new entrant to industrialisation was able to launch its process of development. Even when the new entrants did not introduce overall development planning, each of them most carefully cultivated the rapid training of their skilled personnel, and the establishment of a powerful national capital goods industry, the two processes in which technology is embodied. They also avoided foreign investment in their major productive industries. The literature indicates that some LDCs have followed the Russian and Japanese strategy. The two largest users of computers in the developing world are India and Brazil, though in relation to the size of their economies, computer deployment is minimal (see Burton, 1992: P 73-75). However, the adoption of information technology policy by these two countries was intended to boost information technology industries (Ouma-Onyango, 1997).

Walsham *et al.* (1988) have indicated that in the developing countries there is more emphasis on financial rather than social or political impacts, and the favouring of short term over long term objectives. Therefore, they suggested three approaches need to be recognised and implemented to achieve satisfactory use of the new technology:

1) Research is needed to develop underlying methodologies, which should address information systems in organisations from the social, organisational and political perspectives;
2) In education, more attention should be given more to technical skills, supplemented with behavioural awareness, concern for human values and, at a higher level, organisational and political skills;
3) Practitioners should be prepared to learn and practise their profession related to IT with regard to the social, organisational and political context of their work.

Walsham *et al.* (1988) concluded that information systems should not be regarded as technical systems with behavioural implications but are better conceptualised as social systems in which technology is only one of the elements.

All the writers reviewed above realised the enormous impact and benefit that IT offers to LDCs. According to Rada, IT will affect the LDCs by increasing the obsolescence of their industries, services, and development strategies. However, Su has indicated that IT offers unique opportunities for the LDCs to leap-frog in economic development and might allow these nations not only to catch up, but even potentially to bypass the developed world. Beside that, IT will have an overall impact on political and social aspect in a given society, involving economic growth, efficiency, the employment level and structure, income management, a change in the requirements for particular human skills and capabilities, a change in the structure of world trade and intensification of international competition. Stover (1984) has indicated that IT promotes integration, fosters the building of interest groups and facilitates greater popular participation. In short, IT charts the blue-print for future development.

3.4.4. The challenges for IT strategy and deployment in LDCs

Technology can be divided into 1) capital goods and direct material; 2) qualified and specialised manpower and 3) technical and commercial information (Djeflat, 1988). It may be imported as complete packages or unpacked. The former commonly results in cost overruns and limited transfer of capability and experiences while the latter can lead to long completion times and high costs. Djeflat (1988) notes the discouraging results of technology transfer efforts in many LDCs and blames the lack of experience of LCD entrepreneurs. Suppliers have not only the technological information but also more experience of contract negotiation. LDCs often do not seek to be better informed and surrender responsibility to suppliers. Djeflat refers to a UNCTAD report that identified LDC buyers as lacking the information and commercial know-how required to assess their needs. Ventura (1988) argues that better information on technologies and suppliers is needed if intelligent decisions are to be made.

Though information studies in LDCs have tended to focus on tangible qualitative developments such as computer diffusion, they have neglected intangibles such as regulations, policies and institutions. Under-emphasis on hardware acquisition at the expense of appropriate institutions for use and management of infrastructures leads to underutilization (Ouma-Onyango, 1988). Information technologies need to be defused within what Katz (1988) calls 'communications ecosystems', i.e. to be supported by previously available technologies already supporting societal information flows. A common problem with the information policies of LDCs is the unrealistic pursuit of costly hardware acquisitions without proper consideration of the extent to which, and the ways in which information is already used. The absence of information in decision-making and poor image of the information professions impede problem identification and the search for solutions (Ouma-Onyago, 1997). If effective, competitive use is not made of existing information systems, additional systems are unlikely to be used optimally.

In addition, technology transfer studies often focus on intra-firm transfers, neglecting these wider decision-making activities. They also often ignore the challenges posed by technology adoption, and the bottlenecks, government controls, conflicts of objectives and interests, ignorance of risks, information asymmetry and lack of co-ordination that often characterise decision-making in LDCs (Ouma-Onyargo, 1997).

One topic that has received much attention is the debate on the appropriateness of imported technologies. There are those who favour the importing of intermediate and second-hand technologies on the basis that LDCs cannot cope with the latest technologies. Others, however, are concerned that by so doing, LDCs become trapped in obsolete, uncompetitive technology that retards development. This debate is unresolved. Moreover, it faces problems in that it tends to focus on final products and maintenance logistics, rather than learning and competitiveness.

Learning and mastering core technology means developing the capability to 'manage' it - including moving to independent product and systems development. What often happens, however, is what Vo (1987) calls industry transfer, rather than technology transfer: the transfer of a little operational knowledge and some limited training of local personnel, but not enough to ensure capability transfer and technology diffusion.

In recent developments, the issue of negotiation for IT transfer in LDCs has become an important strategy. This has been pointed out by Enos and Park (1984) in their studies in technology transfer and industrialisation that having an ability to negotiate to import technology is a fundamental success than good technology selections. Drucker (1986), also, noted that the fundamental changes in the world economy had left economic theories of development behind and that comparative advantages can no longer be based on labour costs or rate commodities or minerals; instead it is exchange rates that are critical. He suggests that LDCs can no longer realistically hope to finance their development by the exporting of raw materials or by low labour costs. LDCs therefore, need to learn to negotiate the 'more complex and internationalist formula of production sharing and sub contracting' as the emerging, information-dominated 'symbol economy' takes hold. This symbol economy is founded on the electronic-based information and communication revolutions.

By contrast, Mabogunje (1989) proposes a new development strategy founded on the premise that every LDC 'has within its boundaries the two most important resources for development – productive land and the labour of its population'. He sees the development process as a country's 'application of rational thought to the mobilisation and utilisation of the two fundamental resources to improving the material conditions of its people as whole'.

In another perspective, many writers: Burton, 1992; Stover, 1984; Su, 1988; Rada, 1983; Barker, *et al.*, 1987; Walsham, *et al.*, 1988; Walsham, 1993; Patel, 1983 agree that IT deployment and use will give rise to several problems, whether resulting from the external or internal environment. The need for IT by LDCs may lead to technological recolonisation or over-dependence (Ouma-Onyango, 1997; Su, 1988; Patel, 1983 and Stover, 1984). Besides, there is concern over the inappropriate adoption of technologies as result of a transfer from one socio-economic context to another (Ouma-Onyango, 1997; Barker, *et al.*, 1987). Another problem is that computers in LDCs require large initial capital outlay and high running costs due to the scarce expertise (Sosa-Iudicissa *et al.*, 1995; Su, 1988 and Stover, 1984). The information systems in developing countries tend to be more expensive than those on the international marketplace, with little developed in-country. According to Rada (1983), the cost differential is a result of tariff barriers, the incentive of industrial policies, the fact that suppliers have to cover maintenance, and the lack of adequate skills, especially managerial ones. These countries typically lack skills and scientific education, especially related to IT. For example, there is a need for 'information analysts' rather than traditional-style systems analysts. These information analysts require 'to understand organisation structures and functions and their decision-making processes' in addition to 'modelling and statistical tools' (Patel, 1983). Most such analysts, if not all, employed by the developing countries, are expatriates. Another problem faced by the developing countries is surplus labour force, resulting in unemployment, which in turn leads to resistance to the use of new technology. The labour forces are also mainly relatively unskilled.

Ouma-Onyango, 1997; Mazaafero *et al.*, (1995); Rada (1983) and Walsham *et al.* (1988) all indicated that the use of IT in developing countries is limited, and most LDCs have not developed policies to confront the challenge at the different levels required (e.g. skills). Walsham *et al.* (1988), referring to a case study in the Philippines, emphasised the importance of budgetary support from the national government, viewing government commitment as vital to the 'success' or 'failure' of the information system. Similarly, Mazaafero *et al.*, (1995) indicated the need to adopt adequate policies and programmes for the use of IT efficiently in Latin America. Barker, *et al.*, (1987) revealed that due to problems of support, training and maintenance and the absence of extensive IT knowledge and a robust strategic framework, health ministers (especially in LDCs) will be vulnerable to the hardest sell, and apparently 'best' deal. He posed the question, will developing country agencies become vulnerable to technological 'lock-in'? (Barker *et al.*, 1987)

Developing countries also face problems related to their environment, resources, culture, education and their financial resources. Ouma-Onyango (1991) and Barker *et al.* (1987) expressed the belief that the provision of health services is mainly driven by the social context with the aim of political gain and accountability, but restrained by other factors which seem to impede its development or may cause it to fail in future. Walsham *et al.*, (1988) suggested that the problems of information systems development and use, especially in health, are often more severe in developing countries in terms of factors such as the current state of knowledge, availability of suitable equipment and infrastructure, a lack of financial resources, shortage of technical competence and constraints imposed by the social and political context. They criticised the tendency to see technology as a tool, socially neutral, with costs and skill requirements which are largely identifiable; the emphasis on financial rather than social or political impacts; and the favouring of short term over long term objectives (Ouma-Onyango, 1997).

Darzentas and Spyrou, (1993); Yacubsohn, (1991); Miles, (1989); Mark and Lloyd, (1988); Osiobe, (1989); Woelk, *et al.* (1987); Ruff, (1985); Tasker, (1982); Fattorini *et al.,* (1982); Gremy, (1982); Gomaa, (1982); Gomez, (1982); Acuna, (1982); Shires, (1982); Molino, (1982); Beltran, (1982); and Vallbona, (1982) have explored several problems that the developing countries face when attempting to use the computer in health care. These are lack of skills, training, education, awareness, funds, support, absence of management knowledge, poor utilisation of the technology that has been installed and the absence of appropriate pre-planning and robust strategic frameworks to accommodate this technology. The lack of sound management knowledge of this technology when used in situations of high control or centralisation has created power struggles, e.g. directed toward administrative purposes more than medical actions. In addition, they have indicated the failure to integrate the planning of the technology with the total planning, the misuse of computers causing change of power and control, and unbalanced use of the technology.

Mark and Lloyd (1988) suggested that the most important difference between the developed and developing countries regarding deployment of computers in health services is the availability of resources, which are frequently absent in the latter. They also indicated that trained staff may not exist or cannot be encouraged to work in rural areas.

According to Yacubsohn (1991) and Hilton and Quirk (1995) developing countries lack specialised staff working in hospitals as system analysts, programmers, terminal operators, computer systems and network administrators, and hardware maintenance. Yacubsohn (1991) regarded the condition of hospital infrastructure, general support and funds as poor. He also pointed out that the problem of inadequate pre-planning was noted in a conference at Nijmegen in 1988. Participants from the developing countries were buying the technology to solve their health information problems without prior planning for the technology deployment and consequently continuing planning would be difficult and costly. Therefore, the developing countries' computer decision-making was based on insufficient knowledge or poor understanding of the system and its benefits and limitations, and how to administer it (Ouma-Onyango, 1997).

Acuna (1982) illustrated the shortage of qualified staff by saying that in developed countries, the computer works 16 hours and the programmer works 8 hours, whereas in developing countries, the reverse is the case. He related the shortage of qualified manpower skills to the much greater time and cost needed to train human staff than to install a computer. He also pointed out that information in the health services should not provide technical and professional service only, but should be an integral part of decision making and strategic planning. It should be possible to reach decisions regarding the system's efficiency, the nation's use of such services and the impact of those activities toward accomplishing desired change. He also emphasised that satisfactory, timely and complete information will fail to produce appropriate benefits unless it is examined, analysed and interpreted by those responsible for technical and administrative aspects of health care procedures.

Shires (1982) believed the main factors causing problems in developing countries are restricted budgets, limited resources, and mismanagement. Beltran (1982) believed the problems of shortage of staff, lack of skills, lack of education and lack of training are even more critical in comparison to needs of more developed countries.

Vallbona (1982) acknowledged that there is incomplete awareness of the power and limitation of Health Information Systems by physicians and other health staff and pointed out that the technology requires investment of considerable capital to get it running, which developing countries lack. He also criticised somewhat haphazard pilot testing. Often, systems are implemented and later on abandoned at a high cost and with little benefit to patient care. Moreover he claimed that manual record systems are still relied on and there is little outright acceptability of automated medical record, resulting in the technology not being used to its full potential. He argued that information system networks or data banks could facilitate the integration of health care at the local, regional and national levels since governments own health systems. However, he warned that providers and health care administrators have limited ability to glean the information contained in the extremely voluminous output reports often produced by computer systems.

Darzentas and Spyrou (1993) pointed out that understanding of the system and its actors is a prime prerequisite to secure technology deployment, utilisation and development. Human factors, rather than technical factors may cause the problems facing the use of technology. They also expressed the view that a real understanding of what the new technology can really do, is a prerequisite to incorporating an Information System into the health centre's everyday operation.

Osiobe (1989) indicated that few Third World Countries (TWCs) have abstracting and indexing services that cover health and drugs-related information and the publishing industry in most TWCs is poorly developed. Also, few TWCs have biomedical journals. He cited Ruff (1985) regarding a paucity of health literature in many TWCs. He also indicated that few TWCs have national health and biomedical policies to support the development of IT and he believed funding and manpower in most cases to be entirely inadequate.

Gomaa (1983) emphasised that computerised HIS need a great financial investment and human effort. Thus, it is difficult for developing countries to set up a computerised information system. Molino (1982) believed that in spite of the possibilities offered by the technology, their practical utilisation for the benefit of medical action is still very limited. Gomez (1982) made a similar point, suggesting that computer systems are less operational in the developing countries because of deficiencies in design, technology constraints, the complexities of their health systems and human factors.

Woelk, *et al.* (1987) have emphasised the need for well-planned, organised and clearly defined health information systems and the paucity of relevant computer programmes and systems for health information in the developing countries. Tasker (1982) believed that to raise the health status of a community needs integration of all efforts to bring about the overall cultural, social, economic and political transformation of society as whole. Gremy

(1982) has referred to long confusion within hospitals, as to whether IT is an aid to hospital management or to medical action. He argues that in many countries the implementation of computer systems has been for the hospital administration more than medical action; administrations have seen information as a source of power and not been keen to share this power with the medical profession. Barker *et al.*, (1987) indicated that an unplanned approach to the deployment of information technology seemed to be extremely wasteful of resources, and to delay the full realisation of its potential. Fattorini *et al.* (1982) emphasised that the health information system must answer the needs of individuals (politicians, administrations, operators, and researchers) as well as institutions, and the kind of health information system that does this is an integrated system.

Fears have been expressed related to the transfer of the technology, its deployment, uses and the dependency on the providers, as have fears of resistance to the technology and concerns about its confidentiality (Gomez, 1982; Tasker, 1982; Vallbona, 1982; Barker et al. 1987; Acuna, 1982). Gomez (1982) argued that developing countries would suffer the problem of dependency on the providers of technologies. Tasker (1982) believed that resistance in India toward the computer occurred because computers are now less expensive and manpower more costly. Therefore, when computers were introduced in India in some public sector undertakings, there were large scale demonstrations by Trade Unions. They feared that computers would bring about sweeping retrenchment of staff, forgetting at the same time that the use of computers would generate more employment opportunities with better services to consumers. Vallbona (1982) pointed out the fear caused by the frequent failure of computers in health systems elsewhere, a pervasive fear of misuse of HISs and fear of protection and confidentiality of the data. Barker *et al.* (1987) indicated the problem of inappropriate adoption of technologies as a result of transfer from one socio-economic context to another (particularly on drugs and medical equipment). Acuna (1982) indicated that it is not enough to transfer technologies appropriate to our own problems and circumstances; we must do so by dint of common and concerted efforts.

In view of these obstacles and problems, Molino (1982) and Beltran (1982) have called for a more rational and intelligent attitude, which necessitates educating and training the society to understand and use the technology. Osiobe (1989) indicated that a database might help but needs a constant electrical power supply, a computer, software, spare parts and computer technicians to service and maintain the facility, which are unlikely to be available.

However, no one could deny the numerous benefits of computers to developing countries. Yacubsohn (1991) argues that without IS it is not possible to think seriously of having a good national health information system, as health systems need good and fast information as a basic input for health policies, health planning and programming and health control.

3.4.5. The use of IT strategy in LDCs as Competitive Advantage

In developed countries, it is part of the competitive nature of industrial operations to accept change and instability. However, LDCs' institutions are configured to resist change (Ouma-Onyango,1997).

Most the competition in LDCs appears in strategic arrangements, which eventually will not support the transfer of competitive practices into the economy as well as the development of technology (Ouma-Onyango, 1997).

According to Mowles *et al.* (1994), most of the case studies demonstrate private companies gaining new markets or competitive edge through the adoption of a strategic approach to IS/IT. However, Mowles *et al.* (1994) emphasise that it is not the technology which important, but the way it is used.

In addition, Ouma-Onyango (1997) believes that the LDCs will not have a chance to compete internationally where there is no equal information access to technology and development.

The survey of Kenya's information infrastructure between December 1987 and June 1988 (Onyango, 1988) confirmed that there was little use of competitive information in decision-making. This is also the case in other LDCs, according to Paez-Urdaneta (1989) and Sturges and Neill (1990).

3.5. Omani and UK/NHS experiences in ISD with respect to IE.

3.5.1. Introduction

In this section the researcher will evaluate the strategic planning for IT development in the UK's NHS and in Oman, by mapping it onto the IE framework discussed in Chapter Two. In so doing, he will draw on the literature on deployment of IT, the development of ISs and their strategic planning in the developed and developing countries, and in relation to Oman in particular, his own experience and knowledge. By this means it is hoped to get a clear understanding of the extent to which the strategic principles and processes embodied in IE have been adopted in the health systems under study.

The discussion examines several important issues related to the four stages of IE outlined in Chapter Two, as well as a number of other issues which are thought to be related to the philosophy and the activities in IE methodology. For each issue, the researcher will, based on his judgement and the available evidence, award each of the health systems under evaluation a score (maximum 5), according to how well that issue has been covered in the health system strategic planning of IT. In total, 17 activities are discussed, giving a possible maximum score of 85 points. Our scoring will also, depend on other points: 1) if any of the statement about the issues presented as an actual implementation or establishment, then the score is 5; if it is an attempt, then the value is 4; if it is recommended or mentioned etc., then the score is 3. But if there is evidence of failure, then 2 points are subtracted; if there is a negative statement other than failure, then one point is subtracted from the score. At the end of this section, the scores of the NHS and Oman methodologies will be summarised in a table, to give an indication of the level of adequacy of the approach adopted in each case.

3.5.2. Information strategy planning (ISP)

IE recognises that ISP is the basis of designing an information system to meet the organisation's requirements. IE regards the information system as strategically important to the organisation. Therefore, the plan should indicate the business goals and strategies, outline the major business functions and their objectives, and identify the organisational structure. In addition, this plan should be in quantitative terms with priorities between objectives established.

ISP is a joint activity of senior general management, user management and information system staff, and needs significant commitment of all these people, and their time. It also ensures to reduce the resistance that may influenced by the introduction of this technology (Finkelstein, 1992). The ISP stage can be broken down into several tasks:

1.A) ISP begins with determining the goals and strategies of the organisation. In the UK, the Department of Health has attempted to define the goals and strategy to produce a national information framework for local investment decisions on IT systems, to minimise waste. In addition, there have been many reforms related to health and IT development. According to Connolly and Huckerby (1998), the Department of Health attempts to ensure that it collects the information required to support its objectives in the most effective and cost-effective way. However, NHS information policy is the outcome of a variety of different policies, each with their own objectives and explicit or implicit effects and lacking internal consistency.

In the case of Oman, there is little evidence of the goals and strategic planning of the organisation being integrated with those for IT/IS situation, although, IT/IS may be presented in the agenda as an issue, which needs to be dealt with.

Based on the above, the NHS is awarded 4 points and Oman, one point, for their dealing with issue.

1.B) ISP identifies the organisation structure by analysing and documenting objectives, functions and information needs, and setting priorities, which provide the rationale for the development of the information system. The majority of hospitals and general practices in the UK have now established their own management structures through hospital trust or GP Fundholding practices. This is regarded as a major achievement of the NHS reforms and can be interpreted as an extension of the desire to establish effective management structures within the NHS which began with *The Griffiths Report* (HMSO, 1983). These proposals stressed the need for a clearer delegation of responsibility and accountability in the process of allocating health sector resources. In this context, there are many HIS used by the NHS. For example, HISS is integrated systems, which supply computerised information support facilities for most hospital functions, using a common MPI as the focal point. Data need be entered only once and information can be supplied from a common data source to all levels of the organisation.

Oman reflects the situation typical of developing countries where their organisations' structure is not well established with respect to responsibility and accountability (Walsham *et al.,* 1988 and Ouma-Onyango, 1997). There is more emphasis on financial rather than social or political impacts, and the favouring of short term over long term objectives. Skills and education related to IT are lacking. There is a lack of 'information analysts' who 'understand organisation structures and functions and their decision-making processes' in addition to 'modelling and statistical tools' (Patel, 1983). Such analysts as are available are mostly expatriates.

It seems that the NHS has made effective efforts to identify the organisation structure and its integrated information. Therefore, we will award the NHS five points. But, in the developing countries there is a lack of consideration of the total structure and skilled personnel lack knowledge of environment structure. Therefore, we will award Oman one point.

1.C) ISP implies that information systems are of strategic importance to the organisation.

By the end of the 1970s, information was recognised in the UK, as a fundamental resource of business and by the mid of 1980s, the role of IS in business emerged as a strategic one and IS professionals gained in status accordingly. Interest has grown in the NHS in the development of strategy for IT/IS to help in making information a strategic resource, reducing expenditure, and using information technology as a competitive weapon.

The main strategic aims of LDCs from acquiring and using information technology are to probe the environment, identify new threats and challenges, and respond in a creative way to new circumstances (Dedijer and Jequier, 1987).

Evidently, some developing countries recognise the strategic importance of information systems. However, this is not the case in Oman, where the aim of using IT/IS is simply to reduce the workload. Therefore, we will give four points to the NHS and one to Oman.

1.D) One of the main aims of IE's ISP phase is to enable the organisation to gain competitive advantage over its competitors (Brathwaite, 1992).

There is an increased recognition of how technology can bring competitive advantage to enterprises by building barriers against new entrants, changing the basis of competition, tying-in customers, switching costs and creating new products and services. In spite of the introduction of the internal market, the NHS up to now is not geared toward this kind of competition. The internal market is meant to be co-operative, rather than competitive behaviour.

However, a report by the Kobler Unit at the University of London's Imperial College (Hochstrasser and Griffiths, 1990) lists findings from a range of studies which show negative results of the use of IT in health care and one of these is that IT seldom leads to sustainable competitive advantage.

As the forgoing review for the literature has shown, there was little use of competitive information in decision-making in LDCs, and Oman is no exception.

From the above it is clear that there is little use of technology for competitive advantage per se, in NHS and none at all in Oman. Therefore, the scores awarded are two points to the NHS and none to Oman.

1.E) ISP seeks to determine the problems the users have with the existing systems and how well these systems support the functions of the organisation (Finkelstein, 1992; Brathwaite, 1992). This will determine what systems should be replaced immediately, which ones can wait and which ones should be upgraded or modified. In contrast, when IT is introduced without such a methodology, these are not specified and the tendency is just to change everything and wait for the new problems.

In most cases, if not all, the impetus for deploying or updating an information system is the problems with the existing system.

For example, in the 1980s, many hospitals in the NHS had implemented patient administration systems, computerised personnel, payroll and financial accounting systems, and had developed stand-alone computer systems to support hospital departments such as pathology and radiology. These systems did not, however, meet all of the hospitals' needs and had significant limitations. Problems may also arise from discrepancies between the information collected in these standalone systems and that available in corporate systems. The literature identifies a number of problems (see Chapter 2 & Chapter 3.2).

In developing countries, in addition to the above problems, a common problem has been the unrealistic pursuit of costly hardware acquisitions without proper consideration of the extent to which, and the ways in which information is already used.

In Oman the difficulties and problems facing the deployment and the use of computer systems are enormous (see Chapter 2 & 3.3). Computer system modules were being implemented without proper testing, since problems were being faced by the users and these were not being rectified in a timely manner. And since there was inordinate delay on the part of OCS in implementing other modules, intervention was required by H. E. the Under-secretary and by the Director General.

This issue until now has not been resolved. Therefore, we may give the NHS two points and Oman one point.

1.F) IE regards the joint activity of senior general management, user management and information system staff in ISP as important to the success of the project.

However, in many cases, the situation in practice is different. It has often been the case in the NHS and developing countries that the people implementing the systems were programmers who did not have a good knowledge of the business functions and were not good communicators. The top management is often too busy to participate in system design or to attend training or meetings on project development and implementation. This may cause frequent dissatisfaction.

Similarly, in Oman, there is no joint activity what-so-ever, between senior managers and IT staff. In addition, all IT projects are planned and implemented and, for the most part maintained by the suppliers.

We can see that joint activity of this kind has been lacking in the NHS, and even more so in Oman; therefore, they are given scores of three points and two points respectively.

1.G) A strategic systems development project, whether for strategic planning, or for system development, or both, is in IE expected to require a significant commitment of people and time (Finkelstein, 1992; Brathwaite, 1992).

One of the fundamental strategies adopted at the Wirral was to secure the co-operation of senior staff and reduce the feeling of remoteness which, he argued, characterises so many NHS hospital systems. Therefore, the successful operation of such a system and its strategy depends on commitment on the part of management, medical and nursing staff (Spours, 1993; Peel, 1995).

With respect to developing countries, commitment is poor as seen earlier. However, another important requirement is budgetary support from the national government, which is viewed by Walsham *et al.* (1988), as vital to the 'success' or 'failure' of the information system.

Therefore, the issue of commitment is related to the earlier result and there is little evidence of such commitment. The NHS and Oman, therefore, are each awarded one point.

1.H) Technology transfer may cause resistance to changes, which may affect individuals or groups or departments (Finkelstein, 1992; Brathwaite, 1992). Therefore, there is need to look at factors that may help to reduce this tension, because resistance may lead to abandonment of the computer, especially if it comes from the senior management (Avison and Fitzgerald 1995).

The resistance to the technology in NHS may result from many factors, such as: increases the power attributed to some groups, while reducing that of others (Hewett, 1986); the need for skills which may require training and change the status of many employees; and the fear that the technology may dominate the professional works and may cause time to be spent using the computers instead of on employees' traditional tasks.

In the developing countries, also, they face a similar situation. In addition, resistance may be caused by the surplus labour force, resulting in unemployment, which in turn leads to resistance to the use of new technology.

The labour forces are also mostly relatively unskilled.

However, recently there has been more awareness of this problem and activities to help in solving it, for example the establishment of IM&T strategy in the NHS. Therefore, we will give 4 points to the NHS and 2 points to Oman.

3.5.3. Business Area analysis

The business areas identified in the information strategy plan are now treated individually and detailed data and function analysis is performed. Maximum involvement of end-users is recommended (Finkelstein, 1992; Brathwaite, 1992).. Therefore, awareness is important at this stage. Also, in this phase, there are many technical tasks (see Avison and Fitzgerald, 1995), of which we will select two examples to discuss here beside the awareness. These are 1) current system analysis to ensure the smooth transition from the old system to the new one; 2) examining the hypotheses concerning business changes.

2.A) The IE methodology attaches importance to ensuring that all users are aware of the new system implementation date and its benefits, often by education and training (Finkelstein, 1992; Brathwaite, 1992).

In the NHS, IMT training focuses on three areas, one of which is information awareness and usage. However, the lack of awareness amongst hospital staff and senior managers is said to be one reason for the slow take-up of integrated systems.

In the developing countries according to Vallbona (1982), there is incomplete awareness of the power and limitations of Health Information Systems among physicians and other health staff. In the Omani case, there is a complaint from the users that many of the staff are surprised by the implementation of the system. Therefore, three points are given to the NHS and two points to Oman.

2.B) Many organisations need to update or change their old system, though, many obstacles and difficulties could hinder this process. One task of IE's business analysis phase is to ensure the smooth transition from one system to the other by using entity-relation models.

The NHS's hospitals implemented their computers on a departmental basis and these systems were not linked. As a result, hospital staff could not pass information easily from one system to another and often had to spend time entering the same information into separate systems. In addition, the literature pointed out the resistance by the users to change their fear and to learn the new system.

In the case of Oman, although it has been decided that all secretaries' PCs should be linked to the main system, so they can be used as a network and also work in stand-alone mode, the work has still not been done. It was also decided that all the PCs which are in the network should have Microsoft Office installed in them so that the user will have only one computer with all the facilities as a network computer or a stand-alone for doing office work. OCS has not yet done this work. Thus, at present, certain users have three computers on their desk, one for WANG, one for SUN and another for office work, none of them compatible with the others.

It seems that the NHS has not always not linked systems but there is an attempt by NHS to integrate health information systems. In the case of Oman, it was not able to ensure the smooth transition from one system to the other. Therefore, we will give four points to the NHS and two points to Oman.

2.C) IE requires examination of the hypotheses that concern business changes, to see what effects these might have. The literature provides evidence of changes resulting from IT introduction to different organisations and countries.

For example, Rae and Dewhurst (1995) believe that an integrated system requires change in the working practices of the health professionals, which will bring benefits in terms of increasing productivity of medical records, nursing and clerical staff, though idea has faced certain practical difficulties (Chapter 2 & 3.2).

Connolly and Huckerby (1998) claim that change in the procurement system in the NHS has left the system in more disarray than ever before. They indicate that the cost of new technology introduction and the advantage of possible management economies are unknown.

With respect to developing countries, WHO (1988) emphasises that developments in national health informatics have implications for education and training of health professionals and the evaluation of IT's impact on health services. In addition, there is a need for IT strategy to improve the communication and collaboration among managers, informatics professionals, and end-users of information.

It is the researcher's impression that the NHS has paid more attention than Oman to such issues. Therefore, the NHS gets 3 points and Oman, two points.

3.5.4. System planning and design

This stage is divided into business system design and technical design (see Avison and Fitzgerald, 1995). In this phase there are many tasks, which do not concern us here; just two of them will be discussed here. They are: 1) Preliminary data structure design, in order to ensure integration and compatibility for all systems in the business area (Finkelstein, 1992; Brathwaite, 1992) and 2) System test design, which includes the definition of system tests and acceptance tests.

3.A) One of the tasks of IE's System planning and design phase to ensure the integration and compatibility of all systems in the business area.

In Health systems this integration would mean linkage of the hospitals, labs, and pharmacy management and administrative functions with the central organisation.

An important issue is the integration of patient records or computer health systems, which has to some extent hindered the development and deployment of the computer in health systems. Hughes (1992) indicated that the lack of comprehensive integration, at even the most basic level, may lead to the situation where systems developed in isolation cannot communicate, data is duplicated and inefficiency and ineffectiveness are the presenting characteristics. Furthermore, the take-up of integrated systems is constrained by several factors, including the capital costs, lack of awareness amongst hospital staff and senior managers, and long timescale before benefits are achieved, the complexity and risks of implementation, and the fear and uncertainty associated with these factors.

However, in spite all of these obstacles, there is a serious attempt by the NHS to resolve such issue. According to Frank Burns (1998) who has been given the key task of reviewing the IM&T strategy for the NHS, the messages he has received from his discussions with personnel from the NHS (see section 3.2) are all aimed at provision of an integrated approach to the management of information and the development of the computer systems and work processes. In this respect, all specialists should have systems to support medical audit, and all hospitals should have links

The NHS's new information management and technology (IM&T) strategy advocates a set of linked policies. All information systems should be person-based, because care must be focused on the needs of individuals and integrated across the healthcare organisations with which they come into contact. If information is person-based, data need only be entered once and can be shared easily between organisations, minimising the data entry required.

Fattorini *et al.* (1982) emphasised that the health information system in the developing countries must answer the needs of individuals (politicians, administrations, operators, and researchers) as well as institutions, and the kind of health information system that does this is an integrated system, which is not available now. Furthermore, finance for Omani health system handled by Ministry of Finance, as the case in most Omani ministries. Moreover, the administrative activities are also separated from the health information systems.

We could see that the NHS gives considerable consideration to this issue, while in the developing countries, especially Oman, it does not receive enough consideration. Therefore, the NHS receives four points while Oman receives one point.

3.B) The IE methodology enhances the information system's capability for sharing data among executives and departments (Finkelstein, 1992; Brathwaite, 1992), while piecemeal systems development leaves many organisations with numerous non-integrated, inflexible information systems.

This issue has been realised as an important issue in the NHS, because of the nature of the quality and the delivery of health services. The current trend is to make information systems person-based, so that data need only be entered once and can be shared easily between organisations, minimising the data entry required (IMGME 1992).

In the developing countries, this issue is of particular importance (see Chapter 2 & section 3.2. & 3.3.). Attention is being paid to it, for example, through the use of Satelife and its electronic network, HealthNet, to make communication links among physicians and allied health workers in the developing world. Satelife has developed the technology to provide inexpensive e-mail messaging services to the developing world. This allows health workers to correspond and share information with colleagues in their own regions, as well as abroad. In addition to e-mail services, Satelife provides off-line access to a range of current health information including articles from respected medical journals and databases (Mullaney, 1995).

However, such developments are still far from being used by the Omani health information systems, because no plans of this kind have been discussed yet.

It seems the importance of this issue is recognised and steps are being taken to address it and Oman sooner or later will be influenced by the activities in the other developing countries. Therefore, we will give four points to the NHS and two points for Oman.

3.C) The other task of IE's System planning and design phase is system test design, including the definition of system tests and acceptance tests.

In the Oman HIS, modules were implemented without proper testing. Problems faced by users were not rectified in a timely manner. In addition, there was inordinate delay on the part of OCS in implementing other modules. Therefore, intervention was required by H. E. the Under-secretary and by the Director General. OCS subsequently took action to change the Project Manager and rectify some of the user's problems and the Ministry accepted the proposal of OCS to convert the modules from character base to graphic user interface.

Vallbona (1982) has criticised haphazard pilot testing, whereby often, systems are implemented and later on abandoned at a high cost and with little benefit to patient care. This kind of system test is used by most of the developing countries when computerising business and services.

Again, Oman failed to carry out the necessary system tests and acceptance tests. However, with respect to NHS and according to the literature and FHSA, most computer systems are tested comprehensively. Therefore, Oman receives one point and the NHS receives four points.

3.5.5. Construction and cutover

This includes construction, cutover and production (see Avison and Fitzgerald, 1995). In this phase there are many tasks, of which we will discuss the following: 1) System generation of models; 2) Preparation: which includes the training of users and the installation of hardware and 3) Technical support to ensure that service is maintained and that changes in the business requirement addressed (Finkelstein, 1992; Brathwaite, 1992).

4.A) Business knowledge models obtained from experience, from the users or users' documentation, from briefing by the analyst's managers, or from other knowledge sources, are crucial to the development of effective business systems designs.

We have commented earlier in this section on the tendency of separation between technical staff on the one hand and users on the other, resulting in tendency to focus on the technical issues while relatively ignoring the social and political processes inhibits understanding the complexity of ISD. This applies to both the NHS and Oman, so one point is given to each of them.

4.B) Training and installation: The organisation may not be prepared to support the new technology. The IE methodology ensures there are adequately trained personnel to operate the technology and to respond to solve problems as they occur.

Rathwell *et al.* (1983a) described the training and education needs of the NHS as in a state of crisis. 72% of NHS districts were of the view that a more co-ordinated programme of training was required for NHS personnel. In NHS IM&T project includes a strategy for training and staff development in IMT, with particular reference to priority learning needs and target groups. The focus is on the need for IMT training in three areas, among them the information awareness and usage.

Vo (1987) noted that in the developing countries, technology transfer often entails some limited training of local personnel, but not enough to ensure capability transfer and technology diffusion. Similarly, Pakenham-Walsh and Priestley (1997) pointed out the lack of trainees and training programmes in information technology in the developing countries.

In many cases of the NHS and developing countries, particularly Oman, the suppliers offer training but at a high cost and not enough to meet the need.

The result here showed that both NHS and Oman suffered from a lack of training. Therefore, we will give two points to each.

4.C) Technical support: such as 1) Software installation; 2) Application of PTFs; 3) Software Maintenance; 4) Performance tuning; 5) Backup and Recovery; and 6) Utilities Maintenance. The most important aspect of the technical support is maintenance.

By the late 1960s, most large corporations had acquired big mainframe computers, and further concerns emerged, such as high maintenance costs, inflexibility of systems and slow response time, and the apparent inability of the computer departments to satisfy users' needs. However, the issue of maintenance stills causes a heavy cost to organisations (see Chapter 2 & section 3.2).

For example, Spencer-Jones (1993) highlighted Ashworth Hospital's need to deal with the disarray of maintenance contracts.

According to Rada (1983) suppliers usually have to cover maintenance in the developing countries. Rada (1983); Yacubsohn (1991), and Hilton and Quirk (1995) have all noted that developing countries lack specialised staff working in software and hardware maintenance.

This problem in Oman has proved very costly. The initial purchase price of the Gerber Alley system of the Sultan Qaboos University Hospital (SQUH) was RO 300,000. Currently, the Hospital spends money directly and indirectly on maintaining this system. The direct cost in terms of maintenance money paid is around RO 9,000 per month for the maintenance of the software and hardware and ensuring the smooth operation of the system. The same applies to the Royal Hospital. With respect to the evaluation, we may give NHS two points and Oman also two points.

Table 3.1 shows the total scores for NHS and Oman with respect to the evaluation of their experiences of the introduction and the development of information systems, to give an indication of how that experience compares with the recommendations and principles of IE. This will contribute to a later critique of this framework with respect to the fieldwork.

Table 3. 1: Present IE process for ISD compared to NHS and Oman experiences.

No / Phase	IE methodology	NHS meth	Oman meth
1/1	IE ISP phase: determine the goals and strategies of the organisation.	4	2
2/1	IE ISP phase: identify the organisation structure.	5	1
3/1	IE ISP phase: IT/ISs are strategic importance to the organisation.	4	1
4/1	IE ISP phase: provide a competitive advantage.	2	0
5/1	IE ISP phase: determine user problems.	2	1
6/1	IE ISP phase: ensure joint activity of senior management, user management and IT staff.	3	2
7/1	IE ISP phase: seek significant commitment and time from senior management, user management and IT staff.	1	1
8/1	IE ISP phase: deal with resistance of IT.	4	2
9/2	IE BA phase: ensure the awareness of system deployment.	3	2
10/2	IE BA phase: makes smooth transition from one system to the other.	4	2
11/2	IE BA phase: examine the hypotheses that concerned business changes to see what effects these might have.	3	2
12/3	IE SP&D phase: ensure integration and compatibility for all systems in the business area.	4	1
13/3	IE SP&D phase: ensure that the system capable of sharing data.	4	2
14/3	IE SP&D phase: ensure system test design & acceptance tests.	4	1
15/4	IE C & C phase: seeks business knowledge models.	1	1
16/4	IE C & C phase: preparation of cutover schedule, to ensure training of users.	2	2
17/4	IE C & C phase: technical support for maintenance of software, hardware and utilities.	2	2
	Totals Divided by the total of 85 points	52/85 = 61%	25/85 = 29.4%

3.6. Conclusion

Clearly, the interest has grown in the use of strategy for IT/IS to help in making information a strategic resource, reducing expenditure and using it for competitive advantage.

In the case of NHS, some important features of the attempts of the NHS to formulate and use IT/IS strategies are: 1) changing the attitude and organisation structure; 2) deploying the system after extensive research and evaluation processes; 3) gradual, piecemeal adoption and planning for IT strategy; 4) a change in the management's old style thinking being brought about with the help of IT strategy.

However, in many cases, NHS plans or attempts were not based on a clear vision or particular methodology. Nor were their attempts free of difficulties, such as high expenditure, but they showed determination to solve these difficulties. In spite of the use of the internal market and information technology, the NHS has not yet turned it to competitive advantage.

In the case of developing countries, the need to make strategy for IT/IS is more important, as there are severe shortages in skills, management competence and funds. However, the attempts of developing countries in this respect failed to produce the right strategy and policy as to why and how they could use IT/IS. In addition, they make no use of IT for competitive advantage. Rather, most the competition in developing countries appears in strategic arrangements, which ultimately will not support the transfer of competitive practices into the economy as well as the development of technology.

The result of the mapping of the NHS and Omani experiences of the introduction and the development of information onto the recommendations and principles of IE revealed deficiencies in the methodologies adopted by both systems. This finding may contribute to a later critique of NHS and Oman methods in strategic planning for and deployment of IT/ISs.

From this chapter, it is hoped we have gained some insight into the attempts to acquire IT and use it strategically, and also what obstacles could be expected from deploying IT and pursuing its strategy.

The next chapter will present the two case studies and the background of computer deployment in NHS/GPs and the Omani health system.

4. CHAPTER FOUR: NHS/GPS AND THE OMANI HEALTH SYSTEM AND THE USE OF COMPUTERS

4.1. Introduction

Two main case studies are covered in this study. These cases reflect two different environments (NHS/GPs representing a developed country and the Oman Health System representing a developing country). This chapter provides a description of each health system, and discusses their deployment of the computer.

The first section discusses the main elements that have influenced the NHS health information system. Fundholding GPs and the role of the East Riding Health Authority (ERHA) in Humberside are considered. It then discusses in detail the GPs' attempts at computerisation, focusing on one particular practice that has installed computers. This includes an update on the changes that have occurred since the case study in the Humberside investigation took place.

Section two describes in detail the Omani Health System (OHS), and the status of the two Computer Systems of Royal Hospital and Sultan Qaboos University Hospital (SQUH). Again, account is taken of changes that have taken place since the original investigation.

4.2. NHS and General Practices

4.2.1. The Development of NHS Information

The many problems present in such a complex structure as the NHS, with a huge administration, the increase of information and advances of technology, and the NHS realisation that only a limited amount of the data collected was actually used, resulted in the appearance of three notable studies: 1) the Korner reports (1982), 2) the Griffiths report (1983), 3) the National Strategic Framework for Information Management in the Hospital and Community Health Services (1986). Also, the NHS has been undergoing a programme of reforms more fundamental then any experienced since its inception in 1948. These reforms are being introduced in a short space of time to avoid unnecessary delay.

All these studies were designed to improve NHS management information, to enable management efficiently and effectively to plan, provide and review services to patients. NHS managers have realised the importance of the production and use of information and this has become a top priority on their agenda, reflected in the NHS budget allocated to IT, which is now over £220 million a year (Peel, 1997).

In spite of a political clash as to whether the NHS should stay under government control or become privatised, questions of mismanagement and new legislation and contracts, the NHS remains unique in providing health care for all people in the UK and searching for the best technology and methodology for progress, not just in curing illness, or helping to deal with disabilities, but in emphasising what can be done to prevent problems in the first place. Among these efforts have been quick reactions to solving the increase of information problems with several reforms and allocation of budget which, it is hoped, will ultimately benefit patients' health as well increase management effectiveness.

Since the inception of the NHS in 1948, it has provided a unique service and become a keystone of the welfare state. However, the government identified a number of interlinked problems such as management competence, the absence of incentives for efficiency, the lack of responsiveness to consumers and the need for more developed responsibility that required fundamental organisation changes. These changes appeared in a White Paper, Working for Patients (Department of Health, 1989a) and eventual legislation the NHS and Community Care Act 1990 which altered the structure and functioning of the NHS.

It appeared that in the UK the privatisation was not feasible, because of political support for the NHS. Therefore, attention has focused on developing a strategy, which actually has been adopted by many different countries, i.e. to apply or restore market principles to formerly publicly financed and publicly provided health care systems (see Chapter 2).

4.2.2. The Role of the FHSA

Humberside Family Health Services Authority (FHSA) is part of the NHS. Formerly entitled the Family Practitioner Committee (FPC) the FHSA is the statutory body responsible for managing the services provided by family doctors, dentists, pharmacists and opticians throughout the county of Humberside. FHSAs became independent authorities in 1985. Their role has been expanded to include assessing local needs for family health services, planning and developing services to meet those needs, and new responsibilities for indicative prescribing, GP Fundholding and medical audit. FHSA management has been strengthened to take on those tasks by the introduction of general and other senior managers, computerisation, significant growth in FHSA management budgets and, in common with other NHS authorities, more streamlined membership. As a result, FHSAs are now fully established NHS authorities in their own right and have become equal partners with DHAs in health care provision (Ham, 1997; NHSME, 1990; Wiles, 1986).

The aim of the FHSA is to ensure people receive better quality treatment and good care in doctors', dentists', pharmacists' and opticians' premises. This involves such activities as the following: a) continually looking to improve services; b) planning changes together with GPs, dentists and opticians; c) considering where new surgeries and pharmacies should be cited and whether there is a need for more staff be made available; d) paying the fees which cover the expenses associated with their business so that good quality services can be made available; e) supporting education and training of staff; f) offering grants to doctors to improve the standards of their surgeries; and g) working closely with other health authorities and social services to link the family health services with the care and treatment that these agencies provide. It also involves conducting consumer surveys to monitor local feelings about local services. Looking into complaints is regarded as an integral part of the FHSA's role, as well as ensuring, wherever possible, that agreed patients' charter standards are adhered to. Health promotion, issuing medical cards, exemption certificates, payment certificates and information leaflets, in short, any aspect of primary care (that means services provided by doctors, dentists, pharmacists or opticians) is the FHSA's concern. (Annual Report, 1993-94; NHSME, 1992).

The Humberside FHSA spent almost £143.8 millions of public money on the provision of services to the residents of Humberside in the year ending 31 March 1994 (see table below).

Table 4. 1: FHSA expenditure distribution on health services for Humberside residents

Management		2,346.7
General medical services:		
- cash limited:	8,057.3	
- non-cash limited:	31,809.1	
Total		39,866.4
GP Fundholding		51,347.0
Pharmaceutical Services		46,342.6
Dental Services		130.0
Ophthalmic Services		3,741.6
Total Expenditure		143,774.3

Source: Annual Report, 1993-94.

4.2.3. General Practice in NHS

General practice (GPR) originally consisted of individual doctors working at home and dependent on their families' help. The situation has developed, however, so that now there is a network of independent group practices. The General Practitioner (GP) is the provider of Primary Health Care (PHC). They are responsible for some 90% of NHS patients and they manage over 90% of all illness episodes (Jarrold, 1997). The realisation of the importance of this group has been reflected in many events, including the establishment of the NHS in 1948, the foundation of the College of General Practitioners in 1952, the vision put forward by doctors such as Hunt, Taylor and Scott (Fry *et al.*, 1983), and the General Practitioner Act 1966. This embraced wide-ranging changes in funding and terms of service of family doctors, and was a major turning point in the fortunes of general practice. By the 1970s, general practice was more comfortable in financial terms, and in terms of professional standing and self esteem. It continues to grow and to adjust to the public health need (Ritchie, 1986; NHSME, 1992).

GPRs' influence over secondary care provision and the new contract may be regarded as powerful instruments for strategic change in the NHS, particularly in emphasising the important role of health promotion and disease prevention. More than 80% of GPs are achieving vaccination and immunisation and cervical screening targets, 53% are participating in the new child health surveillance arrangements and over 250,000 health promotion sessions have been held covering, for example, well-person, hypertension and diabetics screening, diet and exercise, smoking and alcohol control. In addition 68% of GPs have been approved to provide minor surgery (ibid.).

4.2.4. Fundholding

The introduction of the fundholding scheme into general practice in 1990 has been regarded as the most radical change in the structure of primary health care delivery in the United Kingdom. The scheme gives fundholding practices the power to buy health services, which was not the practice prior to 1990 (Gosden and Torgerson, 1997). This scheme gives GPs the chance to make decisions about how NHS money can best be used in order to meet their patients' needs in the most effective way and gives them direct control over a range of secondary care resources. Actually, the main aim of this scheme is to improve the efficiency of resource allocation to general practices and their patient care. For this, it is first necessary to set a fair and accurate budget, for which the process of collection of accurate patient activity information is essential. With more and more fundholding practices challenging hospitals to provide better services, waiting times are being reduced in many geographical and medical areas. Almost 40% of fundholders now have consultant clinics in their surgeries. Nationally, fundholding practices are currently being canvassed by the Department of Health (DoH) for their views on extending the scheme still further (HFHSA, GP Fundholding, 1994; Yorkshire Health Information Services, 1992; HFHSA Annual Report, 1993-94; NHSME, 1992).

To be eligible to become a fundholder a practice must be capable of fulfilling the following criteria:

A) Well organised and with management capability, administrative and financial skills and availability of information technology;

B) Well motivated, i.e. full commitment of all partners; and

C) Viable size: at least 7,000 patients.

Joining the scheme, means taking on certain additional responsibilities, e.g.:

1) Fully computerising patient records for management information purposes;

2) Setting out an annual practice plan detailing objectives, business plans and purchasing intentions;

3) Making reasoned choices for the benefit of patients and constantly monitoring, controlling and containing expenditure within allocated resources (the budget);

4) Monitoring providers' performance against contracted volumes and quality of service;

5) Keeping patients informed of developments;

6) Providing information as required for official monitoring and other relevant purposes;

7) Producing annual accounts that will be audited.

Humberside is making steady progress in the field of expansion of the number of fundholding practices. Current figures locally are as follows: 587,500 of population were registered with general practices, of which 361,754 of them were covered by 43 fundholders, representing over 61% of the whole population registered with GPRs (ERHA, 1997 and HFHSA Fundholding, 1994).

The recent developments that have been observed related to GP Fundholding resulted from some research on GP fundholding. There are no formal monitoring structures and the GP fund-holding schemes were introduced along with a number of other changes in primary care, for example, changes in the GP contract. Nonetheless the work by Glennerster *et al.*, (1994) suggests that GP fundholding has led to more efficient practices than those in non-GP found-holders. Fund-holders have managed, for example, to keep prescription costs down. In 1992/3 the national prescription budget increased by 12%, while for fund-holders the increase was only 8%. Fund-holders tended to have better information and, according to survey, expressed stronger motivation to improve service delivery. Against such improvements there has been a fear that GP fund-holders refer fewer patients to hospital in an attempt to reduce costs. However, a study by Coulter and Bradlow (1993) found no evidence that this was the case. Baines and Whynes (1996) assessed whether any presumed efficiency displayed by fund-holders could be as a result of self-selection. They found that this could indeed be the case as fundholding practices were more likely to accord with a number of quality criteria defined by the government and relating to characteristics such as cost control on prescribing and the attainment of service targets. In addition, the Audit Commission (1996) had just published a report which found that some £200m of efficiency gains had been more than offset by the costs of running the GP fundholding scheme.

4.2.5. Computers in General Practice

4.2.5.1. History of Medical Records in General Practice

The Rolleston Committee was established in 1920, to look at the form of record to be used by general practitioners, with the objective of helping doctors to improve the quality of care for their patients. The committee recommended the Medical Record Envelope (MRE), like Lloyd George's National Insurance card in its form and size.

After this period, many suggestions were put forward, but never implemented. However in 1967 after the initiative of London and colleagues (Hawkey *et al* ,1971) a DHSS- supported introduction of A4 records took place in two practices at Wantage. This method became favoured in general practice. However, a major study by Cormack (1971) of 168 general practitioners, showed that 80% of general practitioners were dissatisfied with the available method of keeping records. He concluded the need for sufficient size to accommodate the background and other important information about the patient. In the meantime, discussion continued in literature on the relative methods of MRE and A4 records. Tulloch and Cormack (1981) favoured A4. Others, like Walker (1981) and Tomson (1981), have argued that A4 records are not a *sine qua non* of systematic recording, through most authorities are agreed that A4 records are superior (Ritchie, 1986).

Therefore, various methods have been developed to improve the utility of manual records, notably the summary card; the E,L,W and F books; Age-sex register. However, all of these except the age-sex register have been ignored by the vast majority of general practitioners.

The appearance of the computer adds a further dimension to the continuing debate. It offers the perfect solution to all the problems of recording of details of patients' medical history and information related to the general practice management, as indicated by the report of a Working Party, charged in July 1987 with the task of reviewing the rapidly advancing computer technology, and making recommendations for its possible application in general practice. They found the manual record lacking in almost all of the following 13 attributes considered desirable for a general practice record information system, all of which could be managed very well by the computer: (Sheldon and Stoddart, 1985; Ritchie, 1986; Malcolm and Poyser, 1982):

1- The record system must be readily acceptable by doctors so as to facilitate and encourage the provision of a high standard of patient care.
2- The record must be stored in a manner which fully satisfies the demand of confidentiality.
3- The method of storage and transmission of the record must ensure that there is negligible risk of losing it temporarily or permanently.
4- The contents of the record must be readily accessible, legible, and easily updated by a doctor working under pressure.
5- It must be possible to remove redundant information and, if desirable, to summarise it quickly and easily during normal use of the record.
6- The system must be of adequate capacity for the storage of a lifetime record of relevant information for every patient.
7- The whole or appropriate parts of the record should normally be easily available whenever required.
8- With the total exclusion of any patient identification particulars, the system should be capable of providing accurate data for health service management at district, area, regional, and national levels.
9- Similarly, the system should facilitate clinical and organisational research.
10- A record must be rapidly and securely transferable when the patient registers with a new doctor.
11-The record must assist practice management.
12-The system must be capable of adaptations to provide new functions.
13- It must be capable of use throughout the HS.

The computer provides the means to manipulate, analyse and search the records, making it possible to carry out normal administrative tasks a great deal more quickly and easily than using conventional methods. The ability to retrieve and manipulate information more quickly and accurately creates the potential for increased understanding of trends within a practice's patient population, and making improvements to the care provided for individual patients, as well as increasing the possibilities for education and research.

4.2.5.2. The Early General Practice Experience of Computer Use.

Ritchie (1986) reports that the first documented instance of computer use for preventive medicine in the United Kingdom (UK) was by Galloway (1963), though Robertson (1968) appears to have been one of the first general practitioners to review the potential use of computers in general practice and he made a reference to Galloway's immunisation document. In the same year, Abrams *et al.* (1968) provided the first description of a GP information system for a health centre. Dinwoodie (1969) described computer use for morbidity recording in his practice. One year later, he underlined the main difficulties: data volume, the cost, accuracy and security of the storage. At that time, many doctors who had experience with the use of computers experienced some difficulties and cost problems. Marinker (1968) and Grene (1969) debated the potential obstacles to use of computers in general practice. And in 1971, Dinwoodie and Grene brought up the subject of cost-effectiveness (Ritchie, 1986).

In 1971 Barber reported analysis of information collected in his practice over a period of one year and found the information was of value for practice management and the forward planning of medical service requirements. Others feared that computers might thrust the doctors into spending more time on administrative issues rather than spending it with the patient. However, Metcalfe and Reid (1982), following on from the work of Byrne and Long (1976) on variable behaviour in the consultation, reported that the moment the doctor turns away from the patient to the notes, the exchange of information and its quality changes. In contrast, the computer system might actually take less time and will display many different functions without impinging on the doctor/patient relationship. The Metcalfe and Reid research suggested that doctors should change their behaviour toward the computer system to gain its benefits and to develop it (Ritchie, 1986).

Most of the computer experiments in the early '70s were, however, batch and not real-time, which accounts for their shortcomings. Moreover, computers at that time were more expensive than they are today (Malcolm and Poyser, 1982).

4.2.5.3. The Recognition of the Computer in General Practice

The above information shows the early interest in computers by general practitioners. Later, in 1978, interest at corporate level was shown by the Royal Computing General Practitioner (RCGP) and the Computing Working Party. This interest resulted in the issue of a report by the RCGP (1980), soon followed by the document, "*Computing in General Practice*" (Palmer and Rees, 1980), which provided guide-lines for a more unified approach, a list of recommendations and also advocated a careful, phased introduction (Ritchie, 1986).

As a result of attention given to the use of IT in Primary Health Care (PHC), in early 1980, GP-INFO-80, a highly successful symposium on the use of computer technology in PHC, took place in London (Aylett, 1988). It proved to be a stimulus for information of the Computer Club of the RCGP. Then in June 1982, a £2.5 million scheme was set up jointly by the Department of Industry and the DHSS. 150 GPs throughout the UK received half the cost of installing specified microcomputer systems. The scheme recognised IT Year-IT 82, and was the first step toward real deployment of IT in GP (Ritchie, 1986).

In Table 2 a Gallup Poll 1993 survey of NHSME, 1993 gives estimated figures for computerisation of general practices as follows:

Table 4. 2: Computerisation Practices

Year	% of practices computerised to the total of 9682	Number of practices computerised
1987	10%	942
1988	19%	1,802
1989	28%	2,674
1990	47%	4,612
1991	63%	6,130
1992 (no survey)	71% (estimate)	6,688
1993	79%	7,613

Source: Social surveys (Gallup Poll) Ltd.

In a recent survey, 40% of practices without a computer stated that they planned to obtain one before 31 March 1994. Nine per cent had already signed an agreement to obtain a computer. Assuming that all these practices did obtain a computer, levels of computerisation would have reached 87% at April 1994 (Social Surveys ((Gallup Poll) Limited, 1993).

4.2.6. Computer System in Old Fire Station Surgery in Beverly.

This section describes one of the many computerised information health systems used in general practice in the UK market. The EMIS (Egton Medical Information System) was initially investigated at Hall Road in Hull. However, as a consequence of the involvement of the practice manager and physicians at that time with new researches and organisation, it was necessary to move the investigation to another practice, the Old Fire Station Surgery in the town of Beverley.

4.2.6.1. Background

The practice is a 12,000-patient, 5-Doctor Group, General Practice, regarded as Second Wave Fundholders, meaning they joined the scheme in 1991 (the Act came into effect in 1990). The work in the practice could not covered by the two partners so a succession of assistants were employed. They initially introduced the computer some six years ago. This first effort was essentially a single PC covering areas such as age/sex register, cervical cytological, repeat prescribing and some morbidity collection. However, over the ensuing few years it became apparent that as they wanted to put more onto the computer they would have to expand to Multi terminal as access time became a problem on a single terminal and yet they also wanted to run 'over the counter' available MS DOS programmes on their PC. The introduction of the preparatory year for Fundholding in 1991 also caused them to completely revise their system with one of the specific aims being to computerise all prescribing, both acute and repeat.

They chose a computer system by initially deciding what they wanted their system to do and sent the systems suppliers a six page questionnaire to be filled in before they presented their equipment to the General Practice, preferably posted several days before so that the general practice was in a good position to assess their suitability first. The EMIS was chosen by the general practice for many factors including user friendliness, ability to support their PC as a dumb terminal through communication software, extensive use of dictionaries to aid data input, locally base, and use of Reid classifications. One of the main disadvantages, however, was the expense.

4.2.6.2. Establishment of EMIS

EMIS was introduced initially into the office area with a three terminal system plus their PC in order for the office and reception staff to get accustomed to it in areas in which they were involved. Introduction of the system into the consulting rooms for consultation interactions and prescribing was actively postponed to a later date. This is because the practice wanted to see first of all whether it actually needed them in the consulting rooms and secondly so that the staff could become familiar with them on a small scale and only expand when they felt that there was a need for expansion. They have also recently expanded down to their branch surgery at Swinemoor through a land line. This general practice had the wiring done by an independent local firm of whom they have no complaint. Hardware installation and support for EMIS is adequate. The help line is obviously useful but certainly of unexpected usefulness was the modem, allowing interrogation of their system from EMIS headquarters to sort out any faults down the phone without the delay in waiting for an engineer.

4.2.6.3. The Effect of EMIS on the Practice

An EMIS is a method of supplying patient and patient related to general practice data in a manner that will provide the maximum assistance to GPs in the performance of their duties. The EMIS will collect, record, store, process, retrieve summarise, transmit and display this information. An EMIS also has the ability to retrieve and organise stored data for special reports and analyses by the use of appropriate computer programs. The primary purpose of EMIS is to serve GPs engaged in daily outpatient activities and this accumulated information will be available for medical research, education and further investigation and management process.

The effects on the practice have been manifold. After understandable initial apprehension, the benefits of access to data and single data entry seem to be appreciated, but for this to be successful, time and training are needed. Like most computer systems it is beneficial in the repetitive areas such as repeat prescribing, cervical cytological call and recall, but its benefits in consultation interaction have yet to be fully realised. The ability to retrieve instant information and not have to have manual access to notes has made a difference, not in number of personnel but in the job descriptions, as people move to a more clerical data input role from reception.

4.2.6.4. Benefits

The main benefit to date has been the improvement in the practice's prescribing policy. By having one prescribing data base they are able to monitor and control prescribing a lot more tightly than with a manual system. Whilst currently not aiming at an absolutely paperless General Practice business, the next benefit they are aiming for is a "noteless" General Practice record system. They intend to look at the feasibility of not using manual records for consultations patient interaction, to try and avoid the problems of filing and re-filing, storage, loss and deterioration of manual notes.

4.2.6.5. General Practice Information Requirements

General Practice needs clear, concise information that is inputted in the appropriate form where necessary. The information comes with EMIS's and FHSA download, although there are some problems with non-reproducibility of information, particularly with names and addresses. The simplest data required by the general practices are the details on the front of the patient record envelope. These data can be extracted and entered by practice staff since they present few, if any, problems of confidentiality. These items are: Title, Surname, Forenames or single preferred name, Address, Date of Birth, Sex, NHS number, Registering FHSA, Registering doctor, Date of registration, Dispensing status and Mileage.

4.2.7. Recent development in the NHS/GPs

In this section we will present several important changes that have happened in the NHS and general practices since the case study took place.

One of the most significant features of the development of the NHS is the creation of the internal market, which allows the growth of GP fundholders initiative. However, the early competitive forces expected to dominate the internal market are being replaced by more mature and appropriate strategies of collaboration and this all points to a more effective internal market structure and better services for patients (Lloyd and Hill-Tout, 1997).

Another recent reform is '*A Service with ambitions: 1996 White Paper*'. This outlines the government's vision for the NHS. It emphasises that both future health service policy and performance will rely heavily on better data, new communications and information technologies. Resulting from this was the 1997 information and technology initiative, which are expected to have an impact on NHS professionals and management. In general the aim is for better administration, better communication and better professionals, resulting in better quantity and quality of care, cutting waste and achieving better value for money.

These reforms and other developments that need technology are reflected in the NHS budget allocated to IT, which is now over £220 million a year (Peel, 1997). This is an increase by £20 million compared with 1994, or 1% of the total figure.

East Riding Health Authority (ERHA) is part of the NHS, which replaced Humberside Family Health Services Authority (FHSA). From April 1st 1996, ERHA became responsible for commissioning health services on behalf of approximately 587,500 residents spread out over some 2,500 square kilometres of land (East Riding Health Authority, 1997). This land divided into five health zones. These are East Hull, West Hull, Bridlington, Hornsea and Whithernsea.

In addition, the new further development that DHAs and ERHA were merged in April 1996 to form unified health authorities (Ham, 1997). The reason for this is that unified health authorities are better placed to take an all round view of the health needs of the population they serve.

The Humberside ERHA spent almost £178.3 millions of public money on the provision of services to the residents of Humberside in the year ending 31 March 1996 (Kingdom *et al.*, 1996) (see table below), an increase of more by £34 million over the 1994 level, or 8% of the total. This increase appeared as in the following table.

Table 4. 3 FHSA expenditure distribution on health services for Humberside residents (£000)

Management		4,697
General medical services:		
- cash limited:	10,177	
- non-cash limited:	33,899	
Total		45,076
GP Fundholding		44,239
Pharmaceutical Services		48,235
Dental Services		223
Ophthalmic Services		4,357
DOH initiative funding		107
Total Expenditure		178,310

Source: Annual Report, 1996.

GP fundholding was established in 1991 and by April 1996 over 50% of the population of England are covered by fundholding (Punt, 1997), compared with 36% in 1994, an increase of 28%.

With respect to the Old Fire Station Surgery in Beverley, there was no change except an increase in the number of terminal from three to ten terminals.

4.3. Oman Health System and the Computer

4.4.1. Introduction

Computers were introduced by government departments in the form of word processing in 1972, but computer systems as such were first introduced in 1980 by the Royal Oman Police (ROP) and Ministry of Finance (MoF). Demand increased when they were used in the Ministry of Health (MoH) for statistical purposes. Their use in the Health System developed when, in 1989, the Royal Hospital (RH) introduced a Wang System and was shortly followed by Sultan Qaboos University Hospital when it introduced a Gerber Alley System.

The information presented in this part is derived mainly from the Annual Statistical Report 1997 which was presented by the Directorate of Planning in the MoH in the Sultanate of Oman, RH yearly Report of 1992 and 1997, RH Computer Systems-Appraisal & Recommendations and the Executive Report on SQUH Hospital Information System. This information is supplemented by information from hospitals leaflet, and interviews and discussions conducted with several heads of departments and sections in the hospitals and MoH.

4.4.2. Oman Geographic, Economic and Demographic Profile

The Sultanate of Oman occupies most of the south-eastern corner of the Arabian Peninsula. It is the third largest country in the Arabian Peninsula (After Saudia Arabia and Yemen). It has a coastline stretching almost 1700 km from the strait of Hormuz in the North to the borders of Yemen. The total land area of the country is 309,500 sq. kms, which includes over 253,000 sq. kms of wadis (valley/dry river beds) and desert areas, over 46,000 sq. kms. of mountains and over 9000 sq. kms. of coastal plains.

The Sultanate of Oman is administratively divided into 8 Governorates/ Regions to ensure consistency and hence compatibility between the information provided by different sectors. The administrative regions with main administrative headquarters are the Governorates of Muscat, Dhofar, and Musandam, and the regions of Al-Dakhilya, Al-Sharqya, Al-Batinah, Al-Dhahira and Al Woustah.

No population census was undertaken in the Sultanate before

December 1993, when it was revealed that the total population was 2,018,074 of which 534,848 which is represented 26.5% of the population were expatriates. However, according to MoH Annual Statistical Report 1997, estimated that the population has increased to 2,255,630, of which 613,690 were expatriates, who thus make up 27% of the total population (see Table 3). Before this census, demographic information and population estimates and projections were based on survey results such as the '1985 Demographic Survey' and the '1989 Child Health Survey'.

Oil and gas are the main sources of national income, accounting for over 77% of Government revenues and about 42% of Gross Domestic Product, although, in recent years, considerable emphasis has been placed on industrial development and there has been increasingly successful diversification from dependence on an oil-producing economy. Agriculture and fisheries are being developed as additional sources of national income. Major development has also taken place in the exploitation of mineral resources. The Ministry of Health Expenditures accounted for around 5.6% of the total Government Expenditures, which counted for 2,292.5 Million Rial Omani in 1997 (see Table 4). According to the 1994 World Development Report, Oman is classified as upper-middle-income, with GNP per capita calculated in 1992 as $6,480 and the average annual growth from 1980-92 was 4.1%. The average annual growth rate in 1980-92 of: GDP was 7.7%, agriculture was 7.1%, industry was 9.6%, manufacturing was 18.3%, and services, etc. 6.0%. The economy of Oman grew at high levels during 1970-90 and then fluctuated due to changes in international oil prices.

Table 4. 4 Demographic Indicators 1990-1997 in the Sultanate

Indicator	1997	1996	1995	1990
Population ('000)				
Omani	1,642	1,602	1,552	1,297
Expatriates	614	613	539	295
Total	2,256	2,215	2,091	1,592
Crude Birth Rate (per 1000 population)	29	30	34	44.7
Total Fertility Rate (berth per woman 15-49 years)	4.8	5.2	6.0	na
Life Expectancy at Birth	72	71.6	67.4	66.5

Table 4. 5 Economic Indicators 1990-1997 in the Sultanate

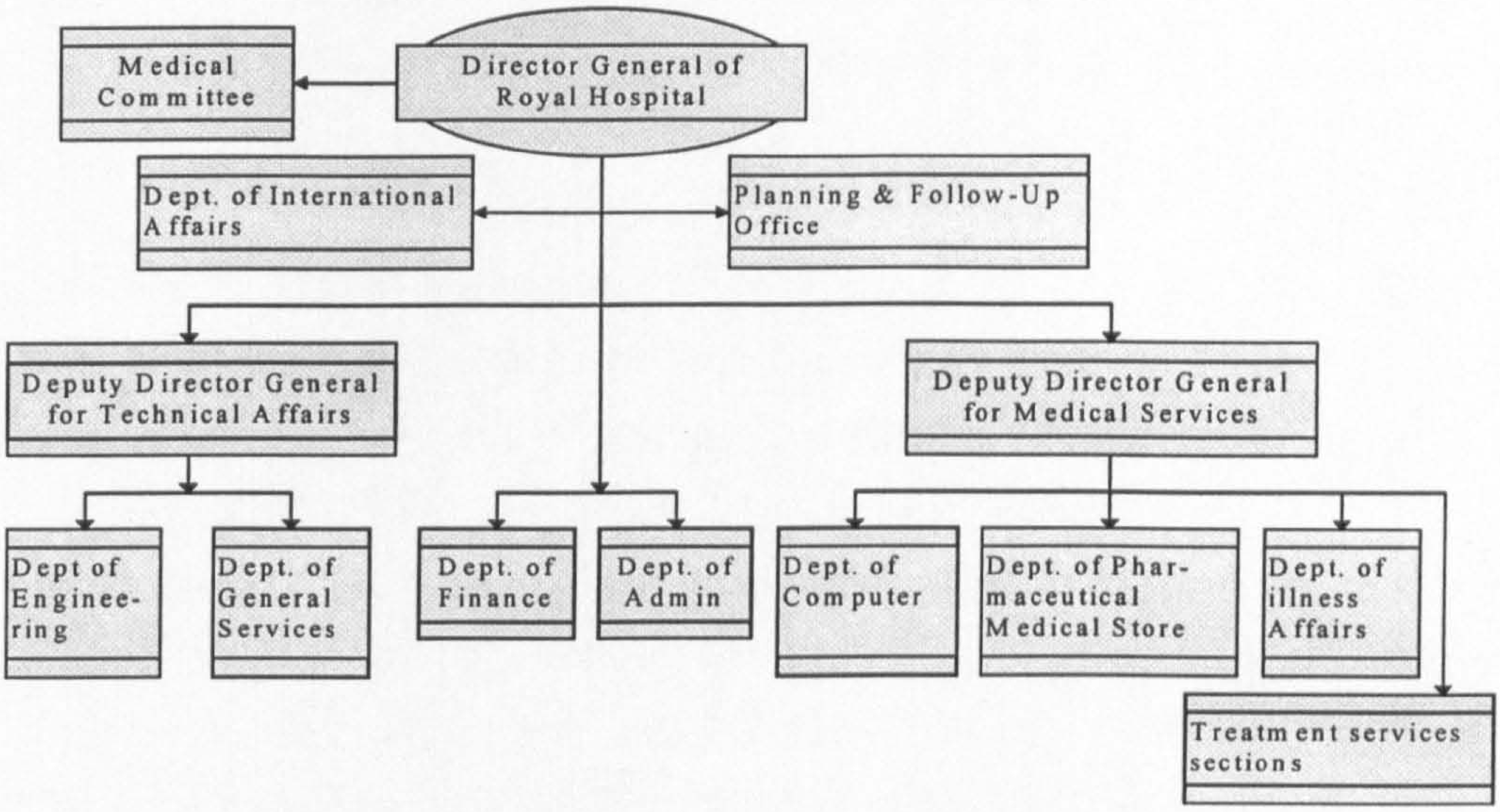
Indicator	1997	1996	1995	1990
GDP at Current Prices (million R.O.)	6,058	5,890.3	5,307.2	4,050
GDP per Capita (R. O.)	2,686	2,660	2,538	2,411
Government Expenditures (million R. O.) Total	2,292.5	2,253.7	2,331.0	1,887.4
Recurrent	1,823.0	2,253.7	2,331.0	1,887.4
Development	469.5	416.0	471.5	317.3
Ministry of Health Expenditures (million R. O.) Total	127.3	133.2	121.7	92.9
Recurrent	113.2	103.6	77.9	49.9
Development	14.1	20.2	18.1	15.0
Ministry of Health Expenditures (% of Government Expenditures)	5.6	5.9	5.2	4.9

4.4.3. Health Care Delivery Systems in Oman

The Ministry of Health (MoH) is the main provider of health care in the country, though three other organisations, the Ministry of Defence (MoD), the Royal Oman Police (ROP) and Petroleum Development Oman (PDO), provide medical care for their employees and their dependants. The Royal Hospital, which opened in late 1987, is the largest, most modern hospital in the Sultanate, providing the most up-to-date medical, surgical, gynaecological and obstetric facilities consistent with the requirements of the very best modern-day acute care hospital. It provides the following services: Medical Departments; Cardiology Section; Department of Surgery; Paediatric Unit; Emergency and Out Patient Delivery (O.P.D.) Unit; Medical Support Services Unit; Radiology Department; Laboratory Section; and Pharmacy Section.

The RH is an independent Directorate General, in the sense that it is financially and administratively independent, but this independence only applies to the internal administration. Future planning, expansion, and increased finance must be approved by MoH. Also, the Ministry of Health has the power to change the top management of the hospital. The top management of the hospital is represented by the Director General, a Deputy Director General for Technical Affairs, a Deputy Director General for Administrative Affairs and Services, and a Medical Committee, which proposes the policies, plans and work procedure in the hospital (please see Figure 4.1).

Figure 4. 1 Organisation Chart of the Royal Hospital



In 1990, SQUH joined the ranks of health providers, with the co-operation of the MoH. SQUH is more autonomous in planning and finance than the RH, its finance and administration being the responsibility of Sultan Qaboos University (SQU) rather than the MoH. SQUH co-operates to a large extent with the RH in health provision as the RH provides training for SQU medical students. Computer systems and a range of advanced health technology have been introduced and used in these two hospitals. There are no private hospitals in Oman, but Primary Health Care (PHC) is provided by private physicians who work in their own clinics.

4.4.4. Distribution and Utilisation of Health Services

As a measure of the contribution of the provision of health services to the improved health of the population, Table 5 and Table 6 show the trend in health service indicators for the Fifth Five-Year Health Development Plan, which started in January 1996 tell the end of December 2000. In addition we include the years 1990 and 1995. The year 1990 represents the end of the Third Five-Year Plan period and 1995 is the last year of the Fourth Five-Year Plan period. Of the 54 hospitals, 47 are operated by MoH. Three hospitals belong to the Armed Forces, one to the Royal Oman police, another to SQUH and the other two, to the private sector. Of 159 health centres, 114 are operated by the MoH, 57 of them with beds and 45 belong to other authorities.

In addition, there are plans to open new health centres in 1998 and afterwards (Omani Annual Statistical Report 1997). However, Tables 3, 4, 5, 6, 7, 8 and 9 are all based on the Annual Statistical Report 1997, which is the only published document. The next one will be available at the end of 1999.

The total number of inpatients discharged from MoH hospitals in the end 1997 was over 214 thousand. An average of 2,550 inpatients per day were managed in MoH hospitals, giving bed occupancy rate of 61%. The *Mean* length of stay in hospitals in days is 4.2. These discharges represent 94% of total discharges from all hospitals in the Sultanate. The total inpatient discharges by other health institutes than MoH was 13,417. There were more than 12 million outpatient visits, an *average* of 33, 577 per day, and the *Mean* number of visits per person was 5.4. The total outpatient visits to health institutes other those of than MoH was 844,079, a daily average of 2,313.

There were a total of 41,058 deliveries in MoH institutes and a total of 6,840,603 laboratory procedures were performed in MoH institutions during 1997. This represents about 3 laboratory procedures for every individual in the sultanate and a 5% increase compared to 1996. About 43% of inpatients and 7.1% of outpatients made use of the radiological services. The radiological services procedures performed during 1997 by MoH accounted for a total of 709,884 procedures representing 315 radiological procedures for every 1000 of the population. With respect to institutes other than MoH, the number Delivery and births; Laboratory procedures; and Radiology procedures were 3,939; 1,197,719; and 97,260 respectively (Omani Annual Statistical Report 1997).

During 1997 there was a decline in the number of deliveries in MoH institutions of 3% compared to 1996. This has resulted from a decrease in total fertility rate from 5.2 in 1996 to 4.8 in 1997, and a drop in the crude birth rate from 30 to 29 live births per 1000 population. Life expectancy has increased to 72 years (see Table 3).

The changes in child and infant mortality showed that Oman, instead of being one of the high mortality countries of the Middle East, has joined the countries with a much longer history of development. The overall mortality has declined by almost 50% during the last 7 years (see Table 7). However, some of these indicators, such as Crude Birth Rate are still quite high. Moreover, the

Fertility Rate (births per woman 15-49) is high, due to the tradition of women marrying at an early age (Table 3).

Table 4. 6 Utilisation Indicator of Health Services

Utilisation Indicator	1997	1996	1995	1990
Outpatient Visits:				
No. at Hospitals	7,076,469	7,382,767	7,400,908	5,625,713
No at Health centre	5,179,053	5,087,139	4,832,294	2,970,837
Total Visits	12,255,522	12,469,906	12,233,202	8,596,550
Inpatient Services:				
Total Discharge from Hospitals	214,634	217,070	220,846	183,201
Bed Occupancy Rate %	61	63	69	70
Mean length of stay in Hospitals	4.2	4.3	4.4	4.7
Deliveries: Total Deliveries	41,058	42,301	44,210	44,131
Laboratory Services: Total No. of Procedures	6,840,603	6,500,158	6,117,002	4,420,838
Radiological Services				
Total No. of Procedures	709,884	687,067	592,030	391,444

Table 4. 7 Health Facilities Indicators 1990-1997 in the Sultanate

Health Facilities Indicator	1997	1996	1995	1990
Hospital	54	54	50	49
Hospital Beds	5,015	4,798	4,315	3,624
Hospital Beds (per 10,000 of total population)	22.2	21.7	20.6	22.8
Health Centres, Clinics and Dispenses (Governmental)	159	161	134	124
Private Clinics	461	439	471	334

Table 4. 8 Health Care Indicators 1990-1997 in the Sultanate

Health Care Indicators	1997	1996	1995	1990
Immunisation in Children one year of age Coverage %				
BCG	96.3%	96.3%	96.3%	96.0%
DPT3 / OPV3	99.4%	99.6%	99.0%	98.0%
Measles	98.1%	98.1%	97.5%	98.0%
Mean No. of Outpatient Visits (per person per year)	5.4	5.8	5.8	5.4
Nutritional and Some Morbidity Indicators				
Low birth weight infants %	8.2	7.8	7.5	8.7
Children below 5 years with Protein Energy Malnutrition (PEM) (Rate per 1000 Children below 5 years)	141	128	80	na
Acute Respiratory Infections (ARI) (per child below 5 years per year)	2.1	2.3	2.5	2.4
Diarrhoeal Diseases (per child below 5 years per year)	0.4	0.50	0.50	0.65
Mortality Indicators				
Crude Death Rate (per 1000 Population)	3.8	4.4	6.1	7.6
Infant Mortality Rate (per 1000 live births)	18.0	18.0	20	29
Under 5 Mortality Rate (per 1000 live births)	27.5	29	27	35
Still Birth Rate (per 1000 births)	13.0	10.0	11.8	13.3
Maternal Mortality Rate (per 100,000 live birth)	na	21	22	na

* na = not available.

Treatment abroad is another important phenomenon that has been on the increase. The Omani government has funded the medical treatment of patients who cannot be treated locally and are sent for treatment abroad. MoH has sent 251 patients and their companions abroad in 1997. The principal countries used overall were India (39.4%) and the United Kingdom (26.2%). Other government institutions, individuals and private institutions send their patients to many other countries, such as Germany and Jordan.

4.4.5. Health Personnel

Manpower statistics are one of the pillars for proper planning of a health care delivery system. Staff working in the health system are distributed among a number of categories and all contribute to providing health services and care (see Table 8).

During 1997, for every 10,000 population, there were 12.8 doctors and 30.2 nurses. The Government sector accounts for 90% of the total health staff. These numbers continue to increase in all categories, as a result of rapid development and increasing awareness of health issues. The speeches and decrees of the Sultan have played an important role in this respect (see Table 8).

Table 4. 9 Health Personnel by Category as the end of 1997 In the Sultanate

Indicator	Total	MoH No. & %	Governmental Non-MoH No. & %	Private No. & %
1) Health Administrators:	110	103 / 93.6%	6 / 5.5%	1 / 0.9%
2) Doctors	2,815	1,921 / 68.2%	182 / 6.5%	712 / 25.3%
3) Dentists	182	84 / 46.2%	11 / 6.0%	87 / 47.8%
4) Pharmacists	389	62 / 15.9%	10 / 2.6%	317 / 81.5%
5) Nurses	6,822	5,792 / 84.9%	597 / 8.8%	433 / 6.3%

Adopted from: MoH The Annual Statistical Report 1997.

4.4.6. Health Finance

In 1997 total Government expenditure was 2,292.5 million Omani Rials. The MoH expenditure accounted for around 5.6% of the total Government expenditure (see Table 4). The total budget of the MoH for providing all the above services in 1997 totalled RO 127.3 million. Recurrent expenditure was 113.2 million, while development expenditure was RO 14.1 million. Therefore, the total percentage during 1997 of MoH expenditures to the government expenditures was as follows: Total (5.6%), Recurrent (6.2%) and Development (3.0). (refer to Table 4). The breakdown of the recurrent expenditures is given in Table 9.

Table 4. 10 Recurrent expenditure by type and budget location of expenditure (million RO)

A) Type of expenditure (in million Rials)	1997
1) Salaries, allowances etc.	70.9
2) Repair, maintenance, supplies, materials & miscellaneous	19.9
3) Services	12.3
4) Electric, water, Post and Communication	5.7
5) Contribution to National & International organisation	0.1
6) Furniture, equipment, vehicles etc.	4.3
TOTAL	113.2
B) Budget by location (Centre/ Regional)	
Ministry Headquarters	30.0
Directorate general of Education & Training	1.9
Royal Hospital	19.7
Regional Health Services:	
Muscat	15.8
Dhofar	6.1
Dakhilya	6.4
Sharqia	9.5
Batinah	13.9
Dhahira	7.8
Musandam	1.5
AL Woustah	0.7
TOTAL	113.2

Source from: MoH The Annual Statistical Report in 1997.

It is clear that the availability of accurate information on health services is crucial and strategic planning must play an important role in decisions on Omani health delivery. These considerations have prompted several Omani health institutions to introduce computers into their activities and development to cope with the pace of change in Oman. The information will provide a sound framework on which to plan the future developments of Omani health services in both the short-term and the long-term (see the next section for computer deployment and development).

4.4.7. Computers in Oman Health System

Recent developments in health services have been accompanied by availability of vast facilities to collect, analyse and present health data. The Royal Hospital (RH) and the Sultan Qaboos University Hospital (SQUH) were the first health institutions in the sultanate to implement computer health information systems. Any innovation or new installation of technology is subject to experimental scrutiny and could be a failure before its worth can be proved or refuted. The deployment of computers in NHS has been attended by great difficulties and there were many obstacles and failures in the first stage of the implementation as has been mentioned elsewhere. Such has also been the case in the Omani Health System (OHS). Currently, the RH and SQUH information systems are not producing what was anticipated from the new technology. They are difficult to understand, insufficiently reliable, and respond poorly overall. This section provides a summary of total process of computer deployment, the hardware and software components installed, and the various shortcomings that have been reported and observed.

4.3.7.1. The Process of Deployment of Computer into RH & SQUH

The process of deployment process of both systems into the two hospitals was almost similar. The deployment was the result of an overwhelmingly large volume of paperwork for patient records and administration, the availability of new medical technology, the university student training programme and the increased demand by the surrounding population for better treatment. It was concluded by the top management that a computer system would be the solution to these problems, as well as enhancing the prestige of the hospitals concerned, and they gave the go-ahead for acquisition of an appropriate system. These reasons are consistent with what the literature has indicated. Lucas *et al.,* (1990) presented several reasons for institutes deploying computer information systems, such as:

1) the system is the only way to solve the institute's information problems;
2) the organisation is forced to undertake the computer applications;
3) the firm wants to improve analysis capabilities or decision making;
4) the organisation feels a system can help it obtain an advantage over the competition;
5) the firm feels a system will help reduce costs or generate revenues.

According to a top management interviewee, the first problem was to decide what was 'appropriate'. It is clear that, none of the members of the committee were sure of their real needs and objectives, or of computers' requirements or functions. They only knew that they wanted a computer to solve the problem of patients' medical records and to have less paperwork, and to do things faster, easier and more efficiently - and 'to do all these at the press of a button.' They decided to buy a ready-made system and to shop abroad and they sent a mission to Europe and America and Canada to approach a number of companies specialising in medical health systems. However, there was no clear competitive tendering on this issue and there was no approach to local companies, since the companies could not offer a sufficient HIS of the capacity required.

In the case of the RH computer system, the committee members included Under-secretary General and his consultants and the heads of selected departments such as finance, planning and building, recruitment, purchasing, medical staff units, etc. None of them had any knowledge of computer functions and some of them had never worked with a computer. However, the RH was in a hurry to have the computer installed on time as its introduction was to be marked by a visit from the Sultan. They chose a system, which they had seen in operation in a European hospital.

In SQUH, deployment was more organised. The computer director of SQU was in the committee. According to him there was disagreement on whether full computerisation (integration of all medical systems plus administration and finance) was to be undertaken or whether just the medical record and laboratory system should be computerised, to be followed by the rest later. The latter opinion was supported. The SQUH committee invited local suppliers to present their tender documents. These concentrated almost exclusively on technical matters concerning the hardware and software, and said little about the overall benefits which the system should deliver. Then, they invited suppliers from Europe, America and Canada to present their systems in SQUH. Finally, they went abroad on a similar missions to that undertaken by RH. The system eventually chosen was one that had been demonstrated using a sales package.

However, in practice, neither system performed as expected. Also the installation packages took a long time to be implemented and more money was needed to finish the implementation job. Another problem that was mentioned by a member of the committee was that 'Some of the directors wanted a terminal on their desks for their personal use with no clear idea of why they wanted it, or what it was supposed to do. They were motivated by the consideration that managers of similar grade in other departments had terminals on their desks.'

The coming section will provide more information on these systems and their problems.

4.3.7.2. Royal Hospital System

After a period of eight years the old RH system was changed to a new system called SUN 1000E. This system has the following hardware and software capabilities: solar operating system 5.5, size 20 GGB external drive, two CPUs and four processors, 256 MB Ram Memory. ORACLE application, Network open system, using fibre-optic cable, distribution client help for the client PC and Annex for printers. 104 terminals are running under the system now and able to extended up to 1000 terminals. The total number of printers is 40 and response time is very high. This new system is believed to be the solution to the problems of the old system. Keeping this in mind, the next section will describe the old system's capabilities and problems.

a) RH Computer System Hardware and Software

The RH computer WANG system was installed in 1987, by a company called Oman Computer Services (OCS). The system is based on WANG VS 300 which supports the main patient care information. There are three 620 MB drives, two of which are connected to WANG VS 300. Another WANG VS 100A is used for back-up and WANG VS 100B supports the laboratory. In addition, the main hardware system is supported by 14 data communication controllers, and 200 terminals with 65 main printers. Regarding stand alone personal computers, the RH has 60 PC with their printers, of which only 5 are laser jet printers. At the time of investigation only 120 terminals were in use, though this number has subsequently been increased to 172 terminals.

The RH software can be classified into two main categories, namely, 'Patient Related Applications (PRA)' and 'Non-Patient Related Applications (NPRA)'. PRA can be further classified into Central Applications and Departmental Applications, the latter being specific to individual departments (e.g. the laboratory department application system). It is worth noting that these applications are installed in WANG VS 300. This system of classification will help in solving some of the computer load in future. The patient related applications are comprised of: 1) patient registrations, 2) in-patients 3) out-patients, 4) radiology, 5) medical records, 6) tracking of patients' notes, 7) pharmacy, 8) operating theatre, 9) accident and emergency, and 10) patient billing. The non-patient related applications are comprised of: 1) general stores, 2) spare parts stores, 3) medical stores, 4) ward intending, 5) purchasing, 6) work orders, 7) accounts, 8) word processing and 10) personnel. For further information or description of these applications please see Appendix B.

4.3.7.3. Sultan Qaboos University Hospital

This hospital was initially planned to be a referral hospital, to provide treatment for the University staff and their families and mainly run by professional medical teachers and their students under the University's College of Medicine.

a) SQUH Computer System Hardware and Software

The SQUH information system was installed in 1990. It consists of three high-range HP 3000/935 minicomputers and one HP personal work station, namely the MICRO/LX system. One of the HP 3000/935 is used to support patient care and laboratory systems, the second to support the Administration and Finance system and the third to provide the HP Desk system for internal hospital use. In addition, the main hardware system is supported by two tape drive units, two central printers, five disk storage drive units, and eight data communication controllers. There are 300 terminals and 115 personal computers with 133 printers, of which 54 are laser jet printers, two id-card printers, two bar-code printers, and 60 bar-code readers.

The SQUH software system can be classified into two different categories: 1) Administration and Finance System, and 2) Hospital Information System. The first provides computerised administrative and financial services. It is comprised of: 1) maintenance system, 2) inventory management, 3) purchase orders, 4) accounts payable, 5) general ledger and 6) budgeting.

The Hospital Information System (The Gerber Alley System) can be further divided into two sub-systems: 1) Patient Care Management System and 2) Laboratory System. The patient care system is comprised of: 1) census registration, 2) patient history, 3) medical records, 4) physician registry, 5) case mix management, 6) radiology management, 7) patient care plans, 8) professional staffing, 9) theatre management, 10) waiting list, 11) appointments schedule, 12) order management, 13) results reporting, 14) patient billing, 15) statistics control, 16) accounts receivable and 17) pharmacy management. The Laboratory System is comprised of: 1) biochemistry, 2) microbiology, 3) haematology, 4) anatomic pathology and 5) blood bank. For further information or description of these applications please see Appendix C.

4.3.7.4. The Current State of the two Systems

It might be thought that as the RH information system faced some difficulties, SQUH information system would have learned from these difficulties and avoided the mistakes made by RH. However, such has not been the case. The initial strategic planning for the introduction of the new technology into the OHS was poor, as has been described in the earlier section that described the initial process of deploying the computer systems. Problems have resulted from poor estimation and judgement of the appropriate platform to install and miscalculation of the data that could be entered into these systems. Because the health care utilisation behaviour of Omani people was not explained to the consultants, they did the estimations on volume data alone. Management had poor understanding of the new technology's capabilities, which were not explained well. There was also a failure to explain to the users of the new technology their responsibilities and the tasks they should perform. Insufficient attention was paid to enabling the user groups to adapt to the operational procedures supported by the system, as opposed to trying make the system adapt itself to satisfying the existing diversity among users.

a) The Current State of the Royal Hospital System

The system is overloaded tenfold as a result of underestimation of data volume by the consultants. A number of laboratory functions that could be computerised are currently being withheld in order to avoid degrading the system's performance any further. In an interview with one of the expatriates concerned with computerised laboratory work, he said, "I blame the consultant for poor estimation and failing to take time to study the patients' attendance and their treatment behaviour, as well as the hospital authorities for providing insufficient information on their people's health culture and also for not pushing hard to solve computer problems."

According to one of the technical management personnel, the RH management have been made aware of the escalation of difficulties by way of reports, special inquiries, letters and board meetings. However, there has been little response, and such response as has been made, has been slow. They are aware that the WANG VS system is a closed system and is now over six years old, and that data storage utilised is over 1800 MB which means over 85% of total installed capacity. A number of enhancements to the already existing functions are also not being carried out for want of additional system resources. The data are growing at the rate of 40 MB per month. At this rate, the currently available disk space will not last more than four months. Most of the packages mentioned in section 4.2.8.2.1 have been implemented except, on the PRA side, pharmacy, operating theatre, accident and emergency and patient billing; and on NPRA, personnel. It is worth noting here that not all the applications implemented are utilised to the full (e.g. tracking patient notes and ward intending). Regarding the first, there is a debate in progress as to whether it is proper to Omani culture, and for the second there has been a long dispute as to how it could be implemented.

b) The Current State of the Sultan Qaboos University Hospital

All the packages that make up the Administration and Finance system (mentioned in section 4.2.7.3.1) have successfully been developed and implemented by IMTAC (Industrial Management Technology And Contracting). Regarding the patient care management system, out of the 17 modules that make up the patient care system, only four have been installed: census registration, patient history, medical records, and physician registry. This implies that only 24% of the patient care management system has been installed. According to IMTAC's schedule, four additional modules were expected to be delivered within two to three months, but they took two years to be installed and most have not been used yet. These modules cover appointment scheduling, order management, results reporting, and radiology management. The remaining nine modules were expected to be delivered by the end of 1993 but have not yet been installed. On the laboratory system side, out of five modules, only the Biochemistry module is running. Thus, technology is wasted and inconvenience caused.

4.3.7.5. Shortcomings and Problems

Several problems with the current systems have been reported, and observed to face the users.

a) Operational and Technical Problems

The most significant problems, from both operational and technical perspectives, are: 1) extremely poor response time, 2) inadequate disk resources, 3) lack of adequate processing power and 4) cabling and network breakdowns due to poor installation. These problems face both the RH and SQUH. It is the researcher's view that the main causes of these problems, and especially the poor response time (which is the most annoying and embarrassing feature of the system) lie in both hardware and the network.

b) Political and Social Problems

Installing a hospital information system is among the most complicated projects to undertake in the world of computer information systems. The task requires a great deal of careful strategic planning and good team work from all sides (by this is meant the people who own the technology and the people who get to use it). The operational and technical problems have resulted in dissatisfaction with the system's performance. Above all, there is a need for the involvement of all users, with co-ordination among the user community, co-operation with the implementation teams and attendance at training sessions. Computer instructions and performance need to be integrated systematically into the work personnel involved, rather than applied on a casual, ad hoc basis. Having users from various different countries and backgrounds, with different requirements and with different expectations working together, seems to have made it difficult for the hospitals to offer the project an appropriate and peaceful environment. This problem is more apparent in SQUH than in RH. Three additional factors contributing to unsatisfactory outcome are: lack of confidence among the user groups in the technical capability of the suppliers; lack of technical management and personal competence on the deputy director's side; and the slow response to requests for enhancements and new applications.

4.4. New developments in the Omani HIS

4.4.1. Introduction

Despite the expansion in health services, there has been a decline in the utilisation of such services over the years (Tables 5 & 6). This decline may have been caused by the new government policy that has been in force since the end of 1996 of charging each patient 200 Pissah for each visit. 200 Pissah is 1/5 of the Omani Rial, one Omani Rial is equivalent to £1.40.

Information Technology (IT) has been acknowledged by the Ministry of Health in Oman as an essential service in the health care delivery system. The important IT policy decision in this respect is the 'paperless' direction taken for the health centre information system. In addition, there is also a proposal under study to replace by the year 2000 all the paper based outpatient notes with electronic records.

Recently the Council of Ministers took a decision to create a body that will manage the Civil Registration Services. With the introduction of this new service, the Ministry of Health will plan to have a unique registration per patient across the Sultanate.

4.4.2. Royal Hospital's HIS Development

The main developments in the Royal Hospital's HIS are the following: 1) at the end of 1995, a new computer system called SUN system was introduced, influenced by the decision to provide state-of-the-art tertiary care services. This is intended to serve as an ultimate referral centre for Ministry of Health institutions, as planned for the Royal Hospital since its establishment. For this reason, 2) the government has established the 'Bousher clinic' just across the road to help provide primary and secondary health care services. 3) Implementation of MEDICOM Models: Medical stores, Purchasing, Histology Cytology and Microbiology, using the new SUN system. There is a plan to continue the implementation of the Medicom Modules.

4.4.3. Sultan Qaboos University Hospital's HIS Development

The SQUH policy aims to formulate a uniform policy on Health information. This policy is reviewed periodically and amended as and when required. Future strategic information system planning for SQU Hospital focuses on upgrading the present system to a state of the art system based on client server technology. The Hospital is on the look out for any ready made system, which can match the requirements of the Hospital. The system is expected to have teleconferencing facilities.

HIS is engaged in a study of the current requirements. The system study is expected to start in August, 1998 and the analysis is expected to be completed by the end of November, 1998.

4.5. Conclusion

The chapter has indicated the background context to this study, in terms of the case studies and the relevant information about the nature of the health services, and their computer deployment and use, in NHS and OHS.

As we have seen in the earlier chapters, the introduction of computer technology into health care, and its implementation, has been fraught with difficulty and many projects result in failure. Whereas the process of computer deployment in NHS involved intensive research, planning and evaluation, and was done piece-meal, computer deployment in RH and SQUH in the OHS came in a short period of time (ad hoc), with very little investigation and evaluation. In addition to this, the IT strategic issues presented in the literature, i.e. cost-effectiveness and competitive objective, were not considered.

In addition we saw few progress toward the computer deployment and use especially in the NHS.

This chapter completes the preliminary part of the research which establishes the context in which the empirical work was carried out. The methodology adopted in the empirical part of the research is explained in the following chapter.

5. CHAPTER FIVE: THE RESEARCH METHODOLOGY

5.1. Introduction

The main aim of the two field studies, one in Oman and the other in general practices (GRPs) in Humberside, UK, was to investigate computer deployment into their health system, and assess whether or not these two environments are similar or have had different experiences of computer deployment, as indicated in the literature review. It was thought that the UK general practice experience might be of interest and benefit in formulating guidelines for computer deployment and utilisation in Oman. In this survey, the views of a wide sample of those involved in IT deployment and utilisation were sought.

The study examined whether the computer fitted into the health system's overall information strategy, whether computers were being adequately utilised and whether technical problems or fear of computers have had an effect on deployment and utilisation. It also examined the impact of computer technology in health information and administration.

This chapter aims to give a description of the procedures that were followed in this research in order to collect the baseline data related to the above issues. The chapter discusses the research questions, survey population and sampling rationale, key players in the survey and methods of collecting data. The benefits derived from the researcher's attendance at meetings of Humberside Computer Users' Group (HCUG) are outlined. A description is then given of the questionnaire development procedure, content and rationale of the questionnaire, classification into sections and validity. The method of administration of the questionnaire, and the statistical techniques applied to the data are outlined. The outcomes of the interviews carried out in the UK and Oman are also presented. Conventional system analysis techniques were used to obtain data for the two Omani hospitals and GPRs computer system descriptions presented in Appendixes A, B and C.

The following two tables show the procedures and the time spent on the two field studies conducted in UK and Oman.

Table 5. 1 Timing and Sequence of Fieldwork for GPRs in the UK

1) January to March of 1991	Enquired about possibility of doing fieldwork in Hull Royal Infirmary but was not possible.
2) April to August of 1991	Switching to GPs systems and studying literature on the issue.
3) September to November of 1991	Attending HCUG meetings and observing GPs systems and their implications.
4) March to May of 1992	Completing the questionnaire and selecting interviewees.
5) June to July of 1992	Conducting the interviews and than distributing the questionnaire.
6) July to August 1992	Following-up and receiving the questionnaire responses

Table 5. 2 Timing and Sequence of Fieldwork for Omani Hospitals

1) September to October of 1992	Preliminary investigation and obtaining permission to conduct the study
2) October to November of 1992	Investigating the two systems, mostly by way of observation and discussion
3) November to January 1992	Finalising the questionnaire while carrying out the interviews, distributing and then later collecting the questionnaire personally.
4) The end of January 1993	Back to the UK

5.2. Research Questions

In the light of the research aims and the issues surrounding computer deployment strategy and failure, particularly in health services, referring to the literature reviewed in the previous chapters of this study, the empirical survey was designed to collect data that might provide answers to the following questions or that might show how far these issues have affected and still dominate computer deployment and development. The problems and issues concerning the deployment and use of computers in health care are numerous, but the interest of this research can be grouped into the following categories or questions, which emerged from preliminary field explorations in the GPRs and Oman.

1- Is there a difference between the perceptions of different groups of employees as to how they felt that the computer was strategically deployed into health system? This main question was tested by several questions in the questionnaire, details of which are can turned in Appendix D section three.

It was suspected that in Oman decisions are being taken regarding computer deployment, development and selection without an appropriate strategy, and with a lack of local personnel sufficiently well-versed in the new technology as well as lack of awareness on the part of the expected users, This poor strategic planning for the deployment and development of this technology in the health system will delay the full realisation of its potential and will impede the development of the new technology and Omani local skills with adverse consequences for future health service delivery and spending. This issue, I personally regarded as one of the main causes of computer failure in both the developing and the developed countries. In the GPRs the focus with regard to strategic planning was mostly in the areas of information requirements, system specification, guarantee and plans for future development of the computer system. Direct and indirect evidence was sought to examine these issues, which discussed in Chapter One, section 1.1; Chapter Two, sections 2.3 & 2.4; Chapter Three, section 3.3 and Chapter Four sections 4.2 & 4.3.

2- Is there a difference between the perceptions of different groups of employees about how well the computer has been utilised since its deployment in health system? This main question was tested by a range of questions in the questionnaire contained in Appendix D.

Despite the rapid growth of computer application, the deployment of systems and use remains a significant issue. The literature has suggested that computer systems are under-utilised. The problem of systems being deployed but not being properly or fully used is common in developing countries (see Chapters Two & Three). The reasons for this problem may be poor planning, poor management, lack of training, skills, computer technical failure and other organisational problems. Consequently, information was sought to investigate utilisation by specific personnel, the range of applications and an overall evaluation of how well the computer is used based on the material in Chapters Two, section 2.3 & 2.4; Chapter Three, section 3.3 and Chapter Four sections 4.2 & 4.3.

3- Is there a difference between the perceptions of different groups of employees toward the negative input of computers on health service organisations? This question was tested by a range of questions in the questionnaire given in Appendix D.

It has often been remarked that computer deployment gives rise to various negative aspects among staff. The researcher expected that these might be most evident with regard to doctors' relationships with patients, job security and status, which explored in Chapter Two, sections 2.3 & 2.4 and Chapter Three, sections 3.3 & 3.4).

4- Is there a difference between the perceptions of different groups of employees toward how computer impact has been felt? This main question was tested by a range of questions in the questionnaire. Please see Appendix D, for impact questions.

The importance of the quality and detail of health information will be reflected in any decision, development or change in the health delivery. Information may be seen as a corporate resource which requires to be developed and controlled. Moreover, the production of information that is not used, is wasteful of resources. Also, technology deployment may cause changes that could affect organisation management (i.e. decisions, style), individuals (i.e. work, function) and production (i.e. services, products). The researcher aimed to test the impact of computers on the quality of health information, and their influence on users and on hospital management and their work (Please see Chapter One, section 1.0; Chapter Two, sections 2.3 & 2.4; Chapter Three, section 3.2 and Chapter Four sections 4.2 & 4.3).

5- Is there a difference between the perceptions of different groups of employees toward the evaluation of computer technical problems and performance? This main question was tested by a range of questions in the questionnaire. Please see Appendix D, for computer evaluation.

The aim of this question was to evaluate the performance and to identify the main technical problems encountered when using these computer systems. This question was viewed in relation to the findings from the strategy's questions and computer utilisation questions.

6- Is there a difference between the perceptions of different groups of employees in their overall satisfaction toward the computer system information, performance and management handling computer deployment?

The researcher sought to ascertain the satisfaction of the users toward the performance of their institution's existing system, its quality of reports and management handling of the computer. All the satisfaction questions were included in other sets of questions. However, they are analysed separately in Chapter Six.

5.3. Survey Population and Sampling Rationale

5.3.1. Sampling consideration

Ideally one would take a complete list of computer users and randomly select a sufficiently large sample of these to give statistically significant results. In practice no complete list of computer users has ever been compiled. Nor would it have been possible to compel all of a randomly selected sample of individuals to complete the questionnaire (see next section).

In our case, the first population considered in this study was the users of computer systems of hospitals which have implemented computer systems. The Royal Hospital in Oman was the first choice of location for conducting the main fieldwork, because it was assumed to be the most troubled. The Royal Hospital is using a WANG system (see Chapter Four, recently it has been changed to a SUN system). The other hospital chosen was Sultan Qaboos University Hospital, also in Oman, which uses Gerber-Alley (again see also Chapter Four). In fact, the selection of the University Hospital was suggested by the health administration authorities in Sultan Qaboos University, on the basis that the University Hospital's new system was facing similar problems to those faced by the Royal Hospital. It was believed that there had been no co-operation to help the University Hospital avoid the mistakes, slow implementation, slow response time and other problems that had occurred with the Royal Hospital's computer system deployment and operation. Another reason for the choice of the two hospitals was that they are the only two hospitals in Oman, which use the computer for medical records.

In the UK, the researcher's initial intention was to investigate the computer system use in Hull Royal Infirmary Casualty Ward. However, as a result of the Gulf War and frequent system breakdowns, the hospital authorities had, with apologies, to decline to take part in the investigation. As an alternative, it was decided to examine a General Practice system. However, this raises the issue of the difference in sampling size between hospital and general practice. Actually, the investigation was on the issue of computer deployment planning and use, and was not concerned with the size of patients or staff in the hospitals or GPs (see next section). According to Howell (1997), a survey population can range from a relatively small set of numbers, which can be collected easily, to large numbers which it is impractical to collect. Therefore, it was necessary to draw only a sample of observations from the hospital and GPRs populations, to represent the actual computer use and provide information on the planning, utilisation and development involved in computer deployment into two health systems.

5.3.2. Sampling Rationale

The essential requirement of any sample is that it has to be as representative as possible of the population from which it is drawn (Gronlund and Linn, 1990). In Chapter Four (section 4.2.6) the researcher indicated that around 120 terminals were in use in the Royal Hospital. Since there is no list of users and no restriction on use of available terminals, the sample of respondents in the Royal Hospital was determined on the basis of these terminals. In the case of SQUH, the researcher sent 35 questionnaires to cover the 35 terminals in use in SQUH units that are opened for work; i.e. each terminal was provided with one questionnaire. Heads of units were asked to distribute the questionnaire to those who were actively involved in the computer deployment or utilisation. Therefore, this was a non-random sample. Howell (1997) believed that the nonrandom sample is the cornerstone of most statistical procedure and he warned that the use of nonrandom samples may lead to the belief that randomness is not important. Therefore, he recommended that researchers' interpretation of the results be limited.

In the case of GPRs the sample of respondents was determined to include all the GPs in Humberside area that have deployed computers for their patient records. A list of 120 general practices, which had been computerised, was obtained from the FHSA. Interviews and participation in HCUG meetings, indicated which personnel would be most appropriate to participate in answering the questionnaire, such as practice managers and doctors (see next section). Therefore, one questionnaire was sent to each general practice to be answered by whoever was most involved with computer deployment and utilisation. This method of selecting the sample is known in statistics as the stratification method. According to Moser and Kalton (1971), Keeves (1988) and Borg and Gall (1989), one way to increase the precision of a random sample is to increase its size. However, they pointed out that this is not the only way to increase precision. They indicate that the use of stratification and knowledge about the population to ensure adequate representation may reduce cost of the research execution and increase accuracy. The researcher used the stratification method to increase the precision of a random simple by selecting as respondents those who might have knowledge or be regular user of the computer, or be involved in decisions regarding computer deployment or development (see the covering letters and the questionnaires in Appendix D).

5.3.3. Key players in the survey sample

The survey identified the main groups of players in the computer system deployment, implementation and utilisation (Please see Table 5.3 for the GPRs and Table 5.4 for the Omani hospitals):

Table 5. 3 Groups of players for IT deployment in GPRs

1- Practice managers *	Senior administrative staff employed to manage the practice's affairs and involved in IT deployment decision, IT maintenance and development decisions or in using the output of the system for management issues.
2- Physicians	Doctors who own or share the practice, involved in IT deployment decision, IT maintenance and development decisions or in using the output of the system for patients and management issues.
3- Computer staff	Persons working full time in IT department, such as IT managers, advisors, engineers analysts or programmers.
4- Users	Staff who use a terminal or PC as a regular part of their work, e. g. as data entry clerks, or to retrieve information etc..

* This group could be the physicians themselves acting as the practice managers.

Table 5. 4 Groups of players for IT deployment in Omani hospitals

1- Top management	Senior level staff involved in IT deployment decision, skills and IT maintenance and development decisions or in using the output of the system for management issues.
2- Technical management	(Middle management) including managers of departments and sections or units that run the procedure of IT system utilisation.
3- Computer staff	Persons working full time in IT department, such as IT managers, advisors, engineers analysts, programmers, or technicians
4- Users	Staff who use a terminal or PC as a regular part of their work, e.g. as data entry clerks, or to retrieve information etc..

These groups were divided by the researcher into two main groups, A & B (group A: represents top management + technical management in Oman and practice managers + physicians in GPR and group B includes all other users). Questionnaires were sent to both groups to get their opinions on the systems they are using, from different perspectives, such as whether computer deployment was part of a total organisation strategy or an ad hoc decision, whether there is adequate utilisation, whether computer fears are prevalent, whether and how the computer has impacted on the activities of the health organisation and whether respondents are satisfied with the computer.

5.4. Methods of Collecting Data:

5.4.1. Introduction

According to Moser and Kalton (1971), methods of collecting data are not very developed or systematised. Each surveyor may use his/her ideas or whatever means are available to collect the data. The only difference is in the degree of validity and reliability of the resulting information. Fieldwork is not a single method or technique. Evaluation fieldwork means that the researcher is on-site (where the investigation is happening) observing, talking with people, and going through situation records. Multiple resources of information are sought and used, because no single source of information can be trusted to provide a comprehensive perspective on the method. By using a combination of documentation analysis, observations, and interviewing, the researcher was able to use different data sources to validate and cross-check findings (Patton, 1990 and Creswell, 1998).

In this section, we will explain the main methods of obtaining data, which were adopted here. These can be classified as follows: 1) documentary sources, 2) observation, 3) interviewing, and 4) mail questionnaire. It has been indicated by Moser and Kalton (1971) and by Harper (1991) that two or more of these methods may be combined to make use of their strengths. Therefore, using a combination of data types increases validity as the strengths of one approach can compensate for the weaknesses of another approach (Gray and Gee (1972) described how a mail questionnaire survey was complemented by interviewing to increase the response rate (Frey and Oishi, 1995).

5.4.2. Documentary sources

It is important at the very beginning of an investigation to negotiate access to fieldwork documents and records (Patton, 1990). The researcher should attempt to anticipate as many different sources of information as possible, which will provide many things that cannot be observed. This can help the researcher to understand the institution whose decision behaviour and background he is investigating, and give the researcher ideas about important questions to pursue through more direct observations and interviewing.

However, in the field of this investigation, there were many restrictions on access to documentary sources and little of help (see section 5.12). In Oman the researcher was not allowed to see the documentation for computer system tendering, financial spending on system maintenance. However, it was possible to see some letters and reports directed to the top management, asking about or suggesting developments to the computer system. This revealed the slow response of the top management and the fact that they delayed a decision until the next five-year plan meeting, which could be five years later.

In the case of GPs there were restrictions on the access to GPs' system and documentation (see section 5.12 and Appendix E), mainly to safeguard the confidentially of patient records.

The documentation difficulties may have influenced the interview and questionnaire questions and may have meant that the full picture of the strategy for system deployment and associated financial issues were not uncovered. This limitation had to be borne in mind for the main fieldwork.

5.4.3. Observation

What people say is a major source of qualitative data, whether what they say is obtained orally through an interview or in written form through document analysis or survey responses. There are limitations, however, to how much can be learned from verbal reports. A fully picture of the complexities of many situations, can often only be obtained by direct participation in and observation of the phenomenon of interest (Patton, 1990, Creswell, 1998).

Since the purpose of observational analysis is to take the reader into the setting that was observed, a certain degree of depth and detail is required although in these two field studies, the aim was not to obtain detailed information but to get an overall impression of how the users and top management behaved and thought about the system that had been introduced and used by them.

In practice, observation and interviewing are often fully integrated approaches, because every face to face interview also involves and requires observation. The skilled interviewer is thus also a skilled observer, able to read non-verbal messages, sensitive to how the interview setting can affect what is said and carefully adjusting to the intensity of the interviewer-interviewee interaction and relationship.

Observation is a classic method of scientific inquiry (Moser and Kalton, 1971). In this case, observation consisted of asking people about the system performance and their attitude to computer deployment and observing technical performance and problems. When studying opinions and attitudes, there are situations where the link between opinion and behaviour is close enough for observation of the latter to afford a good clue to the former (Moser and Kalton (1971). Therefore, observation helped the researcher to make his own judgement about the nature of the problems experienced with the computer system.

There are five types of observations (Bright, (1991):

1) Structured Observation: this involves the use of a schedule or coding sheet within which the behaviours or features of the topic under study are to be identified.

2) Unstructured observation: this type of observation is not defined by a schedule or rating scale designed before the observation. The observer makes notes relative to what is occurring and what he/ she considers may be interesting and useful to later analysis. This type of observation is usually associated with participant observation.

3) Participant observation: in this type of observation, the researcher engages

in the activities that he/ she is observing. The researcher influences the activities they are observing, the researcher being a participant observer rather than a passive, uninvolved observer.

4) Non-Participant observation: the researcher is uninvolved with the activities he/ she observing, and attempts to observe in as neutral and unobtrusive a manner as possible, without influencing the activities under observation.

5) Controlled observation: this type of observation includes non-participant, structured observation, but also includes the use of standardised tests.

Non-Participant observation was adopted in the UK and Oman without use of standardised tests. However, in the Royal Hospital and University Hospital, direct observation was made of the expected respondents of the questionnaire, to whom it was necessary to explain the interview and the questionnaire, since many were not of English origin. During these observations and informal discussions, many technical problems emerged and the advantages and impact of the computer in health delivery were noted (see the case study in Chapter Four).

Both observation and documentary study provided insights, which helped to produce and shape the final questions to be given to the same sample as had been observed. Observation served to introduce the researcher to the Omani Health System (OHS) and the General Practice system (GPRs) with which (especially the latter) he had previously been unfamiliar.

In addition, given the absence of documentation, observation was an important way of finding out more information about the issues of interest in the fieldwork, as explained in an earlier paragraph. However, there were several obstacles such as obtaining permission from Director General in Royal Hospital and SQUH, the researcher faced suspicion and was quested by the staff and not allowed at busy times to observe the system working at its maximum capabilities. The researcher had to overcome these difficulties by explaining and demonstrating his work, making friends and finally talking to the head of units to gain help and enable them to understand his work.

5.4.4. Interview

Interviews are one of the major methods used in research for gathering information. It is used in historical, development, survey, case-study, ex-post facto, action and ethnographic approaches to research. It is mainly used where qualitative information (e.g. 'how did you feel about?' is required, but it can be used for limited types of quantitative data such as demographic detailed and types of frequency of data (e.g. attitude scales, frequency of events) (Bright, 1991).

According to Moser and Kalton (1971), a survey interview is a conversation between the interviewer and respondent with the purpose of drawing out certain information from the respondent. According to Borg and Gall (1989), the interview is a popular and effective method, which can be used to assess views when the target sample is small.

Furthermore, the purpose of interviewing is to find out what is in and on someone else's mind. The interview allows us to enter into other person's perspective, which could be different from our own (Patton, 1990). Nevertheless, the interview method was considered as one of the best ways of exploring the views and attitudes of the group sampled towards the introduction of computers into health systems. These qualitative findings may be presented alone or in combination with quantitative data.

However, Harper (1991) indicated that the interview has a serious disadvantage, that inaccurate or false data may be given to the interviewer, either by mistake or by deliberate intent to mislead or to cover up a certain issue, or hide failure. It also, can be affected by the researcher's personality, moods, interests, experiences, and bias (Rubin, H. and Rubin, I., 1995). A bias against the group or person being interviewed may block access or distort the results, but too much sympathy can also be blinding. On the other hand, it is probably unrealistic to aim for neutrality, which is unlikely to be attainable (Rubin, H. and Rubin, I., 1995).

Interview subjectivity and bias may appear through the interpretations of other people via verbal and non-verbal modes of communications or through facial expressions. In addition, the interview is subject to avoidance and resistance by the interviewee to some type of questions.

To maximise the information obtained, the interviewer needs to have an ability to probe and use techniques to generate more information when a response is unclear or incomplete. Probes include simple gestures, such as nodding or saying 'uh-huh,' and neutral questions like 'could you tell me more about that?' to motivate the respondents to say more.

There may be a lack of validity, which refers to the presence of bias as result of 1) the interviewer's attitude and opinion, interpretation of interviewees, seeking confirming data and/ or misperception of interviewees' statements; 2) the interviewee trying to please the interviewer – feeling obliged to present a good image, avoiding some questions or even telling lies; and 3) questions being unclear, ambiguous, loaded and/ or asking for information interviewees do not have (Patton, 1990).

There are five types of interview:

1- Structured interview: This type of interview involves the use of an interview schedule, which is prepared in advance by the researcher. It consists of a set of questions carefully worded and arranged with the intention of taking each respondent through the same sequence and asking each respondent the same questions in essentially the same words. This type of interview may be used when the interviewees have limited time to offer.

2) Semi-Structured interview; A set of prepared questions (interview schedule) is used but the sequence and the wording of the questions can be varied by the researcher. Additional supplementary questions, which are not prepared in advance, can be inserted at any point if the researcher requires clarification or elaboration of interviewees' response.

3) Unstructured interview: in this type of interview, no set of prepared questions or interview schedule used. However, the researcher has list of key issues or topics he/ she wishes to obtain information about. These issues are raised in an informal, conversational style in which the use, type, wording and / or sequencing of questions is not specified. The interviewer is free to explore, probe, and ask questions that will elucidate and illuminate that particular subject. The researcher suggests the subject for discussion but has few specific questions in mind (Rubin, H. and Rubin, I., 1995).

4) Non-Directive interview: This type of interview is derived from the therapeutic interview in which the interviewer takes a subordinate role and allows the interviewee to raise issues and express feelings as he/ she sees fit; and

5) Focused interview: In this type of interview the researcher will know of, and will have analysed, in advance, a particular experience (event, task, situation, state) that the interviewee will have had in the past (e.g. religious conversation, loss of child, unemployment). The purpose of the focused interview is to focus upon a specific experience of the interviewee in more detail to discover more about it (Bright, 1991).

Structured interviews were conducted with the GPs practice in the UK (see section 5.13). The researcher also, did semi-structured interviews whilst carrying out the structured interview with the GPs. Unstructured interviews were conducted with the Omani interviewees (see section 5.13), because the interviewees did not wish to answer structured or specific questions. They wanted to be allowed to speak more generally. However, when interviewees' interest and confidence had been gained, elements of the semi-structured approach were included, whereby the interviewer raised topics, then guided discussion by asking specific questions.

Similar problems as we faced in the observation and the documentation methods were faced in the interview also. Some people showed reluctance to co-operate with the project and were unwilling to answer questions or discuss issues that might touch upon government failure or criticise their superiors or their work procedures. However, many of the questions added to the Omani questionnaire arose out of points noted during the discussions and the interviews.

5.4.5. Questionnaire

The other source used to collect data was the questionnaire, which in this survey, was regarded as the main source of data for the research.

Mail questionnaires are widely criticised because of the difficulty of securing an adequate response. According to Borg and Gall (1989) and Harper

(1991), questionnaires are often shallow, i.e. they may not dig deeply enough to provide a true picture of respondents' opinions and feelings. There are also the problems of non-return and the possibility of the misinterpretation of the questions. Despite these limitations, the merits of the questionnaire may be strong enough to weigh the balance in its favour. Keeves (1988), Cohen and Manion (1986) and Johnson (1977) draw attention to the following points:

1) They permit wide coverage at minimum expense both in money, time and effort.
2) They permit more valid answers, as they give opportunity for the respondent to consult his or her sources of information.
3) They allow greater uniformity in the manner in which the questions are posed and ensure comparability.

With the help of printed instructions and definitions, questionnaires become sufficiently simple and straightforward to understand. Various steps were taken in developing the questionnaire, to ensure its relevance, and to avoid ambiguity, vagueness, technical expressions and so forth (see later sections of this chapter).

5.5. Humberside Computer Users Group (HCUG)

As part of the investigation of the general practice system and before launching the survey, the researcher was invited by the FHSA information system officer to attend several meetings of the Humberside Computer User Group (HCUG). This group had been created as result of the market forces affecting the use of such computer systems (see Table 5.3). The basic aim of the HCUG is to encourage GPs in using computers, learning about its potential and introducing new systems. Another important aim is to obtain feedback from the system users by evaluating and discussing the difficulties and problems they face, which will help in modification and development of their systems.

Darby and Malcolm (1980) have described the group task as educational and the method of choice, small group work in which participants learn about easy-to-use systems by the 'look and see' approach. They also showed how such groups have helped in describing the role of the new technology, by listing in detail what they want to do with the information and what they want the computer to do for them. He admitted that such small group work is slow, but argued that these groups have contributed to the development of the computer, quoting as an example the directory driven standard for repeat prescribing, which today is reflected in the labelling systems used by chemists, as well as by the safest commercial registration systems. In addition to the above aims, the meetings of HCUG often included matters such as suppliers' presentations of new systems, discussion of the group's system problems, and also a discussion of the financial situation and training problems.

Several benefits were obtained from the researcher's attendance at these meetings: firstly, they facilitated understanding of the different kinds of system that general practitioners use (see Table 5.5); secondly, they provided a valuable insight into GPs' problems, attitudes and fears; thirdly, they made it possible to establish contacts which helped in conducting the interviews later on; and finally, the insights obtained helped in shaping the questionnaire.

Table 5.5 presents in the first two columns the names and the numbers of the systems used by General Practices in April 1992, when the investigation was conducted. The next two columns present the most recent information given to the researcher regarding the situation of computerisation in General Practices (in September 1997) and the last column presents the changes in the take up of these systems by the GPs. There has been increased take up of four types of system, with a total of 44 installations, the highest increases being 27 new EMIS and 15 new Pennine. However, there has been a decrease in the number of uses of some systems. These are 8 fewer AMSYS and 4 fewer MicroDoc and Genisyst. The M-Tech is the only computer system whose use by GPs remains unchanged. Moreover, four new computer systems have been introduced into the general practices, while nine of the computer systems used in 1992 do not appear in the new 1997 list (see the Table 5.5). EMIS was the system on which the researcher focused for the general practice fieldwork.

Table 5. 5 Humberside FHSA Computerisation

GPs Systems	No. of Systems 1992	GPs Systems	No. of Systems 1997	Changes
VAMP	20	VAMP	21	+ 1
Micro Doc	18	Micro Doc	14	- 4
EMIS	16	EMIS	43	+ 27
Meditel	12	Meditel	13	+ 1
AMSYS	11	AMSYS	3	- 8
Genisyst	6	Genisyst	2	- 4
Pennine	5	Pennine	20	+ 15
Medico System	2	Medico System	1	- 1
M-Tech	1	M-Tech	1	0
Update*	9	HCSL**	13	
Own System *	9	ITS**	5	
Option Software *	2	GP Surgery manager **	4	
Saxon Computing*	2	TOREX**	2	
Ambridge *	1			
Meduser*	1			
Image*	1			
Datom*	1			
Clinical Network*	1			
Total	118	Total	142	(+44) (-17)

* This indicates computer systems that were formerly used by GPs but now appear to have been changed.
** This indicates the new computer systems that have been introduced to GPs by 1997.
(+) means increase by; (-) means decrease by; (0) means no change.

5.6. Questionnaire Development Procedure

5.6.1. Development Procedure

The aim of the questionnaire was to collect data on the opinions and satisfaction of the employees toward computer deployment and utilisation in health systems. In addition to the main questions explained earlier, consideration was given to other issues specifically relevant to General Practice (e.g. FHSA involvement) or to the Omani health system (e.g. five-year financial plans). In constructing the questionnaires, note was taken of advice given during the interviews, in participating in HCUG, and during the system investigation, for example not to use over-technical language and to use sample wording and phrasing. The questionnaire was developed and constructed by the researcher while in the Department of Computer Science at Hull University. This questionnaire was initially directed to each General Practice in Humberside area deploying computer systems. Then this questionnaire was used to survey the two Omani hospitals, with some amendments to suit the Omani environment.

5.6.2. Description and Rationale of the Questionnaire

The questionnaire was designed as a set of pre-coded or checklist questions. These are called closed-ended and structured questions. A closed-ended question offers a selection of answers from which the respondents are asked to select one (for example, answering Strongly Agree .. Undecided .. Strongly Disagree). A closed-ended checklist is a collection of related items presented to the respondent, who is asked to check items that are applicable. The researcher included in each question of these types an extra item: other(s) (specify) at the end of each question, so that responses need not be restricted to the given list. Thus, balance was maintained between preventing irrelevant information and giving respondents enough freedom to express their views. It has been indicated in the literature that great many checklists have been used in different surveys. An advantage of closed-ended questions is that they force all respondents to answers the same questions with answers that can be meaningfully compared, and analysed using computer techniques (Foddy, 1993).

The second technique used was the Likert scale, where the respondents are asked to choose between several response categories that indicate various strengths of agreement and disagreement. The technique is widely used in social research and is considered to provide an accurate measure of the respondent's opinion (Ebel and Frisbie, 1986; Fishbein and Ajzen, 1975; Foddy, 1993). Normally, five categories are employed, designated: Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree. Scales of three or seven can also be used. From the preliminary discussions and the interviews, the researcher felt that a scale larger than 5 might cause confusion and difficulties in distinguishing degrees of disagreement and agreement. Much effort went into making questions as short as possible, complete, and easy to read.

5.6.3. Questionnaires Classification into Sections

The Omani and GPRs questionnaire were divided into seven sections. The two questionnaires contained some different questions, to suit the different environments. It should be noted that when the variables were coded into SPSS, Omani variables received a code starting with 'S', while GPRs variables started with 'US'. An example of an Omani coding is S1Q1: S = section, 1 = one, Q = question and 1 = one, so S1Q1 means section one question one of the Omani questionnaire. In the GPRs coding US1Q1 means U = UK, S = section, 1 = one, Q = question and 1 = one, so US1Q1 means UK questionnaire, section one question one, and so on.

The first section of the GPRs' questionnaire was to investigate the respondents' job title, general practice profile, and knowledge of the computer. Similarly, the first section in Omani questionnaire was to investigate the respondents' job title, and their knowledge (skills and training).

Section two of the GPRs' questionnaire was to investigate the general practices' utilisation of their computer applications, their use by the different staff, the computerised reports produced and the extent of the utilisation of these reports. Similarly, the second section in Omani questionnaire was to investigate these issues of utilisation.

Section three of the GPRs' questionnaire was to investigate the general practices strategic planning toward their system deployment. Similarly, section three in Omani questionnaire dealt with the strategy of computer deployment. The questions used were different for each questionnaire, being chosen to investigate the strategic issues that the researcher felt most applicable in each environment.

Section four of the GPRs' questionnaire was to investigate any fears arising from computer deployment into general practices. Similarly, section four in the Omani questionnaire investigated the fear of the computer. Several questions on fears were added to each questionnaire, to fit each environment.

Section five of the GPRs' questionnaire was to investigate the computer's impact on general practices. Similarly, section five in Omani questionnaire investigated the impact of computer in the Omani health system.

Finally, section six of the GPRs' questionnaire was to investigate technical problems. It also included a question on satisfaction of computers performance. Similarly, section six in the Omani questionnaire investigated technical problems and computer performance as well as a questions on satisfaction toward the management handling the computer process.

An important point worth mentioning here is that many of the questions added to the Omani questionnaire arose out of points noted during the discussions and the interviews.

In total, the questionnaires covered the following points:

1) Questions to provide a profile of the system in use;

2) Questions about usage of the computer;

3) Questions intended to assess the degree of strategic planning that went into the deployment and use of the computer system;

4) Questions to assess the level of knowledge and awareness;

5) Questions to assess the impact of computer;

6) Questions intended to assess the degree of satisfaction with the system and the management involved in its deployment;

7) Questions related to the availability of skills and support for training;

8) Questions related to the fears that may result from computer deployment;

9) Specific questions concerning GPs and the FHSA support of general practice with regard to computer deployment;

10) Specific questions relating to the Omani environment.

5.7. Validity of the Questionnaire

To confirm the relevance of items to their scales and sections the questionnaire was reviewed and corrected by a panel of experts and independent judges who participated in HCUG, and the interviewees. It was also reviewed by experts such as the researcher's supervisor at the Hull University Department of Computer Science, Mr. I. Shand from the FHSA in Hull and finally, Dr. R. Turner from the public health authority, who lectures part-time at the University of Hull, on the subject of health legislation. These individuals varied in the degree of their involvement in the questionnaire development (see Figure 5.1). A similar procedure was used in Oman. Since the questionnaire was prepared in the UK, a few changes were needed to suit the Omani environment. There was also the matter of addition of questions to the Omani questionnaire, as indicated above. Therefore, the questionnaire was shown to experts in the Educational Research Centre in the College of Education and then the Language Centre of Sultan Qaboos University. It was also presented to a steering committee of both hospitals to get permission for the survey and further advice on the questionnaire. These validation procedures were adopted to obtain help in the following respects:

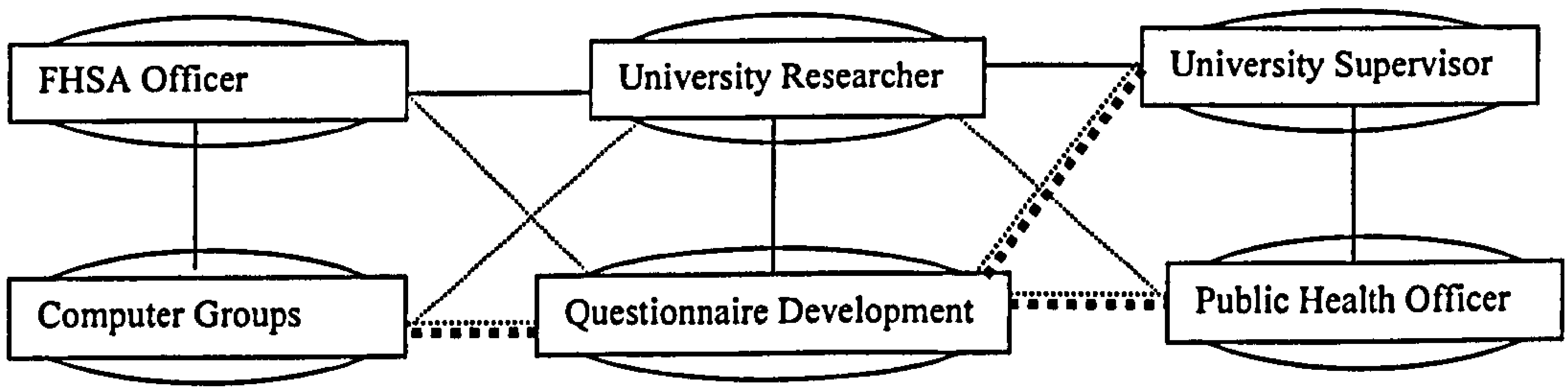
1) to examine the questionnaire in the light of the research objectives, to make suggestions and comments on the appearance of the questionnaires and to judge their suitability for computer analysis;

2) to revise or reword any vague items, to eliminate items found to be inappropriate and to add any necessary additional items;

3) to make suggestions about the appearance and the structure of the questions;

4) to verify questions and relate them to their sections and scales.

Figure 5. 1: Contribution to the development of the Questionnaire



This broken line indicates weak involvement with the researcher and questionnaire development.
The strong broken line indicates a moderate relation and/or contribution.
This straight line indicates a stronger relation and/or contribution to the questionnaire development.

For example, the FHSA officer was very much in contact with the researcher and provided much support in the fieldwork but his contribution to the questionnaire development was not strong. However, the University supervisor was of more help with the conduct of the fieldwork, through her/his frequent advice and follow-up, corrections to the questionnaire and advice, e.g. that I see the public health officer who gave further help in the questionnaire development.

In this way, the questionnaire gained validation, valuable advice was received and permission was obtained for the questionnaire to be distributed. However, a few questions were deleted as they were found almost invariably to elicit affirmative responses. Examples include "Do you maintain manual files along-side computer records?" "Do you use the hospital's computer?" " Do you think your job requires the use of computer?" All these questions were answered in the affirmative. Some questions were omitted because they were considered too sensitive, such as "Do the managers/ administrators know enough about how the system operates?" Other questions were deleted because of repetition and similarity. For example "Practice managers/General managers do not make full use of computer reports" "Doctors do not use the computer sufficiently."

5.8. Questionnaire Administration

According to FHSA sources at the time of the investigation there were around 120 general practices using computer systems (see section 5.4, Table 5.5). Mailed questionnaires were sent to all these general practices (see section 5.2.2) using FHSA mail facilities. In the case of Omani hospitals, selection was made according to the terminals in use and heads of the departments or units, from which came 150 potential respondents. The questionnaires were directed to those personnel actively involved in computer deployment or utilisation.

The questionnaires in the UK were delivered and collected using FHSA facilities, but in Oman, mailing a questionnaire is not a common practice; therefore, the questionnaires were delivered and collected personally by the researcher himself. A covering letter was sent out with the questionnaire to explain its purposes, the identity and aims of the researcher, the importance of the respondents' participation in the research and why and how the survey was being undertaken. A return address was given in the case of GPRs' questionnaires. Respondents were assured of the confidentiality of the information (see Appendix D).

5.9. Data Type

Information obtained from surveys may include various types of data. These types of data can be divided mainly into four basic classifications: categorical (nominal or ordinal) and continuous (interval or ratio). Table 5.6 reproduces an illustration given by Anderson *et al.* (1986) for the above classification.

Table 5. 6 Summary of four types of data classification

Type of Classification	Characteristics	Examples
Nominal	Measure assigned is a Label or number	Measure is used to identify religion affiliation: Jew, Christian, Muslim. - Numbers on soccer player uniforms
Ordinal	Measure assigned permits ordering of items.	- Measurement of size of car: compact, intermediate, full size. - Class rank for high school students.
Interval	- Measure defined in terms of fixed and equal units. - Items can be ordered.	Measurement of temperature-e.g., 40°, 20° , etc. note: 40 is not twice as warm as 20°. 0° C is just the freezing point of water, not 'no heat.'
Ratio	- Measures defined in terms of fixed and equal units. - Zero is meaningful. - Items can be ordered.	Measurement of height; e.g. height in centimetres stick 10 CM, 20 CM. Note; 20 CM is twice as long as 10 CM. 0 CM is 'no length'

Data gathered in these surveys were often subjective and dependent upon an individual's feeling and interpretation of the question. Also our data showed an important characteristic of the nominal and ordinal variables, that there are differences between categories, but it is not meaningful to quantify how much difference there is (de Vaus, 1996). Therefore, this indicates that our data are ordinal (rank order) as well as nominal, based on the definitions given by de Vaus (1996, p. 130): "A nominal variable is one where we can distinguish between categories of a variable but cannot rank the categories in any order. ... people in different categories differ from one another but it is not meaningful to quantify how much difference there is." And "An ordinal variable is one where it is meaningful to rank the categories: there is some justifiable order between the categories. However, it is not possible to quantify precisely how much difference there between the categories." In the ordinal scale only the order of numbers is meaningful. Moore (1985, p. 122) gave an example that if a committee ranks 10 fellowship candidates from 1 (weakest) to 10 (strongest), the candidate ranked 8 is better than the candidate ranked 6; not just different (as a nominal scale would tell us), but better. But the usual arithmetic is not meaningful: 8 is not twice as good as 4, and the difference in quality between 8 and 6 need not be the same as between 6 and 4. Only the order of the values is meaningful. These class ranks are ordinal data. As with the nominal data, ordinary arithmetical operations with ordinal data make no sense.

5.10. Statistical Approach

Two quite distinct approaches are used in opinion and attitude inquiries. One of the most common in opinion polls attempts simply to estimate what proportion of the survey population say they agree with a given opinion statement; the second goes further by including the respondents' answers to the set of questions as a whole. According to Moser and Kalton (1971) the Gallup Poll questionnaire has many examples of opinion questions. Many researchers produce data on frequencies, percentages and cross-tabulations. All of them are important aspects of survey analysis. Therefore, several statistical methods were undertaken and some advice was sought from a number of experts. The researcher must decide not only between parametric and nonparametric tests, but also which tests within the major fields to use. Because the data in the present study are nominal and the ordinal (see section 5.8), a nonparametric statistical test was chosen. This decision was based on several important criteria:

1) Upon studying and testing several statistical models we found that the nonparametric tests have high probability of rejecting the null hypothesis and this indicates that the test is a powerful one. This criterion has been stated by (Siegel and Castellan, 1988) as follows:

> 'It is a powerful test if it has a large probability of rejecting *Ho* when *Ho* is false.' (p. 19).

2) A nonparametric statistical test is a test whose model does not specify conditions about the parameters of the population from which the sample was drawn. In other words it requires very limited assumptions about the distribution of the data which can be used, and this is regarded as an advantage (Norusis, 1991). However, the disadvantage of nonparametric tests

is that they are not as powerful as their parametric counterparts, because they usually ignore some of the variable information (Norusis, 1991; Siegel and Castellan, 1988).

3) Some nonparametric tests are appropriate to apply to data measured in ordinal scales and others to data in nominal scales (Siegel and Castellan, 1988).

From the variety of nonparametric tests, we chose the chi-square test. The rationale for choosing this test is that the researcher desired to find out about the responses that fall into various categories and how they were distributed, and chi-square is suitable for analysing data like this (Siegel and Castellan, 1988; Blalock, 1979). Thus, the chi-square was used to test whether significant differences existed between the observed number of responses falling in each category and the expected number based on the null hypothesis (for example see Figure 5.2 and Figure 5.3). We also decided to use crosstabulation, because it gives more information about the respondents than tables of frequencies. A crosstabulation (Contingency table) contains a cell for every combination of categories of the two variables (for example see Table 5.7 and Table 5.8). The most important of information for our analysis has been taken from the crosstabulation results and displayed in specific tables (see Chapter Six).

Table 5. 7 S1Q1 Respondent's Position by S3Q9: Computer Users Made Aware

	S3Q9 Count Row Pct	Strongly Disagree 1	Undecided 3	Strongly Agree 5	Row Total
S1Q1	Gen (1) Mgmt	11 42.3%	9 34.6%	6 23.1%	26 25.5%
	IT/IS (3) Staff	50 65.8%	12 15.8%	14 18.4%	76 74.5%
	Column Total	61 59.8%	21 20.6%	20 19.6%	102 100.0%

Chi-Square	Value	DF	Significance
Pearson	5.33520	2	.06942

Minimum Expected Frequency - 5.098 Number of Missing Observations: 0

Figure 5. 2 Chi-Square for S3Q9 Computer User Made Aware

	Category	Cases Observed	Expected	Residual
Strongly Disagree	1	61	34.00	27.00
Undecided	3	21	34.00	-13.00
Strongly Agree	5	20	34.00	-14.00
Total		102		

Chi-Square	D.F.	Significance
32.1765	2	.0000

* In the above case the nonparametric chi-square test supports the null hypothesis, stated as 'no differences or equal', because the value of significant level is 0.069 which is greater than 0.05. This result concerned the two groups (A and B) responses toward the question. However, NPAR chi-square test shows a significance result of .0000. This result shows the difference between the three choices (strongly agree, undecided and strongly disagree).

Table 5. 8 S1Q1 Respondent's Position by S2Q1.2 Computer use in Word Processing

	Count Row Pct	S2Q1.2 No 0	Yes 1	Row Total
S1Q1	Gen (1) Mgmt	8 30.8%	18 69.2%	26 25.5%
	IT/IS (3) Staff	45 59.2%	31 40.8%	76 74.5%
	Column Total	53 52.0%	49 48.0%	102 100.0%

Chi-Square	Value	DF	Significance
Pearson	6.27789	1	.01223

Minimum Expected Frequency - 12.490 Number of Missing Observations: 0

Figure 5. 3 Chi-Square for S2Q1.2 Computer Use in Word Processing

	Category	Cases Observed	Expected	Residual
No	0	53	51.00	2.00
Yes	1	49	51.00	-2.00
Total		102		

Chi-Square	D.F.	Significance
.1569	1	.6921

* In the above case the chi-square tests reject the null hypothesis, stated as 'no differences or equal', because the value of the significance level of 0.012 is less than 0.05. However, the NPAR chi-square accepts the null hypothesis in the case of the three choices, giving a value 0.6921.

An important point, which ought to be explained related to the result of these tests is that the NPAR chi-square tests the significance of the frequency of the choices, which may indicate agreement or disagreement. In this case, the researcher will interpret the nature of this significance, in the context of the issue in question. The chi-square test gives the significant differences between two groups, A and B, to allow the researcher to reject or support the hypothesis.

5.11. Significance level and Confidence level

The observed significance level is the probability that the sample could show a difference at least as large as the one that is observed, if such groups or means etc. are equal. Since our analysis depends on producing differences, then our procedure is to reject the null hypothesis in favour of the alternative hypothesis if the probability of occurrence under the null hypothesis is equal to or less than the level of significance of 5%. The confidence level is the range within which a sample population is likely to lie as the result of an experiment including sampling. Then confidence level = 1- significance level = 95%. The relationship between the two is that if we take any value within a 95% confidence interval and test the null hypothesis, that it is the sample value, then we will not reject the null hypothesis. Then the observed significance level will be greater than 0.05. If the value is outside of the 95% confidence interval, and the hypothesis test rejects the null hypothesis, that it is likely to be the sample value. The observed significance level will be less than or equal to 0.05.

5.12. The setting of the hypotheses

When the researcher conducts a study, he/she has some ideas that he/she wants to explore. These ideas are often known as the hypotheses or the alternative hypotheses. This is the hypothesis of interest that the researcher thinks is really true for the sample under investigation, which typically involves comparisons of several groups' characteristics or of the attitude of a sample or of different samples. The researcher may feel there are differences in those characteristics, opinions or groups, or no differences;

therefore, he/she wants to know how much the participants in the sample differ. Therefore, the researcher should set the frame of reference that will be used to evaluate the alternative hypothesis. This is true in the sample if the alternative is wrong. This frame of reference is called the null hypothesis (Norusis, 1991). Usually the null hypothesis is stated as all things are equal or there are no differences between them. According to Siegal and Castellan (1988), "the null hypothesis is any hypothesis of 'no effect' and stated to be rejected." (P. 7). If the probability of this hypothesis is calculated then the observed significance level should be smaller or equal to 0.05, to reject the null hypothesis. If the observed value is large, then the null hypothesis will not be rejected.

The research hypotheses were mainly related to the main five categories of questions (see section 5.1). The major hypothesis in each case is that there are differences in the variables measured. The evidence of the reality of these differences is evaluated by testing the null hypothesis that there are no such differences within the significance level of 5%.

The null hypothesis is as follows:

"There are no differences in opinion between groups A and B of respondents in measuring the level of strategic planning, utilisation, fears, impact and satisfaction toward computer system deployment into their health system".

The alternative hypotheses are:

1) Hypothesis A: "There are differences in opinion between group A and B of respondents in measuring the level of strategic planning, utilisation, fears, impact and satisfaction toward computer system deployment into their health system.";

Hypothesis A was constructed on the basis of differences in opinion between two groups (in our case group A and group B, see their definition in section 5.2.3) involved in computer deployment and utilisation. The researcher, during his fieldwork investigation, noticed differences in opinion between these two groups

2) Hypothesis B: "The top management and technical management from the Omani respondents and from GPRs respondents practice managers and physicians will have more favourable attitudes toward the system or the outcomes of using the system that has been deployed under their decision or recommendations while those not involved in this kind of decision will be less favourable.";

The aim of hypothesis B is to provide a further check on the results of hypothesis A, which may not able to pick the smallest differences in the data, as they may be ignored by the use of the chi-square significance test (see section 5.2).

3) Hypothesis C: "Group B will use the undecided choice to avoid responding to certain questions that may criticise management actions toward the new technology";

The above hypothesis was based on observations and discussion with computer users in Oman, when there appeared objection and resistance to co-operating to fill in the questionnaire. Some expressed that they were not willing to answer questions that might criticise their boss or their work procedure, and so it was thought they might use the undecided choice to avoid responding to these kinds of questions.

4) Hypothesis D: "There is a difference between group A in the UK and group A in Oman in their responses to the above situations";

This hypothesis was based on the assumption that the Omani group A would be more biased than the GPR group A in their responses to the same questions. The main reasons for such an expectation are that few studies of this kind have been undertaken in Oman; therefore, there is poor awareness and lack of knowledge of the aims of this kind of academic study and the style of the questionnaire. Respondents may fear getting in trouble by responding to questions that involve criticism of management and their own work, as mentioned earlier. Finally, attempts to improve the situation in Oman have been slow, although many evaluations have taken place.

5) Hypothesis E: "The overall failure of the computer will be more related to human issues than to the machines."

Hypothesis E was tested by the result of computer technical problems and system evaluation compared to the main human problems such as: 1) poor strategy; 2) poor utilisation, 3) fears of the technology, and 4) lack of skills and training.

5.13. Limitations

This study has limitations common to most survey research, namely, that the validity and reliability of the instrumentation can be questionable, as well as the external validity of the findings.

In the present study, unfortunately, the investigation and the interviews did not go smoothly. Some of the obstacles are mentioned elsewhere. The first problem was a restriction on access to the GPs' system because of security and confidentiality of patients' records. Several letters on this matter are in Appendix E. This restriction impeded full understanding of each function of the system. However, systems were seen running in certain functions and for a limited time, which provided a reasonable insight into their functions (see EMIS and the two hospital systems in appendices (A,B and C) respectively.

The second limitation was that it was necessary to produce a letter from the Qaboos University under-secretary general before the investigation could be conducted (see Appendix E).

A third problem was that hospital staff in Oman were reluctant to co-operate at first, some because they thought the research was for the Ministry of Health or the University and others because they saw no point in participating in research that was not to be used by the authorities. However, after further explanation of the research aims and objectives, some agreed to co-operate, but others asked not to be recorded.

The fourth problem was that at the regular Monday meeting of the head of SQUH units it was decided not to accept the questionnaire on the ground that it was sensitive and then the research was stopped for two weeks until permission was eventually granted.

The fifth limitation was that official information was not available about financial spending (past or intended) on the Omani computer systems; such information as was heard from staff was, in the circumstances, not recorded. The researcher was told, 'This information is not allowed to be given to any one! Please bring permission from the under-secretary or general manager.'

In view of these limitations, it can be realised that the degree of co-operation, trust and honesty in responding to the questionnaire may have been limited.

5.14. The Interviews

The interview method was considered as the best way of exploring the views and attitudes of the group sampled towards the introduction of computers into health systems. In this qualitative survey the views of a specific sample of these involved in computer deployment and utilisation were sought. According to Thomas (1978), there are three kinds of face to face interview commonly used: the structured, semi-structured and unstructured interview.

The interviews conducted in the UK were a combination of structured and semi-structured interviews, based on presentation of certain questions together with a schedule of key points around which to build the interview (see Appendix D). They required careful wording and short answers or ticking of categories by the investigator. Such interviews are similar to a written questionnaire, except that much more latitude is permitted (Moser and Kalton (1971); Thomas, (1979) and Youngman (1982). In contrast, the interviews conducted in Oman were unstructured interviews, because most of the interviewees refused to answer specific scheduled questions but asked to be set free to talk about matters related to computer deployment and use. Also, most of them were unwilling to be recorded. It was therefore necessary to identify from the discussions the points relevant to my schedule and to record them quickly on paper. Further detail or clarification was requested as necessary during the interviews.

In spite of these difficulties, information was obtained which might not otherwise have emerged. The interviewees were given freedom to go further than answering the interview questions, so that they might link any important issue raised by them with any of the matters under investigation. The time spent on each interviewee differed from one individual to another. Most of them lasted 20-30 minutes, but a few took over two hours (this happened only in Oman).

5.14.1. The General Practice Interviews Results

The interviews in UK were conducted in various locations in Humberside, including urban and suburban areas, and covered different computer systems. The Humberside Computer User Group (HCUG) meetings provided introductions to most of the interviewees, though much help in scheduling appointments came from the FHSA officer. Nine interviewees were selected, all of them either practice managers or doctors or both.

These interviews mainly covered the following issues:

A) how well planned was the deployment of computers into the practice in terms of initial decisions on cost, utility, new staff recruitment and training; how the planning was done for computer installation requirements, hardware provision, and computer maintenance; and future plans for the computer system, e.g. expansion of system hardware and use of software;

B) how training requirements have been handled;

C) the problems that may result from computer deployment;

D) the impact of the introduction of the computer system into their health system;

E) evaluation of the system.

To cover these issues, a series of questions was scheduled, including both structured and semi-structured types (see Appendix D). Open-ended interview questions were posed and sufficient time was allowed for the interviewers to express individual views and comments. It was felt that open comments might give some more insight into the area of deployment and its implications, training problems, the GPs system and FHSA.

All interviewees questioned responded in a remarkably similar way despite the different systems used in their practices. The answers outlined below should be taken as common to all the interviewees. However, some specific statements by individual interviewees have been expressed.

A- The main issue about which the interviewees were asked was the strategic planning and preparation for computer implementation and operation, as follows:

1) Did you make an initial decision on the cost, utility, new staff to be recruited and training incurred by the use of this technology?

The responses of the interviewees indicated that they had thought of these and undertaken some planning. However, during the discussion around this question the feeling was expressed that they had not fully appreciated the cost of this technology and the need for continuing training; in other words, their long-term strategic planning in this respect was poor.

2) Did you plan for installation requirements such as electricity, adequate spacing and peripherals?

Respondents were sure about the electricity requirement and its adequacy but were less certain about peripherals. They hesitated to deploy these at once, but did so piecemeal. This might have been because of rapid changes in prices and in the machines themselves.

3) Did you feel your planning for the hardware provision was adequate for the practice requirements?

Most agreed they had tried to make sure the provision of the hardware was adequate, but again, in view of the changes in the nature of health information and computer technology, they felt the need for continuous monitoring and improvement.

4) What maintenance support is being offered? (e.g. for both hardware and software, cost for additional years, guaranteed response time in event of breakdown and 24 hour contact for inquiries).

For peace of mind it is necessary to make sure in the planning stage that adequate maintenance will be available to support the practice system. Respondents were happy about the hardware and software maintenance. All of them indicated that they had to pay for additional years' maintenance. Many of them reported there is no guaranteed response time in event of breakdown, but many said a 24-hour inquiry service was available.

5- Future plans to modify the software and hardware, expand the system or install external communication.

Almost half of the interviewees said they did not plan future modification to their hardware and software. However, they expressed their intention to expand the system and to introduce external communication that could link them with other health information, inside or outside the UK.

B- An issue presented to the top management was the training issue. According to Sampson (1984), inadequate staff training may limit implementation effectiveness. Therefore, training for something new has to be considered at an early stage of deployment.

1) Interviewees were asked whether training was part of the initial decision when planning was carried out to introduce computers into the health system.

All respondents expressed their agreement and considered it as the main requirement for this technology. However, under this heading we posed more questions which investigated the training issue in more depth.

2) Managers have to plan whether to have in-service training, to depend on a private institute to provide training, or whether it will be provided by the supplier; how much training is needed; and what it will cost.

Most interviewees said they were not yet willing to have in-service training because their practices were busy and short of space. Training was, most of the time, conducted by the supplier and sometimes by third parties, whether paid for by the supplier or by the practice. However, many expressed their dissatisfaction with the training provided by the supplier or others. They said it was scheduled at inconvenient times or there was not enough time to comprehend and master computer functions. Some believed it costly.

3) In the light of these answers, we asked whether respondents should pay extra money for extra training.

At once they said yes and they expressed their willingness to do so and argued that they still needed more and more training, which should be continuous, and at a more convenient time and place. One suggestion by the researcher was that GPs may take the initiative to make use of the HCUG and have them set up their own training institute to suit their needs. They could find volunteers or pay for special computer staff to train their staff at a convenient time, for a longer period and at less cost.

C- Interviewees were asked about several related questions on problems that may result from computer deployment, such as:

1) Human context related problems.

One of the main problems believed to be crucial in creating fear and resistance was inadequate knowledge of the computer. Another was fear of professionals being thrust into the management role, trying to select and buy the system and allocate staff. There is slightly recognition that there could be an effect on the doctor-patient relationship and the extra time that might be spent using the computer.

2) Technical problems.

Interviewees believed that the computer in many technical aspects is now sufficiently well established. However, in the case of security and confidentiality, they expressed satisfaction with security in term of ease and frequency of back-up, but were divided as to whether they had security against a virus or visual warning of default to the operator. This disagreement might be the result of the different systems they were using, some of which had these kinds of security, while others did not. Regarding confidentiality, most interviewees were satisfied with the level of access.

D- Questions about the impact or the influence of changes resulting from computer deployment and utilisation:

1) Respondents were asked whether changes were made as a result of computer deployment, either in existing functions or introduction of new functions. Such changes are likely to raise fear.

Most interviewees agreed that existing functions had changed, and most of them had introduced new functions. Nonetheless, the responses indicate that the computer has influenced the organisation structure.

2) Does the management use the information produced by the computer?

All the interviewees agreed that management use the information produced by the computer for decision-making on management issues to improve health care, and made it clear that they saw this as the main reason for using computers. The computer had become a very important tool for their survival.

3) A delicate question that had to be asked was whether the management used the computer to monitor the staff's work.

Some interviewees were reluctant to answer this clearly. Those who answered this were divided. Some admitted doing this, and others denied it. They said it had become normal procedure and part of the changes in work routine, of which staff were aware; it was not aimed against them personally but was done for the sake of health care improvement and staff development.

E- Evaluation of their system:

Most of the interviewees agreed that their systems were simple and easy to learn, and that it was easy to search and analyse data. This might indicate the user friendly systems they have deployed in their practices. They agreed their systems were versatile, flexible and quick to use, the systems were not obsolete. The other important aspect of evaluation is that the system was worth its cost; expense is one of the obstacles that causes slow deployment of computers in general practice. Finally, they indicated that the system was reliable and, overall, satisfaction was agreed.

Some of the interviewees complained about particular systems which they had installed, but they said they had been talking about these problems with the companies and in HCUG meetings and they believed the system would be modified to meet their requirements.

F- Other issues raised during the interviews:

1) The question was raised as to the adequacy of the system to cope with changes in the medical industry and legislation. Two thirds believed that their systems were not complete systems for medicine and finance or administration.

2) Another question concerned awareness. All interviewees said that without awareness, the system is likely to be resisted. Some suggested that everyone in the health services should know about the computer function and its benefits for health services, otherwise money and time will be wasted.

3) Interviewees were divided on the issue of whether Humberside Computer User Group's meetings had contributed significantly to development of their systems. This disagreement suggests that the HCUG meetings need greater participation from GPs and support from suppliers, academics and representatives of HAs.

4) When asked whether the supplier offered the practice a long-term commitment to their system maintenance and development, two thirds answered yes but the rest said it was too costly. GPs were not prepared to pay and suppliers were not prepared to provide such a service free.

5) One important question that came up during the interviews was about the issues related to the failure of the computer in NHS, recently raised by a TV programme called Blind Data. The researcher asked whether the general practices agreed with the claims of the programme. The first concerned inadequate planning that accompanied this kind of technology. All of the interviewees agreed on this. The second was poor management, which many also believed to have contributed to this failure. Issues on which many agreed but others thought had no impact on failure were lack of competitive tendering, over-reliance on expensive contract staff and other external assistance, and using computers to try and reduce the staff bill. They believed there was plenty of competition, but the restrictions on the system imposed by the Health Authority might cause this kind of failure. In general, they believed the importance of computer deployment was directed to health provision and help in general practice administration.

6) It was asked whether the future importance of the computer relied on issues such as information stores, interrogation facilities, whether machines can talk

to each other, the ease of integration of the system into general practice system and other health organisations, its maintenance and support and its overall costs. All of these points received full agreement and interviewees were looking forward to seeing them in reality.

5.14.2. The Omani Interviews

In Oman, twenty interviewees were selected, ten from the Royal Hospital and ten from Qaboos University Hospital. Of those staff who were interviewed, four were general managers, eight were technical managers (heads of departments or units), four doctors and four system operators. All of them were involved in computer deployment and used the computer system.

In spite of the restrictions and obstacles, which faced the researcher, it was possible to cover the main issues of interest to the researcher and others were raised which had not previously been considered. Some of these new issues were presented in the main questionnaire and others will be presented later in this section. The main issues that were discussed in the interviews were as follows:

A- The process of introducing computers to both hospitals.

It was explained that personnel were not able to see the systems in question working in Oman but a group of Omanis (top management and doctors, but no computer specialist) had travelled to European Countries and US (see Omani case study in Chapter Four). Thus, implementation was not built on strategic planning or prior study. Also, there was no consideration of the different environment, as one interviewee mentioned. This interviewee suggested there should be consideration of the changes in the system originally built in America when it is brought to Europe and then to the developing countries. For example, some hardware and software might not be available yet. However, many interviewees believed there had been some planning, but it was not well developed and only relevant to the immediate situation.

Problems arising from the different environment include the fact that in Oman patients are admitted to hospital without restriction, wherever they come from, diseases are different, and staff are not well trained to cope with the new technology. Obviously, there was poor initial planning on the part of the management.

B- The issue of training:

This was considered by most interviewees to be a problem that has caused much strain. The suppliers only provide a short period of training and are not willing to continue it, even though the contract is still under their supervision. The staff who need to be trained have very limited time, or are not co-operative and fear failure with the new technology. There is also a lack of skilled Omani professionals to train the staff. However, this problem might be solved with adequate strategic planning by sending local people abroad to be trained or to study the technology.

C- The evaluation of the two existing systems:

The Royal Hospital system was in chaos, resulting from the huge volume of data stored, which it was not planned to cope with. This has resulted in slow responses and inability to perform some functions such as the pharmacy application or operating theatre application. The laboratory is regarded as the least satisfactory of all the functions running now. The hardware is not adequate and has become obsolete. Steps are being taken to increase the capacity of memories and hard disks but it will be necessary to wait for the next five-year plan for implementation to be considered (see Chapter Two on the state of the Royal Hospital system). The Qaboos University Hospital system was newly deployed. Unfortunately, University Hospital has experienced the same problems as Royal Hospital. The biggest problem is the slow response time. Also, many aspects of the system are being withheld. There is a shortage of operators and a lack of trainees and teachers of this technology. Since the research in Oman, a colleague newly returned after receiving a doctorate in England has said that many of the problems evident at the time of this investigation are now on their way to being solved, by a well-planned schedule for use of the available resources. However, he admitted that there is more to do and Oman will depend on others currently studying in this area.

D- Other issues which were raised during the interviews:

Some of these were added to the questionnaire, such as waiting for the next five year plan, local personnel not trusted because of their inexperience in the subject, etc. It was suggested that there is a feeling that top management are not supporting the technology. It was said they were too busy to attend training sessions, or might feel ignorant about the systems' operation. Some said they saw no need to interact with the system themselves, since they had staff to do that. However, they expressed their willingness to study the reports about how the computer is working and how it needs to be developed to cope with the future situation.

When it was pointed out that some reports and suggestions had been presented one year previously, so far with no effect, the responses were 'yes it is true, but we will consider it when the time is right and the right budget is there,' or 'wait till the five year plan'. It was suggested to the interviewees that waiting and not solving these problems would cost the hospital more in the long run. They said they were aware of that and regretted it, but the decision rested with the Minister and the Under-secretary. They admitted that the problem was one of insufficient resources and lack of long term strategic planning which had influenced those at the top. However, confidence was expressed that students studying abroad and the co-operation of the professionals currently working in Oman would eventually bring these problems to an end.

5.15. Conclusion

This chapter has outlined the methods used by the researcher in carrying out empirical surveys in UK and Oman. The main survey instrument was a questionnaire, designed to provide basic quantitative data, to be complemented by qualitative information derived from interviews and observation. The questions covered a variety of issues, and the analysis of the quantitative and qualitative data, will make possible an assessment of the differences and similarities in the deployment, use and the development of computers in health systems in developed and developing countries, and factors affecting it. They should also give an indication of the effectiveness of how ISD deployment and implementation methodology, people's satisfaction with the system, and their knowledge and awareness of this new technology.

The interviews in the UK and Oman were useful in understanding the actual system situation and the problems that have accompanied computer deployment.

In the next chapter, the researcher will present the results of statistical analysis of the findings of the general practices' questionnaire and the Omani questionnaire.

6. CHAPTER SIX: ANALYSIS OF THE OMAN AND THE U.K. FINDINGS

6.1. Introduction

This chapter presents the results of a detailed analysis of the responses to the Omani questionnaire and the UK/GPRs questionnaire. These are presented according to the main questions that were posed in Chapter One and Chapter Five. Before discussing the results, it is important that a number of points be made regarding their nature and the way in which they should be interpreted. From the initial study, observation, discussion and interviews a lot of information about staff behaviour and problems related to the systems was gained, and from preliminary reading of the results, some clarification of the responses to certain questions appeared to be needed.

6.2. Statistical software used

The tests were initially processed on *Atomstyle apc* 486 SX/25, IBM compatible with 8MB RAM at Hull University Management Systems & Science (MSS), Newland House Building, Unit 16 which has a connection to the main computer centre of the University. They were completed on Pacard Bell DX4/100, IBM compatible with 20 MB RAM at Sultan Qaboos University, Muscat, Sultanate of Oman. The researcher used the Statistical Package for Social Science (SPSS) package version 6.0 for Windows. "SPSS is one of, if not the, most widely used and comprehensive statistical programs in the social sciences" (Bryman and Cramer, 1993, p.16). In addition, Window eight Excel was used to produce the graphs.

6.3. Statistical analysis of findings

A summary is presented for each question, both overall and by group (A & B), which indicates the significant findings and, as many significant relationships exist between variable cells contained in the samples, a comparative summary is also provided of the GPRs' questionnaire and the Omanis' questionnaire, where each contained similar questions. It should be kept in mind that what is described in this chapter should be seen within the context of the implications of computer deployment into health care and in particular into the Omani Health System (OHS) and GPRs in the UK, that are outlined in Chapter 4 and the literature review in Chapter 2 and 3; they should also be viewed in tandem with the interview results (see Chapter Five) and the pre-investigation of the two field studies. The total number of questionnaires distributed, collected, and completed by GPRs in UK & RH and SQUH in Oman is presented in Table 6.1.

Table 6. 1 Questionnaire response rate

HOSPITALS	Questionnaires Distributed	Questionnaires completed	Percent completed
ROYAL HOSPITAL (RH)	120	73	61%
UNIVERSITY HOSPITAL (UH)	35	29	83%
OMAN TOTAL (OT)	155	102	66%
UK GPs (UK)	120	35	29.2%
GRAND TOTAL (GT)	275	137	49.8%

Several important points need to be explained about the nature of the coming analysis. Firstly, several abbreviations have been used. SDA & DA: represent Strongly Disagree + Disagree with values of 1 and 2 respectively, UND: represents Undecided with a value of 3 and A & SA: represent Agree + Strongly Agree, with the values of 4 and 5 respectively. GM is used to represent General Management; TM represents Technical Management; PM = Practice Manager; Sec/Rec = Secretaries/Receptionists and Others refers to respondents who do not fall into any of the above categories.

There are several abbreviations in the table headings as follows: 'Ques Code' represent beneath the questions code in SPSS; ' X^2 ': represents the Chi-Square results; ' F ': represents the frequency; ' % ': represents the percentage of the frequencies and '(A & B)': representing groups A & B of respondents (see two figures below).

Figure 6. 1 Outcome of NPAR tests for the three categories

Ques Codes	SDA & DA		UND		SA & A		X^2
	F	%	F	%	F	%	

Figure 6. 2 Outcome of Chi-Square tests for groups (A & B)

Ques Codes	SDA & DA (A & B)		UND (A & B)		SA & A (A & B)		X^2
	%	%	%	%	%	%	

The NPAR chi-square test was used to test three categories of responses such as SDA, UND and SA. This test shows whether a significant difference exists between the observed number of cases in each of the three columns and the expected number specified. The next test is the chi-square test, which is used to test whether a significant difference exists between an observed number of responses falling in each category (group A and B) and an expected number specified. Thirdly, some of the results show the significance as .0000; however, this does not mean the probability is zero. It is less than 0.0005, and SPSS/PC+ prints it as zero (Norusis, 1991). Percentages are rounded up or down to the nearest integer, and averages to the nearest fractions. In addition, we will highlight the hypotheses for reference. They are as follows:

1) Hypothesis A: "There are differences in opinion between group A and B of respondents in measuring the level of strategic planning toward computer system deployment into their health system.";

2) Hypothesis B: "The top management and technical management from the Omani respondents and from GPRs respondents practice managers and physicians will have more favourable attitudes toward the system or the outcomes of using the system that has been deployed under their decision or recommendations while those not involved in this kind of decision will be less favourable.";

3) Hypothesis C: "Group B will use the undecided choice to avoid responding to certain questions that may criticise management actions toward the new technology";

4) Hypothesis D: "There is a difference between group A in the UK and group A in Oman in their responses to the above situations";

5) Hypothesis E: "The overall failure of the computer will be more related to human issues than to the machines."

The respondents in Omani hospitals and GPRs in the UK are divided into two main categories. The first one is Group A. This group included respondents in positions such as top management and technical management (the head of dept. or unit) in the Omani hospitals and practice manager or physician in the GPRs in the UK. Membership of group A is based on involvement in computer deployment and development decisions or in use of the output of the system for management issues. Group B consists of staff who use a terminal or PC regularly as part of their work, either as data entry personnel or to retrieve information etc.. The IT staff are those working full time in the IT department, such as IT managers, advisors, engineers analysts, programmers, or technicians and they are regarded as group B in both environments.

The total number of respondents in groups A and B in the Omani questionnaire was 26 (25.5%) and 76 (74.5%) respectively. For more details of the respondent types, see Table 6.2. In the case of groups A and B in the GPRs in the UK the total numbers of respondents were 29 (82.9%) and only 6 (17.1%) respectively. Further details on the respondents' type are given in Table 6.3. Because of the small size of UK group B, it is excluded from the testing of the hypotheses.

Table 6. 2 Response frequency for (S1Q1) Job titles of Omani hospitals

Value Labels	Value	Frequency	Percent
General management	1	6	5.9
Tech management	2	20	19.6
IT/IS staff	3	6	5.9
Physician	4	9	8.8
Secretary or Receptionist	5	10	9.8
Nurses	6	15	14.7
Others (specify)	7	36	35.3
Total		102	100.00%

Table 6. 3 Response frequency for (US1Q1) Job title of GPRs in the UK

Value Labels	Value	Frequency	Percent
Practice manager	1	11	31.4
Physicians	2	18	51.4
IT/IS staff	3	3	8.6
Receipt/Sec	4	2	5.7
Nurses	5	0	0.0
Others (specify)	6	1	2.9
Total		35	100.0

An important point that has to be explained here is the result of item seven (others, specify) in the S1Q1 of the Omani questionnaire. It refers to several types of staff who use and are involved in entering data to the system. These staff, totalling 36 respondents, were identified as follows: 10 of these staff were from the medical record department whose main work is to enter patient medical records, 7 staff were from the pharmacy, 5 staff were technicians working in different units in the hospitals, 5 staff respondents were from medical purchase and 9 were data entry personnel working with medical staff (doctors & nurses). Moreover, some respondents in this category were added to the general management or technical management positions because the title of their position was not on the list but came under the general management position as identified earlier, such as chief of pathology laboratory and chief of microbiology section etc.. In the case of GPRs' respondents in this category, there were only three responses. These included two assistant practice managers who were treated as practice managers and one trainee pharmacist. However, the striking observation is that most of those who responded to the GPRs' questionnaire were doctors and practice managers, a total of 82.9% of the respondents. This might reflect the involvement of this group but might cast doubt on the reliability of answers to questions seeking evaluation of matters related to them. However, it also shows that these personnel, who are presumably the busiest, nonetheless gave their co-operation. It can also be noticed that no nurses responded to the GPRs' questionnaire. It might be that nurses knew less about this technology, or were less involved in using the computer. Keeping these points in mind will help in understanding the data and its analysis.

6.3.1. Analysis of questions related to strategic issues

6.3.1.1. Omani strategic issues questionnaire

The Omani questionnaire contained eleven items concerning the strategic issue, answered Strongly agree ..Undecided.. Strongly disagree. The GPRs' questionnaire had five items on this issue, answered in the same way. For analysis purposes, the responses were scored 5, 3 and 1 respectively.

The analysis below includes a list of the relevant items, their results and analytical observations (see Appendix D).

S3Q1: 'The plan to deploy computers into hospital has taken into account Organisation structure.'

S3Q2: 'The plan to deploy computers into hospital has taken into account organisation culture.'

S3Q3: 'The plan to deploy computers into hospital has taken into account staff skills level.'

S3Q4: 'The plan to deploy computers into hospital has taken into account staff training.'

S3Q5: 'The hospital's management made a prior study involving implementation of this system.'

S3Q6: 'The computer system was brought to the OHS on the basis of the health information system.'

S3Q7: 'Strategic planning was a consideration when the computer was purchased.'

S3Q8: 'Doctors and other hospital system users were consulted when planning of the computer system took place.'

S3Q9: 'The potential computer users within the hospital have been made aware of the system operation.'

S3Q10: 'The hospital has invested more in their computer to provide health care information in Oman.'

S3Q11: 'The deployment of the computer system was integrated into the total hospital organisation activities.'

Table 6. 4 Responses for Omani strategic issues

Ques Codes	SDA & DA		UND		SA & A		X^2
	F	%	F	%	F	%	
S3Q1	33	34	34	35	29	35	.8035
S3Q2	34	35	42	43	21	43	.0310
S3Q3	45	46	21	21	32	21	.0121
S3Q4	43	44	22	22	33	22	.0341
S3Q5	58	57	27	27	17	27	.0000
S3Q6	50	51	32	32	17	32	.0003
S3Q7	54	54	30	30	17	30	.0000
S3Q8	58	59	26	26	15	26	.0000
S3Q9	61	60	21	21	20	21	.0000
S3Q10	83	83	14	14	3	14	.0000
S3Q11	77	82	14	15	3	15	.0000
Average		55		26		26	

X^2 = .05 or less is significant

Table 6. 5 Omani responses to strategic issues by group (A & B)

Ques Codes	SDA & DA (A & B)		UND (A & B)		SA & A (A & B)		X^2
	%	%	%	%	%	%	
S3Q1	30	36	44	33	26	32	.6499
S3Q2	44	32	48	42	9	26	.2132
S3Q3	46	46	29	19	25	35	.4823
S3Q4	38	46	33	19	29	35	.3389
S3Q5	54	58	31	25	15	17	.8462
S3Q6	50	51	38	31	13	19	.7164
S3Q7	48	55	24	32	28	13	.2218
S3Q8	65	55	12	31	23	12	.0977
S3Q9	42	69	35	16	23	18	.0694
S3Q10	84	83	16	13	0.0	4	.5771
S3Q11	80	83	16	15	4	3	.9450
Average	52.8	55.8	29.6	25.1	17.7	19.5	

X^2 = .05 or less is significant

Figure 6. 3 Summary of responses to Omani's strategic issues, by job title

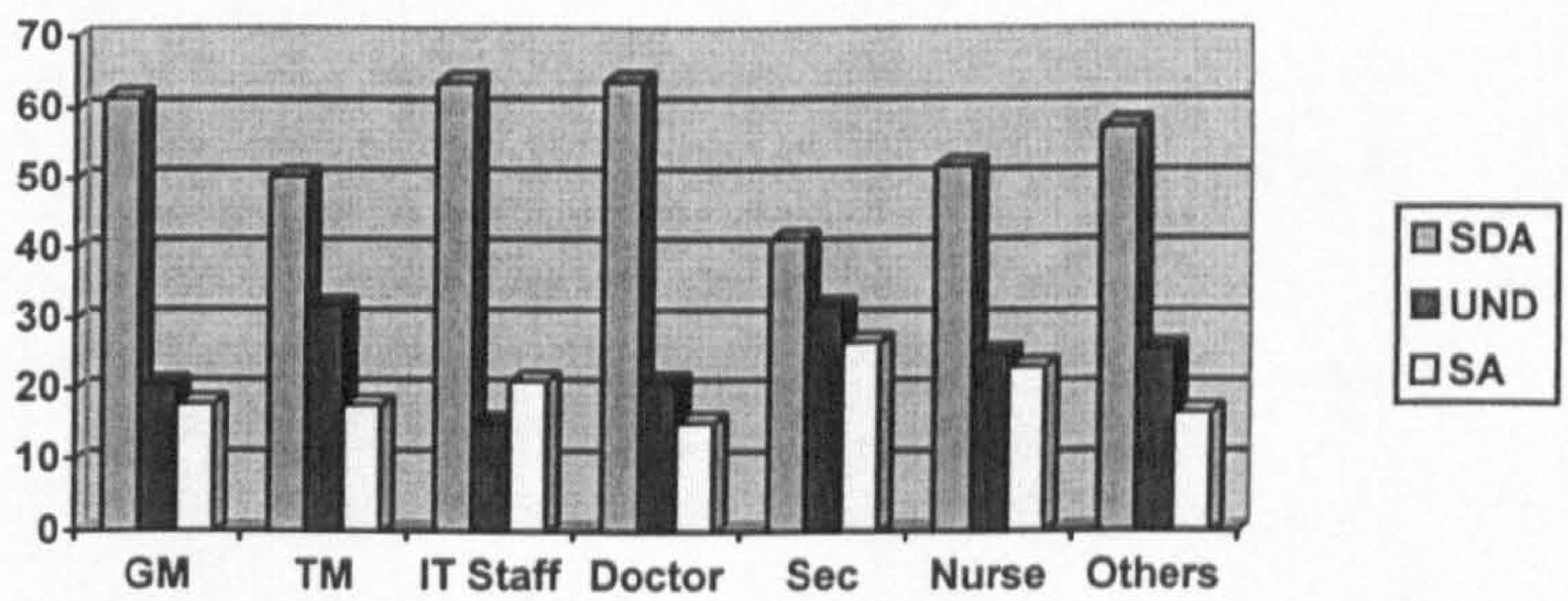


Table 6.4 and Table 6.5 present the results of the statistical analysis of the above questions using crosstabulation and chi-square (see Chapter 5). For detailed results for job title please see Table 1 in Appendix F.

By looking at Table 6.4, Table 6.5 and Table 1 we can summarise the results as follows:

1) Table 6.4 shows the differences in the distribution of responses are significant; NPAR chi-square test shows that 10 out of 11 items are significant, since the total number of strongly disagree (including disagree) responses to these questions is higher than that of the other choices (strongly agree and undecided) with an average score of 55%. Therefore, this result confirms that strategic information planning for this technology's deployment into the Omani health system was not initiated or not carried out as the literature recommends. This result also goes in line with the interview result. Also it was noticed that the three highest disagreement scores were given to items S3Q10, S3Q11 and S3Q9, concerning investment, integration and awareness respectively.

2) In respect of hypothesis A (see section 6.2), Table 6.5 shows that the differences between group A and B are not significant; their response choices were similar. Therefore, hypothesis A is not supported. Their average scores of strongly disagree, undecided and strongly agree for group A & B are 52.8% / 55.8%, 29.6% / 25.1% and 17.7% / 19.5% respectively.

3) For hypothesis B (see section 6.2), the questions in the questionnaire for the strategic issue are all positive to confirm that strategic planning has been conducted with respect to computer deployment. Therefore, a higher score for strongly agree or lower score for strongly disagree by group A than group B will make group A more favourable in their responses. Table 6.5 shows that the difference between average scores of group A and B for strongly agree is 1.8% in favour of group B. However, group A has a lower score in strongly disagree. The difference between group A and B for strongly disagree is 3% in favour of group B. The difference between the two averages is 1.2% in favour group B for disagree, therefore, hypothesis B is slightly supported.

4) The Undecided score can be seen to be very high, averaging 26.0% (see Table 6.4). Table 6.5 shows that for many of items group A has higher undecided scores than group B, their respective averages being 29.6% and 25.1%. Therefore, this result does not support hypothesis C (see section 6.1). However, Table 1 shows that the three highest average scores of undecided are: 32.0%, given by both technical management and secretaries/receptionists; 25.8%, given by respondents in the (others) category and 25.1%, given by nurses. Therefore, we may conclude that undecided responses were frequently given by groups A & B.

5) Table 1 in Appendix F, shows that the three highest average scores for disagree were 63.7%, 63.6 and 61.5 for doctors in group B, IT staff in group B and general management in group A respectively. Figure 3 shows a general agreement that strategic issues were not considered in computer deployment.

6.3.1.2. GPRs' strategic issues questionnaire

Items were posed to general practice respondents, related to strategic deployment of their systems, to find out whether computer systems in GPRs were deployed for their requirements and under their control, or according to the suppliers' and market interest.

US3Q1: 'The supplier of the computerised system asked you what information you require for your General Practice duties.'

US3Q2: 'You have been involved in making enquiry to the supplier about the system information design or specification.'

US3Q3: 'You have participated in the planning and the design of your computerised system.'

US3Q4: 'The suppliers should give a guarantee that they will update the system's capabilities and software.'

US3Q5: 'You're planning to add to the equipment as a result of your experience to date.'

Table 6. 6 Responses for GPRs strategic issues

Ques Codes	SDA & DA		UND		SA & A		X^2
	F	%	F	%	F	%	
US3Q1	13	38	1	3	20	59	.0003
US3Q2	6	17	2	6	27	77	.0000
US3Q3	12	35	4	12	18	53	.0129
US3Q4	3	9	2	6	29	86	.0000
US3Q5	5	15	2	6	27	79	.0000
Average %		22.8		6.6		70.8	

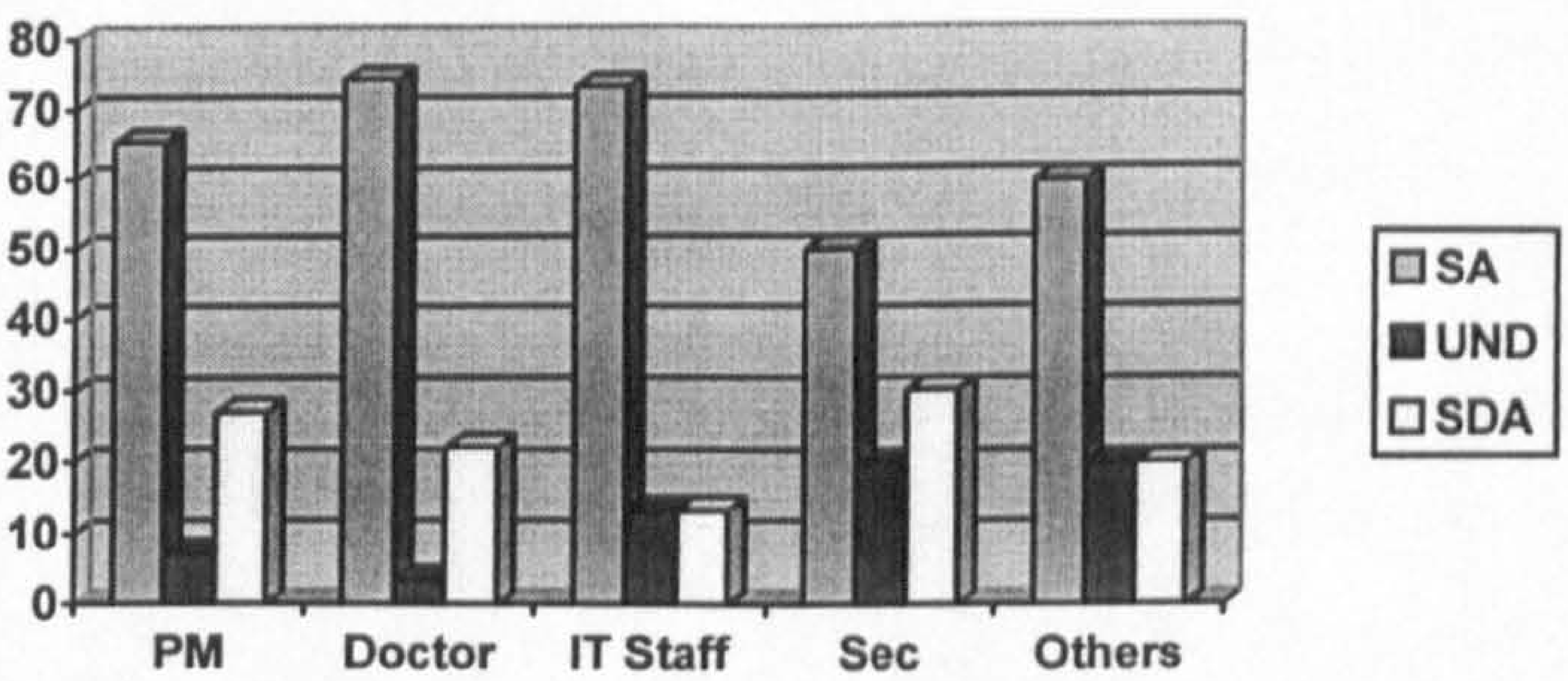
X^2 = .05 or less is significant

Table 6. 7 GPRs' responses to strategic issues, by group (A & B)

Ques Codes	SDA & DA (A & B)		UND (A & B)		SA & A (A & B)		X^2
	%	%	%	%	%	%	
US3Q1	43	17	4	0	54	83	.3975
US3Q2	17	17	7	0	76	83	.7982
US3Q3	43	0.0	4	50	53	50	.0029
US3Q4	4	33	4	17	93	50	.0239
US3Q5	14	17	7	0	79	83	.7938
Average	24.2	16.8	5.2	13.4	71	69.8	

X^2 = .05 or less is significant

Figure 6. 4 Summary of responses to GPRs' strategic issues, by job title



By looking at Table 6.6, Table 6.7 and Table 2 in Appendix F, and Figure 4, the results can be summarised as follows:

1) Table 6.6 shows that the differences in the distribution of responses are significant; NPAR chi-square test has shown that all five items are significant. The strongly agree score is higher than the other choices (strongly disagree and undecided), with an average score of 70.8%. Therefore, the respondents did not support the view that the deployment of computer into GPRs was an

ad hoc decision with poor strategic planning. The three highest scores of 86%, 79% and 77% for strongly agree were given to items US3Q4, US3Q5 and US3Q2 respectively. Those three items concerned the demand of guarantee by the suppliers for the technology, future planning to develop the system and involvement in making enquiry for the system design and specification to the supplier.

2) Table 6.7 shows that the differences between groups A and B are not significant; only two questions out five are significant. This result does not support hypothesis A. The groups were very close in their responses, with average scores of 71% and 69.8% respectively.

3) In the case of hypothesis B, Table 6.7 shows the difference between group A and B is 1.2% for strongly agree in favour of group A. However, the difference between group A and B for strongly disagree is 7.4% in favour of group A. Therefore, the difference between (7.4% - 1.2%) is 6.2% for strongly disagree which is in favour of group A. Therefore, hypothesis B is not supported. Since group B is small in size as explained earlier, their contribution in relation to any of the hypotheses will not be counted for critical analysis or conclusions, but will be shown when possible.

4) Table 6.6 shows very low average scores for the use of the undecided choice, averaging only 6.6%. There is only one high undecided score in Table 6.8 which was given to US3Q3 by group B. Therefore, we may conclude that there is no unexpected use of 'undecided'. This result does not support hypothesis C. However, this result for hypothesis C will be disregarded, for the reason explained earlier.

5) Table 2 also shows that the three highest average scores for strongly agree are 74.4%, 73.3% and 65.4% for doctors in group A, IT staff in group B and practice managers, group A, respectively. It also shows that the highest scores of 94.1% and 90.9% for demanding a guarantee by the supplier were given for doctors and practice managers respectively. However, practice managers

were less keen to plan for additional computer development, perhaps because of their concern for the financial demand implications of such development as mention in the interview. Figure 4 shows there is a general agreement that there was a strategic issues were considered in computer deployment. This is contrary to the Omani result.

6.3.2. Analysis of questions related to computer utilisation

6.3.2.1. Omani utilisation questionnaire

S2Q1.1-7: 'For which of the following do you use the computer?' This question included six items (plus others, specify) which investigated the system applications or for what purposes the computer is used (see Appendix D).

S2Q2.1-7: 'Who is the system used by' This question included seven items to investigate who uses the system and to what extent. The scores here are 1 for never or rarely use, 3 for sometimes use and 5 for often or very often (see Appendix D).

S2Q3.1-7: This question asked which computer reports are produced and used. Six reports were identified by the researcher in the list and the 'other, specify' category allowed scope for more reports to be mentioned by respondents (see Appendix D).

S2Q4: asked the respondents, 'To what extent do you think the hospital staff utilise the computerised reports that are received?'

Table 6. 8 Responses for utilisation questions (S2Q1.1-7)

Ques Codes	No		Yes		X^2
	F	%	F	%	
S2Q1.1	38	37	64	63	.0100
S2Q1.2	53	52	49	48	.6921
S2Q1.3	67	66	35	34	.0015
S2Q1.4	81	79	21	21	.0000
S2Q1.5	98	96	4	4	.0000
S2Q1.6	66	65	36	35	.0030
S2Q1.7	72	71	30	29	.0000
Average		66.6		33.4	

X^2 = .05 or less is significant

Table 6. 9 Responses, by group (A & B) for utilisation questions (S2Q1.1-7)

Ques Codes	No (A & B)		Yes (A & B)		X^2
	%	%	%		%
S2Q1.1	27	41	73	59	.2068
S2Q1.2	31	60	69	41	.0122
S2Q1.3	58	68	42	32	.3199
S2Q1.4	77	80	23	20	.7161
S2Q1.5	96	96	4	4	.9816
S2Q1.6	42	72	58	28	.0056
S2Q1.7	84	65	12	36	.0204
Average	59.3	68.9	40.1	31.4	

X^2 = .05 or less is significant

Figure 6. 5 Summary of Oman's responses to (S2Q1.1-7), by job title

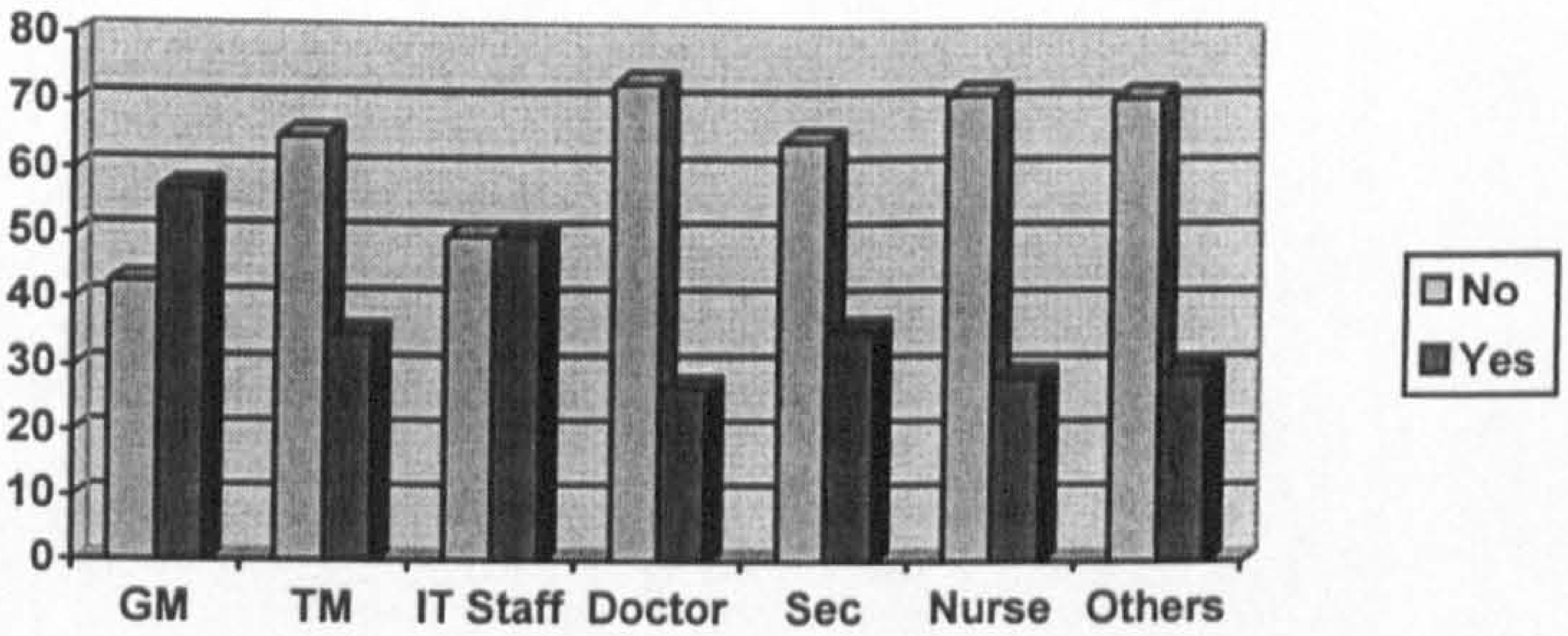


Table 6.8, Table 6.9, Table 3 in Appendix F, and Figure 5 present the results regarding computer applications' utilisation. The following observations may be made:

1) Table 6.8 shows that the total utilisation of these applications is poor, with average scores for use and not use of 33.4% and 66.6% respectively. Patient records is the most used application, with a score of 63% of responses and the least used computer application is repeat prescriptions, with a score of 4% of responses. The differences between the responses for use and not use are significant, except for one item, word processing.

2) Table 6.9 shows that the differences between groups A and B in responding to these items are not more than 43% significant. Therefore, we cannot say that this result supports hypothesis A.

3) To analyse hypothesis B for computer application use, group A should scores higher responses for computer application use or lower responses for not use than group B scores. Table 6.9 for the utilisation questions of computer applications shows that the difference between average scores of group A and B for use is 8.7% in favour of group A. Group A also has a lower score for not use. Therefore, these two results support hypothesis B. This result implies that there are differences between group A and B in their opinion, which were not revealed in testing hypothesis A.

4) Table 3 shows that the only response that resulted in high average score for use of the applications was 57.1% for general management in group A. IT staff in group B split their responses, 50.0%/50.0%. Figure 5 graph shows there is a tendency to indicate of low use of the available computer applications.

From the (other specify) category we found other applications such as laboratory system, X-ray system, storing system, inventory system, and purchasing ordering system in use.

Table 6. 10 Omani' responses for utilisation questions (S2Q2.1.1-7)

Ques Codes	Rarely		Sometime		Frequently		X^2
	F	%	F	%	F	%	
S2Q2.1	53	53	17	17	29	29	.0000
S2Q2.2	11	11	41	41	47	48	.0000
S2Q2.3	20	20	43	43	37	37	.0140
S2Q2.4	9	9	15	15	76	76	.0000
S2Q2.5	3	3	14	14	82	82	.0000
S2Q2.6	10	10	53	53	34	35	.0000
S2Q2.7	2	2	7	7	92	91	.0000
Average		15.4		27.1		56.9	

X^2 = .05 or less is significant

Table 6. 11 Omanis' responses to utilisation questions (S2Q2.1-7), by group (A & B)

Ques Codes	Rarely (A & B)		Sometime (A & B)		Frequently (A & B)		X^2
	%	%	%	%	%	%	
S2Q2.1	46	56	27	14	27	30	.3043
S2Q2.2	4	14	28	46	68	41	.0512
S2Q2.3	21	20	42	43	38	37	.9870
S2Q2.4	8	9	21	13	71	77	.6561
S2Q2.5	4	3	13	15	83	83	.9065
S2Q2.6	9	11	52	55	39	34	.8812
S2Q2.7	4	1	0	9	96	90	.2149
Average	13.7	16.3	26.1	27.9	60.3	56	

X^2 = .05 or less is significant

Figure 6. 6 Summary of Oman's responses to (S2Q2.1-7), by job title

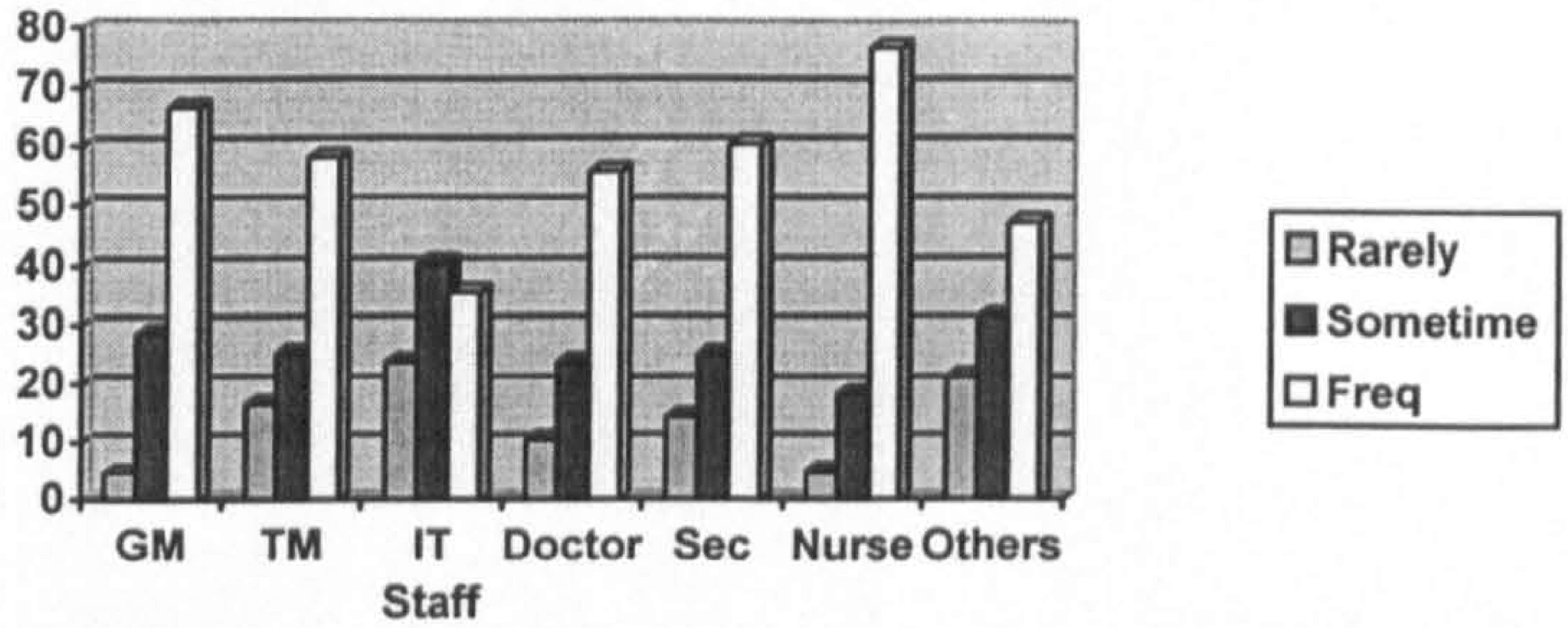


Table 6.10, Table 6.11, Table 4 in Appendix F and Figure 6 represent the findings as to who utilises these computer applications and how much. These can be summarised as follows:

1) Table 6.10 shows that the staff use the computer system well with scores of 56.9% for often or very often use the system, 27.1% for sometimes and 15.4% for never and rarely use the system. This result is significant. The three highest scores for frequently use the system were given to item 7, those who use the system for data entry, with a score of 91%, secretaries with a score of 82% and receptionists with a score of 76%.

2) Table 6.11 shows that the differences between group A and B are not significant. This is so, because the average scores of group A and B in choosing any of the scores are very close. Therefore, hypothesis A is not supported.

3) To analyse hypothesis B for measuring staff use of computer, group A should scores higher responses for staff use computer frequently or lower responses for staff use computer rarely, than group B scores. Table 6.11 for staff utilisation of the computer shows that the difference between average scores of group A and B is 4.3% frequently use in favour of group A. Group A also, has a lower score for rarely use. Therefore, these two results support hypothesis B. This result implies that there are differences between group A and B in their opinion which were not revealed by testing hypothesis A.

4) Table 4 shows that the three highest average scores for frequently use are 76.6%, 66.7% and 65.7% for nurses, group B; general management, group A and doctors, group B, respectively. Figure 5 shows confirmation that certain groups use the computer frequently. However, this does no alter the fact that use of computer applications in general is low.

Table 6. 12 Omanis' responses for utilisation questions (S2Q3.1-7)

Ques Codes	No		Yes		X^2
	F	%	F	%	
S2Q3.1	15	15	87	86	.0000
S2Q3.2	65	64	37	36	.0056
S2Q3.3	78	77	24	24	.0000
S2Q3.4	44	43	58	57	.1657
S2Q3.5	44	43	58	57	.1657
S2Q3.6	66	65	36	35	.0030
S2Q3.7	79	78	23	23	.0000
Average		55		45.4	

X^2 = .05 or less is significant

Table 6. 13 Omanis' responses by group (A &B) for utilisation questions (S2Q3.1-7)

Ques Codes	No (A & B)		Yes (A & B)		X^2
	%	%	%	%	
S2Q3.1	4	18	96	82	.0700
S2Q3.2	58	66	42	34	.4585
S2Q3.3	69	79	31	21	.3133
S2Q3.4	23	50	77	50	.0167
S2Q3.5	42	43	58	57	.9211
S2Q3.6	77	61	23	40	.1310
S2Q3.7	65	82	35	18	.0880
Average	48.3	57	51.7	43.1	

X^2 = .05 or less is significant

Figure 6. 7 Summary of Oman's responses to (S2Q3.1-7), by job title

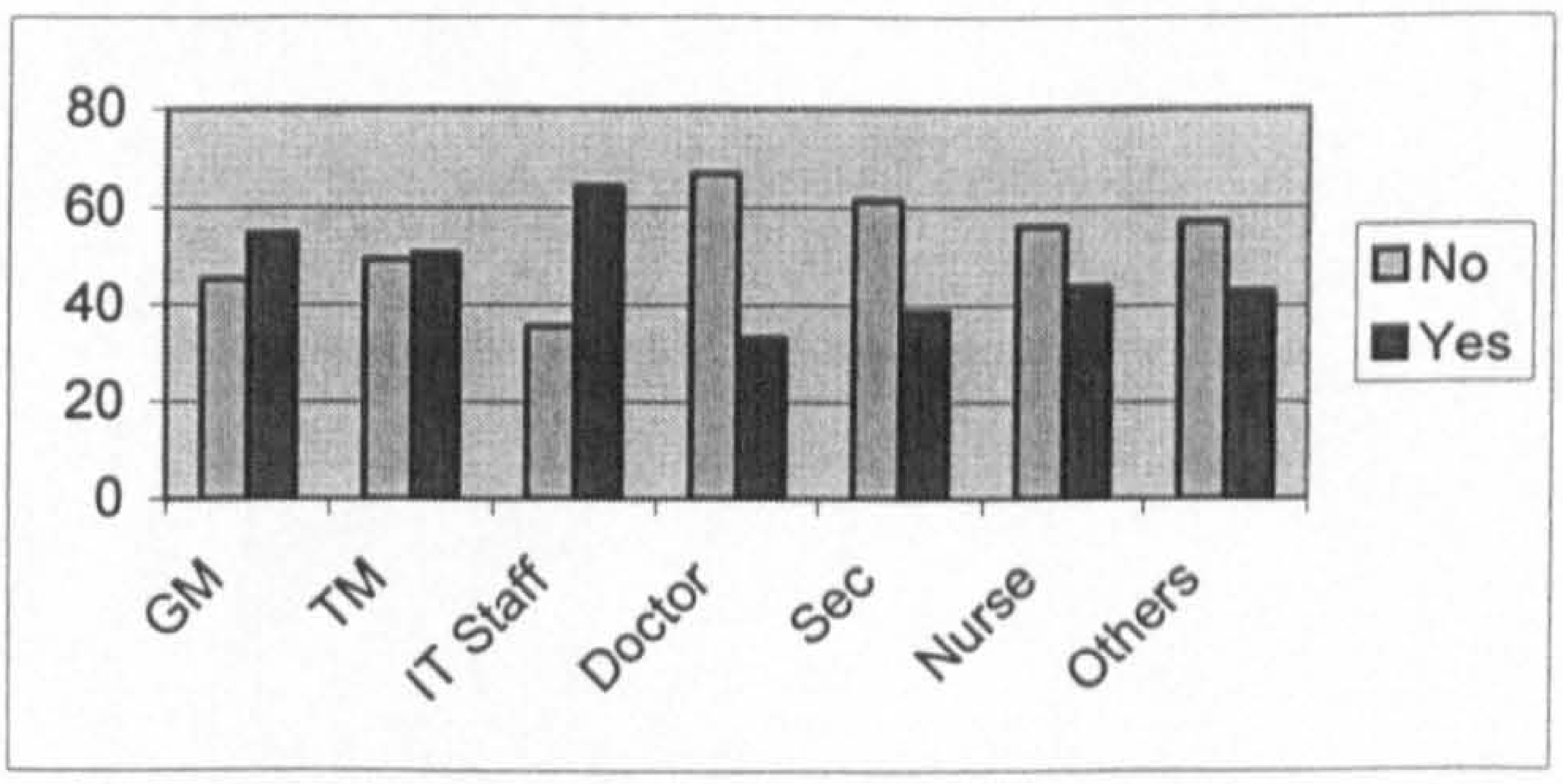


Table 6.12, Table 6.13,Table 5 in Appendix F and Figure 7 present the findings on computer reports, summarised as follows:

1) Table 6.12 shows that the average availability of these reports is low; 45.3% of the respondents said these reports are produced by the computer and 55% they are not. The reports most recognised by respondents are the daily reports, annual reports and special inquiry messages, with scores of 86%; 57% and 57% respectively. Quarterly reports and exception reports are less recognised and used, with 23% and 35% respectively. The differences between the 'available' and 'not available' responses are significant, except for two of these reports, which are annual reports and special inquiry messages. Therefore, many computer reports are not very well known to all users.

2) Table 6.13 also shows that the differences between group A and group B are not significant. Therefore, this result supports hypothesis A. To analyse hypothesis B for reports that are produced by the computer, group A should score higher responses for computer reports produced or lower responses for no computer reports produced, than group B. Table 6.17 for reports produced by the computer shows that the difference between the average scores of group A and B is 8.6%, saying reports are produced by the computer, in favour of group A. Group A has also, a lower score for responses that reports are not produced by the computer. Therefore, these two results support hypothesis B. This result implies that there are differences between group A and B in their opinion which were not revealed by testing hypothesis A.

3) Table 5 shows that the three highest average scores for computer reports available in use are 64.3%, 54.8% and 50.7% for IT staff in group B, general management from group A and technical management from group A respectively. The reports mostly used by general management are daily reports and annual reports, with 100% for both. Technical management deals with daily reports, annual reports and special inquiry reports, with 95%, 70% and 65% respectively. IT staff mainly deal with annual reports (with 100% of responses), daily reports, special inquiry reports and exception reports, with 83.3% for each. Doctors deal most with annual reports and special inquiry,

with 77.8% and 55.6% respectively. Figure 7shows that an average the least use of reports is by doctors, secretaries and 'others'.

From the category of 'other, specify' we identified other reports which are not on the list. These reports are monthly statistical data reports, laboratory result reports which are asked for by the doctors on a daily and monthly basis and stock reports with consumption reports. It can be said that there are many reports produced by the computer but most of them are not familiar to all respondents.

Table 6. 14 Omanis' responses for utilisation question (S2Q4)

Ques Codes	0%-25%		50%		75%-100%		X^2
	F	%	F	%	F	%	
S2Q4	9	9	29	29	62	62	.0000

X^2 = .05 or less is significant

Table 6. 15 Omanis' responses to utilisation question (S2Q4), by group (A & B)

Ques Codes	0%-25% (A & B)		50% (A & B)		75%-100% (A & B)		X^2
	%	%	%	%	%	%	
S2Q4	4	11	17	33	79	57	.1369

X^2 = .05 or less is significant

Figure 6. 8 Summary of Oman's responses to (S2Q4), by job title

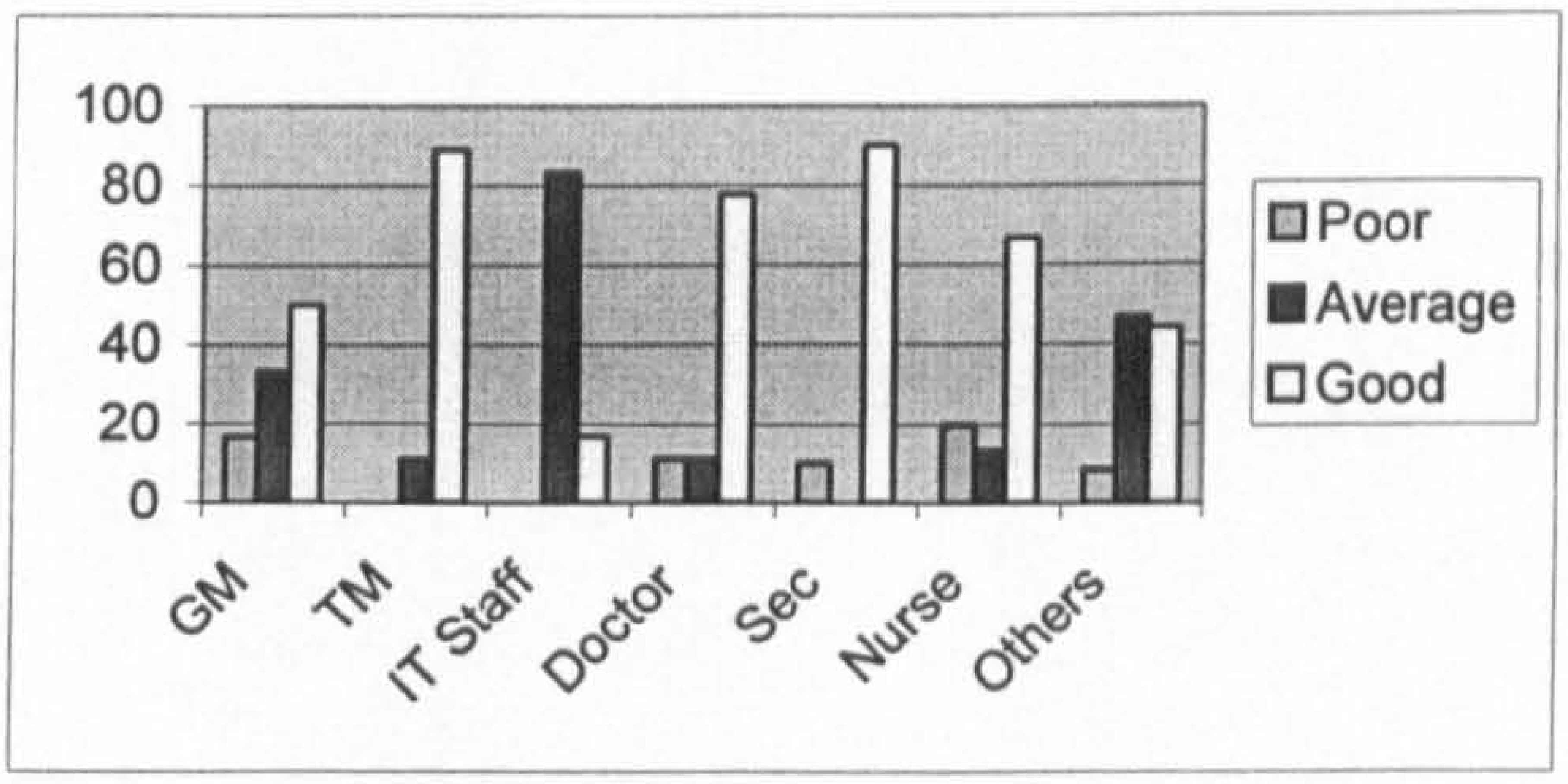


Table 6.14, Table 6.15, Table 6 in Appendix F and Figure 8 represent the responses to question S2Q4, concerning the extent of use of reports by the hospital staff. The summarised observations are as follows:

1) Table 6.14 shows that the utilisation of the computer reports by staff is between 75% and 100% with a score of 62%. This result is significant

2) Table 6.15 shows that the differences between group A and B are not significant. Therefore, hypothesis A is not supported. To analyse hypothesis B for extent of use of the reports, group A should score higher responses for extent of use of computer reports or lower responses for extent of use of computer reports, than group B. Table 6.20 for the extent of use of computer reports shows that the difference between average scores of group A and B is 22% in favour of group A. This result supports hypothesis B. This result implies that there are differences between group A and B in their opinion which were not revealed by testing hypothesis A.

3) Table 6 shows that the three highest scores for 75% and 100% of utilisation are 90.0%, 88.9% and 66.7% for secretaries/receptionists in group B, technical management in group A and doctors from group B respectively. Figure 8 shows that a high level of use of computer reports was reported by the technical management, secretaries, doctors and nurses.

6.3.2.2. U. K. utilisation Questionnaire.

In this analysis of the GPRs' questions, we will process the findings from group B but we will not consider its result in the conclusion, as indicated elsewhere.

US2Q1.1-7*:* 'For which of the following do you use the computer in general practice?'

US2Q2.1-7 'Who is the system use by?'. This question included seven items investigating the degree of interaction and involvement of the different computer users listed in the question in using the system in their work (see Appendix D).

US2Q3.1-7: This question asked, "what kind of reports are produced by the computer?" This question included seven items investigating the availability of computer reports (see Appendix D).

US2Q4: This question investigated the extent of use of computer reports by the GPRs staff who receive them.

Table 6. 16 GPRs' responses for utilisation questions (US2Q1.1-7)

Ques Codes	No		Yes		X^2
	F	%	F	%	
US2Q1.1	5	14	30	86	.0000
US2Q1.2	6	17	29	83	.0000
US2Q1.3	1	3	34	97	.0000
US2Q1.4	12	34	23	66	.0630
US2Q1.5	6	17	29	83	.0001
US2Q1.6	7	20	28	80	.0004
US2Q1.7	17	49	18	51	.8658
Average		22		78	

X^2 = .05 or less is significant

Table 6. 17 GPRs' responses for utilisation questions (US2Q1.1-7), by groups (A & B)

Ques Codes	No (A & B)		Yes (A & B)		X^2
	%	%	%	%	
US2Q1.1	10	33	90	67	.1429
US2Q1.2	17	17	83	83	.9728
US2Q1.3	3	0	97	100	.6444
US2Q1.4	35	33	66	67	.9569
US2Q1.5	10	50	90	50	.0180
US2Q1.6	17	33	83	67	.3697
US2Q1.7	45	67	55	33	.3299
Average	19.9	33.3	80.6	66.7	

X^2 = .05 or less is significant

Figure 6. 9 Summary of GPRs' responses to (US2Q1.1-7), by job title

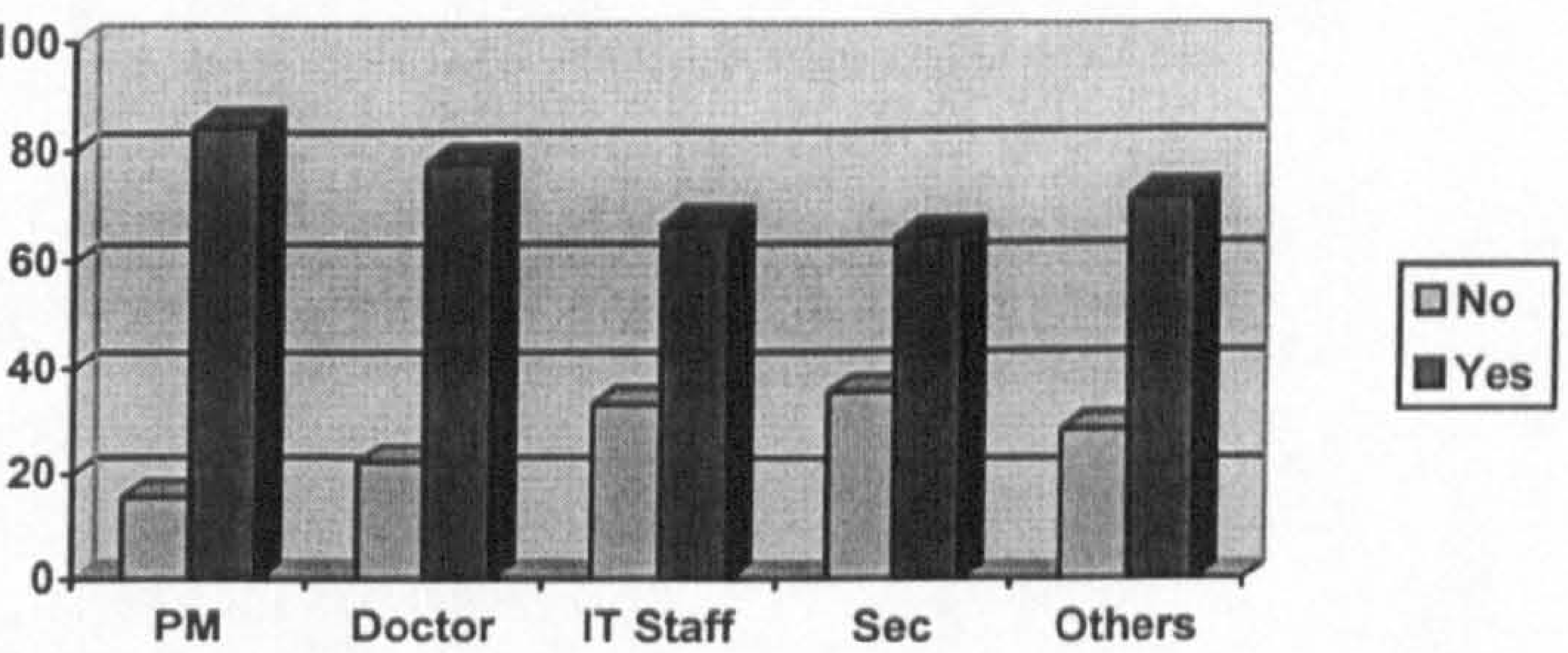


Table 6.16; Table 6.17, Table 7 in Appendix F and Figure 9 present the results as to the computer applications utilised in GPRs. The following observations may be made;

1) Table 6.17 shows that the average total utilisation of these applications is very good; the scores for use and non-use are 78% and 22% respectively. The Age/Sex application is one of the computer applications in most use with a

score of 97% 'yes' responses and the least used computer application is hospital referral, with 66% yes responses. The differences between use and non-use responses are significant, except for one of the items in the list, namely, hospital referral.

2) Table 6.17 shows that the differences between group A and B in responding to these items are not significant. Therefore, this result does not support hypothesis A. To analyse hypothesis B for computer application use, group A should score higher responses for computer application use or lower responses for non-use than group B. Table 6.23 for the utilisation questions of computer applications shows that the difference between average scores of group A and B for use is 13.6% in favour of group A. Group A also, has a lower score for non-use. Therefore, these two results support hypothesis B. Therefore, this result shows a difference between group A and B in their opinion which was not significant according to hypothesis A's result.

3) Table 7 shows that the three highest average scores for use of these applications were 84.4%, 77.8% and 71.4% for practice managers from group A, doctors from group A and others from group B, respectively. Figure 9 shows agreement on frequently use of computer applications by all groups except IT staff.

Table 6. 18 GPRs' responses for utilisation questions (US2Q2.1-7)

Ques Codes	Never		Sometimes		Frequently		X^2
	F	%	F	%	F	%	
US2Q2.1	4	13	7	22	21	66	.0004
US2Q2.2	6	17	7	20	22	63	.0010
US2Q2.3	2	6	2	6	31	89	.0000
US2Q2.4	4	12	8	24	22	65	.0004
US2Q2.5	5	15	12	35	17	50	.0405
US2Q2.6	27	79	6	18	1	3	.0000
US2Q2.7	3	17	6	33	9	50	.2231
Average		22.7		22.7		55.1	

X^2 = .05 or less is significant

Table 6. 19 GPRs' responses to utilisation questions (US2Q2.1-7), by groups (A & B)

Ques Codes	Never		Sometimes (A & B)		Frequently (A & B)		X^2
	%	%	%	%	%	%	
US2Q2.1	4	50	23	17	73	33	.0083
US2Q2.	17	17	17	33	66	50	.6586
US2Q2.3	7	0	3	17	90	83	.3760
US2Q2.4	10	20	21	40	69	40	.4568
US2Q2.5	14	17	39	17	46	67	.5655
US2Q2.6	82	67	18	17	0	17	.0898
US2Q2.7	17	17	42	17	42	67	.5352
Average	21.6	26.9	23.3	22.6	55.1	51	

X^2 = .05 or less is significant

Figure 6. 10 Summary of GPRs' responses to (US2Q2.1-7), by job title

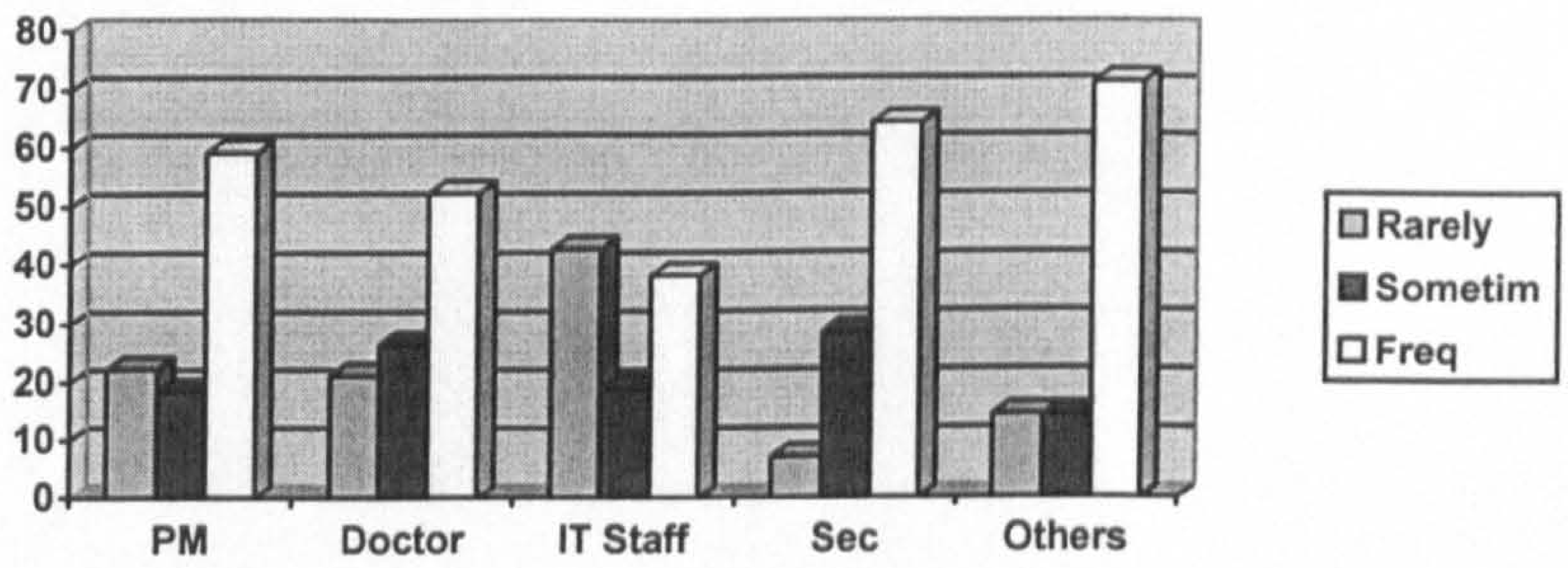


Table 6.18, Table 6.19, Table 8 in Appendix F and Figure 10 present the findings as to who utilises these computer applications, as follows:

1) Table 6.18 shows that the staff use the computer system well, with average scores of 55.1% for frequently use the system, 22.7% for sometimes and 22.7% for rarely use the system. This result is significant. The three highest scores for frequent use of the system come from receptionists, with a score of 89%, practice managers with a score of 66% and secretaries with a score of 65%.

2) Table 6.19 shows that the differences between group A and B are not significant. This is so, because the average scores of group A and B in choosing any of the scores are very close, with scores of 55.1%/51%, 23.3%/22.6% and 21.6%/26.9% respectively. Therefore, hypothesis A is not supported. Table 6.26 for staff utilisation of the computer shows that the difference between average scores of group A and B is 4.1% frequently use in

favour of group A. Group A also, has a lower score for never use. Therefore, these two results support hypothesis B. Therefore, this result shows a difference between group A and B in their opinion, which were not revealed in testing hypothesis A.

3) Table 8 shows that the three highest average scores for 'frequently use' are 71.4%, 64.3% and 59.2% for 'others' in group B, secretaries/receptionists from group B and practice managers from group A, respectively. This table shows also that IT staff had a high average scores for never and rarely use. Figure 10 shows that the high responses for the use of reports are given by 'others', secretaries, practice managers and doctors.

Table 6. 20 GPRs' responses, for utilisation questions (US2Q3.1-7)

Ques Codes	No		Yes		X^2
	F	%	F	%	
US2Q3.1	30	86	5	14	.0000
US2Q3.2	33	94	2	6	.0000
US2Q3.3	26	74	9	26	.0041
US2Q3.4	10	29	25	71	.0112
US2Q3.5	16	46	19	54	.6121
US2Q3.6	27	77	8	23	.0013
US2Q3.7	25	71	10	29	.0112
Average		68.1		31.9	

X^2 = .05 or less is significant

Table 6. 21 GPRs' responses, for utilisation questions (US2Q3.1-7), by group (A&B)

Ques Codes	No (A & B)		Yes (A & B)		X^2
	%	%	%	%	
US2Q3.1	90	67	10	33	.1429
US2Q3.2	93	100	7	0	.5076
US2Q3.3	72	83	28	17	.5774
US2Q3.4	24	50	76	50	.2018
US2Q3.5	45	50	55	50	.8169
US2Q3.6	76	83	24	17	.6915
US2Q3.7	69	83	31	17	.4782
Average	67	73.7	33	26.3	

X^2 = .05 or less is significant

Figure 6. 11 Summary of GPRs' responses to (S2Q3.1-7), by job title

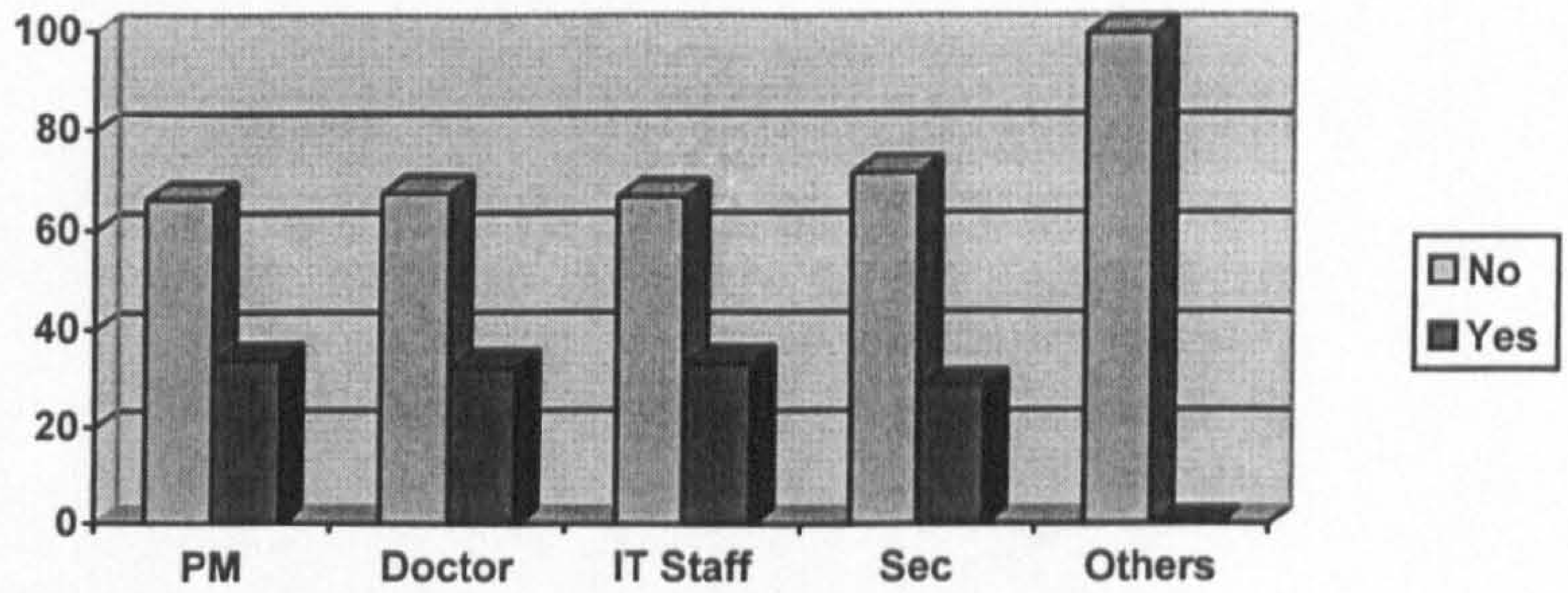


Table 6.20, Table 6.21, Table 9 in Appendix F and Figure 11 present the results regarding computer report output, on which the following observations may be made.

1) Table 6.20 shows that there are a few output reports produced by the computer, but only two reports are widely recognised, namely, annual report with a score of 71% and special inquiry messages with 54%. The difference between the 'available' and 'not available' responses are significant. The table shows that the weekly report is available in only 6% of GPRs.

2) Table 6.21 shows that the differences between group A and group B are not significant. Therefore, this result does not support hypothesis A. To analyse hypothesis B for reports produced by the computer, group A should score higher responses for computer reports produced or lower responses for no computer reports produced, than group B. Table 6.21 for reports produced by computer shows that the difference between average scores of group A and B saying reports are produced by the computer is 6.7% in favour of group A. Group A also has a lower score for responses that reports are not produced by the computer. Therefore, these two results support hypothesis B. Therefore, this result shows a difference between group A and B in their opinion, which was not revealed by testing hypothesis A.

3) Table 9 shows that twice as many people said these reports are not available, as that they are available (see also Figure 11).

We can see that the GPRs computers produce or use a few computer reports. The 'other, specify' category has identified other reports not on the list, namely target figures, monthly reports and medical audit rate reports.

Table 6. 22 GPRs' responses to utilisation question (US2Q4)

Ques Codes	0% - 25%		50%		75% - 100%		X^2
	F	%	F	%	F	%	
US2Q4	12	38	7	22	13	41	.3796

X^2 = .05 or less is significant

Table 6. 23 GPRs' responses to utilisation question (US2Q4), by group (A&B)

Ques Codes	0%- 25% (A & B)		50% (A & B)		75%-100% (A & B)		X^2
	%	%	%	%	%	%	
US2Q4	42	17	15	50	42	33	.1635

X^2 = .05 or less is significant

Figure 6. 12 Summary of GPRs' responses to (US2Q4), by job title

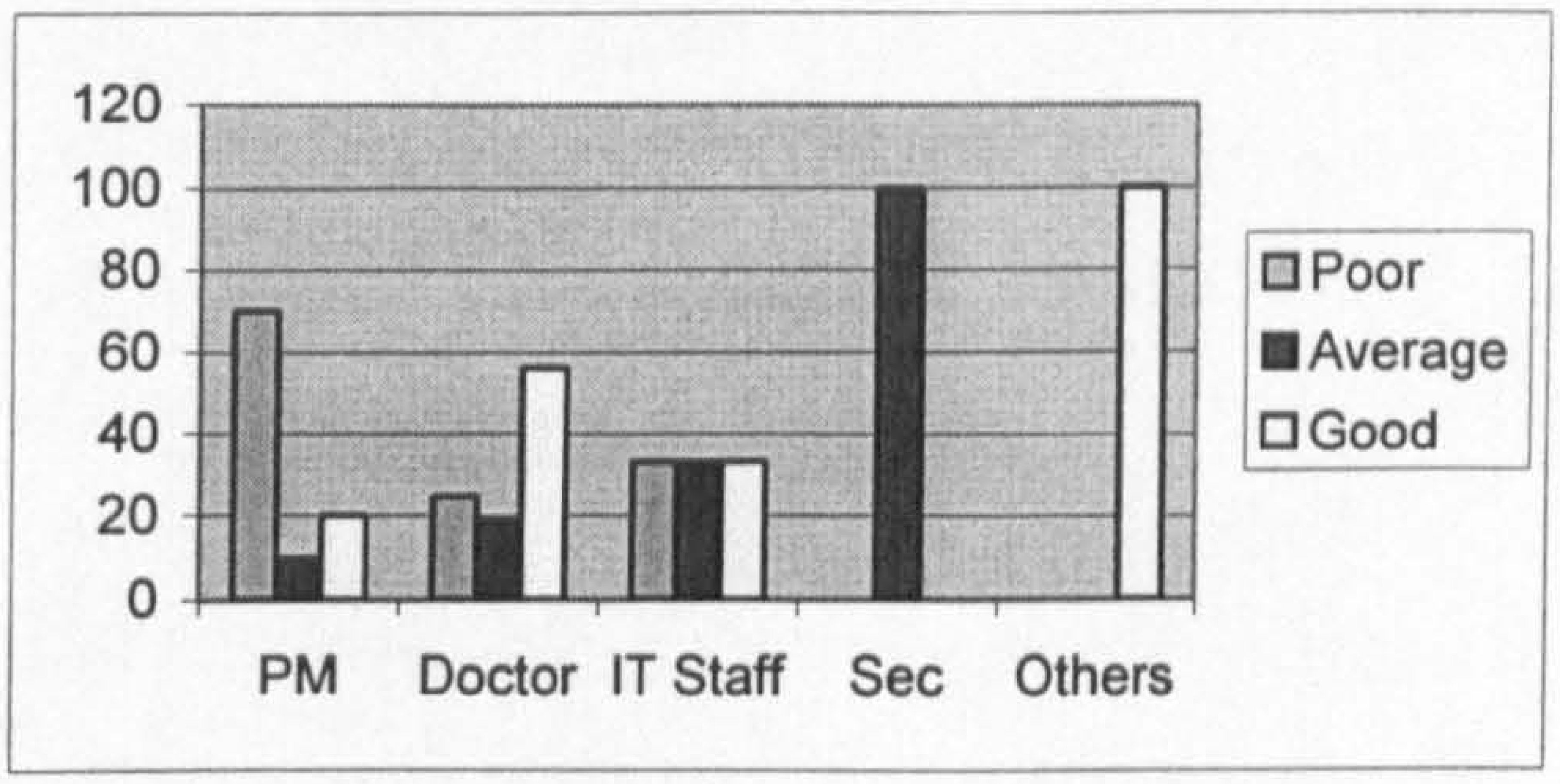


Table 6.22, Table 6.23, Table 10 in Appendix F and Figure 12 indicate the results from US2Q4, regarding 'to what extent the GPRs staff utilise the computer reports.' Summaries of the relevant observations are given below:

1) Table 6.22 shows that the staff utilisation of the computer reports is only 41%, which is close to the poor utilisation score of 38%. Therefore, this result shows the difference is not significant. This utilisation can not be regarded as good utilisation.

2) Table 6.23 shows that the differences between group A and B are not significant. Therefore, hypothesis A is not supported. To analyse hypothesis B

for extent of use of the reports, group A should score higher responses for good use of computer reports or lower responses for poor use of computer reports, than group B. Table 23 for the use of computer reports shows that the difference between average scores of group A and B is 9% in favour of group A. This result supports hypothesis B. However, the difference between group A and B for poor utilisation of computer reports is 25.6% in favour of group A. This big score confirms that hypothesis B is not supported. The difference between these two scores is 25% for poor utilisation of computer reports, in favour of group A. Therefore, we could conclude there is no support for hypothesis B.

3) Table 10 shows a surprising result, that practice managers reported poor utilisation of reports, while doctors indicated good utilisation. Figure 12 shows a high score for high extent use of the report given by Other group.

From the above analysis we conclude that the benefit of these reports is being obtained only slowly. Some of the HCUG blame the excess length and complexity of reports, and lack of time and training for this. However, this result does not agree with what was expressed by the interviewees, all of whom confirmed their use of the reports for the benefit of management and health care issues. The significance tests support the null hypothesis.

Comparing the responses to question one, Omani respondents indicated poor utilisation of computer applications, whereas UK respondents indicated good utilisation. In the second question, both GPRs and Omani respondents agreed that staff utilised the computer applications well. In question three, the Omani respondents indicated moderate reports output by the computer, while the GPRs respondents indicated that few reports are produced by the computer. In question four, Omani respondents reported high utilisation of these reports while GPRs respondents reported poor utilisation. The results of the significance tests in both surveys yielded similar results, that is, group A showed greater utilisation than group B, but the differences between them are not significant.

6.3.3. Analysis of the questions related to the fear of computers

This section deals with eighteen questions, nine for Oman and nine for UK. The first five questions are common to each questionnaire, while the others are designed specifically for each environment.

6.3.3.1. Omani fears questionnaire

S4Q1: 'Doctors will be threatened in future by computer information facilities'.

S4Q2: 'Computers will cause doctors to focus less on treating the patient'.

S4Q3: "The computer has no effective solution to the confidentiality of patients' records".

S4Q4: "The use of computer requires changes in the level of computer skills and expertise needed in hospitals' health care".

S4Q5: 'There is no obvious benefit from using computers in the hospitals, proportionate to its cost'.

S4Q6: 'Computer could interfere in making vital decisions for which doctors are responsible'.

S4Q7: 'The managers/administrators feel threatened by this technology and its professionals'

S4Q8: 'The failure of the computer results from over reliance on expensive contract staff and other external assistance.'

S4Q9: 'The financial strain of "waiting for the five year plan" does not justify the development of the new technology.'

Table 6. 24 Omanis' responses for fear questions

Ques Codes	SDA & DA		UND		SA & A		X^2
	F	%	F	%	F	%	
S4Q1	29	28	38	37	35	34	.5392
S4Q2	58	58	27	27	15	15	.0000
S4Q3	37	38	28	29	33	34	.5366
S4Q4	9	9	18	18	73	73	.0000
S4Q5	67	70	17	18	12	13	.0000
S4Q6	53	55	31	32	12	13	.0000
S4Q7	44	43	37	36	21	21	.0168
S4Q8	16	16	33	33	51	51	.0001
S4Q9	11	11	29	29	61	60	.0000
Average		36.4		28.8		34.9	

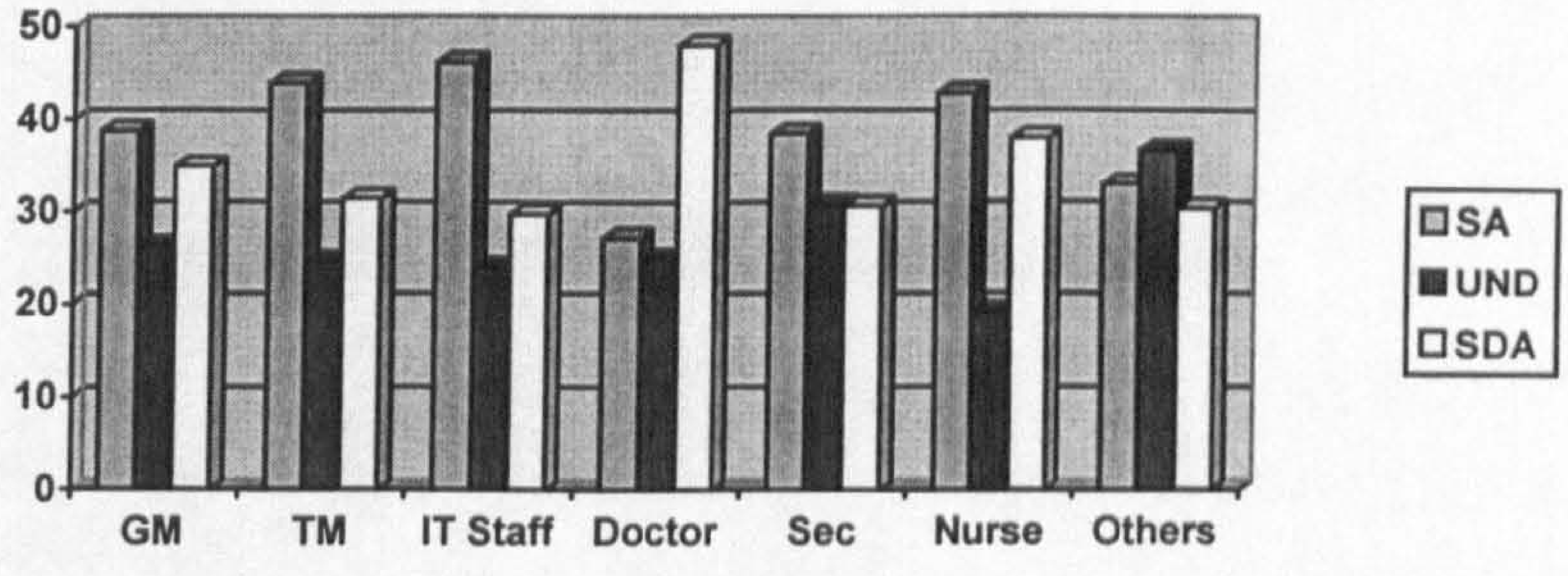
X^2 = .05 or less is significant

Table 6. 25 Omanis' responses for fear questions, by group (A&B)

Ques Codes	SDA & DA (A & B)		UND (A & B)		SA & A (A & B)		X^2
	%	%	%	%	%	%	
S4Q1	35	26	42	36	23	38	.3692
S4Q2	77	51	12	32	12	16	.0620
S4Q3	46	35	31	28	23	38	.3865
S4Q4	15	7	15	19	69	74	.4079
S4Q5	73	69	23	16	4	16	.2501
S4Q6	54	56	27	34	19	10	.8812
S4Q7	46	42	27	40	27	18	.4504
S4Q8	25	13	25	36	50	51	.3300
S4Q9	15	9	23	31	62	60	.5933
Average	42.9	34.2	25	30.2	32.1	35.7	

X^2 = .05 or less is significant

Figure 6. 13 Summary of Oman's responses to questions (S4Q1-9), by job title



By looking at Table 6.24, Table 6.25, Table 11 in Appendix F and Figure 13 we can summarise the results as follows:

1) From Table 6.24, it can be seen that the average percentage of strongly disagree responses is very close to that of strongly agree responses, with

scores of 36.4% and 34.9% respectively. This casts doubt on whether there are fear or not. Since the questions stated negatively in the questionnaire then (disagree is mean no fear and Agree mean fear). The highest three scores of disagreement that there is no computer fear are given to questions S4Q5, S4Q2 and S4Q6 with scores of 70%, 58% and 55% respectively. The three highest scores of agreement that there is computer fear are given to questions S4Q4, S4Q9 and S4Q8 with scores of 73%, 60% and 51% respectively. The differences in the result of responses on each side are significant; the NPAR chi-square test shows that the findings from 7 out of 9 questions are significant.

2) Table 6.25 shows that the differences in response between group A and B are not significant. Hypothesis A is not supported. However, for many questions, the percentage of group A who strongly disagreed is higher than that of group B, while group B scored higher than group A in many questions for strongly agree. This means that group A shows more favourable responses than B. Thus, hypothesis B is supported.

3) The Undecided score is very high, averaging 28.8% (see Table 6.24). Table 6.25 shows that in response to many questions, group B was more undecided than group A, with average scores of 30.2% and 25% respectively. This result supports hypothesis C. Table 6.36 shows that the three highest average scores of 'undecided' are: 36.7% for respondents in the category (others); 30.8% for secretaries/receptionists and 26.3% for general management.

4) Table 11 shows that the three highest average scores for strongly disagree were 46.2%, 44.0% and 42.9% for IT staff in group B, technical management in group A and nurses from group B respectively. The three highest 'strongly agree' scores given by respondents were 83.3% by both general management and IT staff, 77.8% for secretaries/receptionists and 75.0% for technical management. Therefore, as Figure 13 shows, there is a tendency to fear the influence of the computer.

6.3.3.2. UK fears questionnaire

The questions put to GPRs in the UK related to computer fears were:

US4Q1: 'Doctors will be threatened in future by computer information facilities'.

US4Q2: 'Computers will cause doctors to focus less on treating the patient'.

US4Q3: 'The computer has no effective solution to the confidentiality of patients' records'.

US4Q4: "The use of computer requires changes in the level of computer skills and expertise needed in hospitals' health care".

US4Q5: 'There is no obvious benefit from using computers in the hospitals, proportionate to its cost'.

US4Q6: 'Fund holding will slow the deployment of computers by GPs'.

US4Q7: The statement was, 'The FHSA link project will increase the cost of IT to GPs'.

US4Q8: 'The supplier should be free to deal with the general practice'.

US4Q9: 'The Practice should either be reimbursed more than 50% for their outlay on the system or have fewer conditions imposed.'

Table 6. 26 GPRs' responses for fear questions

Ques Codes	SDA & DA		UND		SA & A		X^2
	F	%	F	%	F	%	
US4Q1	19	56	7	21	8	24	.0200
US4Q2	24	69	4	11	7	20	.0000
US4Q3	7	20	8	23	20	57	.0113
US4Q4	1	3	4	11	30	86	.0000
US4Q5	22	63	8	23	5	14	.0009
US4Q6	24	69	6	17	5	14	.0001
US4Q7	3	9	14	41	17	50	.0083
US4Q8	3	9	16	47	15	44	.0099
US4Q9	1	3	5	14	29	83	.0000
Average		35		23		44	

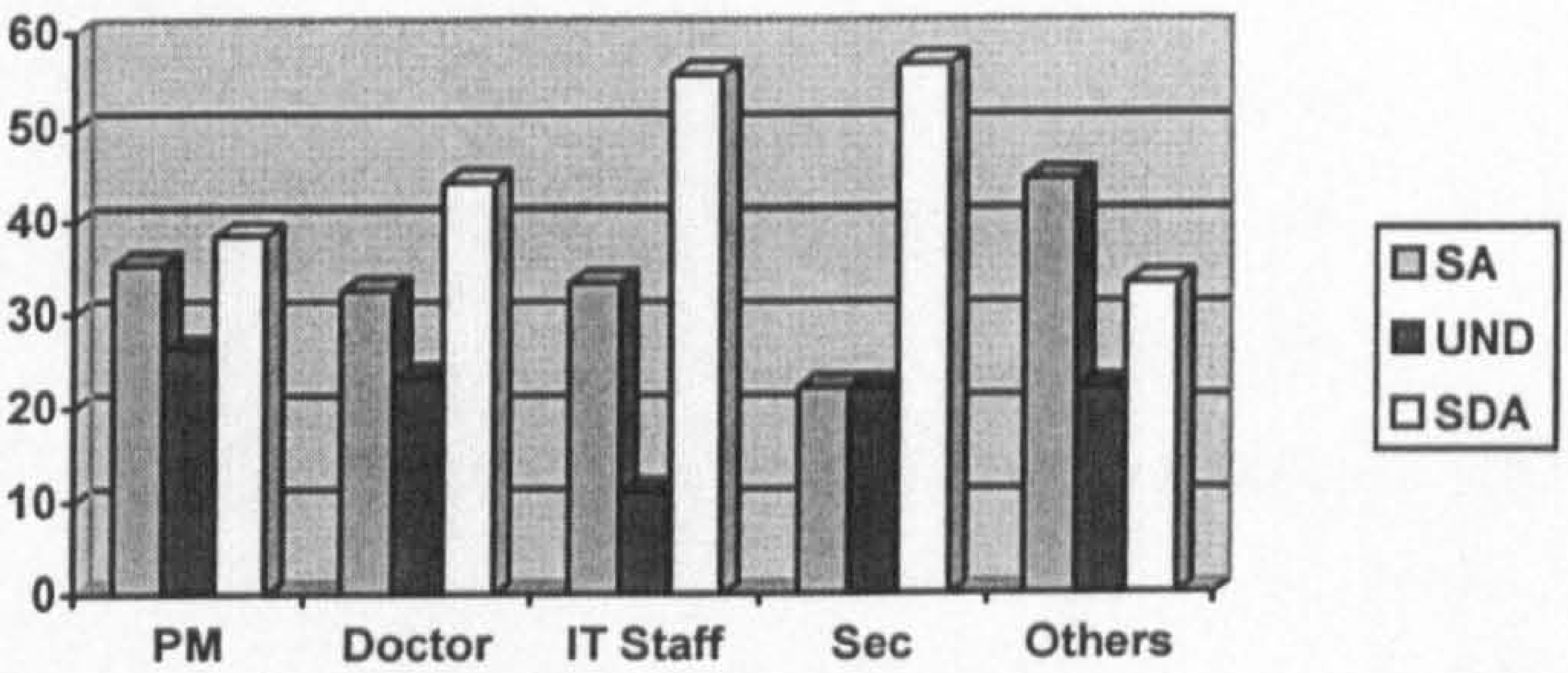
X^2 = .05 or less is significant

Table 6. 27 GPRs' responses to fear questions, by group (A&B)

Ques Codes	SDA & DA (A & B)		UND (A & B)		SA & A (A & B)		X^2
	%	%	%	%	%	%	
US4Q1	61	33	18	33	21	33	.4640
US4Q2	69	67	10	17	21	17	.8967
US4Q3	24	0	28	0	48	100	.0661
US4Q4	0	17	14	0	86	83	.0588
US4Q5	62	67	28	0	10	33	.1728
US4Q6	66	83	21	0	14	17	.4723
US4Q7	11	0	46	17	43	83	.1896
US4Q8	7	17	39	83	54	0	.0561
US4Q9	3	0	17	0	79	100	.4727
Average	33.7	31.6	24.6	16.7	41.8	51.8	

X^2 = .05 or less is significant

Figure 6. 14 Summary of GPRs' responses to questions (US4Q1-9), by job title



Looking at Table 6.26, Table 6.27, Table 12 in Appendix F and Figure 14 we can summarise the results as follows:

1) Table 6.26 shows that there is a feeling of fear by the respondents, with an average score for strongly agree of 44% of responses to these questions, which is higher than the average scores of strongly disagree and undecided. The three highest scores for 'strongly agree' were given to questions US4Q4, US4Q9 and US4Q3, with scores of 86%, 83% and 57% respectively. The three highest scores for 'strongly disagree' were given to questions US4Q2, US4Q6 and US4Q5, with scores of 69%, 69% and 63% respectively. The differences in the responses in each case are significant.

2) Table 6.27 shows that the differences between group A and group B in responding to these questions are not significant. Hypothesis A is not

supported. However, the percentages of group A in the strongly disagree category is a little higher than group B and in strongly agree group B shows higher scores. This result suggests that group A felt less fear of the computer. Therefore, hypothesis B is supported. The highest percentages of both groups A & B responding 'strongly agree' are 79%/100%, 86%/83% and 48%/100% for questions US4Q9, US4Q4 and US4Q3 respectively, and the highest percentages of both group A & B responding 'strongly disagree' are 66%/83%, 69%/67% and 62%/67% for questions US4Q6, US4Q2 and US4Q5 respectively.

3) The Undecided score is high, averaging 23% (see Table 6.26). Table 6.27 shows that for many of these questions group A had a higher percentage of undecided scores than group B, with averages of 24.6% and 16.7% respectively. This result does not supported hypothesis C. Table 12 shows that the highest three average scores for 'undecided' are: 100% given to US4Q8 & US4Q7 by respondents in the category (others) and secretaries/receptionists, 66.7% given for US4Q8 by IT staff and 47.1% given for US4Q8 by doctors.

4) Table 12 shows that the three highest average scores for strongly agree are 55.6%, 55.5% and 44.0% for secretaries/receptionists in group B, IT staff in group B, and doctors in group A respectively. The three highest average scores for strongly disagree are 100%, 81.8% and 72.2% for IT staff, 'Others' and secretaries/receptionists; practice managers and doctors, respectively. Figure 14 shows a greater tendency to disagree than to agree that staff feel fear of the computer.

6.3.4. Analysis of questions related to computer impact

During the investigation the researcher felt that staff valued their system for its help in handling the huge volume of paper-work related to patients and administration. Therefore, there is a feeling of computer system impact. This issue was explored by a number of questions in the questionnaire, covering computer impact on administrative work and health care information.

Additional questions added to Omani questionnaire were S5Q6.1-6 and S5Q7 which concerned the impact on management approaches and the impact on users' work. The first one was added at the suggestion of senior staff and the second question was added at the suggestion of users. Originally, after studying and discussing this matter, the researcher had decided to include it in the interviews. However, the interviewees resisted the way that the interview was posed in the UK, as mentioned elsewhere, and so this issue was added to the questionnaire.

6.3.7.1. Omani impact questionnaire

S5Q1: asked whether 'computers are used successfully to improve administration work in the hospital.'

S5Q2 asked whether 'the use of computers provides more detailed information on the effectiveness of care provided.'

S5Q3: concerned computers 'Computers help to make good decisions on hospital issues'

S5Q4: This question investigated 'The computer system has increased the number of clinical/administrative staff in the hospital'

S5Q5.1-7: This question contained seven items intending to investigate the quality of the reports produced by the computer compared to non-computer reports that have been produced and utilised by the hospitals staff.

(S5Q5.1): 'computer information is more complete and precise'.

(S5Q5.2): 'computers decrease the amount of irrelevant information.'

(S5Q5.3): 'computers make the reports more timely'.

(S5Q5.4): 'computers minimise errors in data recording'.

(S5Q5.5): 'computers make the reports more easily understood'.

(S5Q5.6): 'computer reports are more accurate'.

(S5Q5.7): 'computer reports' information is more up-to-date.'

S5Q6.1-6: This question concerned how the availability of powerful computers with their new capabilities will influence the hospital management. This question included 6 items.

S5Q6.1: 'management approach.'

S5Q6.2: 'organisational structure.'

S5Q6.3: 'organisational relationship.'

S5Q6.4: 'hospital resources.'

S5Q6.5: 'monitoring the daily operation of the hospital.'

S5Q6.6: 'to make changes to the existing function of hospital's staff.'

S5Q7: impact on users to improve their work

Table 6. 28 Omanis' responses to impact questions

Ques Codes	SDA & DA		UND		SA & A		X^2
	F	%	F	%	F	%	
S5Q1	17	17	23	23	61	61	.0000
S5Q2	9	9	15	15	77	76	.0000
S5Q3	17	17	27	28	54	55	.0000
S5Q4	31	30	15	15	56	55	.0000
S5Q5.1	5	5	21	21	74	74	.0000
S5Q5.2	15	16	22	23	60	62	.0000
S5Q5.3	5	5	20	20	76	75	.0000
S5Q5.4	6	6	15	15	80	79	.0000
S5Q5.5	10	10	5	5	85	85	.0000
S5Q5.6	10	10	14	14	75	76	.0000
S5Q5.7	10	10	16	16	74	74	.0000
Average		15.1		17.7		70.2	

X^2 = .05 or less is significant

Table 6. 29 Omanis' responses to impact questions, by group (A&B)

Ques Codes	SDA & DA (A & B)		UND (A & B)		SA & A (A & B)		X^2
	%	%	%	%	%	%	
S5Q1	16	17	24	23	60	61	.9819
S5Q2	12	8	12	16	76	76	.7641
S5Q3	20	17	32	26	48	48	.7101
S5Q4	31	30	19	13	50	57	.7260
S5Q5.1	12	3	12	24	76	73	.1017
S5Q5.2	13	16	25	22	63	62	.8785
S5Q5.3	12	3	16	21	72	76	.1633
S5Q5.4	8	5	8	17	84	78	.5006
S5Q5.5	4	12	0	7	96	81	.1881
S5Q5.6	8	11	8	16	84	73	.5121
S5Q5.7	4	12	20	15	76	73	.4603
Average	12.7	12.2	16	18.2	71.4	68.9	

X^2 = .05 or less is significant

Figure 6. 15 Summary of Oman's responses to questions (S5Q1-5.1-7), by job title

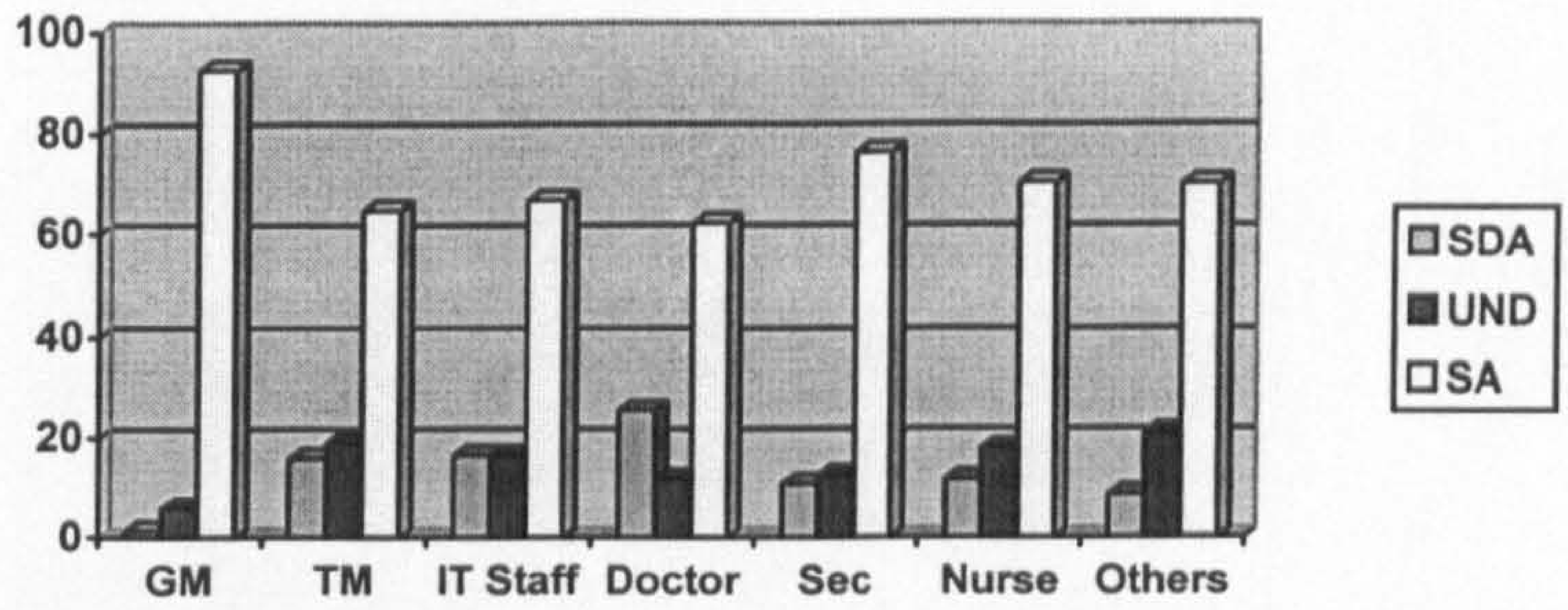


Table 6. 30 Omanis' responses to impact questions

Ques Codes	SDA & DA		UND		SA & A		X^2
	F	%	F	%	F	%	
S5Q6.1	26	26	29	29	44	44	.0597
S5Q6.2	24	24	35	35	40	40	.1313
S5Q6.3	26	26	31	31	42	42	.1313
S5Q6.4	21	21	19	19	59	60	.0000
S5Q6.5	21	21	21	21	56	57	.0000
S5Q6.6	24	25	34	35	40	41	.1353
S5Q7	10	10	9	9	78	80	.0000
Average		21.9		25.6		52	

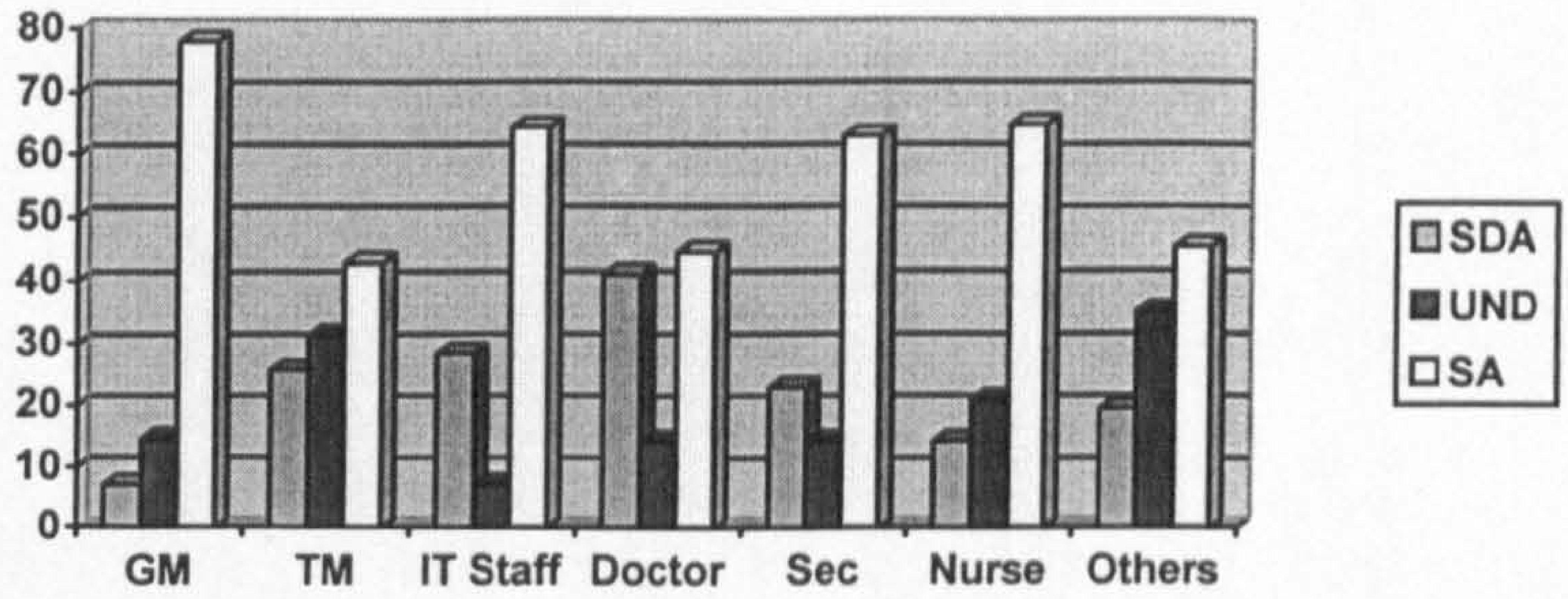
X^2 = .05 or less is significant

Table 6. 31 Omanis' responses to impact questions, by group (A&B)

Ques Codes	SDA & DA (A & B)		UND (A & B)		SA & A (A & B)		X^2
	%	%	%	%	F	%	%
S5Q6.1	27	26	31	29	42	45	9664
S5Q6.2	23	25	35	36	42	40	.9719
S5Q6.3	23	27	35	30	42	43	.8784
S5Q6.4	15	23	27	16	58	60	.4308
S5Q6.5	19	22	23	21	58	57	.9387
S5Q6.6	28	23	44	32	28	45	.3077
S5Q7	15	9	0	13	85	79	.1187
Average	21.4	22.1	27.9	25.7	50.7	52.7	

X^2 = .05 or less is significant

Figure 6. 16 Summary of Oman's responses to questions (S5Q6.1-6 & S5Q7), by job title



Looking at Table 6.28, Table 6.29, Table 6.30, Table 6.31, Table 13 & 14 in Appendix G and Figures 15 & 16 we can summarise the results as follows:

1) Table 6.28 and Table 6.29 show that the respondents expressed appreciation of computer impact by responding with agreement on all the questions. The average scores for this agreement were: 70.2% for the questions S5Q1 to S5Q5.1-7, and 52% for questions S5Q6.1-6 and S5Q7, giving a total average for of all the questions of 61.1%. The significance test shows the differences between the scores of agreement and other choices are significant.

2) Undecided scores are high for several questions. These are: S5Q6.2, S5Q6.6, S5Q6.3 and S5Q6.1 with scores of 35%, 35%, 31% and 29% respectively. These questions are mostly concerned with the impact of computers on management behaviours. This is not surprising but we will wait to see other tables to see who gave the undecided responses.

3) Table 6.30 and Table 6.31 show that the percentages of groups A and B responding in each category, (SDA, UND, and SA), are close; therefore, there is no significant difference between the groups. Thus, hypothesis A is not supported. However, group A shows slightly more favourable responses than group B; where is the difference between the two average scores only .3% in

favour A therefore, hypothesis B is supported. The table also shows that undecided scores were equally divided between groups A and B. Therefore, we can not say that hypothesis C is supported or not supported (see section 7.2 for discussion).

4) Table 13 and Table 14 show that the three highest averages scores for agreement are: 71.2%, 71.1% and 68.1% for secretaries/receptionists, general management and nurses respectively. The greatest users of undecided responses are technical management in group A, others in group B and IT staff in group B. Figures 15 & 16 showed a general agreement on the impact and the benefits of the computer.

6.3.7.2. UK impact questionnaire

The general practice questions related to the impact of computer systems were as follows:

US5Q1: 'Computer is used successfully to improve administration work in general practices'.

US5Q2: 'The use of computers provides more detailed information on the effectiveness of care provided'.

US5Q3: 'Has the computer enabled you to make new decisions?'

US5Q4: 'What effect has the computer system had on the number of clinical/administrative staff in general practice?'

US5Q5.1-7 This question investigated the quality of information in computer reports compared to other reports that were not computerised. This question contained 8 items, including one item to indicate overall satisfaction with the present computer reports:

(US5Q5.1): 'computer information is more complete and precise.'

(US5Q5.2): 'computers decrease the amount of irrelevant information.'

(US5Q5.3): 'computers make the report more timely.'

(US5Q5.4): 'computers minimise errors in data recording.'

(US5Q5.5): 'computers make the reports more easily understood.'

(US5Q5.6): 'computer reports are more accurate.'

(US5Q5.7): 'computer reports' information is more up-to-date.'

Table 6. 32 GPRs' responses to impact questions

Ques Codes	SDA & DA		UND		SA & A		X^2
	F	%	F	%	F	%	
US5Q1	5	14	7	20	23	66	.0002
US5Q2	4	11	12	34	19	54	.0080
US5Q3	21	60	14	40	0	0	.2367
US5Q4	15	43	20	57	0	0	.3980
US5Q5.1	1	3	10	29	23	68	.0000
US5Q5.2	10	29	10	29	14	41	.6246
US5Q5.3	4	12	7	21	22	67	.0002
US5Q5.4	11	32	7	21	16	47	.1663
US5Q5.5	6	18	7	21	20	61	.0039
US5Q5.6	5	15	9	27	19	58	.0089
US5Q5.7	3	9	6	18	25	74	.0000
Average		22.4		28.8		48.7	

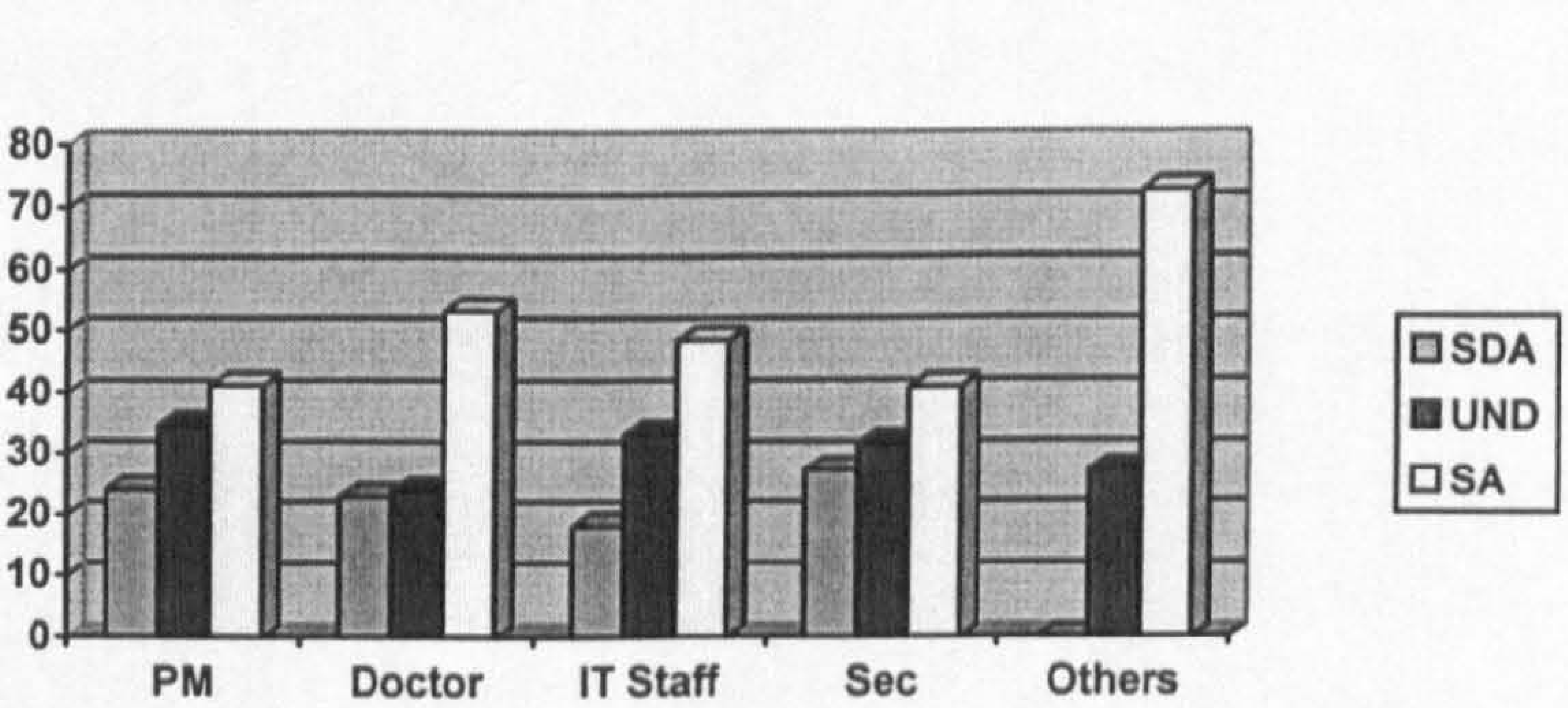
X^2 = .05 or less is significant

Table 6. 33 GPRs' responses to impact questions, by group (A&B)

Ques Codes	SDA & DA (A & B)		UND (A & B)		SA & A (A & B)		X^2
	%	%	%	%	%	%	
US5Q1	14	17	17	33	69	50	.6235
US5Q2	14	0	28	67	59	33	.1630
US5Q3	59	67	41	33	0	0	.7142
US5Q4	45	33	55	67	0	0	.6045
US5Q5.1	4	0	32	17	64	83	.6435
US5Q5.2	32	17	29	33	39	50	.7489
US5Q5.3	11	17	26	0	63	83	.3704
US5Q5.4	36	17	21	17	43	67	.5477
US5Q5.5	22	0	15	50	63	50	.1144
US5Q5.6	11	33	30	17	59	50	.3724
US5Q5.7	11	0	14	33	75	67	.4262
Average	23.5	18.3	28	30.4	48.5	48.5	

X^2 = .05 or less is significant

Figure 6. 17 Summary of GPRs' responses to questions (US5Q1-5.1-7), by job title



By looking at Table 6.32, Table 6.33, Table 15 in Appendix F and Figure 17 we can summarise the results as follows:

1) Table 6.32 shows that there is total agreement that the computer has an impact on the health information reports, administrative work and health care delivery. However, respondents do not believe that the computer has an impact on making new decisions regarding GPRs' issues or has increased the number of clinical/administrative staff. The table showed also high undecided scores for several questions. These are: US5Q4, US5Q3 and S5Q2 with scores of 57%, 40% and 34% respectively.

2) Table 6.33 shows that the average percentage of groups A and B in responding 'strongly agree' to these questions is equal with a score of 48.5%. Therefore, no significant differences are shown by the chi-square test. Therefore, hypothesis A is not supported. The table also shows that undecided responses were mostly higher in group B. Therefore, hypothesis C is supported. It is also shown that group A has a higher score than group B for strongly disagree, while the two groups responded equally for strongly agree. Therefore, group A is less favourable, so hypothesis B is not supported.

3) Table 15 shows that the three highest average scores for strongly agree responses are: 72.7%, 53.2% and 48.5% for others in group B, doctors in group A and IT staff in group B respectively. The greatest percentage of undecided responses came from secretaries/receptionists in group B, others in group B and IT staff in group B. Figure 17 indicates that the respondents generally agree on the beneficial impact of computers.

6.3.5. Analysis of questions related to computer satisfaction

Several questions were used to pinpoint satisfaction. The researcher sought to ascertain the satisfaction of the users toward their institution's existing system performance, its quality of reports and management handling of the computer (the latter issue was raised only in Omani questionnaire). During the investigation and the discussion with the people expected to respond to the questionnaire in both preliminary field studies (Oman and UK GPRs), it appeared that they were not entirely satisfied with management handling of the deployment process.

6.3.7.1. Omani satisfaction questions

S5Q5.8 'I am satisfied with the present computer reports'.

S6Q2.6: 'Are you satisfied with the computer system's performance?'

S6Q3: 'Are you satisfied with the overall management handling the computer systems?'

Table 6. 34 Omanis' responses to satisfaction questions

Ques Codes	SDA & DA		UND		SA & A		X^2
	F	%	F	%	F	%	
S5Q5.8	17	17	15	15	69	68	.0000
S6Q2.6	29	29	27	27	43	43	1.0000
S6Q3	43	43	28	28	29	29	.1212
Average		29.7		23.3		47	

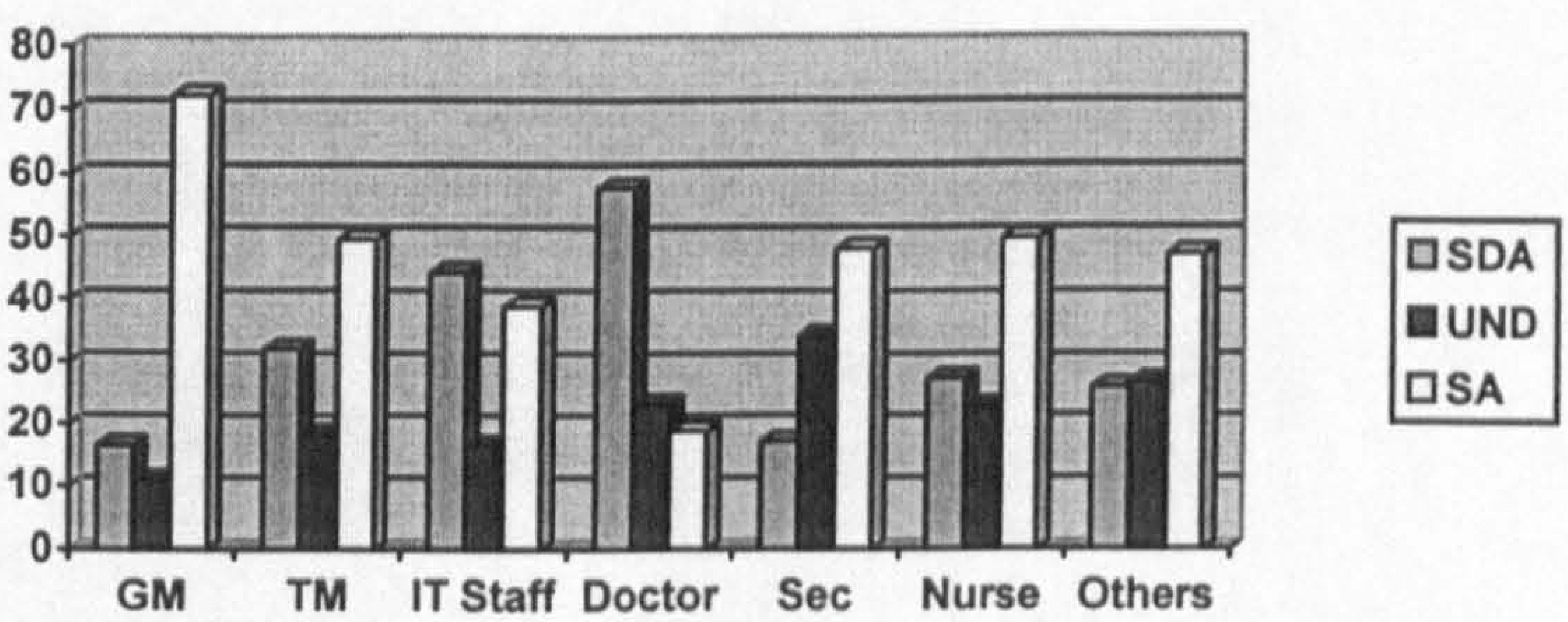
X^2 = .05 or less is significant

Table 6. 35 Omanis' responses to satisfaction questions, by group (A&B)

Ques Codes	SDA & DA (A & B)		UND (A & B)		SA & A (A & B)		X^2
	%	%	%	%	%	%	
S5Q5.8	16	17	8	17	76	67	.5089
S6Q2.6	39	26	19	30	42	44	.3948
S6Q3	31	47	23	30	46	23	.0784
Average	28.7	30	16.7	25.7	54.8	44.7	

X^2 = .05 or less is significant

Figure 6. 18 Summary of Oman's responses to satisfaction questions, by job title



Looking at Table 6.34, Table 6.35, Table 16 in Appendix F and Figure 18, we can summarise the Omani results as follows:

1) Table 6.34 shows that there is satisfaction with computer reports and computer performance. However, there is dissatisfaction with management handling of the computer deployment process. The table also shows high undecided scores. The significance test shows only one set of responses is significant.

2) Table 6.25 shows that there is no significant difference between groups A and B in responding to these questions. Therefore, hypothesis A is not supported. However, the results show that group A responded more favourably than group B, therefore, hypothesis B is supported. The table also shows that undecided scores are mostly higher in group B. Therefore, hypothesis C is supported.

3) Table 16 shows that the highest average score for satisfaction is 72.2%, for general management and the highest score of dissatisfaction is 57.8%, for doctors. The highest undecided score is 34.4%, for secretaries/receptionists.

6.3.7.2. UK satisfaction questions

US5Q5.8: 'I am satisfied with the present computer reports.'

US6Q2: 'Are you satisfied with the computer system in the practice?'

Table 6. 36 GPRs' responses to satisfaction questions

Ques Codes	SDA & DA		UND		SA & A		X^2
	F	%	F	%	F	%	
US5Q5.8	4	12	12	36	17	52	.0201
US6Q2	8	23	0	0	27	77	.0013
Average		17.5		18		64.5	

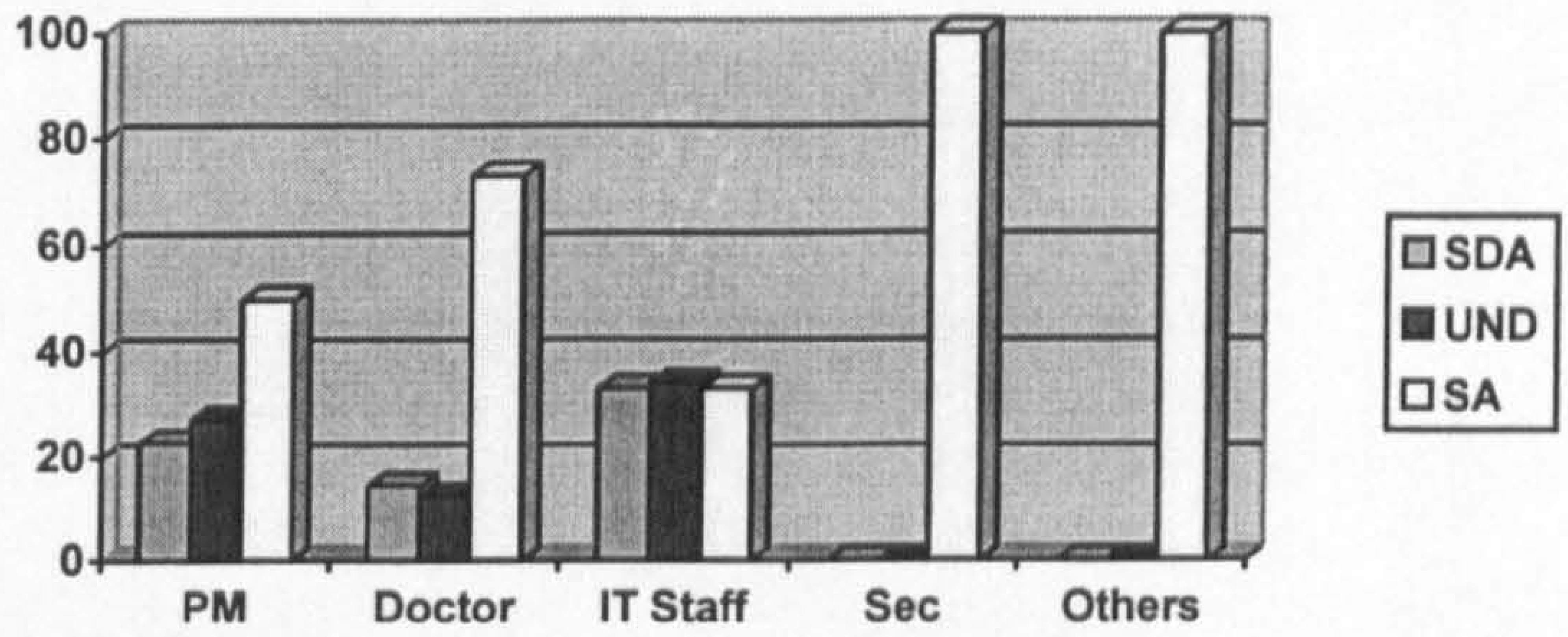
X^2 = .05 or less is significant

Table 6. 37 GPRs' responses to satisfaction questions, by group (A&B)

Ques Codes	SDA & DA (A & B)		UND (A & B)		SA & A (A & B)		X^2
	%	%	%	%	%	%	
US5Q5.8	11	17	37	33	52	50	.9292
US6Q2	24	17	0	0	76	83	.6915
Average	17.5	17	18.5	16.5	64	66.5	

X^2 = .05 or less is significant

Figure 6. 19 Summary of GPRs' responses to satisfaction questions, by job title



The analysis of GPRs satisfaction questions by Table 6.36, Table 6.37, Table 17 in Appendix F and figure 19, reveals the following:

1) Table 6.36 shows that there is satisfaction with computer reports and computer performance. This result confirms the interview finding that overall satisfaction with the system was expressed. There is significance in the distribution of these responses.

2) Table 6.37 shows that there is no significant difference between group A and B in responding to these questions. Therefore, hypothesis A is not supported. The average scores of group A and B for 'strongly agree' are 64% and 66.5%. These scores shows that group B is more favourable in their responses. Therefore, hypothesis B is not supported. The table also shows that 'undecided' scores were slightly higher in group A. Therefore, hypothesis C is not supported.

3) Table 17 shows that the highest score for satisfaction is 100.0%, for secretaries/receptionists and others and the highest score for dissatisfaction is 33.3% for IT staff. The highest undecided score is 33.4%, also for IT staff. Figure 19 shows high overall satisfaction with the computer.

6.3.6. Analysis of questions related to computer technical performance

The new technology has been developed to cope with most of the technical problems as well as with high performance (see Chapter two, section 2.2). However, still there are problems of slow response and software compatibility with the requirement.

6.3.7.1. Omani technical problems questionnaire

In this survey we are investigating to what extent the most commonly reported problems are still in existence and how well the computer performs. The range of occurrence of these problems was set as (1 = no significant problems ... 5 = significant problems). For analysis purposes, 1 & 2 responses were regarded as an indication of no significant problems, 3 as moderate problems, 4 and 5 as significant problems.

S6Q1.1-9: This question contained 9 items, including 'other, specify' to investigate any problems encountered with the computer that were not on the list. However, this category is not included in this analysis, because no respondents gave this answer. The categories of problems investigated were:

S6Q1.1: Software problems;

S6Q1.2: Hardware problems;

S6Q1.3: system response time;

S6Q1.4: Information utilisation problems;

S6Q1.5: Information structure problems;

S6Q1.6: Information input/output problems;

S6Q1.7: Information storage problems;

S6Q1.8: Processing and maintaining computer data problems.

S6Q2.1-5: This question contained 6 items, which were set to evaluate the existing system in use. The last item was analysed separately in the satisfaction section.

S6Q2.1: The computers' use was simple and easy to learn;

S6Q2.2: The computer is quick;

S6Q2.3: It was easy to search and analyse prescribing data;

S6Q2.4: The computer was reliable;

S6Q2.5: Is the layout of the system in the hospitals efficient?

Table 6. 38 Omanis' responses for technical problems questions (S6Q1.1-8)

Ques Codes	Not Significant		Moderate		Significant		X^2
	F	%	F	%	F	%	
S6Q1.1	33	33	33	33	33	33	1.0000
S6Q1.2	48	49	25	25	26	26	.0060
S6Q1.3	20	20	26	26	55	55	.0000
S6Q1.4	30	30	34	34	35	35	.8089
S6Q1.5	45	47	34	36	16	17	.0011
S6Q1.6	31	31	39	39	29	29	.4281
S6Q1.7	51	52	27	28	20	20	.0003
S6Q1.8	41	43	30	32	24	25	.0956
Average		38.1		32.3		30	

X^2 = .05 or less is significant

Table 6. 39 Omanis' responses to questions (S6Q1.1-8), by group (A&B)

Ques Codes	Not Significant (A & B)		Moderate (A & B)		Significant (A & B)		X^2
	%	%	%	%	%	%	
S6Q1.1	44	30	40	31	16	39	.1001
S6Q1.2	44	50	28	24	28	26	.8705
S6Q1.3	23	19	34	23	42	59	.3313
S6Q1.4	32	30	36	34	32	37	.9208
S6Q1.5	42	49	33	37	25	14	.4622
S6Q1.6	50	25	29	43	21	32	.0762
S6Q1.7	42	55	33	26	25	19	.5037
S6Q1.8	50	41	27	33	23	26	.7589
Average	40.9	37.4	32.5	31.4	26.5	31.5	

X^2 = .05 or less is significant

Figure 6. 20 Summary of Oman's responses to questions (S6Q1.1-8), by job title

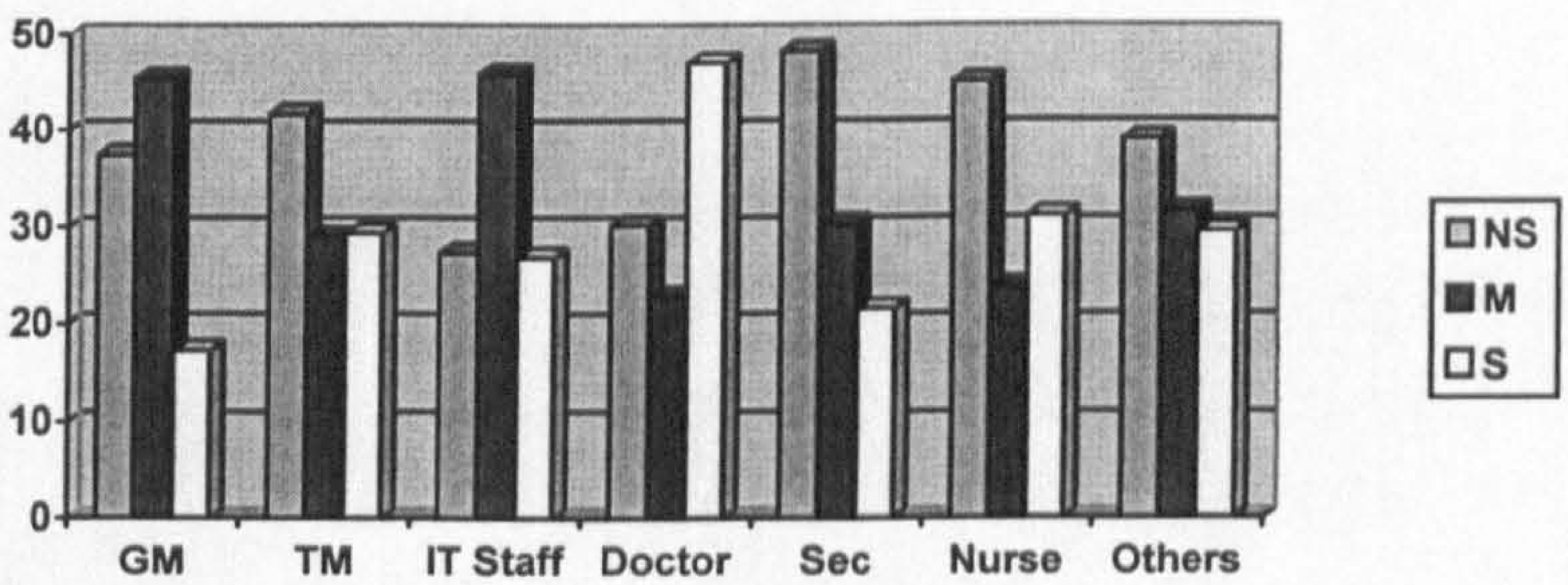


Table 6. 40 Omanis' responses to questions (S6Q2.1-7)

Ques Codes	SDA		UND		SA		X^2
	F	%	F	%	F	%	
S6Q2.1	8	8	11	11	83	81	.0000
S6Q2.2	40	40	9	9	52	52	.0000
S6Q2.3	22	24	32	34	39	42	.0949
S6Q2.4	12	12	36	37	49	51	.0000
S6Q2.5	17	18	28	29	51	53	.0001
Average		20.4		24		55.8	

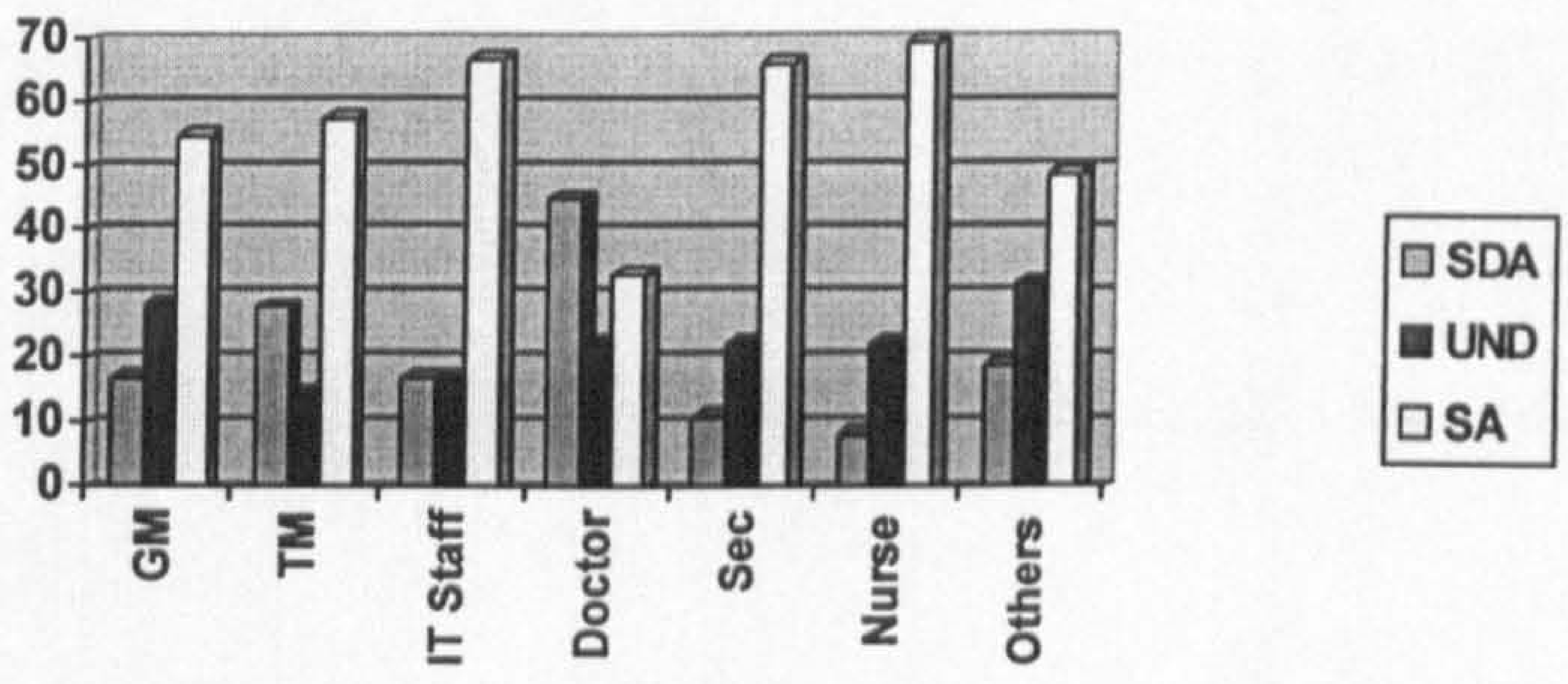
X^2 = .05 or less is significant

Table 6. 41 Omanis' responses to questions (S6Q2.1-7), by group (A&B)

Ques Codes	SDA (A & B)		UND (A & B)		SA (A & B)		X^2
	%	%	%	%	%	%	
S6Q2.1	15	5	8	12	77	83	.2317
S6Q2.2	56	34	8	9	36	57	.1470
S6Q2.3	22	24	35	34	44	41	.9875
S6Q2.4	15	11	23	42	62	47	.2230
S6Q2.5	16	18	16	34	68	48	.1761
Average	24.8	18.4	18	26.2	57.4	55.2	

X^2 = .05 or less is significant

Figure 6. 21 Summary of Oman's responses to questions (S6Q2.1-5), by job title



Looking at Table 6.38, Table 6.39, Table 6.40, Table 6.41, Table 18 & 19 in Appendix F and Figures 20 & 21, which present the responses regarding technical problems encountered by the respondents during their work with the computer system, we can summarise the results as follows:

1) Table 6.38 shows that more respondents evaluated their system as having no significant problems, than said it had moderate or significant problems (scores of 38.1%, 32.3% and 30% respectively). However, S6Q1.3 question, S6Q1.4 question and S6Q1.1 had high scores for 'significant problems', 55%,

354% and 33% respectively. The table also shows that for hardware and its specification, there were high responses for 'no significant problems' The differences between these scores have NPAR with 50% significance. We can say an overall that computer technical problems appear still not to have been solved completely, especially that related to system response time.

2) Table 6.39 shows that the differences in percentage of groups A and B in responding to these questions are not significant. This result shows hypothesis A is not supported. With a close look at the result, we see that group A responded more favourably than group B, where is the difference between the two scores of averages in significant problems is 2.2 in favour group A, but the difference between the two average scores with respect to no significant problems is bigger by 4.2%. Therefore, this result shows that hypothesis B is supported.

3) Table 18 show that general managers and IT staff claim their system has moderate problems, while doctors claim significant problems. The secretaries/receptionists, nurses, technical managers and data entry personnel were more inclined to report no significant problems.

By looking at Table 6.40, Table 6.41 and Table 19, which present the results of responses for computer performance, we can summarise the results as follows:

1) Table 6.40 presents the responses for computer performance. This table shows high scores for 'strongly agree', which indicates that the computer is performing well. The average score is 55.8%. The differences between these scores show responses to 4 out of 5 questions are significant. This result shows that the technical performance is not causing system failure.

2) Table 6.41 shows that the percentage differences between group A and B in responding to these questions are not significant. This result shows that hypothesis A is not supported. The table also shows that groups A and B

scored very similarly for 'strongly agree' as well as 'strongly disagree'. This result does not give a clear indication whether hypothesis B is supported or not. However, the result shows that group B has more and higher undecided scores than group A. This result supports hypothesis C.

3) Table 19 shows that most of the respondents had responses with high scores for 'strongly agree', except doctors who responded with high scores for 'strongly disagree'. The table also shows that the categories of 'others' and general management had a high level of undecided responses, with scores of 31.7% and 28.3% respectively. By looking at Figures 20 & 21 we can see doctors' showed computer encounter significant problems and showed less agreement than that of other groups on computer evaluation.

6.3.7.2. UK technical problems questionnaire

GPRs section six in the questionnaire has two questions. One question includes nine items that concerned problems encountered during computer operation and utilisation. The other question has been analysed in discussion of questions related to satisfaction. These questions are:

US6Q1.1-8: This question contained 9 items, including 'other, specify' to investigate any problems encountered with the computer that were not on the list. However, this category is not included in this analysis, because no respondents gave this answer. The categories of problems investigated were:

US6Q1.1: Software problems;

US6Q1.2: Hardware problems;

US6Q1.3: system response time;

US6Q1.4: Information utilisation problems;

US6Q1.5: Information structure problems;

US6Q1.6: Information input/output problems;

US6Q1.7: Information storage problems;

US6Q1.8: Processing and maintaining computer data problems.

The analysis of GPRs' questions related to the technical problems encountered by the respondents during their work with the computer system, can be summarised in the following tables.

Table 6. 42 GPRs' responses to technical problems questions (US6Q1.1-8)

Ques Codes	Not Significant		Moderate		Significant		X^2
	F	%	F	%	F	%	
US6Q1.1	23	66	3	9	9	26	.0001
US6Q1.2	30	86	3	9	2	6	.0000
US6Q1.3	13	37	10	29	12	34	.8187
US6Q1.4	25	71	5	14	5	14	.0000
US6Q1.5	25	71	4	11	6	17	.0000
US6Q1.6	26	74	3	9	6	17	.0000
US6Q1.7	26	77	2	6	6	18	.0000
US6Q1.8	26	74	5	14	4	11	.0000
Average		69.5		10.9		17.9	

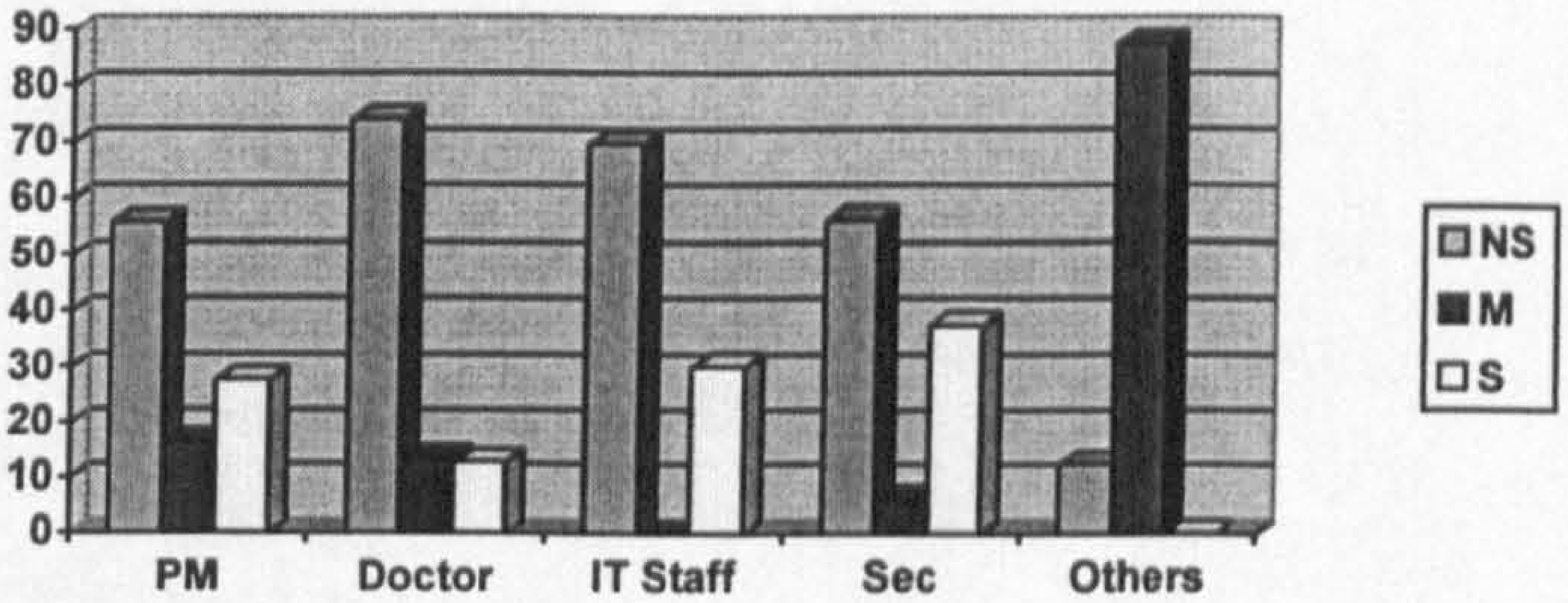
X^2 = .05 or less is significant

Table 6. 43 GPRs' responses to questions (US6Q1.1-8), by group (A&B)

Ques Codes	Not Significant (A & B)		Moderate (A & B)		Significant (A & B)		X^2
	%	%	%	%	%	%	
US6Q1.1	69	50	3	33	28	17	.0583
US6Q1.2	86	83	7	17	7	0	.6150
US6Q1.3	35	50	35	0	31	50	.2330
US6Q1.4	76	50	14	17	10	33	.3114
US6Q1.5	72	67	10	17	17	17	.9058
US6Q1.6	79	50	7	17	14	33	.3269
US6Q1.7	82	50	4	17	14	33	.2097
US6Q1.8	79	50	14	17	7	33	.1617
Average	72.3	56.3	11.8	16.9	16	27	

X^2 = .05 or less is significant

Figure 6. 22 Summary of GPRs' responses to questions (US6Q1.1-8), by job title



Looking at Table 6.42, Table 6.43, Table 20 in Appendix F and Figure 22, which present the responses regarding technical problems encountered by the GPRs respondents during their work with the computer system, we can summarise the results as follows:

1) Table 6.42 shows that most respondents encountered no significant problems with an average score of 69.5%. The differences between the distribution of these scores using NPAR test were 88% significant. We can say that technical problems are almost absent in the GPRs computer system. This result also, has been confirmed by the interview.

2) Table 6.43 shows that the percentage differences between group A and B in responding to these questions are not significant. This result show that hypothesis A is not supported. However, group A scored higher responses for no significant problems than group B. This result shows that hypothesis B is supported.

2) Table 20 shows that most of the respondents responded 'no significant problems', except that 'others' responded with moderate problems. Figure 22 illustrates this finding.

6.3.7. Analysis of questions in the first section in the Questionnaires

A variety of issues that did not fit into any of the other sections were put at the beginning of the questionnaire, as section one.

6.3.7.1. Omani first section questions

S1Q2: This question investigated the issue of knowledge of the computer. This question contained five items plus an extra one (other) which has been added to most of the checklist questions in this questionnaire, to give more freedom to the respondents to express other issues or other items not in the list.

S1Q3: 'training programmes are made accessible to Omanis'

S1Q4: 'managers/administrators attend computer training session.'

Table 6. 44 Omanis' responses to knowledge questions (S1Q2.1-6)

Ques Codes	No		Yes		X^2
	F	%	F	%	
S1Q2.1	52	51	50	49	.8430
S1Q2.2	74	72	28	28	.0000
S1Q2.3	81	79	21	21	.0000
S1Q2.4	78	77	24	24	.0000
S1Q2.5	86	84	16	16	.0000
S1Q2.6	97	95	5	5	.0000
Average		76.3		23.8	

X^2 = .05 or less is significant

Table 6. 45 Omanis' responses to knowledge questions (S1Q2.1-6), by groups (A&B)

Ques Codes	No (A & B)		Yes (A & B)		X^2
	%	%	%	%	
S1Q2.1	39	55	62	45	.1390
S1Q2.2	62	76	39	24	.1449
S1Q2.3	69	83	31	17	.1369
S1Q2.4	58	83	42	17	.0082
S1Q2.5	81	86	19	15	.5647
S1Q2.6	100	93	0	7	.1798
Average	68	79.3	32	20.8	

X^2 = .05 or less is significant

Figure 6. 23 Summary of Oman's responses to questions (S1Q2.1-6), by job title

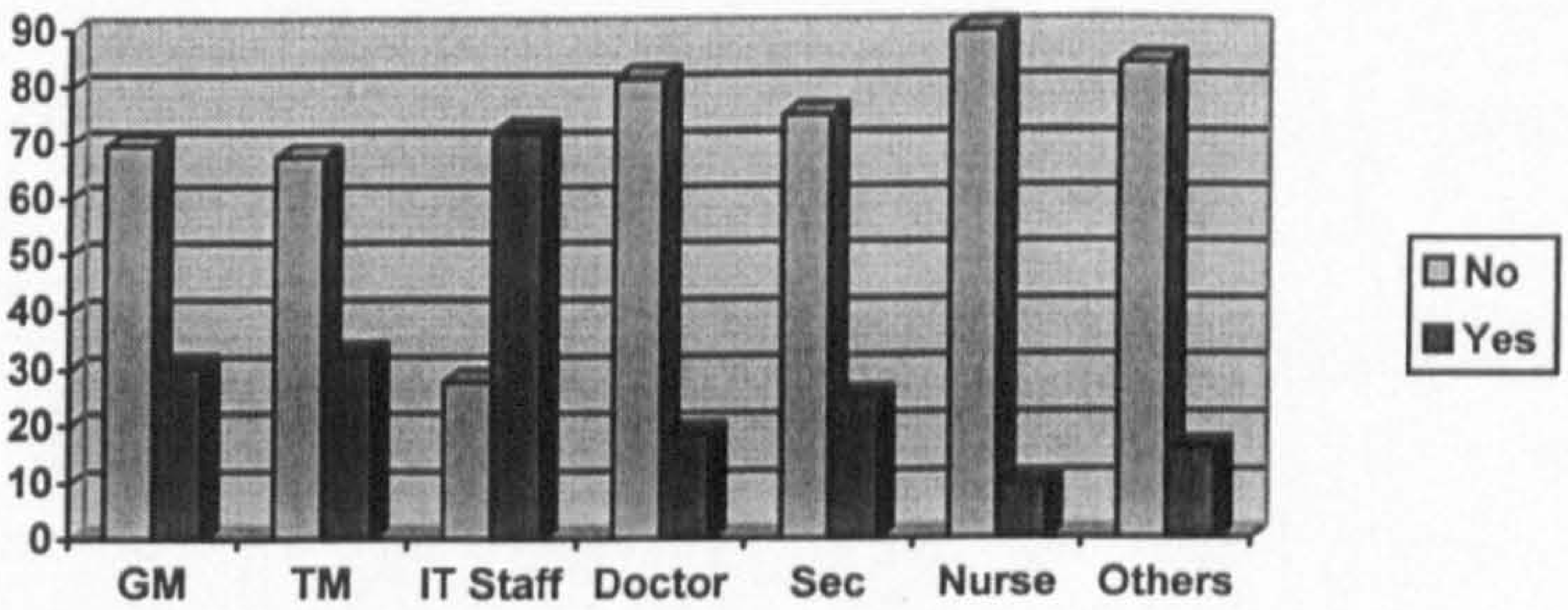


Table 6. 46 Omanis' responses to questions (S1Q3 & S1Q4)

Ques Codes	SDA & DA		UND		SA & A		X^2
	F	%	F	%	F	%	
S1Q3	32	33	17	17	49	50	.0004
S1Q4	40	40	41	41	19	19	.0098
Average	36	36.5	29	29	34	34.5	

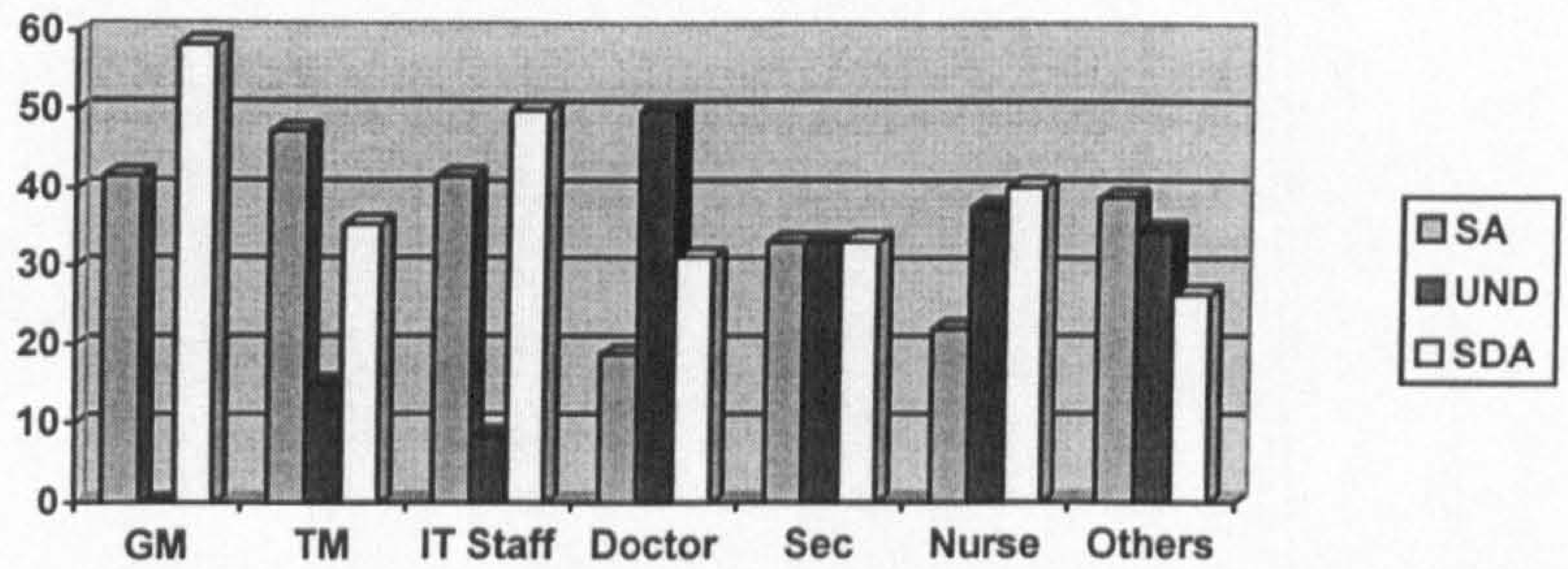
X^2 = .05 or less is significant

Table 6. 47 Omanis' responses to questions (S1Q3 & S1Q4), by group (A&B)

Ques Codes	SDA & DA (A & B)		UND (A & B)		SA & A (A & B)		X^2
	%	%	%	%	%	%	
S1Q3	42	29	4	22	54	49	.0892
S1Q4	50	37	23	47	27	16	.0910
Average	46	33	13.5	34.5	40.5	32.5	

X^2 = .05 or less is significant

Figure 6. 24 Summary of Oman's responses to questions (S1Q3 & 4), by job title



By looking at Table 6.44, Table 6.45, Table 6.46, Table 6.47, Tables 21 & 22 in Appendix F and Figures 23 & 24, which display the results of section one in the Omani questionnaire, which mainly concerned knowledge and training, we can summarise the results as follows:

1) Table 6.44 and Table 6.45 showed poor knowledge of the computer system. The only area in which knowledge scored close to 50% was the entry of data. So there is a lack of computer skills. The table shows that the percentage differences between groups A and B in responding to these questions are not significant. This result shows that hypothesis A is not supported. However, group A scored higher responses for knowledge than group B. This result shows that hypothesis B is supported.

2) Table 21 shows that IT staff are the only group who are more knowledgeable than not, about the computer. Nurses and those entering data are the weakest in computer knowledge.

3) Table 6.46 shows that training programmes are available for Omanis. However, managers and administrators do not attend computer training sessions. This result of availability of training to the Omanis is consistent with the reports by interviewees, that local personnel were sent abroad to be trained.

4) Table 6.47 shows that the percentage differences between groups A and B in responding to these questions are not significant. This result shows that hypothesis A is not supported. However, group A scored higher responses in 'disagree' and 'agree' than group B. However, the result gives indication that hypothesis B is not supported. Also group B was more negative responding to these two questions given greater use of undecided responses. Therefore, hypothesis C is supported.

5) Table 22 shows that general management indicated in response to S1Q3 that training programmes are accessible. However, managers' responses are split regarding S1Q4, which is concerned with managers' attendance on training sessions. Technical managers were split on the accessibility of training programmes. However, they gave higher scores to the claim that managers do not attend these programmes. IT staff gave support to S1Q3 but not to S1Q4. Doctors gave support for S1Q3 and were undecided on S1Q4.

6.3.7.2. GPRs' first section questions

US1Q2: No. of partners in the practice.

Table 6. 48 GPRs' responses to No. of partners question

Value Label	Value	Frequency	Valid Percent
1) Number of partners	1	4	11.4
2) Number of partners	2	4	11.4
3) Number of partners	3	9	25.7
4) Number of partners	4	6	17.1
5) Number of partners	5	9	25.7
6) Number of partners	6	2	5.7
7) Number of partners	7	1	2.9

Before we proceed to the result of this question, a point worth mentioning here is that many practices depend to some extent on part-time doctors, but the question did not specify whether partners were full time or part time. The responses are summarised in Table 6.48. It can be seen that around 23% of the practices have only one or two partner (s) but the majority of practices, around 68.5%, have between 3 and 5 partners. Around 9% have 6 partners or more. This result, taken in conjunction with the next question, will help to understand the pressure on doctors in their work.

US1Q3: Practice list size.

Table 6. 49 GPRs' responses on practices list size question

Value label	Value	Frequency	Percent
1) Size of the practice	1900	2	5.7
2) Size of the practice	1950	1	2.9
3) Size of the practice	2750	1	2.9
4) Size of the practice	3750	1	2.9
5) Size of the practice	3800	1	2.9
6) Size of the practice	4900	1	2.9
7) Size of the practice	5200	1	2.9
8) Size of the practice	5700	2	5.7
9) Size of the practice	6000	1	2.9
10) Size of the practice	7000	1	2.9
11) Size of the practice	7200	1	2.9
12) Size of the practice	7500	2	5.7
13) Size of the practice	8000	2	5.7
14) Size of the practice	8233	1	2.9
15) Size of the practice	8330	2	5.7
16) Size of the practice	8350	1	2.9
17) Size of the practice	9500	2	5.7
18) Size of the practice	10200	1	2.9
19) Size of the practice	10260	1	2.9
20) Size of the practice	10300	1	2.9
21) Size of the practice	10400	3	8.6
22) Size of the practice	11000	1	2.9
23) Size of the practice	12000	1	2.9
24) Size of the practice	12500	1	2.9
25) Size of the practice	13000	3	8.6
Total	277,453	35	100.0

Mean 7927.229 Std dev 3280.667

Table 6.49 shows that 11.5% of the practices had from 1,000 to 3,000 patients registered. 8.7% of the practices had from 3,001 to 5,000 patients registered. 14.4% of the practices had from 5,001 to 7,000 patients registered and a similar percentage had from 11,001 to 13,000. 25.8% of the practices had from 7,001 to 9,000 patients registered. 25.9% of practices had from 9,001 to 11,000. Looking again at the previous result (Table 6.48) we can see that around four practitioners worked alone, without partners and there are three values in Table 6.49 in the range from 1,900 to 2,750. If we assume, therefore, that a single practitioner can handle 1,900 to 2,750 patients with an average of 1,650 patients we see the unequal distribution of patients around these practices, suggesting that many doctors may be suffering overload, which might have consequences for patient health provision and quality. For example, the highest number of patients registered was 13,000 and this size category also had the high frequency. If a practitioner can handle 1,900 to 2,750 patients, we would expect a patient list of 13,000 to be served by 5-7 partners. Yet the highest percentage of practices, around 68.5%, had 3 to 5 partners, while 51.7% of practices had from 7,000 to 11,000 patients.

US1Q4: Respondents were asked how long they had this system, to give an idea of their experience with the computer.

Table 6. 50 GPRs' responses length of system use

Value Label	Value	Frequency	Valid Percent
1) 6 months to 2 years	1	18	51.4
2) 25 months to 3 years	2	9	25.7
3) over 3 years	3	6	17.1

Table 6.50 shows that the result was that around 12% had used the computer for 1 year or less, and around 41% from 13-24 months. Over 26% had used it for 25 to 36 months. Around 12% had used for 37 to 48 months. Only around 6% had used it for more than four years. Since the survey was conducted in May 1992, these data indicate that the main deployment of the computer system came between 1989 and 1991, during which around 78% of the GPs deployed computer systems. The peak time was in 1990, when around 41% of the GPs introduced computers. This was followed by a decline

in 1991. The reasons for this are not clear yet; however, Wiles (1986) indicated that GPs in Humberside were not covered by the DHSS scheme, while the FHSA personnel indicated that it began in late 1986 and by 1991 and 1992 it might be that most GPs had already computerised.

US1Q5.1-6: This question investigated the issue of knowledge of the computer.

Table 6. 51 GPRs' responses to knowledge questions (S1Q5.1-6)

Ques Codes	No		Yes		X^2
	F	%	F	%	
US1Q5.1	16	46	19	54	.6121
US1Q5.2	21	60	14	40	.2367
US1Q5.3	23	66	12	34	.0630
US1Q5.4	18	51	17	50	.8658
US1Q5.5	30	86	5	14	.0000
Average		61.8		38.4	

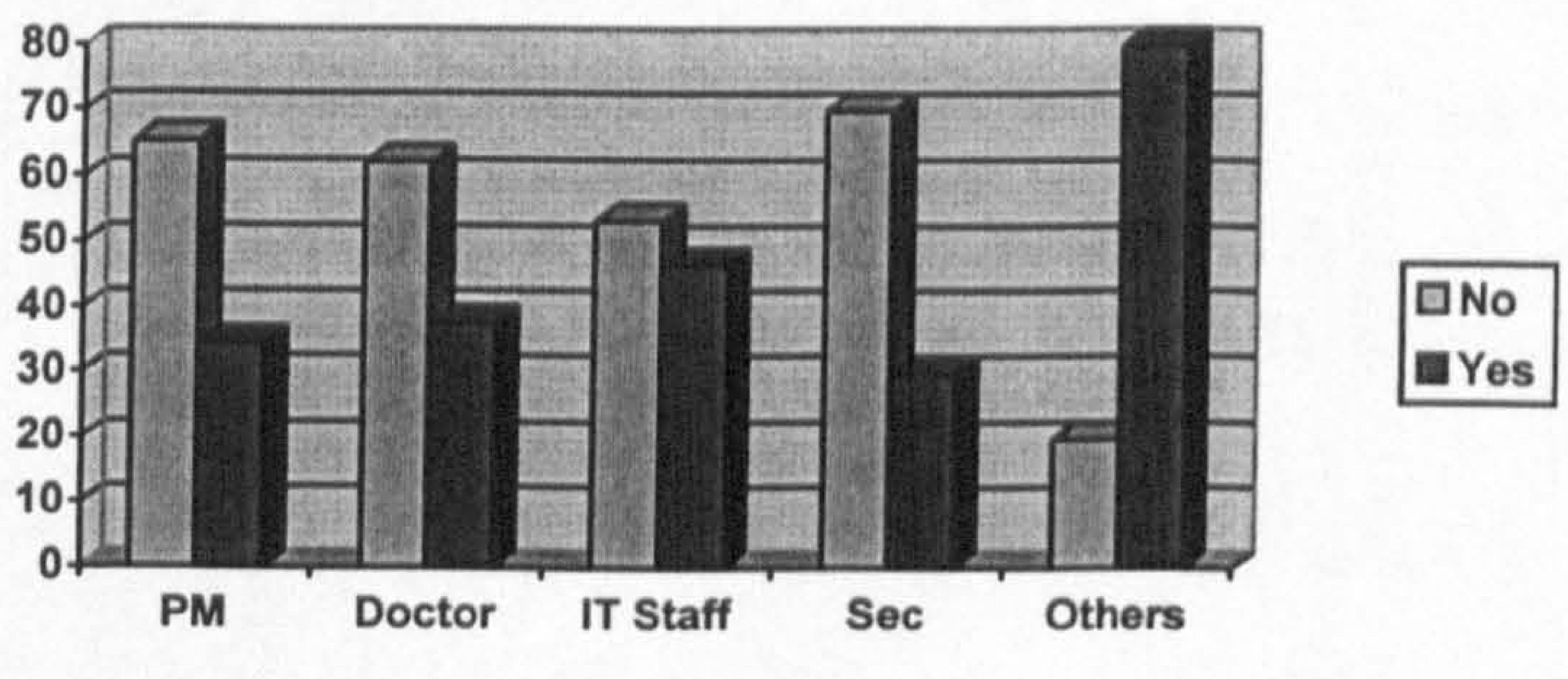
X^2 = .05 or less is significant

Table 6. 52 GPRs' responses to knowledge questions (S1Q5.1-6), by group (A&B)

Ques Codes	No (A & B)		Yes (A & B)		X^2
	%	%	%	%	
US1Q5.1	48	33	52	67	5036
US1Q5.2	62	50	38	50	.5828
US1Q5.3	69	50	31	50	.3729
US1Q5.4	52	50	48	50	9386
US1Q5.5	86	83	14	17	.8547
Average	63.4	53.2	36.6	46.8	

X^2 = .05 or less is significant

Figure 6. 25 Summary of GPRs' responses to questions (US1Q5.1-5), by job title



By looking at Table 6.51 Table 6.52, Table 23 in Appendix F and Figure 25, which give the results of the questions on knowledge of the computer, we can summarise the findings as follows:

1) Table 6.51 shows poor knowledge of the computer system. The only area of knowledge that scored over 50% is the entry of data. So GPRs lack computers skills. The inadequacy of computer knowledge was expressed by the interviewees as the main cause of fear and resistance. Table 6.52 shows that the percentage differences between group A and B in responding to these questions are not significant. This result shows that hypothesis A is not supported. Group B scored higher responses in relation to knowledge than group A. This result shows that hypothesis B is not supported. However, this result will be disregarded, because of the small number of group B in the sample.

2) Table 23 shows that the categories 'Others' and 'IT staff' have the most knowledge of computers, with scores of 80% and 45.6%. Secretaries/ receptionists have the lowest level of knowledge of the computer.

6.4. Conclusion

The overall assessment of strategic planning for introducing this technology into the Omani health system was poor. However, GPRs showed better planning than the Omanis. The overall assessment of utilisation showed that the system is not fully utilised by either Omanis or GPRs. The GPRs showed satisfaction while Omanis were split between those who were satisfied and those who were dissatisfied.

With regard to the above main issues it appears that strategic planning for IT in Oman, especially, was in many cases a failure and this has been accepted by the top management. Also, technical management, doctors and IT staff were more critical of the top management's strategic planning behaviour.

The Omanis' responses showed a split in opinions whether the negative aspects of computer may influence staff and health system. However, a tendency to feel fear of such affects was apparent. In contrast, the GPRs' responses did not manifest such feelings.

With respect to the beneficial impact of computers, there was a general agreement on the matter by both Omani and GPRs respondents.

There was general agreement that few problems had been encountered in computer use, by both Omani and GPRs' respondents.

The findings showed a lack of computer knowledge by both GPRs and Omani respondents, although, it appeared that the situations in this respect was better among GPRs than in the Omani hospital.

This analysis shows a variety of differences of views and provides rich information that needs to be carefully looked at in the next chapter, which presents the conclusions and recommendations of the study. Also, we shall consider the implications of these findings for the framework of information systems development that was described in Chapter 2, and which was mapped onto the Omani and UK experiences in Chapter 3. This may help to achieve a useful evaluation of the behaviour and the situation of these respondents and their responses.

7. CHAPTER SEVEN: SUMMARY and DISCUSSION

7.1. Introduction

This chapter contains a summary of research undertaken and reported in detailed in previous chapters, and a discussion of the conclusions that have been drawn from the analysis that has been undertaken. In the next chapter the limitation of this work are considered and some comments on issues for further consideration are made.

7.2. Summary

7.2.1. Overview

My research in the area of computer deployment, development and utilisation in developed and developing countries' health care (with an emphasis on Oman) is worthwhile. In view of the rapid growth in this field, this study has sought to shed light on the problems and risks that may emerge with computer deployment, development and utilisation. The assessment of the existing methodologies and examination of how they pursued the use of IT/IS strategic planning for computers deployment, development and utilisation, will provide a basis for improving current methods and policies as well as practice, and increasing the efficiency of the existing instruments. Thus, considerations about computer strategic planning deployment, utilisation, training, integration, investment and other related issues, must be taken into account in preparing recommendations and policies for computer strategic information system development methodologies. This goes in line with the point made by Boland and Hirschheim (1993), that information systems are concerned not only with the development of new information technologies, but also with questions of how they can be best applied, how they should be deployed and managed, and of their possible wider implications.

As a means of exploring the above issues, first, an initial review of literature and collating of up-to-date information in the field was undertaken for use in this thesis as well as a contribution to the literature. Secondly, two case studies in two different environments were described. Thirdly, strategic planning and use of methodologies to guide IT/IS development were explored.

Fourth, three computer-based patient record systems were reviewed. Fifth, responses to questionnaires sent to Humberside GPs computer users and Omani RH and SQUH computer users were analysed.

The questionnaire responses were used mainly to obtain opinions on how computers were strategically deployed and utilised, their impact, fears raised, technical and performance problems and overall satisfaction with respect to job classification and two levels of computer users (decision makers and ordinary users).

Since the research is exploratory in nature (i.e. it does not test a previous hypothesis) it may serve as a basis for new research. Its findings can help to develop strategies, use of IT/IS methodologies and awareness of problems and computer risks with particular reference to developing countries and their health care systems.

7.2.2. Literature review and the two case studies

The primary objective of this study has been to study computer deployment and utilisation in the Omani health System as compared with computer deployment in general practices in the UK. Information technology may be a key tool which will assist Oman to pursue development through the availability and use of information, and the Omani government has in recent years become interested in the use of computers as part of its extensive modernisation efforts in various fields, including health care. At the same time, concerns are expressed regarding the cost of the technology and its failure to deliver the expected benefits, and Oman is continuing to shop for new system in the market. This may be due to lack of strategic planning for computer deployment, poor utilisation and overall the absence of use of specific strategic development methodologies for IT/IS. However, disappointment with computer systems is not uniquely an Omani problem, or even a problem of developing countries. Developed countries also have stories of costly failures. This study, therefore, has attempted not only to explore quantitatively and qualitatively the process of computer deployment in UK and Omani health systems, assessing satisfaction and identifying problems, but also to see whether the UK's experience and progress in this field yields insights which may be exploited to benefit Oman.

After a short introductory chapter, which highlighted the aims and importance of the study and provided background information on the UK and Oman health systems, in Chapter Two the study explored the use of information system development methodologies. It showed new trends in pursuing IT/IS methodologies and explained why IE might be the most suitable methodology for Oman's environment. A discussion was then presented of the use of IT/IS in the NHS and developing countries, in the former case highlighting the impact of the internal market and new contracting system. Recent developments in OHS and NHS strategic policy and deployment toward computers and information system development were also noted. The need in both developed and developing countries to use IT to optimise health care provision was highlighted. It was shown that deployment and use of technology has been constrained by failure to carry out proper strategic information system planning and lack of any recognition of information system methodologies.

These themes were explored further in Chapter Three, which concentrated on the use of IT/IS strategy, and mapping the experiences of Omani and NHS in using IT/IS onto the chosen methodological framework from Chapter Two. In this context, it explored the many obstacles that may impede such development, such as lack of financial or other resources or lack of commitment to investing in IT. Many problems are experienced at the human level-for example lack of training, lack of awareness, fear of the computer and resistance to change-rather than at the technical level. Whilst such problems have affected both developed and developing countries, the latter have been more severely affected by them. Three conditions for IT deployment, utilisation and development have been suggested in the literature as prerequisites to success. The first is integration of strategic planning for IT into total organisation strategic planning. The second is the use of information system methodologies. The third is to turn the IT strategic planning towards the pursuit of competitive advantage.

Efforts at adoption of IT strategy in the NHS came slowly and gradually, after extensive research and evaluation, and linked with changes in organisation structure. IT strategy has been instrumental in bringing about changes in management thinking. Nonetheless, IT deployment in health care, including the NHS, has not been without its problems. The exercise has been costly, and there is little evidence of sustainable competitive advantage. Information system methodologies and competitive rational strategy formulation have not always been carried out. It seems that the use of recognised methodologies for information system development and turning IT strategy for competitive advantage in NHS is in a stage of immaturity, whereas in the developing countries these issues appeared not to be on any agenda of IT/IS development.

Chapter Four sought to establish in more detail, the context in which the empirical component of this study was carried out, by describing in some detail two health systems and their deployment of the computer.

In the UK, the focus was on Humberside General Practices. As the source of primary health care and (since the introduction of fundholding) an important influence over secondary provision, general practice may be regarded as a powerful instrument for strategic change in the NHS. Joining the fundholding scheme imposes on GPRs additional managerial responsibilities. Full computerisation of patient records for managerial information purposes is also a requirement. The importance of fundholding has increased by the introduction of an internal market (see Chapter 2 & 4). A case study was presented of Old Fire Station Surgery, Beverley, which had first introduced a single PC several years ago, but undertook complete system revision as requirements changed, especially with the introduction of fundholding. Their choice of EMIS was made after careful consideration of requirements and detailed investigation of the systems available. The system is said to have brought changes in job descriptions of some personnel and to have improved prescribing policy. Further developments in system use are planned. However, since this case study took place in May 1992, there has been little change in the system software or hardware specifications except an increase in the number of terminals. However, EMIS is now the most popular choice of health system among general practices in Humberside.

The other case study presented was that of the Omani health system, where computer systems have been introduced in Royal Hospital and Sultan Qaboos University Hospital. In comparison with the UK experiences, computer deployment in these hospitals was undertaken in an *ad hoc* manner, with little preliminary research. The mistakes made by RH were repeated by SQUH. The main reason seemed to be poor inter-organisational communication and lack of clear national policy on information standards. Also, not all applications are implemented; and those implemented are not fully utilised. There are problems of inadequate capacity, poor response time, lack of skills to operate the computer technology, and poor planning that may be associated with political and social criteria that may have influenced the acceptance, use and development of the new technology. The reason for this may be a system culture that does not practise consultation of users (bottom-up approach); rather, the top man decides on an issue, then the rest are expected to follow without question; most of the time the top man has little information on the project (risks and benefits). The team responsible for the project are not competent to evaluate alternatives or there is no proper study, the top man is ignorant of scientific management approaches, and the only criterion he has to rely on is the availability of budget; absolutely no strategic information planning is carried out before a project is implemented and for future development there is no thought of using a specific development methodology. This sort of scenario has been described by Walsham (1993), who commented that developing countries' systems are characterised by a strong sense of social hierarchy/ respect for authority, and no questioning of instructions from superiors. Three years later after this survey was completed, the RH has changed its operating system to SUN and introduced Medicom software applications. The SQUH is shopping around for a new system to meet its new requirements (see Chapter Two).

To explore these issues further, in both the UK and Omani environments, qualitative and quantitative investigation was undertaken of the strategy for computer deployment and utilisation, computer fears, attitudes towards computers, and the impact of their deployment on health information and administration in NHS/GPR and in RH and SQUH. Preliminary insights gained through observation and through attendance at meetings of the Humberside Computer Users' Group were drawn on, in developing questionnaires, which were administered to personnel at GPRs in Humberside, and at the two Omani hospitals. These formed the basis of the questionnaire survey. The information obtained in this way was supplemented by qualitative information gained through observation, interviews and prior personal involvement in computer deployment and utilisation.

7.2.3. Interview results

7.2.3.1. General Practice Interview Results

Interviewees had done some planning in relation to the cost and utility of computer deployment, and the need for training, though they had not fully appreciated the implications of computer deployment in these respects. Peripherals were deployed piecemeal. In responding to other questions they showed satisfaction with system maintenance, but indicated no plans for future plans developments except those related to modification of the existing systems. Therefore, we can conclude that there is a need for further improvement in the strategic planning for computer resources.

The need for training was recognised, but many interviewees, though unwilling or unable to provide in-house training, were not entirely satisfied with the training provided by suppliers.

Respondents acknowledged problems with computers, related to the human context, but did not see technical problems as an issue.

The computer was said to have changed some job functions and organisation structure. Respondents saw computer information as an important tool and agreed that it is used in management decision-making to improve health care, as well as to monitor staff's work.

General satisfaction was expressed with the various systems in use. They were said to be simple, user-friendly, versatile, flexible and reliable.

At the same time, it was recognised that computer deployment in the NHS has not always been successful. The main reasons put forward for failure were inadequate planning and poor management, though a number of other factors were cited, including over-reliance on external assistance, and restrictions on the system imposed by the Health Authority.

7.2.3.2. Omani Interview Results

The choice of computer system had been influenced by systems seen in action in Europe and US; no previous planning or study had been done, and the differences between the Omani environment and those where the systems originated, had not been taken into account.

There have been problems with regard to training, because the training provided by the suppliers has been inadequate, and there are few indigenous personnel with the required knowledge to provide training. The RH system was severely overloaded and the hardware was obsolete. SQUH fared little better. Although its system was new, there was a problem with response time, a shortage of operators, and many applications were being withheld.

Efforts to remedy these problems were constrained by lack of resources and the need to wait for the next five year plan in order to get the approval and budget allocation for change. Dissatisfaction was also expressed with management support for the new technology.

As a result of those problems, the RH has eventually introduced a new operating system, SUN, and implemented Medicom models, while the SQUH is now shopping for any ready-made system to fit their requirements.

7.2.4. Summary Results of the two findings

We present here a summary of the findings relating to the main questions and the hypotheses for the Omani and GPRs' questionnaire. This analysis is concerned only with those items that were common to both questionnaires, unless stated otherwise. Please note the following: N/A means not applicable; Sp: means the result supports the issue; NSp: means the result does not support the issue; HA, HB, HC, HD and HE represent the hypotheses described in Chapter Five (see Table 7.1 below). For the definition of Groups A & B see Chapter Five also. These hypotheses are:

1) Hypothesis A: "There are differences in opinion between groups A and B of respondents in measuring the level of strategic planning toward computer system deployment into their health system.";

2) Hypothesis B: "The top management and technical management from the Omani respondents and from GPRs respondents practice managers and physicians will have more favourable attitudes toward the system or the outcomes of using the system that has been deployed under their decision or recommendations, while those not involved in this kind of decision will be less favourable.";

3) Hypothesis C: "Group B will use the 'undecided' response option to avoid responding to certain questions that may criticise management actions toward the new technology";

4) Hypothesis D: "There is a difference between group A in the UK and group A in Oman in their responses to the above situations";

5) Hypothesis E: "The overall failure of the computer will be more related to human issues than to the machines."

Table 7. 1 Summary of the two sets of findings

Items (Questions)	Total Results	Values	HA	HB	HC	HD	HE
Omani strategic Questions	26% (SA) there is strategic planning	Poor*	NSp	Sp	NSp	NSp	Sp
GPRs strategic Questions	70.8% (SA) there is strategic planning	Good*	NSp	NSp	NSp	NSp	NSp
Omani utilisation Questions (1)	33.4% of computer applications utilised.	Poor	NSp	Sp	N/A	NSp	Sp
GPRs utilisation Questions (1)	78% of computer applications utilised.	Good	NSp	Sp	N/A	NSp	NSp
Omani utilisation Questions (2)	56.9% of staff use computer frequently.	Good	NSp	Sp	N/A	Sp	NSp
GPRs utilisation Questions (2)	57.5% of staff use computer frequently.	Good	NSp	Sp	N/A	Sp	NSp
Omani utilisation Questions (3)	45.3% of the reports produced by the computer.	Poor	NSp	Sp	N/A	Sp	Sp
GPRs utilisation Questions (3)	31.8% of the reports produced by the computer.	Poor	NSp	Sp	N/A	Sp	Sp
Omani utilisation Question (4)	62% of reports used by staff	Good	NSp	Sp	N/A	Sp	NSp
GPRs utilisation Question (4)	41% of reports used by staff	Averag e *	NSp	NSp	N/A	Sp	Sp
Omani fear Question	36.5% (SDA) for no fear of the computer	Poor	NSp	Sp	Sp	Sp	Sp
GPRs fear Questions	35.3% (SDA) for no fear of the computer	Poor	NSp	Sp	NSp	Sp	Sp
Omani impact Questions	70.2% (SA) there is computer impact	Good	NSp	Sp	NSp	Sp	Sp
GPRs impact Questions	48.7% (SA) there is computer impact	Averag e	NSp	NSp	Sp	Sp	NSp
Omani satisfaction Questions	47.1% (SA) general satisfaction	Averag e	NSp	Sp	Sp	NSp	Sp
GPRs satisfaction Questions	64.5% (SA) general satisfaction	Good	NSp	NSp	NSp	NSp	NSp
Omani technical Questions	38.1% no significant problems	Averag e	NSp	Sp	N/A	NSp	NSp
GPRs technical Questions	69.5% no significant problems	Good	NSp	Sp	N/A	NSp	Sp
Omani knowledge Questions	76.3% of staff have no computer knowledge	Poor	NSp	Sp	N/A	NSp	Sp
GPRs knowledge Questions	61.8% of staff have no computer knowledge	Poor	NSp	NSp	N/A	NSp	Sp

1) utilisation that is related to system applications;
2) utilisation that is related to staff positions;
3) utilisation that is related to the type of reports;
4) utilisation that is related to the extent use of these reports by the staff.

* **Good:** is the evaluation of the above percentage compared to percentages for the others two choices.
* **Poor:** is the evaluation of the above percentage compared to percentages for the others two choices.
* **Average:** used when the percentage is not high enough for convincing results but bigger than the percentages for the other choices.

7.2.5. Result of the analysis of the main questions

- Strategic planning issue

Only 21% of the Omani respondents believed there is strategic planning. This result is an indication that poor planning accompanied computer deployment and utilisation. In contrast, among GPRs, 70.6% of the respondents said that strategic planning had been undertaken, suggesting that much better strategic planning was conducted for computer deployment by GPRs.

- Utilisation issue

a) Computer application utilisation

Overall, Omani responses on utilisation of computer applications gave a score of only 33.5%, showing poor utilisation of the many computer applications in Oman. In contrast, 78% of GPRs respondents reported utilisation of the various computer applications, suggesting GPRs are making good use of the various applications available with their systems.

b) Staff utilisation of their computer

For the Omani sample, average responses to all questions on staff utilisation of the computer indicated 57% of the respondents said that staff utilised the computer frequently, while 27% said staff "sometimes" utilised the computer. Similarly, 58% of respondents to the GPRs questionnaire said that staff frequently utilised the computer. In addition, 23% sometimes utilised the computer. By looking at the results for 'frequently use' and 'sometimes use' we may conclude there is a good use of the computer system by the individual staff in both Oman and the GPRs in the UK.

c) Availability of computer reports and its use

Omani total responses average to all questions on reports produced by the computer showed that 45.3% of the respondents recognised the reports listed in the questionnaire as being produced by the computer, while 62% of the respondents believed that the extent of use of these reports was from 75% to 100%. This is an indication of average computer reports production, but with good use of those reports produced. In contrast, only 31.8% of GPRs' respondents said the listed reports were produced by their computers, and 40.6% of the respondents believed the extent of use of these reports to be from 75% to 100%. This result indicated that few reports are produced by the computers and GPRs make average use of them.

- Computer fear

Taking average total responses to all questions related to computer fear, 34.8% of Omani respondents said there is fear of the computer, while 36.5% of them said there is no fear of the computer. This may an indication that the problem of computer fear (human context) is still a significant one in Oman. The corresponding scores for GPRs were that 43.5% reported of computer fear, and 35.3% indicated no fear of the computer, indicating that the problem of computer fear (human context) is an obstacle to computer deployment and utilisation in GPRs, also.

- Computer impact

Omani average total responses to all questions related to computer impact showed that 63.1% of respondents felt the computer had had an impact on health organisation. The impact felt on the Omani health system appears to have been rather greater than on the GPRs, where 48.6% of the respondents said there is a computer impact. This result shows an average impact of computers in GPRs health systems, where 22.5% of the respondents strongly disagreed on the existence of the computer impact on health system and 28.9% of the respondents were undecided.

- Computer overall satisfaction

Omani average total responses to all questions related to overall satisfaction with the computer showed 46.9% of the respondents were satisfied, which does not denote a very convincing level of satisfaction. Satisfaction in Oman may be regarded as average, in that 29.7% of the respondents were dissatisfied with the computer and 23.4% were undecided. In contrast, the GPRs scored 64.3% for satisfaction with the computer, a convincing indication of satisfaction with the computer on the part of GPRs.

- Computer technical problems

Average totals for Omani responses to all questions related to computer technical problems indicated that 38.3% of the respondents thought there are no significant problems, 31.6% of the respondents thought there are moderate problems and 30.1% of the respondents thought there are significant problems. These results suggest that computer technical problems are not yet over. However, GPRs fared better, with only 18% of the respondents reporting significant problems, convincing evidence that computer technical problems are not an issue in GPRs.

- Computer knowledge

Overall, 23.5% of Omani respondents said they had computer knowledge, while 38.5% of GPRs respondents said so. These results show a poor level of computer knowledge among both sets of respondents.

7.2.6. The hypotheses results

- Hypothesis A Result

Hypothesis A is not supported by either survey, using chi-square as a test of significance. It shows there is no significant difference between group A and B in agreeing or disagreeing on the issues presented to them, regarding computer deployment and utilisation.

- Hypothesis B Result:

Hypothesis B is supported by all the Omani results, but by only 50% of the GPRs results. This means that the Omani group are more favourable in their responses toward computer deployment and utilisation. However, GPRs' results can not be taken as conclusive evidence for purposes of comparison, because of the small size of group B.

- Hypothesis C Result:

Hypothesis C is supported by 50% of the Omani results, but not by the other 50%. This result is considered as one of the limitations of this study (see section 7.3). In the GPRs case, 75% of their item results show no support for hypothesis C. This implies that GPRs' respondents used the undecided score less, as well as that group B used it more than group A.

- Hypothesis D Result:

Hypothesis D is not supported by 50% of the items, whereas 50% of the items support it, suggesting that group A in GPRs and group A in Oman have different attitudes toward their computer deployment and utilisation. This result is surprising.

- Hypothesis E Result:

This hypothesis was concerned whether computer failure is mainly related to human aspects rather than technical aspects. In this case we calculated the total result for Sp and NSp as a measurement for this hypothesis. We found 60% of all results support the view that failure is caused by human aspects. With the Omani results it was found that 70% of items' results supported hypothesis E, while for GPRs' items, 50% of results supported hypothesis E. Therefore, we could say that computer failure mainly results from human issues, rather than technical issues.

7.3. Discussion

7.3.1. Discussion related to the main questions results

7.3.1.1. Strategic issues

In the light of the above summary and chapters' conclusions, it can be concluded that in Oman, strategic planning for computer deployment is lacking and utilisation is poor. The result reflects failure in making an earlier study, creating awareness in the expected future users, linking computer deployment to the health system's overall strategy, investment, preparing the necessary financial resources, skills and training. This result is consistent with the interview findings. Strategic planning for computer deployment was not initiated or carried out as the literature recommends. One striking point emerging from this study was that group A supported this view. Also, doctors and IT/IS staff from group B were critical of the top management planning for computer deployment. Failure to undertake proper strategic planning for computer deployment and utilisation has been seen throughout the literature as a characteristic of developing countries. Walsham (1993) has commented on this, claiming that developing countries do not carry out deep evaluation before the deployment of the new technology, except a form of evaluation discourse which provides the impetus for system approval. This empirical result is consistent with the poor evaluation of Oman's experiences in information system strategic development methodologies in Chapter 3. Therefore, there is a need for improved strategic planning and the use of information system methodologies for computer deployment and its future development.

GPRs in the UK appear better off in this respect. Their survey result indicated that strategic planning was taken into account. Therefore, the respondents did not support the view that the deployment of computer into GPRs was an *ad hoc* decision with poor strategic planning as indicated in the literature review. Referring to US3Q5, which concerned future plans to develop the computer system, the interviewees did not show a strong interest in doing this. This was confirmed by the survey, which showed that practice managers were less keen to plan for additional computer development, perhaps because of their concern for the financial implications of such development, as mentioned in the interviews. The fact that GPRs carried out strategic planning for their computer deployment and utilisation could be due to the following reasons: 1) availability of this technology, 2) availability of information on this technology, 3) a number of competing suppliers in the same area, anxious to show that their product meets the general practice requirement, and 4) the responsible team for the deployment of the new technology is accountable for their decision to deploy such technology. As expressed by one interviewee, "We paid from our budget to introduce this computer and we are accountable for reimbursement from FHSA. Therefore, we have to set our requirements and find the computer system with the right hardware and software." This point is regarded as the most crucial distinction between the NHS and Oman. Since the Omani government is paying for the hospital computers, no one is made accountable for failure. The empirical result goes in line with the result of the evaluation of GPRs experiences in developing information system strategic methodologies in Chapter 3, which showed a better outcome to their experiences than was expressed by the Omanis. However, GPRs generally need to improve their training programmes, and computer integration and their planning for a specific recognised methodology.

7.3.1.2. Utilisation issue

The second issue is computer utilisation. The questions on utilisation were expected to highlight the main functions for which the two different environments (Oman and UK) still use manual information processing, and to give an indication of how far their large integrated systems are being used.

In Oman the results revealed a picture of poor utilisation of the many computer applications bought by the Omani government. This problem has been indicated by the literature as a common one in the developing countries; many computer systems are bought and then many of the applications withheld or not fully used. Some reasons that have been mentioned in the case study and the literature review are: insufficient memory, slow response, lack of operating skills and financial difficulties preventing changing the system or increasing its capacity. It was also found that one important system application, repeat prescription, which is available in the Omani system package, is not in use because the Omani health system does not approve of this kind of function. As one of the senior doctors summed up "Yes, the computer is here but we do not see its many packages in action." However, the result of computer use at the individual level was showed good, the least utilisation being among general managers and nurses. In respect of computer reports and the extent of their use by staff, the results showed 45% of the respondents believed that the computer produces several computer reports and that these are well utilised.

In general, the utilisation of the computer system revealed by this survey did not appear to be a strategic use; it did not follow the methodology principle of involvement of all interests (see Chapters 2 & 3). The term, "strategic use" was employed by Duncan *et al.* (1995) to refer to utilisation of the system's full capabilities; using the information system as a strategic weapon. Moreover, as indicated by Zuboff (1988), the use of information technology to its full potential means using human beings to their full potential.

In the case of the GPRs, the results show high utilisation of their computer applications. Age/Sex application is one of the most common computer applications in use, while the least used is hospital referral, with 65.7% of responses. The reason for this high rate of utilisation is that GPRs undertook proper strategic planning of their requirements and so obtained the right system with the applications they needed. This procedure was indicated by one of the interviewees who said, "We sent our application with a list of requirements asking the suppliers to tick what their computer system could perform and then we brought the top five suppliers that most fitted our list to do a demonstration. Only then did we choose the one most fitted to our requirements."

Cross-tabulation of utilisation with job title showed that receptionists, practice managers, secretaries and physicians depended heavily on the computer in their work, while the nurses showed less dependence on the computer, especially in the case of district nurses. It seems that district nurses are not involved in using the computer because of the nature of their work. They move around most of the time and few of them could afford to carry a portable computer. The active utilisation of the computer by practice managers and physicians may influence satisfaction and be reflected in the quality of support for future development of the computer and its application. It may also encourage the staff to use the system and obtain adequate training and education.

With respect to computer reports and their utilisation, there are many reports produced by the computer, but only two are widely familiar to the respondents, namely, annual report and special inquiry message. However, the utilisation of these reports is only moderate. Therefore, we conclude that the benefit of these reports is being obtained only slowly. Some of the HCUG blame the excess length and complexity of reports, and lack of time and training for this. However, this result does not agree with what was expressed by the interviewees, all of whom confirmed their use of all computer reports for the benefit of management and health care issues.

From this survey result, we could conclude the following: the general practitioners are improving in deploying and using computer applications. With regard to the two surveys by Wiles (1986) and Brown (1988) it seems that GPs in Humberside county have reached a level of use consistent with the level of interest revealed in the Oxford survey, within four years.

Another important point worth mentioning here is that our survey was conducted in May 1992. Question US1Q4 asked "How long have you had this computer system?" see section 6.2.8.2. The results indicate that the main deployment of the computer system came between 1989 and 1991, during which around 78% of the GPs deployed computer systems. The peak time was in 1990, when around 41% of the GPs introduced computers. This was followed by a decline in 1991. The reasons for this are not clear yet; however, Wiles, (1986) indicated that GPs in Humberside were not covered by the DHSS scheme and the FHSA personnel indicated that it began in late 1986 and by 1991 and 1992 it might be that most GPs had already computerised. This result is in line with Table 4.2, a Gallup Poll 1993 survey of NHSME. The table shows that in 1989 the percentage of practice computerised in UK was 28%, then it jumped to 47% in 1990, almost twice as much as the earlier score. In 1991 it went up to 63% and in 1992, when my survey was carried out, although no survey was carried out by Gallup, the estimation was of 71%. By 1993, 79% of GPs were computerised. No decline is shown by the Gallup survey, but a slow increase, and this increase may have happened elsewhere in the UK but not in Humberside.

7.3.1.3. Computer Fear

Computer negative aspects (fears) could be related to human context problems or technical problems, which may seen as the main cause of failure in computer deployment (see sections 2.2; 2.3; 3.2 & 3.3). The Omanis' fears appeared mostly toward the change of skills requirements, financial support for computer system development and the dependency on expensive outside contractors. These problems do not appear likely to be solved quickly, given the absence of strategic development of IT/IS methodologies and inadequate allocation of financial resources. Any change has to wait for the main five-year plan. This problem was admitted by the interviewees. Therefore, fears mentioned in the literature cannot be discounted. However, the question of computer cost compared to its benefits was not a source of much anxiety; the computer is considered worth the expense. The doctor-patient relationship was not an issue of fear, nor was there a fear of computers influencing doctors' decisions on health issues. Therefore, the idea that fear may influence doctors or administrators in the use of computer is not supported by this survey. This goes in line with the findings of Young, Chapman and Poile (1990) and others (see section 3.2).

In respect of the GPRs' survey, the result shows that fear was mostly centred on changing skills requirements, expense, the regulations involved in introducing computers for GPRs and confidentiality. The confidentiality result went against the finding from the interviews, in which most interviewees expressed their satisfaction.

In conclusion, both Omani and GPRs' survey results show that some anxieties are raised by computers. In general GPRs' respondents show more fear than Omani respondents.

7.3.1.4. Computer technical problems

With regard to computer technical problems, the Omani results show that 38% said there were no significant problems, while 30% said there were significant problems and 32% said there were moderate problems. This result is to some extent may consistent with the situation observed and discussed by the researcher during the fieldwork investigation. However, the observations suggested were problems than the actual scores imply. The most likely explanation for this result is that the majority of respondents who filled in the questionnaire had not personally experienced the many problems that were listed in the question presented to them, except the slow response time, which over 54% of respondents said was a significant problem. However, the interview results and the discussion during the investigation with top management, technical management, and computer specialists and operators revealed that the main computer problems were slow response and lack of compatibility of hardware with Omani health provision requirements. As a several actions have taken place since this survey was completed, RH bought a new operating system (SUN) and new software applications of Medicom, while the SQUH is shopping around for a new system (see Chapters 2 & 3). Therefore, we could say overall that technical issues have not yet been solved.

The problem of hardware was mostly related to poor planning and an inadequate initial specification of system requirements.

In the GPRs' questionnaire, the results gave a strong indication that computer technical problems are not an issue. 69.5% said there were no significant problems, while only 17.9% reported significant technical problems and 10.9% said there were moderate problems. We can say that technical problems are not significant, a cause of concern in the GPRs' computer system. This result, also, was confirmed by the interviews.

In conclusion, it appeared that technical problems create fewer obstacles and failure to computer deployment and utilisation than human problems.

7.3.1.5. Computer impact and satisfaction

Omani respondents felt the computers impact more than GPR respondents, the results being 70.2% and 47.1% respectively. This low score toward computer impact by GPR respondents may result from the high expectation of computers in GPRs. However, GPR respondents showed a high level of satisfaction, with 64.5% saying they were satisfied with the computer. In contrast, the Omani respondents seemed less satisfied with the computer. This may result from the strong dissatisfaction with management's handling of the computer deployment. Omani respondents were more satisfied with computer reports than GPR respondents were, but GPR respondents were more satisfied with computer technical performance than Omani respondents. In respect of job title, the results showed that Omani general management and doctors were convinced that the computer has improved hospital management work. Omani technical management respondents were not, however, convinced that computers aid decision-makers or increase the number of clinical/ administrative staff or have influenced management behaviour. Doctors did not show strong satisfaction with the computer's impact on information reports and management behaviour. Omani managers were more satisfied than GPR practice managers. On the other hand, the physicians in GPRs were satisfied, while Omani doctors were dissatisfied. Omani IT/IS staff showed greater satisfaction than the IT/IS staff of GPRs.

In short, GPRs and Oman computer deployment has improved their health information and improved the organisation's administration work. However, there are differences among staff in perception of its benefits. This may be a result of lack of awareness of the benefits of computer deployment and utilisation. This view is consistent with the low rating of the Omani experience when it was assessed against IE methodology (see Chapter 3).

7.3.1.6. Other questions

This discussion of the main questions ends by considering a selection of questions from section one in both surveys. These are: S1Q2 and US1Q5 which concerned computer knowledge; and US1Q2 and US1Q3 about the number of partners and practice size respectively. Omanis showed less knowledge than GPRs, where 76.3% Omanis and 61.8% GPRs of staff had no knowledge of computers. However, both results are an indication that few comparatively staff have computer knowledge. The only area of knowledge was data entry, acknowledged by 49% and 54% of the sample respectively. Evidently, there is a lack of computer skills. Inadequate computer knowledge was been expressed by the interviewees as the main cause of fear and resistance. However, GPRs showed better knowledge of computer capabilities and computer software, which in turn may help in setting specifications and selecting the computer. This is consistent with the high score for GPRs respondents' involvement in making enquiries about the system design and specification to the suppliers (see section 6.2.1.2). GPRs' practice managers showed slightly more computer knowledge than Omani general managers. Doctors in GPRs were more knowledgeable than Omani doctors. However, Omani IT staff had more knowledge than GPRs IT staff.

The problem that doctors in GPRs suffer from work overload was confirmed by this study using the following two questions: US1Q2 investigated the number of partners in the practice and US1Q3 investigated the practice list size. In relation to these two questions, the results showed that the highest number of patients registered was 13,000 and this size category also had the highest frequency (US1Q3). If a practitioner can handle 1,900 to 2,750 patients, we would expect a patient list of 13,000 to be served by 5-7 partners. Yet the highest percentage of practices (US1Q2), around 68.5%, had 3 to 5 partners (see section 6.2.8.2). Therefore, we can see the unequal distribution of patients around these practices, suggesting that many doctors may be suffering overload, which might have consequences for patient health provision and quality.

7.3.2. Discussion related to the hypothesis results

7.3.2.1. Hypothesis A

Hypothesis A was constructed on the basis of differences in opinion between two groups (designated group A and group B, see their definition in section 5.2.3) involved in computer deployment and utilisation. These differences were noticed by the researcher during his fieldwork investigation. However, hypothesis A is not supported by either survey. Chi-square revealed no significant differences between groups A and B in agreeing or disagreeing with the statements presented to them regarding computer deployment and utilisation. I believe this result is a reflection of the results of the main analysis presented above. For example if there are differences in opinion as to whether computers are deployed strategically or utilised well, then we may not find a clear result for poor or good on the issue of strategic planning and utilisation. Another point is that both groups A and B were aware of the issue that the questions investigated, and were broadly agreed on the prevailing situation. Therefore, this result confirms the reliability of the analysis result.

7.3.2.2. Hypothesis B

Hypothesis B was constructed on the assumption that top management and technical management from the Omani respondents and practice managers and physicians from GPRs' respondents would have more favourable attitudes toward the system or the outcomes of using the system that has been deployed under their decision or recommendations, while other users who were not involved in this kind of decision would be less favourable. However, the GPRs' result was not counted regarding the comparison with the Omani result because group B in the GPRs was very small. The aim of hypothesis B was to provide a further check on the results of hypothesis A, which might not be able to pick up very small differences in the data, as these may have been ignored by the use of the chi-square significance test (see section 5.3).

- Strategic issues: the result of the questions for group A & B slightly supported hypothesis B (see section 6.3.2).
- Utilisation issues: the result of the questions for group A & B supported hypothesis B (see section 6.3.2)

- Computer fears questions: since group A has a higher score for no fear (strongly disagree) and lower score for fear (strongly agree) than group B, it would make group A more favourable in their responses toward this issue. Therefore, hypothesis B is supported (see section 6.3.3).

- Computer technical problems: in the case of technical problems that were encountered by the use of computer, a lower score for significant problems or higher score for no significant problems by group A, compared with group B, means group A were more favourable in their responses. Table 6.39 shows group A more favour than group B in this issue (see section 6.3.6). Therefore, hypothesis B is supported.

- Computer impact: questions related to computer impact were all positive. Therefore, a higher score for strongly agree or a lower score for strongly disagree by group A than group B means group A were more favourable in their responses. Table 6.29 shows the total score of the differences between the averages is 2% in favour A. Therefore hypothesis B is supported.

- Satisfaction: the questions related to satisfaction with the computer system and management handling of computer deployment, a higher score for strongly satisfied or lower score for strongly dissatisfied by group A than group B, would mean group A was more favourable in their responses. Table 6.35 shows that the difference between average scores of group A and B for strongly satisfied was 10.1% in favour of group A, and in this perspective, hypothesis B is supported.

- Computer knowledge: if the questions for computer knowledge, a higher response in 'yes, I have this knowledge' or lower response in 'no, I do not have this knowledge' by group A than group B will make group A more favourable in their responses. Table 6.45 shows that the difference between average scores of group A and B for computer knowledge is 11.2% in favour of group A, and group A also, has fewer responses for the 'no computer knowledge' column. Therefore, hypothesis B is supported. We can conclude that group A claims more computer knowledge than group B.

7.3.2.3. Hypothesis C

Hypothesis C was constructed on the assumption that group B would use the undecided choice to avoid responding to certain questions that may criticise management behaviour toward deploying and managing the new technology. This assumption arose as a result of observation and discussion with computer users in Oman, when there appeared to be resistance to co-operating in completing the questionnaire, and some users said they were not willing to answer questions that may criticise their bosses or work procedure, and suggested they might answer 'undecided' to avoid responding to such questions. This problem does not appear in the UK. However, the GPRs' responses in this matter are also included in the discussion that follows. Moreover, hypothesis C will not be considered to be supported if the undecided score is small and has no effect on the other results. This will be judged by the researcher.

- Strategic issue

Omani strategic questions were all directed to find out how the management pursued computer deployment. Therefore, we might expect to see high responses in the undecided column. Table 6.4 shows the responses in undecided column is high, averaging 26%. However, Table 6.5 shows that group A has more responses in the undecided column than group B, their respective averages being 29.6% and 25.1%. Therefore, this result does not support hypothesis C and also, we conclude that undecided responses were frequently given by groups A & B, which may indicate no clear weight was attached to either of the choices (agree or disagree).

In the case of GPRs, Table 6.6 shows very low average scores for the use of the undecided choice, averaging only 6.6%. There is only one high undecided score in Table 6.7 which was given to US3Q3 by group B. Therefore, we may conclude that there is no unexpected use of 'undecided.' This result does not support hypothesis C.

Therefore, we can see from the above results that the Omani result does not support hypothesis C, because group A used the undecided score more than group B, while the GPRs' result does not support hypothesis C, because the undecided column has a low score.

- Computer fears

For computer fear questions, Table 6.24 shows the responses in the undecided column to be is high, averaging 28.8%. However, Table 6.25 shows that group B has slightly more responses in the undecided column than group A, their respective averages being 30.9% and 25%. Therefore, this result supports hypothesis C. Therefore, we conclude that no clear weight is given to either of the other choices (agree or disagree).

In the case of GPRs, Table 6.26 shows high average scores for the use of the undecided choice, at 23%. However, Table 6.27 shows that group A has more responses in the undecided column than group B, their respective averages being 24.6% and 16.7%. Therefore, this result does not support hypothesis C.

In conclusion, both Omani and GPRs had high undecided scores. However, the Omani undecided score was higher than that of GPRs. The Omani result supports hypothesis C, while the GPRs' result does not support it.

- Computer impact

Omani average responses in the undecided column in questions related to computer impact were not high compared to other choices; therefore, I believed there would be no effect on the result. However, it can be seen that there are high undecided scores for several questions, mostly concerned with the influence of computer on management behaviours. These questions are S5Q6.2 with scores of 35% and 35%, S5Q6.6 with scores of 34.0% and 35%, S5Q3 with scores of 276% and 28% and S5Q6.1 with score of 29% and 29% for group A and B respectively. The average scores of groups A and B with respect to these questions are 31% and 32% respectively. The score of group B is higher than that of group A. Therefore, hypothesis C is supported.

In the case of GPRs, Table 6.32 shows a high average score for the use of the undecided choice, averaging 28.8%, and Table 6.33 shows that group B has higher responses in the undecided column than group A, their respective averages being 28% and 30%. Therefore, hypothesis C is supported.

- Satisfaction

Omani average responses in the undecided column in questions related to satisfaction with the computer were high. We notice that there is high undecided scores for two questions out of the three questions on satisfaction. These two questions are concerned about satisfaction with management handling of computer deployment and satisfaction with computer performance. The scores for these two questions, in the undecided column are 28% and 27% respectively. Table 6.35 shows the average undecided scores of groups A and B are 16.7% and 25.7% respectively. The score of group B is higher than group A. Therefore, hypothesis C is supported.

In the case of GPRs, Table 6.36 does not show high average scores for the use of the undecided choice, with an average of 18%. Therefore, we may conclude GPRs did not make extensive use of undecided scores in the case of satisfaction questions.

7.3.2.4. Hypothesis D

Hypothesis D was constructed to highlight the differences between group A in the UK and group A in Oman in their responses to their questionnaire. This was based on the assumption that the Omani group A would be more biased than the GPRs group A, when responding to the same questions. The main reasons for this assumption are: few studies of this kind have been undertaken in Oman; therefore, there is poor awareness and less knowledge of the aims of this kind of academic study, and the style of the questionnaire. Respondents fear they may get into trouble by responding in ways that involve criticism of management and their own work, as mentioned elsewhere. Finally, there has been little effort to improve the situation when other evaluations have taken place. This last point was expressed with regret by many staff. They said 'there was no chance of change and they were mistrustful.' They said 'previous promises had not been honoured; indeed, more harm had been done.' Therefore, they felt inclined just to say what the bosses wanted to hear. In view of these statements and my own experience, it was expected to see bias in the Omani responses. In contrast, GPRs staff did not show such feeling and were expected to respond more objectively. Keeping this in mind, hypothesis D was used to highlight whether there is any evidence for this bias.

- Strategic issue

On the issue of whether computer deployment was accompanied by strategic planning, the total average scores of the Omani group A were 17.7% for strongly agree and 52.8% for strongly disagree, while the total average of GPRs group A were 71% for strongly agree and 24.2% for strongly disagree. Therefore, hypothesis D is not supported. This result was expected, because Table 6.6 has shown that general managers and technical managers (Oman's group A) reported high responses in the strongly disagree column.

- Utilisation issue

In the case of computer application utilisation, the total averages of Omani group A were 40.1% for utilisation and 59.3% for no utilisation, while the total averages of the GPRs' group A were 80.6% for utilisation and 19.9% for no utilisation. Therefore, hypothesis D is not supported.

With regard to the way that staff utilise their computer, the total average scores of the Omani group A were 60.3% for frequently use and 13.7% for rarely use, while the total averages of the GPRs' group A were 55.1% for frequently use and 21.6% for rarely use. Therefore, hypothesis D is supported.

In the case of computer reports, on average of 51.7% of the Omani group A said that the listed reports were produced by the computer and 48.3%

of the respondents said they were not produced. In contrast, 33% of the GPRs group A said the listed reports were produced by the computer and 67% of the respondents said they were not produced. Therefore, hypothesis D is supported.

In the case of the extent of use of computer reports, 79% the Omani group A said that computer reports were utilised well and 4% of the respondents said they were poorly utilised. For GPRs, 42% said that computer reports were utilised well and 42% of the respondents said that computer reports were poorly utilised. Therefore, hypothesis D is supported. These results show that the Omani group A was more favourable in their view of utilisation issues than the GPRs' group A.

- Computer fear

In the case of computer fear, the average scores of the Omani group A were 32.1% for strongly agree there is computer fear and 42.9% for strongly disagree. The corresponding results for GPRs were 41.8% for strongly agree and 33.7% for strongly disagree. Therefore, hypothesis D is supported.

- Computer impact

In the case of computer impact, the total averages of the Omani group A were 71.4% for strongly agree, that there is computer impact and 12.7% for strongly disagree. The corresponding results for GPRs were 48.5% for strongly agree, and 23.5% for strongly disagree. Therefore, hypothesis D is supported.

- Satisfaction

In the case of satisfaction questions, the total averages of the Oamni group A were 54.4% for satisfaction and 28.7% for dissatisfaction, while, the total averages of the GPRs' group A were 64% for satisfaction and 17.5% for dissatisfaction. Therefore, hypothesis D is not supported.

- Computer technical problems

In the case of computer technical problems, the total averages of the Omani group A were 26.5% of responses indicating that their computer had significant problems and 40.9% of responses indicating no significant problems. For GPRs, 18.3% of responses indicated significant problems and 67.2% of responses indicated no significant problems. Therefore, hypothesis D is not supported. This result was expected, because the computer systems in GPRs were mostly selected according to the GPRs' requirements and there was planning for computer deployment and use (see the strategy issue result).

- Computer knowledge

In the case of computer knowledge, the total averages of the Omani group A were 26.5% for having computer knowledge and 68.0% for not having computer knowledge, while, the total averages of the GPRs' group A were 36.5% for having computer knowledge and 63.5% for lacking computer knowledge. Therefore, hypothesis D is not supported. This result was expected, because most computer users in GPRs are well educated and have used this technology for a long time.

In general we can conclude that 50% of the evaluation does not supported hypothesis D, and this because of the differences of factors and requirements influencing computer deployment and utilisation, as well as the two group As in the Omani and UK environments. Therefore, the two groups show similar bias toward computer deployment and utilisation.

7.3.2.5. Hypothesis E

Hypothesis E was constructed to highlight whether the overall failure of the computer is more related to the human issues rather than to technical issues. The test mainly looked at whether the scores of the main questions were good or poor. If the result was poor for human related items then hypothesis E is supported and if the result is poor for technical related items then hypothesis E is not supported, the converse also being true in each case. Therefore, hypothesis E was tested by examining the results in respect of computer technical problems and system evaluation, compared to those concerned with the main human problems such as: 1) poor strategy, 2) poor utilisation, 3) fears of the technology, and 4) lack of skills and training.

In respect of strategic issues, computer application utilisation, reports produced, computer fear, computer impact, satisfaction and computer knowledge for the Omani results, hypothesis E is supported. In respect of staff utilisation, reports use and technical performance problems for the Omani results, hypothesis E is not supported. The percentage with regard to Omani items that supported the hypothesis is 70%. For GPRs results, hypothesis E is supported by reports produced, extent of report use, computer fear, technical performance problems and computer knowledge. The percentage with regard to GPRs items that supported the hypothesis is 50%.

In conclusion, the results show that computer failure was still related to the human context, rather than technical issues.

7.4. Conclusion

This chapter has outlined the major points arising from the detailed analysis of the hypotheses. Several interesting issues arising from the survey have been noted, which will be considered further in Chapter 8 as having potential for farther investigation.

8. CHAPTER EIGHT: THE IMPLICATIONS, CONCLUSIONS, LIMITATIONS, RECOMMENDATIONS AND FURTHER RESEARCH ARISING FROM THIS STUDY

8.1. Introduction

This chapter contains a discussion of the implications of the findings, overall conclusion, limitations, recommendation and areas for further research that arise from work reputed above.

8.2. The Implications of the findings for IE and other methodological frameworks

Throughout the findings' results, it can be observed that many of the existing theories are upheld, but others are not supported. This appeared clear with respect to the framework of the information technology development methodology of Information Engineering (IE). The most noticeable results are highlighted below:

1) According to the IE framework, information strategy planning is important as the starting point for the methodology. However, the findings showed that Oman failed to develop a strategy for IT/IS (see sections 6.3 and 7.3). In the Omani situation up to now, much deployment and development of information systems has occurred by way of '*ad-hoc* decisions' or 'best deals'. Therefore, the arrangements behind the scenes as to who will be the supplier and from where to buy and who will develop the IT/IS will be an obstacle to implementing such a methodology (see sections 6.3; 7.3; 3.4 & 3.5). In the case of the UK, in contrast, the claims in the literature that IT/IS was introduced piecemeal, without proper strategy, were refuted by the study findings (see sections 6.3 and 7.3).

2) The IE framework is a project management mechanism, which needs a competent management, commitment and involvement of top management for computer deployment (see sections 2.3; 2.4; 3.3 & 3.4). The findings

indicated that the Omani situation is poor in this respect (see sections 6.3 and 7.3). Thus, use of IE methodology would require much time to be spent in training and to gaining the support and understanding of those interest groups. However, the results showed that the UK experience is much better than the Omani in this respect.

3) The system-paradigm methodologies that emphasise high levels of participation would be difficult to apply, as the Omani system is authoritarian and strictly hierarchical (see section 2.2). Moreover, the findings showed lack of awareness and poor skills characterise the management and end-users in respect to these technologies, which may cause the failure of the methodology implementation (see sections 6.3 and 7.3). With respect to the UK, participation did not appear to be strong, but it is enough to carry out such a strategy (see section 6.3).

4) The methodologies which aim at wider organisational changes are unlikely to be accepted in Oman, where the findings showed there is resistance to such changes (see sections 6.3 and 7.3).

5) The tools that may need to be used as part of the development methodology are not available in the developing countries. In addition, the findings indicated that both Oman and UK health staff are lacking in skills and knowledge related to the computer software and hardware. This may affect the use of such tools (see sections 6.3; 7.3 & 2.2), and so delay or even prevent methodology implementation.

6) The methodologies aim to ensure the integration of the system, whereas the findings indicated poor integration (see sections 6.3; 7.3 & 3.4). In this respect this methodology would not work properly (in Oman) where another ministry runs the financial system and the administration system is not tied with the medical records. However, the fieldwork and the literature review indicated that there is determination to pursue these matters (see section 2.3; 2.4 & 4.2).

7) The methodology emphasises the integration of the system and the sharing of information by all, which reflects the full utilisation of the systems. However, the findings showed poor utilisation of computer system applications by the Oman, though not by the GPRs (see sections 6.3; 7.3; 2.3; 2.4; 3.3 & 3.4). However, the use of the system by individuals such as top management or doctors does not support the previous literature, in that on both Oman and GPRs staff, computer use was more frequent than the literature might suggest.

8) The findings showed that the negative aspects that may influence the computer deployment and use have still not been solved (see sections 6.3; 7.3; 2.3; 2.4; 3.3 & 3.4). Therefore, it would be necessary to work hard to raise awareness of such system implementation, to gain the confidence of the interested people.

9) The methodology ensures technical support for the maintenance of software as well as the hardware. The findings showed that Oman suffered technical problems whereas the UK result revealed no significant problems in this respect (see sections 6.3; 7.3; 2.3; 2.4; 3.3 & 3.4). The technical support offered by the methodology is very important for the developing countries which spend large sums on maintenance.

10) The methodology ensures the use of IT/IS to contribute to the organisation's strategic planning goals and competitive advantage. With respect to the results of the findings on computer impact, both the Oman and UK results support this kind of interest that computers may hold (see sections 6.3; 7.3; 2.3; 2.4; 3.3 & 3.4).

In the Omani context, it may not be feasible, yet, to propose a methodology to cover the entire systems development cycle from strategy to cutover and maintenance, but this does not mean that no attempt should be made to use such methods (see sections 8.5). This appeared from the results of the Omani survey, which revealed slow progress and failure to overcome problems in the human context (refer to sections 6.3 and 7.3).

8.3. Conclusions of the study

In Chapter Seven a summary of the study was provided and its findings discussed in detail while in the previous section we showed how far the results challenge or support the methodological framework and the existing theories. Now, an outline of major conclusions on the use of methodology for computer development and deployment and its related obstacles, extracted from the literature and the results of the empirical survey, could be drawn up as follows:

- Computer deployment and utilisation problems are still similar in developed and developing countries.
- Issues related to the human context cause most computer failure for both developed and developing countries.
- Initial strategic information system and evaluation is poor, particularly in the developing countries.
- Utilisation of computer applications in developing countries is poor.
- There is a lack of computer knowledge and skilled manpower, and poor training programmes in both developed and developing countries.
- Inappropriate decision-makers decide what kind of computer should be deployed and how to be used, particularly in the developing countries.
- There is a lack of co-ordination, effective planning and clear national policy, particularly in the developing countries.
- The use of a recognised methodology for information systems development will not be successful, particularly in the developing countries (see section 8.5).

There are two main observations on the survey results worth mentioning here. Firstly, the findings in the main survey suggest that respondents changed their attitudes, compared with their initial responses in the exploratory interviews. For example, top management originally expressed the view that good planning was conducted to introduce their new technology and they showed satisfaction with its utilisation and operation, whereas the ordinary users expressed their dissatisfaction and suggested the introduction of this technology was done without strategic planning. However, the survey results showed that in many cases, top management have accepted that computer failure is caused by poor strategic planning and poor utilisation, and expressed dissatisfaction, whereas many users indicated satisfaction and reported that some strategic planning had been conducted.

Secondly, doctors and IT/IS staff from group B were more critical of top management planning for computer deployment. Therefore, there is a change of opinion. Therefore, this kind of behaviour should be investigated further (see section 7.6).

In general, it should be recognised that the findings of this research constitute only a starting point in addressing areas of concern in computer deployment and utilisation in health care. Individuals and organisations should embark on a continuous process of learning from their own situations and the experiences of others in order to improve their IT deployment and utilisation. A determined and long range vision for strategic information system development should be seriously considered by Omani organisations.

With respect to GPRs there is obvious need for a clear information system development methodology to be adopted to help in long term planning for their IT/IS deployment and development and its use for competitive advantage.

8.4. Limitations of the Research

1- The primary limitations of this research are those characteristic of most opinion surveys (Borg and Gall (1989) and Harper (1991), i.e. that questions may have been interpreted by the respondents differently than intended, and answers to some questions may have influenced answers to others.

2- The basis of this research has been mainly limited to Oman and GPRs in NHS. However, the methodology adopted could be applied in other countries.

3- The sample selection depended on the number of GPRs in Humberside who had deployed and used the computer at the time of the survey, and the available terminals in the Omani hospitals. Thus, it could not be totally random. Unfortunately, because of the way that computers are used by health employees, it was not possible to select a totally random sample in Oman or among GPRs in Humberside.

4- Another limitation is in the statistical analysis of the results. Comparison of variables with small samples casts doubt on the reliability of statistical findings.

5- One important point worth mentioning as a limitation is the high use of the 'undecided' choice, which may in many cases have affected the findings. It appears that there are three main reasons influencing the use of the undecided choice by the respondents: firstly, that several questions were believed to be sensitive or critical of management practice; the researcher was warned that respondents might give no answer to such questions, or be neutral. Secondly, there may not have been enough information available on the issue dealt with by some questions, e.g. the high score in US4Q7 which asked about linking GPRs with FHSA. Thirdly, there may have been poor understanding of some questions. This was revealed in several questionnaires, where the respondent commented on the questions in which he or she chose the undecided score.

8.5. Recommendations

So what do our study and results imply for deployment of information technology into health systems? We want to produce appropriate strategic recommendations for the developing countries to cope with the new technology in the field of the health care and suggest how they may apply methodologies for such development. The following recommendations have been justified by this study.

The literature and the empirical results showed deficiencies in strategic information system planning for IT deployment and utilisation. Therefore, research is needed on the use of strategic information system development methodologies in health care and to direct IT strategy toward competitive objectives. Most system applications that are deployed in health care are very sophisticated and should be used for competitive advantage. However, the methodology will be very difficult to implemented in Oman (see diagram below).

1- There is a need for initial strategic planning and determination that IT/IS is to be deployed for a competitive advantage. Even if no recognised information system development methodology is followed then:

a) A plan should be made for the present and for future development.

b) Once an IT strategy has been set, it should be kept under annual review

c) It should always be related to the organisations' strategic plan.

3- The researcher found several deficiencies in the committee that is involved in the deployment of this technology, which users need to be aware and work to overcome. These issues will have implications for the overall plan for computer deployment into health information systems. They are;

a) a need to identify individuals from different categories who will be actively involved in the computer deployment, who should be led by expert personnel;

b) a need for decision makers in health care to interact with the computer

environment to identify their requirements and their strategic plan for the computer system;

c) a need for clear specification of aims, objectives, functions and strategy for computer deployment and utilisation;

d) a need for sufficient time to be spent in evaluation of the system before its deployment and to give careful thought to the planning for computer deployment, its risks, skills needed and financial support. It is possible that the lack of appropriately trained individuals will prove to be a greater constraint on national economic development than deficiencies in technology. For this reason, in the second Omani five-year development plan (1981-1985), high priority was attached to the development of human resources and to improve their capability to contribute to the national economy (Kline, 1982).

4- Developing countries need to take advantage of the technology that is available by full utilisation, more investment and development for its basic requirements such as training skills and making these tools available. According to Zuboff (1988), the use of information technology to its full potential means using human beings to their full potential. Also according to Duncan *et al.* (1995), the use of information system tools' full capabilities, the information system is a strategic weapon. Expatriates should by all means be exploited to help in developing human resources and technology in the developing countries.

5- There are three mistakes to be avoided when deploying computers in developing countries such as Oman, as follows:

1) Buying computer systems seen in action in another environment;
2) Buying a new system that is not well recognised or proven.
3) Buying a computer system that will soon be become obsolete.

In each of these cases, financial considerations may influence a purchasing decision.

6- The Omani government should set up a health data base to cover all health provision. They should encourage the private health institutes to deploy computer systems and connect them to the government's main health data base. This might need subsidy or reimbursement to assist those who cannot pay.

7- The technology may be available to those who can pay for it, but this is not the whole story. It is not enough just to import the latest technology. Those developing countries racing to show off by importing high technology need to understand the risks of IT and the changes that it brings. Therefore, there is a need for a well developed strategic plan for IT/IS and to pursue the use of an information system development methodology. This will entail establishing the aims of bringing the technology, reviewing relevant literature, setting up workshops for training and practice, education, translation, ensuing availability of the expertise and financial means, and co-operation in exploitation of the use of this technology. It is suggested that the authorities nominate one of the coming years as the Omani Year-of-IT for deployment and learning, as has occurred elsewhere in the world. This should be presented as a Decree by Sultan Qaboos.

From the literature review and the result of the empirical study, it is clear that the use of existing methodologies could be very difficult in developing countries. However, we need a well strategic planning of the methodologies for IT/IS deployment and development. Drawing on the empirical findings and the literature, a suggestion is presented in the following diagram for a simplified methodology that may be feasible in developing countries (see below):

The diagram is divided into three phases. The first phase includes six important steps that need to be undertaken. 1) Use strategic principles of a methodology to highlight the aims and objectives (see sections 2.2 & 3.5). 2) Gain top management support. This at least includes financial support; agreement on the above principles and top management involvement. 3) From this group, a team of personnel should be selected to handle the project, explain the business objectives, strategy and requirements to the technical staff and monitor and review the new system deployment or development. 4) Technical staff support is needed, which will overcome the resistance to the new development. 5) Some of the technical staff should be selected to join the team and be trained to support and run the development of IT/IS deployment and development. 6) Awareness about the system deployment and its benefits for end-user needs to be raised.

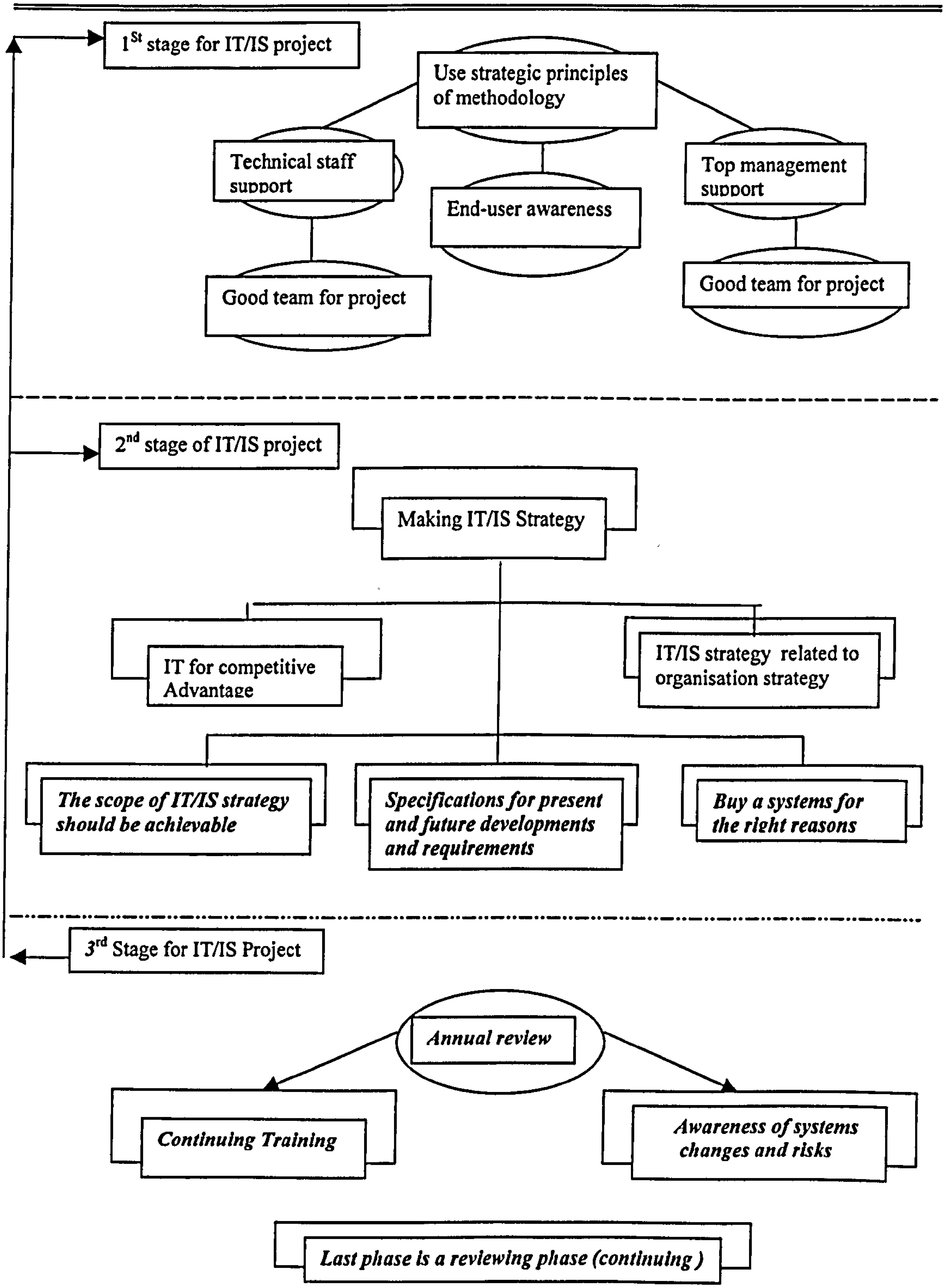
This phase achieves the first important step in actually preparing to implementing the new technology or developing the existing system into the organisation.

The second phase includes six important steps: these are 1) Make IT/IS strategy before starting to buy a new system or developing the existing systems with the help of the two teams (their abilities and the requirements). 2) Check that the scope of IT/IS strategy is achievable within the prevailing constraints (evaluating resources and skills availability). 3) Make a deep investigation and evaluation related to system specifications (hardware and software for future development and requirements). 4) Relate this IT/IS strategy to the organisation's strategic plan. The role of IT is to support the business functions and plans. 5) Plan for IT strategy to be use for competitive advantage in the future, even if not straight away. 6) Buying a system for the right reasons and a) a computer system seen in action only in other environment. It should be seen in action in the environment for which it is intended, for a period of time, b) a new system not yet proven, or c) an obsolete system.

The third phase is the reviewing phase or continuing work phase, which includes three steps 1) Continuing to train the system users. 2) Annual review of stages one and two. 3) Awareness of changes in systems and requirements and system risks.

The hierarchy of priorities among the elements at each phase can be deduced from the diagram: the higher the position, the higher the priority. Elements shown at the same level can be dealt with simultaneously, or in whichever order is convenient and feasible in the circumstances.

Figure 8. 1 Vision of strategy for IT/IS in Oman



8.6. Further Research

As with many studies, this research has raised more questions than it has begun to answer. The study's limitations suggest several fruitful avenues for further research.

1- Other environments and other data sets should be studied in order to determine whether the results of this research can be extended to:
a) other countries with similar socio-economic infrastructure such as other Gulf countries.
b) other geographical areas such as Scandinavian countries or the US.

2) Randomness: another sample should be randomly selected for further investigation.

3) It would be possible to take the result of this study and do an in-depth analysis of specific responses and why they were made.

4) There is a need for more research in the use of information system development methodologies in health care and on directing IT toward competitive objectives.

5) A study of decision makers', physicians' and other users' role toward computer deployment, to identify the influence of the system hierarchy on computer deployment, bearing in mind Walsham's (1993) contention that developing countries are characterised by strong sense of social hierarchy/respect for authority, which inhibits questioning of instructions from superiors. He suggested that this represents a waste of economic and human resources, which are in relatively short supply in countries such as Oman.

6) A study of the relationship between the poor utilisation of various computer applications, and the level of utilisation by different groups of staff.

7) One striking point which emerged from this study was that group A accepted that computer failure was in part due to their poor strategic planning. It also showed that doctors and IT/IS staff from group B were critical of the top management planning for computer deployment. Therefore, there has been a change of opinion. Is this the result of disappointment at the lack of response from the ministry and his under-secretary to address the problems, or have these questionnaires been answered by their secretaries or their co-ordinators?

8) Is the use of the internal market the beginning of a change in the NHS toward competition and privatisation? How does the increasingly competitive environment affect IT/IS strategy in the UK health system, and how far is development of IT as a competitive advantage being achieved?

9) Research is needed to explore the nature of political decision-making and strategy arrangements in developing countries and how these affect the ability to introduce technology for competitive advantage and the benefits that can be derived from it.

8.7. Conclusion

This chapter has presented a discussion of the limitations of the work reported in the preceding chapters, and the conclusion drawn from the survey findings. Recommendations have been made for improving strategic planning for computer deployment and development, with particular emphasis on what is feasible in developing countries such as Oman. Finally, several interesting issues have been highlighted as having potential for further investigation.

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APPENDICES:

Under this title there are several appendixes as follows:

1- APPENDIX A: EMIS is Egton Medical Information System for General Practice System.

1.0- Introduction

The computer system will become more useful the greater the number of items of data stored for each patient, whereas the manual system may become unmanageable if too many items are used. It also would be practically impossible to keep such data completely accurate, whereas computerisation is a powerful tool in this respect. Other important factors in the development of the computerisation system are the complex contract, communication and legislation of the NHS with the GPs which play a major role in persuading general practices to deploy the computer sooner, rather than later.

This appendix describes one of the many computerised information health systems used in general practice in the UK market. The EMIS: Egton Medical Information System was investigated initially at Hall Road in Hull, then because of the involvement of the practice manager and physicians at that time with new researches and organisation, we halted the investigation and moved to the Old Fire Station Surgery in Beverley.

1.1- Describing the EMIS:

EMIS provides two entirely different systems; WORK and PLAY. The WORK system contains age/sex register. The PLAY system contains a copy of it. The WORK system is used for real records and PLAY system may then be used as a training system, for nothing done there will affect the real records. The basic main operation of the system depends on the use of system functions. One such function is to register a patient, another is to add information to the Medical Record and a third might be to carry out a search of all the Medical Records.

According to EMIS design we could divide the system functions into the following main categories: Registration, Prescribing, Dispensing, Diary functions, Medical Records, Immunisations, Drug Data Base, Template, Searches and Statistics. Each of these contains many subsystems or functions. Before we discuss these systems we will explain relevant terms:

- Active Patient:

Whenever the user identifies or registers a new patient in the system they become the 'Active patient'.

- Active problem:

If the patient has a clinical condition which the doctor feels has current medical relevance then it is designated as an active problem but a healed peptic ulcer for example, must always remain one. A common cold may be an active problem for a week but Brucellosis may be an active problem for ever.

- Acute Prescription or Current Prescription:

A prescription issued on one occasion only. For instance a five day course of Penicillin for Acute Tonsillitis. These are to be clearly distinguished from Repeat Prescriptions which may be issued on a number of occasions.

- Mnemonic:

At installation all doctors using the system are assigned a mnemonic of two letters by which they may be subsequently quickly identified to the system.

1.1.1-The main system or subsystems are:

1.1.1.1- Registration subsystem:

The register system is a well established tool for practice management and provides a complete and detailed patient record. Registration is the first task the user performs for any patient and to facilitate this procedure, each patient is allocated a unique practice number. The user is able to register the patient as regular, temporary, emergency or whatever. This system is actually divided into the following subsystems or functions (procedures):

- Registration of Patient:

Enables the user to register patients with the system, and for the patient to become registered with the practice at the same time.

- Registration Details:

Enables the user to review the information collected at registration and amend it if necessary.

- Registration Status:

Enables the user to review a patient's registration status and amend it if necessary.

1.1.1.2- Medical Record:

Enables the user to manage all aspects of medical record making. From the Medical Record function the user can carry out any of the following operations: Adding to the record: add simple data entries or simple text entry or make a record of any consultation in a form suitable for printing, with appropriate headings. Reviewing the record: that appears on the screen with the most important items from it (the Summary) being displayed. These are the Active Problems, Current Medication, Allergies, Screening Status, overdue Diary Entries and the most recent consultation record. All of these or certain parts of the record can be displayed separately in reverse paging order with the most recent page first.

1.1.1.3- Diary functions:

Under this heading we shall describe how the system uses dates and all those functions which, in a manual record system, would depend upon the keeping of a diary.

Every entry in the medical record must have at least one date attached to it; the date of onset if it was a disease for instance, or the date a drug was first started or other treatment instituted. It is also possible to enter when episodes of illness end and when treatment is withdrawn.

The system also tales account of weekends and the public holidays up to the year 2000. The user can also enter the dates when staff and doctors will be on holiday. The system can then take note of this information when calculating when a patient should next be seen.

The system also works out some other dates automatically. When the fact is entered that a child has had its first triple and polio vaccination, the system knows the immunisation schedules and calculates when the next one is due, and automatically enters it into the child's diary. Users may add to these schedules or change the existing ones.

When the user enters an acute or current prescription, the system will work out, if it can, the date when the prescription will run out, remove that drug from the patient's current prescription list and enter it into the drug history the day after.

There are two other main sub-directories: Patient Diary and Practice Diary. In the Practice Diary the system displays all entries in the active patient's diary. The user can add a diary entry, cancel an entry and send reminders. Practice Diary: makes it possible to search the diary entries of all patients, deriving lists of patients for all kinds of recall to whom personal letters may be sent. The user has the choice of place of service or type of service related to patient treatment follow-up.

1.1.1.4- Prescribing:

Enables users to issue a repeat prescription, to add a new prescription to the list of prescriptions available to the patient, issue any prescription already made available to the patient as above, add to the patient's history, make changes to the dose and/or quantity of a drug on a prescription, revise the review period for a repeat prescription, cancel any prescription presently being given to a patient, make a message appear on the screen whenever a certain patient's drug record is being reviewed, record the date on which exemption certificates expire or print a personalised letter reminding a patient that their medication is overdue.

- Prescribing screen:

At the top of the data space is a list of the drugs the patient is currently taking, by name. Below it is a list of current prescriptions by prescribed name, whether Trade or Generic. To the right of each is the date it was last issued. The system automatically removes current prescriptions from the list of medicines currently being taken by a patient the day after the prescription should run out, according to the instructions given on the prescription.

1.1.1.5- The Dispensing Subsystem:

Provides complete dispensary management with stock control. Dispensing is carried out at a designated dispensary terminal. When the user dispenses a drug, he may provide the patient with the actual medicine from a stock kept at the surgery. This normally only applies to practices with patients who live more than a mile from the local chemist. Also, the user can place the prescription in the dispensing queue for attention by the dispenser at an appropriate time. Doctor's acute prescriptions are always given priority and placed at the front of the queue. Many other functions are offered by this module e.g.: user can delete unwanted items from the prescription queue; access the patient's prescription history; add a drug when it arrives from the supplier; amend the list of items to order which has been automatically generated by the system; etc.

1.1.1.6- Immunisations:

The system enables the user to change the schedules as need arises and also the immunisation schedules constantly changes as new vaccines develop and are introduced.

1.1.1.7- Drug Data Base:

This function will enable the user to review the Drug Data Base and add to or amend it in the Drug Data Base Information menu, taking the appropriate option from the Reviewing Drug Data Base Information Menu. Drug Constituents displays the Trade names of all the drugs known to be contained; Drug Groups gives information on the drugs comprised in any drug group or sub-group; ability Prescribe Schedules displays a table of all the known forms of the drug together with their ability prescribe and whether or not they are a scheduled drug; Drug Interactions displays in a column on the left, all the drugs the chosen drug or drug group interacts with and on the right of the screen, the interaction occurring.

1.1.1.8- Template:

Is a collection of prompts on the screen which remind the user of the need to collect the information suggested by them. Template enables users to gather the same information every time a patient is seen in a certain situation. The type and the appear and of the prompts is under the users control. Thus, the user may create a Template which will appear whenever the patient is recorded as having any form of Diabetes so that the user is reminded to test the patient's urine, take their blood pressure, and examine their retinae, etc. Seeing children for developmental screening is a another good example. The template makes a very significant contribution to data entry, enormously improving speed and accuracy and completeness of data entry. This Template displays on the screen a reminder of each test that should be performed and enables the user to record the result.

1.1.1.9- Searches and Statistics:

This gives access to the practice Statistics Menu where there are several options such as:

- Display Age/Sex register:

The system keeps copies of each of these registers for each month in each year. It is necessary only to enter the month and year. The data can be printed either on the screen or the printer. Regarding Search Results: the system will display a table showing the title of each search and the date it was carried out and with a letter to the left of each entry. The user can choose the search he/she wishes to display by typing the letter to the left of its title.

- Display Prescription Statistics:

This will display practice prescribing as numbers of Repeat and Acute prescriptions by BNF drug group and sub-group. The cost of the total prescription in each sub-group is also displayed. Also the system displays a table showing the forty most expensive drugs prescribed by the practice, in cost order and next, the forty most expensive patients, also in cost order.

1.1.1.10- Standard Searches:

This gives access to a set of functions enabling the user to manage searches which need to be carried out repeatedly, for instance, search for patients who are overdue for their Cervical Smear. The parameters of such a search remain the same, but the patients found by search will change over periods of time. The system updates all date sensitive parameters, such as age, so that the same age group is searched for each time, and so that any intervals of time are moved to give the same relative period.

1.1.2- Summary Overview Options:

Enables the user to review every single entry in the Clinical Record, except those made in narrative text under the Consultation Record function, and any entries relating to drugs. Any coded entries made as part of narrative text will be displayed. In this function, the user can add any data such as diagnosis, symptoms or signs, cancel an entry, re-activate a problem, and view consultation records. Consultation records are displayed in reverse paging; then the user can add, edit, cancel or print a record.

From the Summary Overview Menu, the user can process Diary entries by displaying all entries in the active patient's diary and then perform the other Diary entry functions, which will be described later.

From the Summary Overview Menu, the user can also process Medication function which gives access to all the functions of the prescribing option, described under Prescribing.

1.1.3- Summary Details Options:

From this function, the user can process Diseases and Operations. The system prints a list, in reverse order, of all entries of disease or operation in the active patient's record. The same options exist, to add or cancel an entry, or to end an episode, if any has been recorded. Also, the user can, from this menu, process Immunisation function, Screening, Allergies and many other EMIS functions.

1.1.4- Summary Record:

The Medical Record excludes the records of Consultations. It comprises all the information which is available for data processing, including any information entered into the consultation records as coded text.

Some other functions related to the sub-systems indicated above, are:

Summary Printout: Enables user to print out the patient's medical record in summary form.

Personalised Letter: Enables user to write and print a letter addressed personally to the active patient.

Word Processing: Provides word processing functions for creation of documents of all kinds.

Help with the System: Provides a brief on-screen description of the system and how to use it.

Change to the System: Gives access to some of the underlying features of the system, enabling the user to change them to suit his/her needs

The EMIS is a complete health information system that could be ideal for clinic services. The researcher has discussed with EMIS management the Management protocols system and expert systems and the possibility of their widespread use by the general practices. They expressed their confidence that this system is built on a comprehensive knowledge base of structured data collected routinely by computer encounter recording, in the consulting room of a general practice. These data include reasons for encountering symptoms, signs, management and, of greatest importance, outcome. Where the computer can easily manipulate information and if the heuristic rules can be identified and built into the software, the computer could then give guidance equal to the combined knowledge of many experts.

2- APPENDIX B: WANG SYSTEM Hospital Information System (HIS) in Royal Hospital

2.0- Introduction:

The system is regarded as a complete HIS which was bought commercially from Europe. Many of the system's functions are not utilised yet and others only to a limited extent. For more information about software and hardware please see Chapter Four. The following are the systems or sub-systems/functions currently utilised or intended to be utilised.

2.1- Master Patient Index (MPIX):

This module provides for registration of the patient on arrival and recording basic demographic and medical data. It assigns a unique patient number using which all information regarding the patient may be accessed. The main features of this module are that patient registration provides for full registration with all the details and also for a partial registration, in the case of emergency patients. There are several benefits offered by the system such as 1) patient information is maintained centrally and available immediately throughout the hospital. 2) patient identification labels save a lot of time and effort in requisitioning patient services. 3) it helps in detecting and minimising duplication of patient registration. 4) user-definable codes lead to standardisation and facilitate easy extraction of statistics from the system.

The user is enabled to carry out many tasks, such as: process normal registration, emergency registration, outputs of the registration process, modifications to the master patient index, query facilities, registration of new births, reports, etc.

2.2- Duplicate Registration Management:

It is possible that the same patient may, by oversight, get registered more than once. Consequently more than one patient number will refer to the same patient and more than one set of patient notes will exist. The system provides for options to search for possible duplicate registrations on various criteria like name, date of birth, nationality, residence, etc. It can make queries on duplicated numbers and also enables reports to be made with minimal patient details or with full patient details. This helps avoid confusion by aiding in detecting duplicate registrations.

2.3- The Soundex Retrieval

The Soundex Retrieval module is extremely useful in searching for patient names in a large database, like in a hospital, as it retrieves names based on how they sound, rather than their English spelling. This technique brings up all similar sounding names, irrespective of the way they are spelt. This facilitates identification of a patient when only the name and not any unique identity (like the hospital number) is available. Also there is no need to resort to standard English spellings for specific names (especially Asian names) and retrieval will still be easy using the Soundex module. However, this function is not yet used and not expected to be used in future.

2.4- The Out-Patient Management

The Out-Patient Management module registers patient visits to the Outpatient Department and facilitates the capture of the visit details. The benefit that could be offered by this system is that unique identification of each patient visit is made possible. Patient visit history is built up chronologically on a visit basis. Other features provided by the system to generate patient identification are adhesive labels and case sheet for use by the doctor. The system provides for entry of visit details like: clinical/doctor visited; examination carried out; doctors' findings; drugs prescribed. It also enables the user to make reports on patient visit history or patient details by diagnosis.

2.5- The Outpatient Appointments

The Outpatient Appointments services are rendered through various specialist clinics. Patients are treated in these clinics by appointments made earlier. It is possible to draw up a time-table for each consultant and clinic for a period of time. The time-table defines the clinic capacity, which may not be exceeded under normal circumstances. Authorised personnel are given the facility to overbook. The system provides facilities to cancel appointments when necessary. The consulting hours may also be cancelled in part or totally over a period. Appointments can also be blocked temporarily for given timetables. Clinic visits for a day can be concluded by registering attendances and the actual doctor who conducted the clinic, along with the diagnosis in the form of ICD codes. Inquiries are provided for displaying a doctors' schedule for a day. Also patient appointments can be inquired into. Various statistical reports are available on clinic attendances and on disease incidence by diagnosis. The benefits that could be derived from the overview of the system, which is much needed in Omani hospitals, is that it helps in smooth functioning of outpatient clinics by streamlining appointments, controls clinic capacities and aids in avoiding overloading of clinics. It provides a centralised booking facility for the various clinics in the hospital. And assists the records department in preparing the patient notes for the next day clinics with the aid of schedules provided by the system, and helps in building up and analysing disease incidence trends.

2.6- Patient Notes Tracking

All information-medical and demographic- of a patient is stored in a folder. This folder is kept with medical records and bears the hospital number assigned to the patient. From time to time various medical and administrative personnel of the hospital may have to refer to these patient notes. Each time these notes are sent out/received, information pertaining to then is recorded. The system provides assistance in tracking the movement of the notes within the hospital. This has the benefit of highlighting any defaulting staff/ department. The system also enables the user to register notes transfer, archive data older than a specified number of days and follow the movements of a patients' medical notes. The audit trail of notes can be viewed on the screen and the following reports generated: 1) notes not yet returned by doctor; 2) notes not yet returned by department 3) notes not yet returned by date.

2.7- Inpatients module

Admissions, transfers and discharges are taken care of by this module. Patients can either be wait-listed or directly admitted. The waiting list holds information which can be called up at the time of actual admission. Admission can be made to a specific vacant bed in any ward. Transfers can be effected between beds in the same ward or between wards. On discharge, the bed occupied by the patient is released by the system (as also in transfers). Patient discharge summaries can be fed into the system and the diagnoses codified using ICD-9CM codes. These form part of the patient's history. Also various statistical reports on bed occupation and on incidence of diseases can be extracted from the system. The benefits that the system provides are many: admission scheduling can be stream-lined efficiently with the help of the wait-listing features, patient identification is made simpler using system generated wrist-band tags, adhesive labels, etc., Bed occupancy in wards can be monitored easily and efficiently and healthcare audit can be facilitated by recording diagnosis at referral, admission and discharge stages. However, this module not fully utilised.

2.8- Statistics

This module provides the hospital with a comprehensive set of statistical details relevant to the inpatient, outpatient, medical records and support departments. The module provides statistics cumulated for a pre-defined period, usually a month; the system keeps track of the last statistical run carried out for the various applications; and automatic recovery features are built in to clean up results of abortive runs. The queries/reports function is excellent; there are patients' registration statistics; patient admission statistics by date, ward and consultant; patient discharge statistics by date, ward and consultant; patient discharge statistics by diagnosis; birth statistics; mortality statistics by date, ward and consultant; bed occupancy statistics by date and ward; outpatient visit statistics by date and by clinic or by diagnosis; radiology department statistics; cardiology department statistics; operating theatre statistics; and maintenance department statistics, classified by nature of work/equipment. The benefits offered by the module are that it saves a lot of time and manual effort by automatically accumulating statistical detailed from the various modules; figures are stored permanently, thereby making even past details readily available; and establishing, analysis and comparison of trends are made possible.

2.9- Pharmacy Module

This system serves both as a drug information system and as a medication ordering system. It can store all the details of a drug, viz., the generic name, the trade name, standard dosage, contra-indications, interactions, physical and chemical characteristics, etc. Using the module as an ordering system, the user can enter drug prescriptions for inpatient and out-patients; the prescription may be for one-time use or could be a repeating feature over a period specified by the doctor. Also, facilities exist for the pharmacist to authorise restricted drugs that are prescribed before releasing them. The system also highlights drug contra-indications and interactions while entering a prescription. Overdoses prescribed can be reported. The benefits offered by this module are many, e.g.: it serves as an on-line, ready reference for drug information to medical staff throughout the hospital; medication orders can be raised from the various wards themselves and can be consolidated by the system by drug, patient or ward centrally at the pharmacy, thereby saving time and effort; errors or oversight by doctors in prescribing over-doses and adversely interacting drugs can be trapped and reported; a patient's medication history can be automatically and continuously built up and referred to at any time; consumption trends of various drugs can be monitored for efficient stock-control (related to this point was a complaint from pharmacy staff that they get orders at short notice, or drugs are kept in the ward until the expiry date and then thrown out); and patient instruction labels can be generated for drugs dispensed.

The Operation Theatre module is a comprehensive module providing all functions required of an Operating Theatre in a hospital. Operations can be scheduled from within the Operating Theatre or from the Specialist OPD clinics by the concerned surgeons. Waiting lists for operations can be set up by the corresponding specialists and can later on be scheduled. Staff within the theatre can be scheduled by operating theatre. Various risk factors, medicines, anaesthesia, particularities and complications can be coded and identified. Also all relevant information pertaining to the post-surgical registration process can be fed into the system along with text reports, which can be entered in free text mode or can be pulled up from standard text blocks. The system also provides a variety of reports ranging from statistical reports to reports on staff. Further more, various statistics on types of operation performed, can help in formulating relevant administrative policies. Previous history of similar operations, along with their peculiarities, can be saved for educational as well as for analysis purposes and comprehensive documentation of operations done by specialists can be compiled from the data in the system.

2.10- The Radiology module

The Radiology module is a comprehensive one catering to all the requirements of the Radiology Department in a hospital. This module interfaces directly with the master patient index and stores subsystem picking, up all relevant details. This module can be broken up into 5 sub-modules including: 1) Appointments for various clinics and examinations in the department; 2) Registration of requests and X-ray examinations, entered into the system whenever the patient arrives for the examination(s); 3) Reporting of various examinations conducted; 4) Archiving request and report-related information can be archived from the system at user-specified time-intervals and maintained off-line; 5) Post Examination: this accepts inputs into the system from the examinations process.

2.11- Laboratory system

Laboratory system is a sophisticated computer data management system designed to handle a large amount of data quickly and efficiently for all Pathology Laboratory disciplines. The system allows the independent operation of all laboratory departments while using a single data base. This concept gives each department the flexibility to operate in the manner which suits its needs, yet allows rapid recall of all data and test results for a particular patient. Automated laboratory equipment is linked to the computer allowing results for the bulk of the routine analysis work to transferred directly to the computer. Comprehensive and integrated modules to handle data for the specialities of Biochemistry, Haematology, Microbiology, Blood transfusion services, Histology and Cytology create the foundation of the system. The results are available to all authorised users as soon as they are entered. On-line capture of data from automated analysers is provided and manual report preparation is eliminated.

2.12- The Blood Transfusion system

The Blood Transfusion system caters for the management of all blood stock, donor records and laboratory and patient operations within the department. There are several benefits such as on-line availability of stock positions of all blood product, patient inquiry giving all the details of previous transfusions and identification of blood products nearing expiry date.

2.13- Medical Stock Management

This module is a comprehensive tool for managing the inventory of the hospital's drugs and other medical, surgical and laboratory items. Further to keeping track of the movements of individual items, the system also takes into account their cost aspect and expiry dates. Multiple stores and accounting by specific batches of drugs are possible. Various useful inquiries and reports are available. There are many benefits offered by the module, such as: ready up-to-date information on stock status; effective cost control through continuous monitoring of inventory; facilitation of identification of consumption trends, leading to better requirement planning and phase management; and minimisation of wastage by effective monitoring of expiry dates. This module is not fully utilised yet.

2.14- On-line Order Entry

This module makes it possible to request any patient related or other service from the user's place of work by making use of the computer work-station. It allows for on-line follow-up of request status and even retrieval of results (laboratory, X-ray, etc.). The benefit is that time-consuming paper work is avoided in raising requests for services; the request is automatically routed to the relevant service department instantly through the computer; results are automatically routed back to the source of request; thus time that would otherwise have to be spent by the medical/nursing staff in running around to get their services can now be spent on patient care.

2.15- Patient Billing

This module provides the hospital with a comprehensive facility to track all charges for a patient from the point of registration to the stage of discharge. The module is largely parameter-oriented which makes it more flexible to suit user requirements. The billing process can be done at pre-defined periods or at episode level for each patient. This application is fully integrated with other patient-care modules. The benefits of this module are that it enables automatic build up of patient's service charge profile; billing can be done at short notice; it is possible to analyse the hospital's income through various services; the Accounts department is saved a lot of time and effort that would otherwise be spent on tracking patient changes; and the module facilitates effective control and monitoring of receivable. The module is not yet used, because there are no fees for treatment, but in interview, the finance department in the hospital expressed interest in the finance module, because it could be used to aid understanding of budget spending on a variety of services and for future strategic planning. However, the interviewee suggested that this will not happen unless the hospital gets complete autonomy from the MoF.

2.16- The General Ledger system

The General Ledger system is regarded as the nucleus of the entire Financial Accounting System. It can function independently or can be integrated with other subsidiary ledgers such as Accounts Receivable, Accounts Payable, Fixed Assets and Inventory Control. This system provides a simple yet flexible means to codify the Chart of Accounts, incorporating divisions and branches to cater to divisionalized accounting. This system also can support foreign currency processing and supports an unlimited number of currencies. However, up to now, the system is not being used for this purpose, since all finance is governed by the Ministry of Finance.

2.17- The Inventory Control system

The Inventory Control system can be operated stand-alone or in integration with General Ledger. It supports Multi-warehouse stock-keeping, and stock at each warehouse or location can be accurately controlled. It provides the facility to process all types of transactions in all warehouses which also means that costing can be done independently for multiple warehouses. This system can also provide links with Purchaser Order Control and Accounts Payable.

2.18- The Accounts Payable

This application can operate stand-alone or in integration with Purchase Order Control, Inventory and General Ledger. This system maintains details of vendors and also the vendor outstanding details. A cash requirement report can be printed at any time, as of a particular date, to determine the cash required to pay creditors.

2.19- The Accounts Receivable

This application can operate stand-alone or in full integration with General Ledger or Order Entry. For invoices already overdue, the services charge routine can compute the relevant service charge according to pre-determined percentage.

2.20- The Purchase Order Control

The Purchase Order Control maintain all purchase order related information for an organisation. The entire purchasing activity can be started off from sending a request for a quotation, to a firm purchase order. Alternatively, the system can also function from entering a purchase order directly. Because the system maintains purchasing, pricing and stock keeping units information, the purchase order can specify the same terminology as would be appreciated and supported by the vendor. This system can operate in integration with Inventory Control and Accounts Payable.

3- APPENDIX C: GERBER ALLEY Hospital Information System in Sultan Qaboos University Hospital in Oman

3.0- Introduction:

The system is regarded as a complete HIS which was bought commercially from America. Many of the system functions are not utilised yet and others only to a limited extent utilised. For more information about software and hardware, please see Chapter Four. The following systems or (sub-systems/functions) have been utilised or are intended to be utilised.

3.1- The Census/Registration

The Census/Registration module accumulates inpatient admission and outpatient registration data, and manages all admitting/ discharge/ transfer functions. From pre-admissions to discharge, this module manages encounter information for pre-admissions, inpatients, outpatients, and emergency room patients. All data is maintained on-line for instant access. The following are the main system functions:

* Supports pre-admissions.
* Handles real-time patient administrations including printing registration forms.
* Provides discharge processing and notifications.
* Performs real-time registration for patients in outpatient areas and/or emergency rooms.
* Provides multiple types of census inquiry.
* Reports census information on demand.
* Supports Multi-entity capabilities.
* Compiles, maintains and reports statistics.
* Corrects admission and discharge transactions.
* Provides activity reporting.

3.2- The Patient History

The Patient History module retains details of each patient's encounters, including biographic, demographic, and financial information. One of the key benefits this module offers is the ability to access previously served patients, either directly or by guarantor. The quality of care is enhanced because personnel can access previous service services data for reference and medical record retrieval. The main system function are as follows:

* Provides patient and guarantor information to any organisational entity with the proper security clearance.
* Permits access to specific historical data by several identification keys such as patient or guarantor name or number, account or history number, or medical record number.
* Consolidates records by changing the history numbers on two or more patient records, merging the data, and revising all appropriate cross-references.

3.3- The Physician Registry

The Physician Registry module tracks biographic and demographic information for each physician on the medical staff. These include information on licensure, certification status, medical training and speciality designation, and group and committee affiliations. This module also provides the individual physician or physician group with real-time census of the patients. The system also supports physician messages. Additionally, administration personnel can review activity generated by physicians/ physician groups. This sub-system has not been used regularly but it is likely to be used in limited situations. The following are the main system functions:

* Maintains a physician/physician group database.
* Compiles, maintains, and reports physician/physician group statistics.
* Provides real-time inquiry and census reporting.
* Provides physician communications.

3.4- The Medical Records

The Medical Records module automates the functional areas of a medical records department. By monitoring chart location and movement; providing on-line coding and chart abstracting; flagging chart deficiencies; and accommodating multiple groupers with interim, concurrent, and final assignment, this module streamlines medical records processing and abstracting by using previously gathered patient data. The module has the ability to generate an extensive array of standard and customised documentation, including internal analysis reports, special clinical data studies and external reports. We can list the following main system functions:

* Provides abstraction using previously gathered information.
* Reports abstract data for internal analysis of diagnoses, procedures and physician activities as well as special studies of clinical patient data.
* Reports abstract data to support external requirements related to diagnoses, operations and physician indices.
* Provides chart location control and tracking.
* Provides chart deficiency analysis functions.

3.5- The Patient Care Planning

The Patient Care Planning module provides nursing personnel with a tool that can enhance the quality of patient care while increasing the productivity of the professional staff. This module's unique design allows nursing personnel to tailor standard hospital care plans to meet individual patient's needs. Nurses can access care plans on-line and summarise them at discharge. Nursing staff can also maintain standard patient instructions (including checklists and post-discharge regimens) on-line, and can modify them at any time during the patient's stay. This module requires the use of Order Management modules. However, the function is not in use, since the decisions on patients' medication and welfare are under the doctors and management. We can list the following main system functions:

* Provides patient assessment support for admissions, care planning, and re-evaluations.
* Provides both standard and individualised care planning.
* Provides computer-assisted support for updating and revising care plans.
* Provides automated nursing wordlists.
* Provides on-line nursing documentation.
* Automates the patient classification.
* Automates care planning summaries.
* Integrates physician orders, test results, and care planning on a system-wide basis.

3.6- The Case Mix Management

The Case Mix Management module uses patient biographical data (along with current diagnoses and procedure information from the Medical Records module and detailed charge data from the Patient Billing module) to examine the various components of the hospital's case load. The system can examine profitability by entity, by DRG, by major diagnostic category, by individual physician or physician group, or by patient using various parameters and budgets. The benefit that the system offers is the ability to measure reimbursements against billings at any time. This also enables the hospital to monitor service margins and facility utilisation. This system is at present completely on hold, since there is no fee for treatment, but recently there has been interest in using this module for evaluation of the spending on medication which might help for future strategic financial analysing, in spite of heavy objection. The system enables personnel to generate a variety of standard and customised reports. We can list the following main system functions:

* Maintains DRG groups, their standard length of stay, and budget data.
* Maintains case data, length of stay, and billing, by DRG.
* Provides flexible reporting by DRG, physician, procedures, etc.
* Compiles, maintains, and reports statistics.

3.7- The Order Management

The Order Management module automates the communication process, including entry, verification, status checking, and requisition printing. For each patient, the system maintains a complete on-line order history profile that displays all orders and their status. The system can generate patient charges at any point in the order cycle: order entry, order verification, or test completion. To access patient orders, the system provides a search facility based on patient name, physician, department, or order status. The system enables personnel to generate a variety of standard and customised documents. This is another function which is not fully utilised. The main system functions are as follows:

* Supports entry of doctors' orders for tests, examinations, treatments, and patient supplies.

* Optionally allows order verification after entry.
* Charges at the time of order entry, verification, or at the time the service is performed.
* Supports multiple types of order/charge entry.
* Provides multiple types of order entry (i. e. standard, rental and recurring).
* Communications order data to affected departments.
* Provides audit/control capabilities.
* Provides inquiry and/or lists of outstanding orders to selected departments and/or nursing stations.

3.8- The Professional & Scheduling

The Professional & Scheduling module retains expanded biographical information for administrative staffing to review employees' scheduling, education, training, licensure, certification and probation history information. The benefit is that management are enabled to access to current data maintained on the system for daily decision-making and determining short-and long-term planning needs based on census, statistics, resource utilisation, acuity, care background, revenue and budgeting information. This function could enhance the quality of care because the system assists in determining staff needs for the current patient load and employees are given more notice of their work schedules. It is intended eventually to use this module in full, but up to now, it is not used. The main system functions are as follows:

* Provides on-line employee biographical information for administrative, scheduling, and education-related purposes.
* Maintains employee education, training, licensure, certification, and probation history information requirements.
* Automatically generates staffing requirements based on hospital-defined acuity parameters for each department, unit, and nursing staff.
* Provides position control information regarding authorised, budgeted, and assigned hours.

3.9- The Appointment Scheduling

The Appointment Scheduling module manages surgical and departmental appointments for registered and non-registered hospital patients. It is integrated with the Census/Registration module (which provides patient information gathered at admission). The module deals with interdepartmental slots, appointment details, individual patient schedules, and department schedules. For each room, hospital-defined parameters control the number of available appointment days, hours, times and appointment part slot. At present, the system is not used as this way, but is used according to the need of doctors when they authorise appointments. This module is designed to improve efficiency and productivity for both ancillary and nursing departments by providing on-line information regarding available appointment time in minutes, schedule appointment resources, and provide individual patient and department schedules. A system-wide report writer application enables personnel to generate a variety of standard and customised documents, including worksheets, reports, appointment notice, and follow-up notice. The following are the main system functions:

* All schedules-surgical, departmental, rooms, personnel. etc.- are maintained on-line.

* Statistical data regarding actual procedure times versus projected times and their variances are automatically captured and calculated.

3.10- The Pharmacy Management

The Pharmacy Management module automates inpatient and outpatient pharmacy operations, and enables pharmacy personnel to order and dispense medications using either unit dose or traditional methods. Integrated with Census/Registration and Order Management modules (which provide patients demographic and clinical data), the Materials Management module (which provides physical inventory information), and the Revenue & Statistical Control module (which posts patient charges and credits), Pharmacy Management provides functionality specifically designed for the pharmacy department. A system-wide report writer application enables personnel to generate a variety of standard and customised reports to efficiently provide quality service.

However, this system is not yet applied in the hospital. We can list the following main system functions:

* Provides rapid processing of medication and IV orders, with automatic profile updating and label generation.

* Supports clinical screening during order processing.

* Provides on-line formally maintenance with periodic automatic updates.

* Supports automated generation of charges and credits.

3.11- The Laboratory Management

The Laboratory Management is regarded as a solution to clinical laboratory problems, it includes five models: General Lab, Microbiology, Blood Bank, Anatomic Pathology and Cultural Application. The advanced functionality of this system includes such features as the user's ability to define other order able items that might conflict or interfere with a lab test, bar coding of specimen labels, multiple methods of result entry, and patient report generation. These sophisticated modules help ensure accuracy and increase productivity for the Lab staff and the hospital. The entire healthcare institution can benefit from Gerber Alley's system, which can scrutinise new clinical findings against existing and previous clinical, demographical, and biographical data known about the patient to ensure clinicians have the most appropriate, relevant facts when making their diagnostic assessments. Daily activities within the Lab can be dramatically enhanced through the system's ability to assist in the collection process, work-flow management and quality control. The modules are in various phases of development, and some of these not yet working. We can list the following main system functions:

* Maintains current patient ADT data.

* Provides branching between logical functions such as clients registration and order entry.

* Orders are transferred automatically from the Order Management module, and can also be entered directly in the Lab.

* Specimen collection labels can be bar coded and batched. Optional hand-held bar code renders capture accurate collection times at the patient's bedside.

* Results can be process manually, on worksheets, or with interfaced instruments, in either alpha or numeric formats.

3.12- The Results Reporting

The Results Reporting module acts as a central storing -and clearing-house of quantitative and narrative test results. It receives data from results - generating hospital departments (Laboratory, Radiology, Physical Therapy, and other Ancillary mints), and can readily provide this information to the entire patient care staff. A system-wide report writer application enables personnel to generate a variety of standard and customised results documentation, including cumulative results summaries, flowsheets, physicians' rounds, and pending results reports. We can list the following main system functions:

* Supports entry of quantitative and 'free text' results.
* Prints results at designated locations based on parameters.
* Provides results inquiry with screen displays and/or printouts.
* Enables automatic checking for abnormal, panic, and delta values against a hospital-defined range of values and flags any values outside of the defined range.
* Provides a variety of reports (including cumulative reports) that facilitate management, control, and utilisation of test results.

3.13- The Revenue & Statistical Control

The Revenue & Statistical Control module posts charges, cash, refunds, adjustments, and General Ledger cash produced by patient, third party, and non-patient activity. This module generates detailed statistics as a by-product of the centralised database. When integrated with Patient Accounting modules and the Case Mix, General Ledger and Physician Registry modules, the hospital is provided the financial and statistical data necessary for managing an efficient operation. In addition, the system can monitor prices based on inventory-related costs, reflecting refunds in the Accounts Payable module while the Order Management module generates order-based charges. So the benefit offered by the system is greatly enhanced control, through the module's ability to process all activity, not solely patient activity. Administration also benefits from the module's ability to collect price/volume statistics by items, patient type, financial class, department, etc. A system-wide report writer application enables personnel to generate a variety of standard and customised documents. The main system functions can be summarised as follows:

* Accounting for all financial transactions related to revenue.
* Provides flexible cash posting capabilities.
* Supports unit price extensions as well as incremental and depreciating pricing methods.
* Supports multiple adjustment types.

4- APPENDIX D: GPRs' Interviews and Questionnaires Display

General Practice Interviews

Interview aim:

Your assistance would be greatly appreciated. It is important to obtain feedback and honest responses from you. You have been asked to help because you are actively involved in computer deployment and utilisation in your general practice. The aim of this interview is to discuss topics with you which are defined by the interview agenda, and also other topics which you feel relevant. ***I assure you that all information provided will be treated in the strictest confidence.***

Interview Agenda: These interviews mainly covered the following issues:

A) How well planned was the deployment of computers into the practice.
B) How is training requirement has been handled;
C) The problems that may resulted of computer deployment;
D) The impact of the introduction of the computer system into their health system;
E) Evaluation of the system.

A) The strategy of general practice management in setting up a project for computerisation. In relation to these issues:

1) Did you make an initial decision on:	YES	NO	UND
1.1- Cost	☐	☐	☐
1.2- Utilisation	☐	☐	☐
1.3- New staff to be recruited and training for this technology	☐	☐	☐

2) The special installation requirements for the computer system.			
2.1- Availability of electricity	☐	☐	☐
2.2- Environment and adequate space for computers and peripherals.	☐	☐	☐

3) Did you feel your planning for hardware provision was adequate for the practice requirement? (Number and type of VDUs and printer, floppy disc/hard disc, memory capacity)	YES	NO	UND
	☐	☐	☐

	YES	NO	UND
4) What maintenance support is being offered?			
4.1- Hardware and software	☐	☐	☐
4.2- Guaranteed response time in event of breakdowns.	☐	☐	☐
4.3- Availability of contacts for *ad hoc* inquiries -24 hour answering services.	☐	☐	☐
5) What are the future plans for the system?			
5.1- Hardware & software modifications	☐	☐	☐
5.2- Expansion of the system.	☐	☐	☐
5.3- External communications possibilities.	☐	☐	☐
B) What are the training requirements?			
1- Do you have any in-service training?	☐	☐	☐
2- Is training provided by supplier?	☐	☐	☐
3- Has any institute, or private company held any courses related to the use of computer system in practice?	☐	☐	☐
4- Do you think you need more training about your computer system?	☐	☐	☐
5- Are you paying for additional training?	☐	☐	☐
C) There are many problems related to computer deployment and utilisation fears. It categorised into two main part:			
1) Human context related problems such as:			
1.1- Computer could replace health staff (doctors)	☐	☐	☐
1.2- Computer will cause less concentrating on treating patients	☐	☐	☐
1.3- Computer could interfere in making vital decision which they are responsible for.	☐	☐	☐
1.4-The professionals might find themselves thrust into general management roles.	☐	☐	☐
1.5- There is too little knowledge of this technology.	☐	☐	☐
1.6- Doctor-patients relations.	☐	☐	☐
2) Computer technical problems such as:	☐	☐	☐
2.1- inconvenience & extra time taken.	☐	☐	☐
2.2- computer could run out of space.	☐	☐	☐
2.3- inaccurate data entries.			
2.4- The security provisions			
2.4.1- Ease and frequency of making back-up copies	☐	☐	☐
2.4.2- The operator receive visual warning of default	☐	☐	☐
2.4.3- Virus safe	☐	☐	☐
2.4.4- Are you happy with the security provisions?	☐	☐	☐

	YES	NO	UND
2.5- What are the confidentiality provisions?			
2.5.1- Are there levels of access?	☐	☐	☐
2.5.2- Are you happy with the confidentiality provisions?	☐	☐	☐
D) Regarding the impact, influence and changes caused by the computer.			
1) There are changes in the organisational structure.			
1.1- change of the existing function of staff.	☐	☐	☐
1.2- introducing new function.	☐	☐	☐
2) Do you feel the management take into account information produced by computer for decision-making on management issue to improve health care?	☐	☐	☐
3) With computer information, management can easily monitor staff work an health progress.	☐	☐	☐
E) The following questions are related to the evaluation of your system.			
1- Is the system simple and easy to learn?	☐	☐	☐
2- Is the system quick to use?	☐	☐	☐
3- Is the system versatile?	☐	☐	☐
4- Is the system flexible ?	☐	☐	☐
5- Is it easy to search and to analyse prescribing data?	☐	☐	☐
6- Does it meet the cost and efficiency target?	☐	☐	☐
7- Is the reliability of the computer high?	☐	☐	☐
8- Are you satisfied with its performance?	☐	☐	☐
F) Other questions raised during the interviews.			
1- Is your system adequately adaptable to cope with changes in the medical industry and new legislation?	☐	☐	☐
2- Have all the potential computer users within the practice been made aware of the system operation?	☐	☐	☐
3- Does the computer users group meet to make any improvement in the development of the system?	☐	☐	☐
4- The practice needs long term commitment from the suppliers and their investors. Is this offered to you?	☐	☐	☐

5- The failure of computer system in NHS has been blamed on the following:
note: (Strongly Disagree =SD, Disagree =D, Undecided =UND, Agree =A, Strongly Agree =SA

	SD 1	D 2	UND 3	A 4	SA 5
5.1- inadequate planning.	☐	☐	☐	☐	☐
5.2- poor management.	☐	☐	☐	☐	☐
5.3- lack of competitive tendering.	☐	☐	☐	☐	☐
5.4- over-reliance on expensive contract staff & other external assistance.	☐	☐	☐	☐	☐
5.5- using computer to try to cut the staff bills.	☐	☐	☐	☐	☐

5- The importance of the computer nowadays relies on:

6.1- information storage.	☐	☐	☐	☐	☐
6.2- interrogation facilities.	☐	☐	☐	☐	☐
6.3- how well it talks to other machine system.	☐	☐	☐	☐	☐
6.4- integration into the practice organisation & other health organisation.	☐	☐	☐	☐	☐
6.5- maintenance & help support.	☐	☐	☐	☐	☐
6.5- its overall costs.	☐	☐	☐	☐	☐

-------- FINISHED -------

Abdullah A. AL-Nahdi,
Dept. of Computer Science.
University of Hull.

May, 1992

To All Computer Users of General Practices in Humberside.

Dear Sir/Madam,

Your assistance would be greatly appreciated in answering questions regarding planning for computer deployment and utilisation. It is important to obtain feedback from general practitioners, practice managers, and other staff who are involved in computer deployment and use. Therefore, the enclosed questionnaire should be distributed to those most actively involved in the computer deployment and use.

In this survey I wish to ascertain the views of GPs in Humberside on strategic planning for using computers to improve the form and the content of information available for planning and evaluation of health services; and to improve the concepts and the processes used in planning and introducing in health services comparing to developing countries such as Oman.

Note: If you wish to provide more detailed comments on any questions, you may write them on the blank continuation sheet provided. Your answers will be kept completely confidential, and you will not be personally identified in this analysis report. Your answers will be used for statistical purposes only. ***I assure you that all information provided will be treated in the strictest confidence.***

Yours Faithfully,
Abdullah A. AL-Nahdi.

GENERAL PRACTICE QUESTIONNAIRE

SECTION ONE: Questions included General Practice respondent's position, GPs profile and knowledge of the system. **Notice: the group with (*) are regarded as the decision makers for the computer deployment in GPs.**

1) Please **tick** your present position in the practice.
1.1) Practice Manager * ☐
1.2) Physician * ☐
1.3) IT/IS/Computer staff ☐
1.4) Receptionist/Secretary ☐
1.5) Nurse. ☐

1.6) Other (please specify:)--.

2) No. of partners in practice: ....

3) Practice list size: ....

4) How long have you had this computer system?---------------------------.

5) Did you have any computer knowledge before you decided to purchase one?

5.1) Entering data into computers ☐
5.2) Computer software ☐
5.3) Computer hardware ☐
5.4) Computer capabilities ☐
5.5) Computer programming ☐
5.6) Others (please specify):---.

SECTION TWO: Questions related to the system utilisation.

1) In which of the following do you use the computer in general practice? (**tick** as many as are applicable).

1.1) Patients' records. ☐
1.2) Word processing. ☐
1.3) Age/Sex Register. ☐
1.4) Hospital Referrals. ☐
1.5) Repeat prescriptions. ☐
1.6) Statistical/Epidemiology. ☐
1.7) Other (please specify):--.

2) Is the system used by:	Freq 1	Often 2	Sometime 3	Rarely 4	Never 5
2.1- Practice manager	☐	☐	☐	☐	☐
2.2- Doctors	☐	☐	☐	☐	☐
2.3- Receptionists	☐	☐	☐	☐	☐
2.4- Secretaries	☐	☐	☐	☐	☐
2.5- Practice nurses	☐	☐	☐	☐	☐
2.6- District nurses	☐	☐	☐	☐	☐

2.7- Others (please specify): ---.

3) Indicate the computerised outputs: (**tick** as many as are applicable)

3.1) Daily Report ☐
3.2) Weekly Report ☐
3.3) Quarterly Report ☐
3.4) Annual Report ☐
3.5) Special inquiry messages ☐
3.6) Exception Reports ☐

3.7) Other (please specify):---.

4) To what extent do you think the practice staff utilise the computerised reports that are received?

0%	25%	50%	75%	100%
☐	☐	☐	☐	☐

SECTION THREE: Strategic questions for computer deployment in GPs. The following statements reflect issues that concern GPRs when they plan for computer deployment. Please use the scale below to indicate to what extent you agree or disagree with these statements. Notice that: **Strongly Agree (SA), Agree (Agr), Undecided (Und), Disagree (DA) and Strongly Disagree (SDA).**

	SDA 1	DA 2	Und 3	Agr 4	SA 5
1) The supplier of your computerised system asked you, "What information do you require for your General Practice duties."	☐	☐	☐	☐	☐
2) You were involved in making enquiry to the Supplier about the system information design or specification.	☐	☐	☐	☐	☐
3) You have participated in the planning and the design of your computerised system.	☐	☐	☐	☐	☐
4) The suppliers gave a guarantee that they would update the system's capabilities and software.	☐	☐	☐	☐	☐

4) You are planning to add to the equipment as result of your experience to date. ☐ ☐ ☐ ☐ ☐

SECTION FOUR: Fears questions: Computer fears are recognised by the literature as the cause of computer failure. The questions investigate fears of computers effects on doctors, management, finance, skills and special events that concerned GPRs. Please use the scale below to indicate to what extent you agree or disagree with the following statements.

	SDA 1	DA 2	Und 3	Agr 4	SA 5
1) The doctors feel threatened by computer Information facilities.	☐	☐	☐	☐	☐
2) The computer will cause doctors to focus less on treating patients.	☐	☐	☐	☐	☐
3) The computer still has no effective solution to the confidentiality of patients' records.	☐	☐	☐	☐	☐
4) The use of computers may require changes in the level of computer skills and expertise needed in health care.	☐	☐	☐	☐	☐
5) There is no obvious benefit from using Computers in General Practice, proportionate to their cost.	☐	☐	☐	☐	☐
6) Fundholding will slow the deployment of Computers to GPs.	☐	☐	☐	☐	☐
7) The FHSA Links project will increase the cost of IT to GPs.	☐	☐	☐	☐	☐
8) The supplier should be free to deal with general practice.	☐	☐	☐	☐	☐
9) The Practice should either be reimbursed more than 50%of its outlay on the system or have fewer conditions imposed.	☐	☐	☐	☐	☐

SECTION FIVE: Questions for computer impact: The purpose of this section is to determine whether the computer impact is felt by those involoved with it in their General Practices. Please use the scale below to indicate to what extent you agree or disagree with the following statements.

	SDA 1	DA 2	UND 3	Agr 4	SA 5
1) The computer is used successfully to Improve administration work in General Practice. *	☐	☐	☐	☐	☐
2) The computer provides more detailed Information on the effectiveness of care provided.	☐	☐	☐	☐	☐
3) The computer enables you to make new decisions.	☐	☐	☐	☐	☐
4) The computer system has increased the number of clinical/administrative staff in general practice. **	☐	☐	☐	☐	☐

5) Comparing the computerised reports and the information you received with non-computerised reports in the past or with which you are familiar.

	SDA 1	DA 2	UND 3	Agr 4	SA 5
5.1- The information is more complete and precise.	☐	☐	☐	☐	☐
5.2- The amount of irrelevant information is decreased.	☐	☐	☐	☐	☐
5.3- The report(s) are more timely.	☐	☐	☐	☐	☐
5.4- Errors in data recording are minimised.	☐	☐	☐	☐	☐
5.5- The report(s) are more easily understood.	☐	☐	☐	☐	☐
5.6- The computer reports are more accurate.	☐	☐	☐	☐	☐
5.7- The information is more up-to-date.	☐	☐	☐	☐	☐
5.8- I am satisfied with the present computer reports.	☐	☐	☐	☐	☐

* this question also, has been considered by the researcher as a **utilisation question.**
** this question also has been considered by the researcher as a **fear question.**

SECTION SIX: Technical and satisfaction questions of computer performance

1) Does your practice encounter any of the following problems related to the use of the computer?: (1 & 2 = No significant problems; 3= Moderate problems; 4 & 5 = significant problems) please **circle** the appropriate number.

	No Significant problems 1	2	.. 3	Significant problems 4	5
1.1- Software	☐	☐	☐	☐	☐
1.2- Hardware	☐	☐	☐	☐	☐
1.3- System response time	☐	☐	☐	☐	☐
1.4- Information utilisation	☐	☐	☐	☐	☐
1.5- Information structure	☐	☐	☐	☐	☐
1.6- Information input/output	☐	☐	☐	☐	☐
1.7- Information storage	☐	☐	☐	☐	☐
1.8- Handling and maintaining information	☐	☐	☐	☐	☐

1.9- Others (please specify): --.

2- I am satisfied with the computer system's performance.	☐	☐	☐	☐	☐

* Any other comments on the use of computer systems in General Practice:
(please write on the continuation sheet of this questionnaire)

THANK YOU VERY MUCH FOR YOUR HELP AND YOUR TIME

*** I assure you that all information provided will be treated in the strictest confidence.**

Please return this Completed Questionnaire to:

A. A. AL-Nahdi,
pp I. Shand
Humberside FHSA,
32-36 Prospect road,
Hull, HU2 8PL.

To all computer users in the Royal Hospital/Qaboos University Hospital

Your assistance would be greatly appreciated in answering questions regarding planning for computer deployment and utilisation. It is important to obtain feedback from general practitioners, practice managers, and other staff who are involved in computer deployment and use. Therefore, the enclosed questionnaire should be distributed to those most actively involved in the computer deployment and use.

In this survey I wish to ascertain the views of Hospital staff on strategic planning for computer use to improve the form and the content of information available for planning and evaluation of health services; and to improve the concepts and the processes used in planning and introducing in health services comparing to developed countries such as UK

Note*:** If you wish to provide more detailed comments on any questions, you may write them on the blank continuation sheet provided. Your answers will be kept completely confidential, and you will not be personally identified in this analysis report. Your answers will be used for statistical purposes only. ***I assure you that all information provided will be treated in the strictest confidence.

Yours Faithfully,
Abdullah A. AL-Nahdi.

OMAN QUESTIONNAIRE

SECTION ONE: Questions related to Respondent's position, skills and training.

1) Please tick your present position in the hospital:
1.1- General Management. * ☐
1.2- Technical Management. * ☐
1.3- IT/IS/Computer staff. ☐
1.4- Physician.. ☐
1.5- Receptionist/Secretary ☐
1.6- Nurse. ☐

1.7- Other (please specify:)____________________________________

2) Did you have any computer knowledge before using this system? in terms of: (tick as many as are applicable)

2.1- Entering data to computers. ☐
2.2- Computers software. ☐
2.3- Computers hardware. ☐
2.4- Capabilities of the computers. ☐
2.5- Programming. ☐

2.6- Other (please specify)___________________________________.

- Please use the scale below (for the two coming questions) to indicate to what extent you agree or disagree with the following statements regarding utilisation. **(Strongly Agree (SA), Agree (Agr), Undecided (Und), Disagree (DA) and Strongly Disagree (SDA)).**

	SDA 1	DA 2	Und 3	Agr 4	SA 5
2) Training programmes are made accessible to Omanis.	☐	☐	☐	☐	☐
3) The managers/administrators attend Computer training sessions.	☐	☐	☐	☐	☐

Notice that the groups with (*) are regarded as the decision makers in the Omani hospitals

SECTION TWO: Questions related to system utilisation.

1) In which of the following do you use the computer:(tick as many as are applicable)

1.1- Patient records. ☐
1.2- Word processing. ☐
1.3- Age/Sex Register. ☐
1.4- Hospital Referrals. ☐
1.5- Repeat prescriptions. ☐
1.6- Statistical/Epidemiology. ☐

1.7- Other {please specify):__________________________________.

2) Is the system used by: (please circle the appropriate number)

	Never 1	Rarely 2	Sometime 3	Often 4	Frequently 5
2.1- General Management.	☐	☐	☐	☐	☐
2.2- Technical Management.	☐	☐	☐	☐	☐
2.3- Doctors.	☐	☐	☐	☐	☐
2.4- Receptionists.	☐	☐	☐	☐	☐
2.5- Secretaries.	☐	☐	☐	☐	☐
2.6- Nurses.	☐	☐	☐	☐	☐

2.7- Others (please specify):__________________________________

3) Indicate the computerised outputs: (Please tick as many as are applicable)

3.1- Daily Report ☐
3.2- Weekly Report ☐
3.3- Quarterly Report ☐
3.4- Annual Report ☐
3.5- Special inquiry messages ☐
3.6- Exception reports ☐

3.7- Others (please specify):______________________________.

4) To what extent do you think the hospital staff utilise the computerised reports that are received?

0%	25%	50%	75%	100%
☐	☐	☐	☐	☐

SECTION THREE: Strategic questions for computer deployment in OHS: The following statements reflex an important issues that should be looked at when there is a plan to introduce computer system. Please use the scale below to indicate to what extent you agree or disagree with the following statements.

	SDA 1	SD 2	Und 3	Agr 4	SA 5
1) The plan to deploy computers into hospital has taken into account organisation structure.	☐	☐	☐	☐	☐
2) The plan to deploy computers into hospital has taken into account organisation Culture.	☐	☐	☐	☐	☐
3) The plan to deploy computers into hospital has taken into account staff skill level.	☐	☐	☐	☐	☐
4) The plan to deploy computers into hospital has taken into account staff training.	☐	☐	☐	☐	☐
5) The hospital's management had made a prior study involving implementation of this system.	☐	☐	☐	☐	☐
6) The computer systems was brought to the Omani Health System on the basis of the Health information system.	☐	☐	☐	☐	☐
6) Strategic planning was a consideration When the computers were purchased.	☐	☐	☐	☐	☐
8) Doctors and other hospital system users were consulted when planning of the system took place.	☐	☐	☐	☐	☐
10)The potential computer users within the hospital have been made aware of the system operation.	☐	☐	☐	☐	☐
10) The hospital has invested more in their computer to provide health care information. in Oman	☐	☐	☐	☐	☐
11)The deployment of the computer system was integrated into the total hospital organisation activities.	☐	☐	☐	☐	☐

***SECTION FOUR*:** Fears Questions: Computer fears have been recognised by the literature as the cause of computer failure. The following statements investigate possible fears related to effects on doctors, management, finance, skills and other Omani issues.

	SDA 1	SD 2	Und 3	Agr 4	SA 5
1) The doctors will be threatened in future by computer information facilities.	☐	☐	☐	☐	☐
2) Computers will cause doctors to focus less on treating patients.	☐	☐	☐	☐	☐
3) The computer has no effective solution to the confidentiality of patients' records.	☐	☐	☐	☐	☐
4) The use of computers require changes in the level of computer skills and expertise needed in the hospital.	☐	☐	☐	☐	☐
5) There is no obvious benefit from using computers in the hospital proportionate to their cost.	☐	☐	☐	☐	☐
6) Computers could interfere in making vital decisions for which doctors are responsible.	☐	☐	☐	☐	☐
7) The managers/administrators feel threatened by this technology and their professionals.	☐	☐	☐	☐	☐
8) The failure of the computer results from over reliance on expensive contract staff and other external assistance. *	☐	☐	☐	☐	☐
9) The financial strain in terms of "waiting for the next five year plan" does not justify the development of the new technology.	☐	☐	☐	☐	☐

SECTION FIVE: Computer Impact Questions:The purpose of this section is to determine whether the computer impact has bee felt by the users. Please use the scale below to indicate to what extent you agree or disagree with the following statements.

	SDA 1	SD 2	Und 3	Agr 4	SA 5
1) Computers are used successfully to Improve administration work in the hospital. *	☐	☐	☐	☐	☐
2) The use of computers provides more detailed information on the effectiveness of care provided.	☐	☐	☐	☐	☐
3) Computers help to make good decisions on hospital issues.	☐	☐	☐	☐	☐
3) The computer system has increased the number of clinical/administrative staff in the hospital.**	☐	☐	☐	☐	☐

5) Comparing the computerised reports and the information you received with non- computerised reports in the past or with which you are familiar.

	SDA 1	SD 2	Und 3	Agr 4	SA 5
5.1- The information is more complete and precise.	☐	☐	☐	☐	☐
5.2- The amount of irrelevant information is decreased.	☐	☐	☐	☐	☐
5.3- The report(s) are more timely.	☐	☐	☐	☐	☐
5.4- Errors in data recording are minimised.	☐	☐	☐	☐	☐
5.5- The report(s) are more easily understood.	☐	☐	☐	☐	☐
5.6- The computer reports are more accurate.	☐	☐	☐	☐	☐
5.7- The information is more up-to-date.	☐	☐	☐	☐	☐
5.8- I am satisfied with the present computer reports.	☐	☐	☐	☐	☐

6) The availability of the computers with their new powerful capabilities influences the hospital management:

	SDA 1	SD 2	Und 3	Agr 4	SA 5
6.1- For major changes on their approach	☐	☐	☐	☐	☐
6.2- In designing a new type of organisational structure.	☐	☐	☐	☐	☐

*** this question has been considered by the researcher as a utilisation question**

**** this question has been considered by the researcher as a fear question**

6.3- In designing new types of organisational relationship.	☐	☐	☐	☐	☐
6.4- On efficient use of hospital resources.	☐	☐	☐	☐	☐
6.5- To monitor the daily operation of the hospital.	☐	☐	☐	☐	☐
6.6- On changing the existing function of hospital's staff.	☐	☐	☐	☐	☐
7) The system helps the users to improve their work.	☐	☐	☐	☐	☐

SECTION SIX: Computer Technical and Performance questions:

1) Has the Hospital or general practice encountered any of the following problems: (Please circle the appropriate number:

	No Significant problems 1	2	.. 3	Significant problems 4	5
1.1- Software	☐	☐	☐	☐	☐
1.2- Hardware	☐	☐	☐	☐	☐
1.3- System response time	☐	☐	☐	☐	☐
1.4- Information utilisation	☐	☐	☐	☐	☐
1.5- Information structure	☐	☐	☐	☐	☐
1.6- Information input/output	☐	☐	☐	☐	☐
1.7- Information storage	☐	☐	☐	☐	☐
1.8- Processing and maintaining computer data	☐	☐	☐	☐	☐

1.9- Other (please specify):______________________________.

2) Evaluation of the computer system's performance: Please use the scale below to indicate to what extent you agree or disagree with the following statements regarding computer performance.

	SDA 1	SD 2	Und 3	Agr 4	SA 5
2.1- The system simple and easy to learn.	☐	☐	☐	☐	☐
2.2- The system is quick to use.	☐	☐	☐	☐	☐
2.3- It is easy to search and analyse prescribing data.	☐	☐	☐	☐	☐
2.4- The reliability of the computer is high.	☐	☐	☐	☐	☐
2.5- The layout of the system in the hospital is efficient	☐	☐	☐	☐	☐
2.6- I am satisfied with computer performance.	☐	☐	☐	☐	☐
3) I am satisfied with the overall management handling of the computer systems.	☐	☐	☐	☐	☐

* If you have any other information or comments about the questionnaire or your system **please write it on the continuation sheet of this questionnaire.**

THANK YOU VERY MUCH FOR YOUR HELP AND YOUR TIME

*** I assure you that all information provided will be treated in the strictest confidence.**

5- APPENDIX E: Letters related to the fieldworks.

TEXT BOUND INTO

THE SPINE

THE UNIVERSITY OF HULL
DEPARTMENT OF COMPUTER SCIENCE
Head of Department: Professor G.R. Brookes
HULL HU6 7RX
England
Telex 592530
Tel. (0482) 465951
LAMPADA FERENS

TO WHOM IT MAY CONCERN

Mr Abdullah Al-Nahdi is a research student in the Computer Science Department at the University of Hull. His research concerns the use of information technology in health care in Oman. He is at present making a study of the use of IT in the British NHS in order to make comparisons with the Omani Health Service. As part of this work, he would like to look in detail at the use of computers in general practice.

As Mr Al-Nahdi's academic supervisor, I am willing to discuss his work in more detail with any of the surgeries who have agreed to help him.

P A Grubb

3 March 1992

. C. A. JARY
B., B.S., M.R.C.G.P.

DR. JEAN COX
B.Med.Sci., M.R.C.P., M.R.C.G.P.

DR. V. A. RAWCLIFFE
M.B., B.S., D.R.C.O.G.

DR. S. KAPUR
M B., CH.B.

ephone (0482) 43390 or 43937

83/85, HALL ROAD, HULL, HU6 8QL

Ref: | Your Ref: | Hospital Ref:

Mr.A.Ahmed Al Nahdi
C/O Ms.P.Grubb
Department of Computer Science
Hull University
Cottingham Road
HULL

Dear Mr Al Nahdi,

23rd March 92.

I am pleased to inform you that the doctors have agreed to your attending the practice, to assist with your study of the EMIS system.

Initially we would like you to consentrate your studies on the administrative department of the practice, and to leave interviewing doctors and reception staff to a later date.

Before beginning your survey, we will require you to sign the enclosed certificate of confidentiality, which is an essential requirement before any information is given.

Please contact me at your earliest convenience in order that a timetable of your requirements is compiled.

Yours Sincerely,

Malcolm Wood
Practice Manager

HUMBERSIDE FAMILY HEALTH

Mr. A. Ahmed Al Nahdi
c/o Ms. P. Grubb
Department of Computer Science
Hull University
Cottingham Road
HULL

32-36 Prospect Street,
Kingston upon Hull, HU2 8PL.
Telephone: (0482) 25281
Fax No: (0482) 587727

RIS/MR

4th February 1992

Please ask for:
Mr. Shand

Dear Abdulla,

Following your recent visit to this office I am pleased to report that I have spoken with management at EMIS and a local practice who use the system. Both are willing to assist you to gain an understanding of the system.

The practice who have agreed to help you are Dr. C.A. Jary and partners who practise at 85 Hall Road, Hull, Tel. 43390. The surgery is situated quite near to where you are at present living.

The practice consists of a partnership of four GPs and your contact is Dr. V.A. Rawcliffe. When you are ready to see the system please make an appointment to see him.

When you wish to go to the EMIS headquarters please give me a call and I will arrange it.

Yours sincerely,

Ian

Information Development
Officer

Humberside Family Health Services Authority
Chairman: Mrs. Veronica M. Pettifer
General Manager: Clive H. Deach

DR. C. A. JARY
M.B., B.S., M.R.C.G.P.

DR. JEAN COX
B.Med.Sci., M.R.C.P., M.R.C.G.P.

DR. V. A. RAWCLIFFE
M.B., B.S., D.R.C.O.G.

DR. S. KAPUR
M.B., CH.B.

Telephone (0482) 43390 or 43937

83/85, HALL ROAD, HULL, HU6 8QL

Our Ref: *Your Ref:*   *Hospital Ref:*

Certificate of Confidentiality.

This is to certify that I Abdulla Ahmed Al Nahdi, will not record or note patient information obtained accidentally whilst carrying out my survey, nor will I transmit any patient information so obtained to a third party, as a result of my studies at this practice.

Abdulla Ahmed Al Nahdi
/3/92.

بسم الله الرحمن الرحيم

Sultan Qaboos University

Office of the Secretary General

جامعة السلطان قابوس

مكتب الأمين العام

Ref : S.Q.U/S.G/

Date : / /141 Hijra

/ /199

الرقم : ج.س.ق/أ.ع/ ٩٥/ ٨٤٦

التاريخ : ١٦ /ربيع الثاني/ ١٤١٧هـ

الموافق : ١٣ / ١٠ / ١٩٩٦م

الفاضل/ مدير الشؤون الادارية والمالية المحترم

المستشفى السلطاني

تحية طيبة ... وبعد ،،،

نود افادتكم بأن الفاضل/ عبدالله النهدى مبتعث من قبل جامعة السلطان قابوس لدراسة شهادة الماجستير فى مجال النظام الادارى للمعلومات (M.I.S) بجامعة هل بالمملكة المتحدة ، وحيث ان المذكور يرغب فى عمل بحث عن الحاسب فى المستشفى السلطاني من خلال الاهداف التالية لبحثه :-

١) دراسة النظام الادارى للمعلومات وتحديد استراتيجيات للتخطيط ولتطوير تكنولوجيا المعلومات .

٢) البحث فى تاثير الكمبيوتر فى المجال الادارى الصحى خاصة وعليها الصحة العمانية عامة .

٣) القيام بالبحث والوصف لنظام الكمبيوتر المستخدم فى المستشفى السلطانى .

آملين منكم مساعدته من خلال تقديم المعلومات التى يحتاجها لبحثه .

وتفضلوا بقبول فائق الاحترام ،،،

[signature]

سعيد بن مبارك المحرمي

مدير مكتب الامين العام

P.O. Box . 32500 Al-Khod
Muscat, Sultanate of Oman
Telex : 5602 SQU ON Cable : Jami'ah
Telephone : 513333
Fax : 513179

صندوق البريد : ٣٢٥٠٠ الخوض
مسقط — سلطنة عُمان
تلكس : ٥٦٠٢ إس كيو يو أوإن - برقيا : جامعة
هاتف : ٥١٣٣٣٣
فاكس : ٥١٣١٧٩

بسم الله الرحمن الرحيم

Sultan Qaboos University
HOSPITAL

مستشفى
جامعة السلطان قابوس

December 23, 1992

To Whom it May Concern:

Please help Mr. Abdullah A. Al Nahdi in his Computer Health Care Investigation.

Your cooperation is needed.

Thank you.

Dr. Nasser M. Al Lamki
Acting Hospital Director

P.O. Box 32488 Al-Khod
Muscat, Sultanate of Oman
Telex: 5602 SQU ON Cable: Jami'ah
Telephone: 513355
Fax: 513009

صندوق البريد : ٣٢٤٨٨ — الخوض
مسقط — سلطنة عُمان
تلكس : ٥٦٠٢ إس كيو يو أوإن - برقيا : جامعة
هاتف : ٥١٣٣٥٥
فاكس : ٥١٣٠٠٩

Sultan Qaboos University
HOSPITAL

مستشفى
جامعة السلطان قابوس

Dtae:29-12-1992

TO : Prof'·S. Lindell
Head of E thic Committee

From : Dr. Nasser Lamki
Acting Hospital Director

Mr. Abdulla Al- Nahdi wants to do research on COUMPUTER with out involving patients. Ihope it is O.K.

THANK YOU

DR.NASSER AL_ LAMKI

P.O. Box 32488 Al-Khod
Muscat, Sultanate of Oman
Telex : 5602 SQU ON Cable : Jami'ah
Telephone : 513355
FAX. : 513009

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صندوق البريد : ٣٢٤٨٨ — الخوض
مسقط — سلطنة عُمان
تلكس : ٥٦٠٢ إس كيو يو اون - برقيا : جامعة
هاتف : ٥١٣٣٥٥
فاكس : ٥١٣٠٠٩

6- APPENDIX F: Tables questionnaire responses for Job Titles.

The Tables in this appendix have been moved from Chapter Six and they include responses to Omani and GPRs questionnaires by job title. There are several abbreviations you may need to understand. These are as follow:

SDA = Strongly Disagree; Und = Undecided; SA = Strongly Agree; Rare = Rare use computer; Some = Sometime use computer; Freq = Frequently use computer; GM = General managers; TM = technical managers; PM = Practice Managers; Rec/Sec = Receptionist / Secretary; 0 = No 1 = Yes;

NsigPr = No Significant problems; ModPr = Moderate problems and SigPr = Significant problems.

Table 1: Omani responses to strategic issues, by job title

Ques Codes	GM % SDA /Und/ SA	TM % SDA /Und/ SA	IT Staff % SDA /Und/ SA	Doctors % SDA /Und/ SA
S3Q1	60 / 0.0 / 40	22.2/ 55.6/ 22.2	50.0 / 16.7/33.3	50.0/ 25.0/ 25.0
S3Q2	60.0 / 40.0 / 0.0	38.9 / 50 / 11.1	50 / 33.3 /16.7	37.5 / 37.5 / 25.0
S3Q3	60.0/20.0 / 20	42. 1/ 31.6/ 26.3	66.7/16.7 / 16.7	62..5/ 12.5 / 25.0
S3Q4	80 / 0.0 / 20	26.3 / 42.1/ 31.6	50.0 / 33.3 /16.7	62.5 / 12.5/ 25
S3Q5	33.3/33.3/33.3	60 / 30 / 10	66.7 / 0.0/ 33.3	55.6 / 33.3/11.1
S3Q6	50.0/ 33.3 / 16.7	50.0/ 38.9 / 11.1	50 / 0.0 / 50	44.4/ 33.3 /-22.2
S3Q7	33.3/33.3/33.3	52.6 / 21.1/ 26.3	50.0 / 16.7/ 33.3	66.7/ 33.3 / 0.0
S3Q8	66.7/ 16.7/ 16.7	65.0/ 10.0/ 25.0	66.7/ 33.3 / 0.0	77.8 / 22.2/ 0.0
S3Q9	50.0/ 33.3 / 16.7	40/ 35 / 25.5	66.7/ 16.7/ 16.7	55.6 / 22.2/ 22.2
S3Q10	83.3/ 16.7/0.0	84.2 / 15.8/ 0.0	83.3 / 0.0/16.7	87.5 / 0.0/12.5
S3Q11	100.0/ 0.0/ 0.0	73.7 / 21.1/5.3	100.0/ 0.0/ 0.0	100.0/ 0.0/ 0.0
Average	61.5 / 20.6/17.9	50.4 / 31.9/ 17.7	63.6 / 15.2 / 21.2	63.7 / 21.1/ 15.3

Table 1: Continued from Table 1

Ques Codes	Sec/Rec % SDA/ Und/ SA	Nurses % SDA /Und/ SA	Others % SDA /Und/ SA
S3Q1	10.0/ 50.0/ 40.0	15.4 / 46.2/ 38.5	44.4 / 27.8 / 27.8
S3Q2	10.0/ 50 / 40.0	28.6/ 42.9 / 28.6	36.1 / 41.7/ 22.2
S3Q3	30/ 20/ 50	21.4 / 21.4 /57.1	52.8 / 19.4/ 27.8
S3Q4	30 / 20 / 50	28.6 / 14.3/ 57.1	52.8 / 19.4/ 27.8
S3Q5	50 / 30 / 20	53.3 / 20/ 26.7	61.1/ 27.8/ 11.1
S3Q6	55.6/ 44.4 / 0.0	46.7 / 33.3 / 20	52.8 / 30.6 /16.7
S3Q7	50 .0 / 50 /0.0	60.0/ 26.7/ 13.3	52.8 / 30.6 /16.7
S3Q8	33.3/ 44.4 / 22.2	76.9/ 23.1/ 0.0	47.2 / 33.3 /19.4
S3Q9	50 / 0.0 / 50	73.3/ 13.3/ 13.3	69.4 / 19.4/11.1
S3Q10	70 / 20 / 10	80.0/ 20.0/ 0.0	86.1 / 13.9/ 0.0
S3Q11	66.7/ 22.2/ 11.1	85.7 / 14.3/ 0.0	77.4 / 19.4/ 3.2
Average	41.3/ 32.0 / 26.7	51.8 / 25.1 / 23.2	57.5 / 25.8 / 16.7

Table 2: GPRS' responses to strategic issues, by job title

Ques Codes	PM % SA / Und / SDA	Doctors % SA / Und / SDA	IT Staff % SA / Und / SDA	Sec/Rec % SA / Und / SDA	Others % SA / Und / SDA
US3Q1	54.5 / 0.0 / 45.5	52.9 / 5.9 / 41.2	100 / 0.0 / 0.0	0.0 / 50 / 50	100 / 0.0 / 0.0
US3Q2	72.7 / 9.1 / 18.2	77.8 / 5.6 / 16.7	100 / 0.0 / 0.0	50 / 0.0 / 50	100 / 0.0 / 0.0
US3Q3	45.5 / 9.1 / 45.5	58.8 / 0.0 / 41.2	66.7 / 33.3 / 0.0	50 / 50 / 0.0	0.0 / 100 / 0.0
US3Q4	90.9 / 0.0 / 9.1	94.1 / 5.9 / 0.0	33.3 / 33.3 / 33.3	50 / 0.0 / 50	0.0 / 0.0 / 100
US3Q5	63.6/ 18.2 / 18.2	88.2 / 0.0 / 11.8	66.7 / 0.0 / 33.3	100 / 0.0 / 0.0	100 / 0.0 / 0.0
Average	65.4/ 7.3 / 27.1	74.4 / 3.5 / 22.2	73.3 / 13.3 / 13.3	50 / 20 / 30	60 / 20 / 20

Table 3: Omanis' responses to utilisation question (S2Q1.1-7), by Job title

	GM % (0 / 1)	TM % (0 / 1)	IT Staff% (0 / 1)	Doctors % (0 / 1)	Rec/Sec % (0 /1)	Nurses % (0 /1)	Others % (0 / 1)
S2Q1.1	16.7/83.3	30/70	33.3/66.7	11.1/88.9	30 /70	20.0/80	61.1/38.9
S2Q1.2	0.0/100	40/60	33.3 / 66.7	66.7/33.3	20.0/80	73.3/26.7	66.7/33.3
S2Q1.3	16.7/83.3	70/30	50 / 50	77.8/22.2	70/30	53.3/46.7	75/25
S2Q1.4	50/50	85.0/15.0	66.7 / 33.3	88.9/11.1	70/30	73.3/26.7	86.1/13.9
S2Q1.5	83.3/16.7	100/0.0	83.3 / 16.7	100/0.0	90/10.0	100/ 0.0	97.2 / 2.8
S2Q1.6	33.3/66.7	45.0/55.0	33.3 / 66.7	77.8/22.2	100/0.0	86.7/13.3	63.9 / 36.1
S2Q1.7	100/0.0	85.0/15.0	50 / 50	88.8/11.1	70/30	93.3/6.7	47.2 / 52.8
Average	42.9/57.1	65/ 35	50 / 50	73 / 27	64.3/5.7	71.4/28.6	71/ 29

Table 4: Omanis' responses to utilisation question (S2Q2.1-7), by job title

Ques Codes	GM % Rare / Some / Freq	TM % Rare / Some / Freq	IT Staff % Rare / Some / Freq	Doctors % Rare / Some / Freq
S2Q2.1	16.7 / 33.3 / 50.0	55.0 / 25.0 / 20.0	66.7/ 33.3 / 0.0	37.5 /12.5 / 50
S2Q2.2	0.0 / 50 / 50.0	5.3 / 21.1/ 73.7	33.3/33..3/ 33.3	12.5 / 50 /37.5
S2Q2.3	16.7 / 66.7 / 16.7	22.2 / 33.3 / 44.4	33.3 / 50 / 16.7	11.1 / 33.3 / 55.6
S2Q2.4	0.0 / 16.7 / 83.3	11.1 / 22.2 / 66.7	16.7 / 33.3 / 50	0.0 / 22.2 / 77.8
S2Q2.5	0.0 / 0.0 / 100.0	5.6 / 16.7 / 77.8	0.0 / 50 / 50	0.0 / 0.0 / 100.0
S2Q2.6	0.0 / 33.3 / 66.7	11.8 / 58.9 / 29.4	16.7 / 66.7 / 16.7	12.5 / 37.5 / 50
S2Q2.7	0.0 / 0.0 / 100.0	5.3 / 0.0 / 94.7	0.0 / 16.7 / 83.3	0.0 / 11.1 / 88.9
Average	4.8 / 28.6 / 66.7	16.6 / 25.3 / 58.1	23.8 / 40.5 / 35.7	10.5 / 23.8 / 65.7

Table 4: Continued for Table 4

Ques Codes	Sec/Rec % Rare / Some / Freq	Nurses % Rare / Some / Freq	Others % Rare / Some / Freq
S2Q2.1	50 / 10.0 / 40	21.4 / 14.3 / 64.3	74 / 11.4 / 14.3
S2Q2.2	30 / 20.0 / 50	6.7 / 33.3 / 60	8.6 / 60 / 31.4
S2Q2.3	10.0 / 60 / 30	6.7 / 26.7 / 66.7	27.8 / 47.2 / 25.0
S2Q2.4	0.0 / 10.0 / 90	0.0 / 6.7 / 93.3	16.7 / 11.1 / 72.2
S2Q2.5	0.0 / 10.0 / 90	0.0 / 14.3 / 85.7	5.6 / 13.9 / 80.6
S2Q2.6	11.1 / 66.7 / 22.2	0.0 / 33.3 / 66.7	13.9 / 63.9 / 22.2
S2Q2.7	0.0 / 0.0 / 100	0.0 / 0.0 / 100	2.8 / 13.9 / 83.3
Average	14.4 / 25.2 / 60.3	5.0 / 18.4 / 76.6	21.3 / 31.6 / 47.0

Table 5: Omanis' responses to utilisation question (S2Q3.1-7), by job title

Ques Codes	GM % (0 / 1)	TM % (0 /1)	IT Staff % (0/1)	Doctors % (0/1)	Rec/Sec % (0/1)	Nurses % (0/1)	Others % (0 /1)
S2Q3.1	0.0 / 100	5.0 / 95	16.7/ 83.3	22.2/77.8	0.0 / 100	20.0/ 80	22.2 / 77.8
S2Q3.2	50 / 50	60 / 40	50 / 50	88.9/11.1	50 / 50	60 / 40	69.4/ 30.6
S2Q3.3	66.7 / 33.3	70 / 30	50 / 50	88.9/11.1	70 / 30	73.3/26.7	86.1/ 13.9
S2Q3.4	0.0 / 100	30/ 70	0.0 /100	77.8/22.2	70 / 30	46.7/53.3	47.2/ 52.8
S2Q3.5	66.7 / 33.3	35 / 65	16.7/83.3	44.4/55.6	70/ 30	46.7/53.3	38.9/ 61.1
S2Q3.6	50 / 50	85 / 15.0	16.7/83.3	66.7/ 33.3	70 / 30	53.3/46.7	66.7/ 33.3
S2Q3.7	83.3 / 16.7	60 / 40	100 / 0.0	77.8/22.2	100 / 0.0	93.3 / 6.7	69.4/ 30.6
Tot% Avrg	45.2/54.8	49.3/50.7	35.7/ 64.3	66.7/33.3	61.4/ 38.6	56.2/43.8	57.1/42.9

Table 6: Omanis' responses to utilisation question (S2Q4), by job title

Ques Codes	GM % 25% / 50% / 75%	TM % 25% / 50% / 75%	IT Staff % 25% / 50% / 75%	Doctors % 25% / 50% / 75%
S2Q4	16.7 / 33.3 / 50.0	0.0 /11.1 / 88.9	0.0/ 3.3 / 16.7	11.1/11.1/ 77.8

Table 6: Continued from Table 6

Ques Codes	Sec/Rec % 25% / 50% / 75%	Nurses % 25% / 50% / 75%	Others % 25% / 50% / 75%
S2Q4	10.0 /0.0 / 90	20./13.3 / 66.7	8.3/47.2 / 44.4

Table 7: GPRs' responses to utilisation question (US2Q1.1-7), by job title

Ques Codes	PM % (0 / 1)	Doctor % (0 / 1)	IT Staff % (0 /1)	Rec/Sec % (0 / 1)	Others % (0 / 1)
US2Q1.1	0.0 / 100	16.7 / 83.3	33.3 / 66.7	0.0 / 100	100 / 0.0
US2Q1.2	18.2/ 81.8	16.7 / 83.3	0.0 / 100	50 / 50	0.0 / 100
US2Q1.3	0.0 / 100	5.6 / 94.4	0.0 / 100	0.0 / 100	0.0 / 100
US2Q1.4	27.3 / 72.7	38.9 / 61.1	33.3 / 66.7	50 / 50	0.0 / 100
US2Q1.5	9.1 / 90.9	11.1 / 88.9	66.7 / 33.3	50 / 50	0.0 / 100
US2Q1.6	9.1 / 90.9	22.2 / 77.8	33.3 / 66.7	50 / 50	0.0 / 100
US2Q1.7	45.5 / 54.5	44.4 / 55.6	66.7 / 33.3	50 / 50	100 / 0.0
Average	15.6/ 84.4	22.2 / 77.8	33.3/ 66.7	35.7/ 64.3	28.6 / 71.4

Table 8: GPRs' responses to utilisation question (US2Q2.1-7), by job title

Ques Codes	PM % Rare/Somt/Freq	Doctors % Rare/Somt/Freq	IT Staff % Rare/Somt/Freq	Sec/Rec % Rare/Somt/Freq	Others % Rare/Somt/Freq
US2Q2.1	0.0 / 27.3 / 72.7	6.7 / 20.0 / 73.3	66.7/ 0.0 / 33.3	50 / 50 / 0.0	0.0 / 0.0 / 100
US2Q2.2	18.2 / 9.1 / 72.7	16.7/ 22.2/ 61.1	33.3/33..3/ 33.3	0.0 / 50 / 50	0.0 / 0.0 / 100
US2Q2.3	9.1 / 0.0 / 90.9	5.6 / 5.6 / 88.9	0.0 / 33.3 / 66.7	0.0 / 0.0 / 100	0.0 / 0.0 / 100
US2Q2.4	9.1 / 18.2 / 72.7	11.1/ 22.2/ 66.7	33.3 / 33.3 / 33.3	0.0 / 0.0 / 100	0.0 / 100 / 0.0
US2Q2.5	18.2/36.4 / 45.5	11.8/ 41.2/ 47.1	33.3 / 33.3 / 33.3	0.0/ 0.0/ 100	0.0 / 0.0 / 100
US2Q2.6	81.8 / 18.2 / 0.0	82.4 / 17.6/ 0.0	100 / 0.0 / 0.0	0.0 / 50 / 50	100 / 0.0 / 0.0
US2Q2.7	20.0/ 20.0/ 60.0	14.3 /57.1/ 28.6	33.3 / 0.0 / 66.7	0.0 / 50 / 50	0.0 / 0.0/ 100
Average	22.3/ 18.5/ 59.2	21.2/ 26.6/ 52.2	42.8 / 19.0 / 38.1	7.1/ 28.6 / 64.3	14.3 / 14.3 / 71.4

Table 9: GPRs' responses to utilisation question (US2Q3.1-7), by job title

Ques Codes	PM % (0 / 1)	Doctors % (0 / 1)	IT Staff % (0 / 1)	Rec/Sec % (0 / 1)	Others % (0 / 1)
US2Q3.1	72.7 / 27.3	100 / 0.0	66.7 / 33.3	50.0 / 50.0	100 /0.0
US2Q3.2	90.9 / 9.1	94.4 / 5.6	100 / 0.0	100 / 0.0	100 / 0.0
US2Q3.3	81.8 / 18.2	66.7 / 33.3	100 / 0.0	50 / 50	100 / 0.0
US2Q3.4	36.4 / 63.6	16.7 / 83.3	33.3 / 66.7	50 / 50	100 / 0.0
US2Q3.5	27.3 / 72.7	55.6 / 44.4	33.3 / 66.7	50/ 50	100 / 0.0
US2Q3.6	72.7 / 27.3	77.8 / 22.2	66.7 / 33.3	100 / 0.0	100 / 0.0
US2Q3.7	81.8 / 18.2	61.1 / 38.9	66.7 / 33.3	100 / 0.0	100 / 0.0
Average	66.2% /33.8%	67.5% /32.5%	66.8% /33.3%	71.4%/28.6%	100% / 0.0%

Table 10: GPRs' responses to utilisation question (US2Q4), by job title

Ques Codes	PM % poor/avrge/good	Doctor % poor/avrge/good	IT Staff % poor/avrge/good	Sec/Rec % poor/avrge/good	Others % poor/avrge/good
US2Q4	70 / 10 / 20	25 / 18.8 / 56.3	33.3 / 33.3 / 33.3	0.0 / 100 / 0.0-	0.0 / 0.0 / 100

Table 11: Omanis' responses for fear questions, by job title

Ques Codes	GM % SDA / Und / SA	TM % SDA / Und / SA	IT Staff % SDA / Und / SA	Doctors % SDA / Und / SA
S4Q1	0.0/66.7/33.3	45.0/35.0 /20.0	50/33.3/16.7	33.3/22.2/44.4
S4Q2	83.3/0.0 / 16.7	75.0/ 15.0/10.0	50.0/33..3/ 16.7	66.7/11.1/ 22.2
S4Q3	33.3/ 50.0/ 16.7	50.0/ 25.0/ 25.0	66.7/ 16.7/ 16.7	22.2/ 33.3 / 44.4
S4Q4	0.0/ 16.7/ 83.3	20.0/ 15.0/ 65.0	16.7/ 16.7/ 66.7	0.0/ 0.0/ 100
S4Q5	83.3/ 16.7/ 0.0	70.0/ 25.0/ 5.0	83.3/ 0.0/ 16.7	44.4/ 11.1/ 44.4
S4Q6	66.7/ 16.7/ 16.7	50.0/ 30.0/ 20.0	66.7/ 33.3/ 0.0	55.6/ 11.1/ 33.3
S4Q7	83.3/ 16.7/ 0.0	35.0/ 30.0/ 35.0	50.0/ 33.3/ 16.7	22.2/ 66.7/ 11.1
S3Q8	0.0 / 20.0/ 80.0	31.6 / 26.3 / 42.1	33.3 / 16.7/ 50.0	0.0 / 44.4/ 55.6
S4Q9	0.0/ 33.3/ 66.7	20.0/ 20.0/ 60.0	0.0/ 33.3/ 66.7	0.0/ 25.0/ 75.0
Average	38.8 / 26.3/ 34.9	44.0/ 24.6/ 31.4	46.2/ 24.1/ 29.7	27.2 / 25.0/ 47.9

Table 11: Continued from Table 11

Ques Codes	Sec/Rec % SDA / Und / SA	Nurses % SDA / Und / SA	Others % SDA / Und / SA
S4Q1	10.0/ 40.0/50.0	40.0/13.3/46.7	19.4/47.2/ 33.3
S4Q2	44.4/ 22.2/ 33.3	66.7/ 13.3/20.0	42.9/ 48.6/ 8.6
S4Q3	30.0/ 30.0/ 40.0	23.1/ 15.4/ 61.5	38.2/ 32.4/ 29.4
S4Q4	10.0/ 30.0/ 60.0	0.0/ 7.1/ 92.9	8.3/ 25.0/ 66.7
S4Q5	77.8/ 11.1/ 11.1	69.2/ 23.0 / 7.7	69.7/ 18.2/ 12.1
S4Q6	44.4/ 44.4/ 11.1	60.0/ 20.0/ 20.0	54.8/ 45.2/ 0.0
S4Q7	60.0/ 20.0/ 20.0	53.3/ 26.7/ 20.0	36.1/ 44.4/ 19.4
S3Q8	10 / 40 / 50	6.7/ 26.7/ 66.7	16.7 / 38.9 /44.4
S4Q9	20.0/ 40.0/ 40.0	6.7/ 26.7/ 66.7	11.1/ 30.6/ 58.3
Average	38.5/ 30.8/ 30.6	42.9/ 19.1/ 38.0	33.0 / 36.7/ 30.3

Table 12: GPRs' responses to fear questions, by job title

Ques Codes	PM % SDA / Und / SA	Doctors % SDA / Und / SA	IT Staff % SDA/ Und / SA	Sec/Rec % SDA / Und / SA	Others % SDA / Und / SA
US4Q1	54.5/18.2/27.3	64.7/17.6/17.6	33.3/33.3/33.3	0.0/50.0/50.0	100/ 0.0/ 0.0
US4Q2	63.6/9.1/27.3	72.2/11.1/16.7	66.7/0.0/33.3	50.0/50.0/0.0	100/ 0.0/ 0.0
US4Q3	27.3/36.4/36.4	22.2/22.2/55.6	0.0/0.0/100	0.0/0.0/100	0.0/ 0.0/ 100
US4Q4	0.0/9.1/90.9	0.0/16.7/83.3	0.0/0.0/100	50.0/0.0/50.0	0.0/ 0.0/ 100
US4Q5	63.6/27.3/9.1	61.1/27.8/11.1	100/0.0/0.0	0.0/0.0/100	100/ 0.0/ 0.0
US4Q6	81.8/18.2/0.0	55.6/22.2/22.2	66.7/0.0/33.3	100/0.0/0.0	100/ 0.0/ 0.0
US4Q7	18.2/45.5/36.4	5.9/47.1/47.1	0.0/0.0/100	0.0/0.0/100	0.0/ 100/ 0.0
US4Q8	9.1/45.5/45.5	5.9/35.3/58.8	33.3/66.7/0.0	0.0/100/0.0	0.0/100/ 0.0
US4Q9	0.0/27.3/72.7	5.6/11.1/83.3	0.0/0.0/100	0.0/0.0/100	0.0/ 0.0/ 100
Average	35.3/26.3/38.4	32.6/23.4/44	33.3/11.1/55.5	22.2/22.2/55.6	44.4/ 22.2/ 33.3

Table 13: Omanis' responses to impact questions, by job title

Ques Codes	GM % SDA / Und / SA	TM % SDA / Und / SA	IT Staff % SDA / Und / SA	Doctors % SDA / Und / SA
S5Q1	0.0 / 0.0 /100	20.0/ 30.0/ 50.0	33.3/ 33.3/ 33.3	22.2/ 0.0/ 77.8
S5Q2	0.0/ 0.0/ 100	15.8/ 15.8/ 68.4	16.7/ 33.3/ 50.0	11.1/ 22.2/ 66.7
S5Q3	0.0/ 16.7/ 83.3	26.3/ 36.8/ 36.8	0.0/ 33.3/ 66.7	25.0/ 12.5/ 62.5
S5Q4	16.7/ 16.7/ 66.7	35.0/ 20.0/ 45.0	33.3/ 16.7/ 50.0	22.2/ 0,0/ 77.8
S5Q5.1	0,0/ 0,0/ 100	15.8/ 15.8/ 68.4	0.0/ 16.7/ 83.3	12.5/ 37.5/ 50.0
S5Q5.2	0.0/ 0.0/ 100	16.7/ 33.3/ 50.0	33.3/ 16.7/ 50.0	42.9/ 0.0/ 57.1
S5Q5.3	0.0/ 0.0/ 100	15.8/ 21.1/ 63.2	0.0/ 16.7/ 83.3	22.2/ 11.1/ 66.7
S5Q5.4	0.0/ 16.7/ 83.3	10.5/ 5.3/ 84.2	0.0/ 0.0/ 100	33.3/ 22.2/ 44.4
S5Q5.5	0.0/ 0.0/ 100	5.3/ 0.0/ 94.3	16.7/ 0.0/ 83.3	37.5/ 0.0/ 62.5
S5Q5.6	0.0/ 0.0/ 100	10.5/ 10.5/ 78.9	16.7/ 16.7/ 66.7	28.6/ 14.3/ 57.1
S5Q5.7	0.0/ 16.7/ 83.3	5.3/ 21.1/ 73.7	33.3/ 0.0/ 66.7	25.0/ 12.5/ 62.5
Average	1.5/ 6.1/ 92.4	16.1/ 19.1/ 64.8	16.7/ 16.7/66.7	25.7/ 12.0/ 62.3

Table 13: Continued from Table 13

Ques Codes	Sec/Rec % SDA / Und / SA	Nurses % SDA / Und / SA	Others % SDA / Und / SA
S5Q1	10.0/ 20.0/ 70.0	26.7/ 13.3/ 60.0	11.1/ 30.6/ 58.3
S5Q2	0.0/ 10.0/ 90.0	6.7/ 13.3/ 80.0	8.3/ 13.9/ 77.8
S5Q3	20.0/ 20.0/ 60.0	15.4/ 23.1/ 61.5	16.7/ 30.6/ 52.8
S5Q4	40.0/ 0.0/ 60.0	33.3/ 20.0/ 46.7	27.8/ 16.7/ 55.6
S5Q5.1	10.0/ 20.0/ 70.0	00.0/ 13.3/ 86.7	0.0/ 27.8/ 72.2
S5Q5.2	20.0/ 0.0/ 80.0	14.3/ 21.4/ 64.3	8.3/ 33.3/ 58.3
S5Q5.3	0.0/ 30.0/ 70.0	0.0/ 26.7/ 73.3	0.0/ 19.4/ 80.6
S5Q5.4	0.0/ 10.0/ 90.0	0.0/ 20.0/ 80.0	2.8/ 19.4/ 77.8
S5Q5.5	0.0/ 0.0/ 100	6.7/ 20.0/ 73.3	11.1/ 5.6/ 83.3
S5Q5.6	10.0/ 10.0/ 80.0	13.3/ 6.7/ 80.0	5.6/ 22.2/ 72.2
S5Q5.7	10.0/ 20.0/ 70.0	13.3/ 20.0/ 66.7	5.6/ 13.9/ 80.6
Average	10.9/ 12.7/ 76.4	11.8/ 18.0/ 70.2	8.8/ 21.2/ 70.0

Table 14: Omanis' responses to impact questions, by job title

Ques Codes	GM % SDA / Und / SA	TM % SDA / Und / SA	IT Staff % SDA / Und / SA	Doctors % SDA / Und / SA
S5Q6.1	16.7/ 16.7/ 66.7	30.0/ 35.0/ 35.0	33.3/ 0.0/ 66.7	50.0/ 12.5/ 37.5
S5Q6.2	16.7/ 16.7/ 66.7	25.0/ 40.0/ 35.0	33.3/ 0.0/ 66.7	37.5/ 25.0/ 37.5
S5Q6.3	16.7/ 16.7/ 66.7	25.0/ 40.0/ 35.0	33.3/ 0.0/ 66.7	50.0/ 12.5/ 37.5
S5Q6.4	0.0/ 16.7/ 83.3	20.0/ 30.0/ 50.0	33.3/ 0.0/ 66.7	37.5/ 0.0/ 62.5
S5Q6.5	0.0/ 16.7/ 83.3	25.0/ 25.0/ 50.0	33.3/ 16.7/ 50.0	37.5/ 12.5/ 50.0
S5Q6.6	0.0/ 20.0/ 80.0	35.0/ 50.0/ 15.0	33.3/ 16.7/ 50.0	50.0/ 25.0/ 25.0
S5Q7	0.0/ 0.0/ 100	20.0/ 0.0/ 80.0	0.0/ 16.7/ 83.3	25.0/ 12.5/ 62.5
Average	7.2/ 14.8/ 78.0	25.7/ 31.4/ 42.9	28.5/ 7.2/ 64.3	41.1/ 14.3/ 44.6

Table 14: Continued from Table 14

Ques Codes	Sec/Rec % SDA / Und / SA	Nurses % SDA / Und / SA	Others % SDA / Und / SA
S5Q6.1	20.0/ 20.0/ 60.0	7.7/ 23.1/ 69.2	27.8/ 41.7/ 30.6
S5Q6.2	30.0/ 20.0/ 50.0	23.1/ 30.8/ 46.2	19.4/ 50.0/ 30.6
S5Q6.3	20.0/ 10.0/ 70.0	23.1/ 23.1/ 53.8	25.0/ 47.2/ 27.8
S5Q6.4	30.0/ 10.0/ 60.0	15.4/ 7.7/ 76.9	19.4/ 27.8/ 52.8
S5Q6.5	20.0/ 10.0/ 70.0	7.7/ 15.4/ 76.9	22.9/ 28.6/ 48.6
S5Q6.6	20.0/ 20.0/ 60.0	15.4/ 30.8/ 53.8	19.4/ 38.9/ 41.7
S5Q7	20.0/ 10.0/ 70.0	7.7/ 15.4/ 76.9	2.9/ 11.8/ 85.3
Average	22.9/ 14.3/ 62.9	14.3/ 20.9/ 64.8	19.5/ 35.1/ 45.3

Table 15: GPRs' responses to impact questions, by job title

Ques Codes	PM % SDA / Und / SA	Doctors % SDA / Und / SA	IT Staff % SDA / Und / SA	Sec/Rec % SDA / Und / SA	Others % SDA / Und / SA
US5Q1	18.2 / 27.3 / 54.5	11.1 / 11.1/ 77.8	33.3 / 33.3 / 33.3	0.0 / 50.0 / 50.0	0.0 / 0.0 / 100
US5Q2	18.2 / 36.4 / 45.5	11.1 / 22.2 / 66.7	0.0 / 100 / 0.0	0.0 / 50.0 / 50.0	0.0 / 0.0 / 100
US5Q3	63.6 / 36.4 / 0.0	55.6 / 44.4 / 0.0	66.7 / 33.3 / 0.0	100 / 0.0 / 0.0	0.0 / 0.0 / 100
US5Q4	9.1 / 90.0 / 0.0	66.7 / 33.3 / 0.0	33.3 / 66.7/ 0.0	50.0 /50.0 / 0.0	0.0 / 100 / 0.0
US5Q5.1	0.0 / 45.5 / 54.5	5.9 / 23.5 / 70.6	0.0 / 0.0 /100	0.0 / 50.0 / 50.0	0.0 / 0.0 / 100
US5Q5.2	36.4 / 27.3 / 36.4	29.4 / 29.4 / 41.2	0.0 / 33.3/66.7	50.0 / 0.0 / 50.0	0.0 / 100 / 0.0
US5Q5.3	18.2 / 18.2 / 63.6	6.3 / 31.3 / 62.5	33.3 / 0.0/66.7	0.0 / 0.0 / 100	0.0 / 0.0 / 100
US5Q5.4	36.4 / 36.4 / 27.3	35.3 / 11.8 / 52.9	0.0 / 33.3/66.7	50.0 / 0.0 / 50.0	0.0 / 0.0 / 100
US5Q5.5	36.4 / 9.1 / 54.5	12.5 / 18.8 / 68.8	0.0 / 33.3/66.7	0.0 / 50.0 / 50.0	0.0 / 100 / 0.0
US5Q5.6	9.1 / 36.4 / 54.5	12.5 / 25.0 / 62.5	33.3 / 0.0/66.7	50.0 / 50.0 / 0.0	0.0 / 0.0 / 100
US5Q5.7	18.2 / 18.2 / 63.6	5.9 / 11.8 / 82.4	0.0 / 33.3/66.7	0.0 / 50.0 / 50.0	0.0 / 0.0 / 100
Average	24 / 34.7/ 41.3	22.9 / 23.8 / 53.2	18.2 / 33.3/48.5	27.3 / 31.8 / 41	0.0 / 27.3 / 72.7

Table 16: Omanis' responses to satisfaction questions, by job title

Ques Codes	Gen Mgmt % SDA / Und / SA	Tech Mgmt % SDA / Und / SA	IT Staff % SDA / Und / SA	Doctors % SDA / Und / SA
S5Q5.8	0.0/ 0.0/ 100	21.1/ 10.5/ 68.4	33.3/ 16.7/ 50.0	55.6/ 0.0/ 44.4
S6Q2.6	33.3/33.3/33.3	40.0/15.0/45.0	33.3/ 16.7/ 50.0	75.0/ 12.5/ 12.5
S6Q3	16.7/ 0.0/ 83.3	35.0/ 30.0/ 35.0	66.7/ 16.7/ 16.7	42.9/ 57.1/ 0.0
Average	16.7/ 11.1/ 72.2	32.0/ 18.5/ 49.5	44.4/ 16.7/ 38.9	57.8/ 23.2/ 19

Table 16: Continued from Table 16

Ques Codes	Sec/Rec % SDA / Und / SA	Nurses % SDA / Und / SA	Others % SDA / Und / SA
S5Q5.8	10.0/ 20.0/ 70.0	13.3/ 20.0/ 66.7	8.3/ 19.4/ 72.2
S6Q2.6	22.2 / 33.3 / 44.4	28.6 / 28.6 / 42.9	13.9 / 36.1/ 50.0
S6Q3	20.0/ 50.0/ 30.0	40.0/ 20.0/ 40.0	55.6/ 25.0/ 19.4
Average	17.4/ 34.4/ 48.1	27.3/ 22.9/ 49.7	25.9/ 26.8/ 47.2

Table 17: GPRs' responses to satisfaction questions, by job title

Ques Codes	Pract Mgmt % SDA / Und / SA	Doctors % SDA / Und / SA	IT Staff % SDA / Und / SA	Sec/Rec % SDA / Und / SA	Others % SDA / Und / SA
US5Q5.8	9.1 / 54.5 / 36.4	12.5 / 25.0 / 62.5	33.3 / 66.7 / 0.0	0.0 / 0.0 / 100	0.0 / 0.0 / 100
US6Q2	36.4/ 0.0/ 63.6	16.7/ 0.0/ 83.3	33.3/ 0.0/ 66.7	0.0/ 0.0/ 100	0.0/ 0.0/ 100
Average	22.8/ 27.3/ 50	14.6/ 12.5/ 72.9	33.3/ 33.4 / 33.3	0.0/ 0.0/ 100.0	0.0/ 0.0/ 100

Table 18: Omanis' responses to questions (S6Q1.1-8), by job title

Ques Codes	GM % NSigPr/ModPr/SigPr	TM % NSigPr/ModPr/SigPr	IT Staff % NSigPr/ModPr/SigPr	Doctors % NSigPr/ModPr/ SigPr
S6Q1.1	33.3/ 66.7/ 0.0	47.4/ 31.6/ 21.1	33.3/ 50.0/ 16.7	25.0/ 12.5/ 62.5
S6Q1.2	66.7/ 16.7/ 16.7	36.8/ 31.6/ 31.6	33.3/ 33.3/ 33.3	25.0/ 25.0/ 50.0
S6Q1.3	16.7 / 50.0/ 33.3	25.0 / 30.0/ 45.0	0.0 / 16.7/ 83.3	0.0 / 33.3/ 66.7
S6Q1.4	33.3/ 50.0/ 16.7	31.6/ 31.6/ 36.8	0.0/ 83.3/ 16.7	25.0/ 12.5/ 62.5
S6Q1.5	33.3/ 50.0/ 16.7	44.4/ 27.8/ 27.8	16.7/ 83.3/ 0.0	12.5/ 25.0/ 62.5
S6Q1.6	33.3/ 50,0/ 16.7	55.6/ 22.2/ 22.2	16.7/ 33.3/ 50.0	12.5/ 25.0/ 62.5
S6Q1.7	40.0/ 40.0/ 20.0	42.1/ 31.6/ 26.3	33.3/ 33.3/ 33.3	37.5 / 37.5/ 25.0
S6Q1.8	50.0/ 33.3/ 16.7	50.0/ 25.0/ 25.0	33.3/ 66.7/ 0.0	71.4/ 0.0/ 28.6
Average	37.4 / 45.3 / 17.3	41.7 / 29 / 29.3	27.3 / 45.8/ 26.8	30.1 / 22.8 / 47

Table 18: Continued from Table 18

Ques Codes	Sec/Rec % NSigPr/ModPr/SigPr	Nurses % NSigPr/ModPr/ SigPr	Others % NSigPr/ModPr/SigPr
S6Q1.1	50.0/ 40.0/ 10.0	50.0/ 14.3/ 35.7	16.7/ 36.1/ 47.2
S6Q1.2	70.0/ 20.0/ 10.0	57.1/ 28.6/ 14.3	50.0/ 22.2/ 27.8
S6Q1.3	20.0/ 40.0/ 40.0	33.3/ 13.3/ 53.3	20.0/ 20.0/ 60.0
S6Q1.4	40.0/ 40.0/ 20.0	20.0/ 33.3/ 46.7	37.1 / 28.6/ 34.4
S6Q1.5	70.0/ 20.0/ 10.0	60.0/ 26.7/ 13.3	53.1/ 40.6/ 6.3
S6Q1.6	50.0/ 30.0/ 20.0	33.3/ 33.3/ 33.3	19.4/ 55.6/ 25.0
S6Q1.7	77.8/ 11.1/ 11.1	53.3/ 33.3/ 13.3	58.3/ 22.2/ 19.4
S6Q1.8	20.0/ 30,0/ 50.0	46.7/ 20.0/ 33.3	40.0/ 40.0/ 20.0
Average	48.3/ 30.3 / 21.5	45 / 23.9 / 31.1	39 / 31.6 / 29.4

Table 19: Omanis' responses to questions (S6Q2.1-7), by job title

Ques Codes	GM % SDA /Und / SA	TM % SDA /Und / SA	IT Staff % SDA /Und / SA	Doctors % SDA /Und / SA
S6Q2.1	0.0 / 16.7 / 83.3	20.0 / 5.0 / 75.0	0.0 / 0.0 / 100	22.2 / 0.0 / 77.8
S6Q2.2	33.3 / 33.3 / 33.3	63.2 / 0.0 / 36.8	16.7 / 16.7 / 66.7	77.8 / 11.1 / 11.1
S6Q2.3	50.0 / 25.0 / 25.0	15.8 / 36.8 / 47.4	16.7 / 16.7 / 66.7	50.0 / 37.5 / 12.5
S6Q2.4	0.0 / 33.3 / 66.7	20.0 / 20.0 / 60.0	16.7 / 33.3 / 50.0	25.0 / 37.5 / 37.5
S6Q2.5	0.0 / 33.3 / 66.7	21.1 / 10.5 / 68.4	33.3 / 16.7 / 50.0	50.0 / 25.0 / 25.0
Average	16.7 / 28.3 / 55	28.0 / 14.5 / 57.5	16.7 / 16.7 / 66.7	45 / 22.2 / 32.8

Table 19: Continued from Table 19

Ques Codes	Sec/Rec % SDA /Und / SA	Nurses % SDA /Und / SA	Others % SDA /Und / SA
S6Q2.1	0.0 / 10.0 / 90.0	0.0 / 6.7 / 93.3	5.6 / 19.4 / 75.0
S6Q2.2	30.0 / 0.0 / 70.0	20.0 / 6.7 / 73.3	33.3 / 11.1 / 55.6
S6Q2.3	0.0 / 22.2 / 77.8	7.7 / 30.8 / 61.5	32.4 / 41.2 / 26.5
S6Q2.4	11.1 /44.4 / 44.4	6.7 / 33.3 / 60.0	9.1 / 48.5 / 42.4
S6Q2.5	12.5 / 37.5 / 50.0	6.7 / 33.3 / 60.0	14.7 38.2 / 47.1
Average	10.7 / 22.8 / 66.4	8.2 / 22.2 / 69.6	19.0 / 31.7 / 49.3

Table 20: GPRs' responses to questions (US6Q1.1-8), by job title

Ques Codes	Pract Mger % NSigPr/ModPr/SigPr	Doctors % NSigPr/ModPr/SigPr	IT Staff % NSigPr/ModPr/SigPr	Sec/Rec % NSigPr/ModPr/SigPr	Others % NSigPr/ModPr/SigPr
US6Q1.1	54.5/ 0.0/ 45.5	77.8/ 5.6/ 16.7	66.7/ 0.0/ 33.3	50.0/ 50.0/ 0.0	0.0/ 100/ 0.0
US6Q1.2	72.7/ 9.1/ 18.2	94.4/ 5.6/ 0.0	100/ 0.0/ 0.0	100/ 0.0/ 0.0	0.0/ 100/ 0.0
US6Q1.3	27.3/ 36.4 / 36.4	38.9/ 33.3 / 27.8	33.3/ 0.0 / 66.7	50.0 / 0.0 / 50.0	100 / 0.0 / 0.0
US6Q1.4	54.5/ 18.2/ 27.3	88.9 / 11.1/ 0.0	66.7 / 0.0/ 33.3	50.0 / 0.0 / 50.0	0.0 /100 / 0.0
US6Q1.5	54.5 / 18.2 / 27.3	83.3/ 5.6/ 11.1	100/ 0.0/ 0.0	50.0 / 0.0/ 50.0	0.0/ 100/ 0.0
US6Q1.6	63.6 / 9.1/ 27.3	88.9/ 5.6/ 5.6	66.7/ 0.0/ 33.3	50.0/ 0.0/ 50.0	0.0/ 100/ 0.0
US6Q1.7	70.0/ 0.0/ 30.0	88.9/ 5.6/ 5.6	66.7/ 0.0/ 33.3	50.0/ 0.0/ 50.0	0.0/ 100/ 0.0
US6Q1.8	72.7/ 18.2/ 9.1	83.3/ 11.1 / 5.6	66.7/ 0.0/ 33.3	50.0/ 0.0/ 50.0	0.0/ 100/ 0.0
Average	55.8/ 16.5/ 27.7	74.2/ 13.4/12.7	69.8/ 0.0/ 30.2	56.3/ 6.3/ 37.5	12.5/ 87.5/ 0.0

Table 21: Omanis' responses to questions (S1Q2.1-6), by job title

Ques Codes	GM % (0 / 1)	TM % (0 / 1)	IT Staff % (0 / 1)	Doctors % (0 / 1)	Rec/Sec % (0 / 1)	Nurses % (0 / 1)	Others % (0 / 1)
S1Q1.1	33.3 / 66.7	40.0 / 60.0	33.3/ 66.7	66.7 / 33.3	60.0 / 40.0	60.0 / 40.0	52.8 / 47.2
S1Q1.2	66.7 / 33.3	60.0 / 40.0	0.0 / 100	77.8 / 22.2	70.0 / 30.0	93.3 / 6.7	83.3 / 16.7
S1Q1.3	66.7 / 33.3	70.0 / 30.0	16.7 / 83.3	77.8 / 22.2	70.0 / 30.0	100.0 / 0.0	91.7 / 8.3
S1Q1.4	66.7 / 33.3	55.0 / 45.0	16.7 / 83.3	77.8 / 22.2	80.0 / 20.0	93.3/ 6.7	91.7 / 8.3
S1Q1.5	83.3 / 16.7	80.0 / 20.0	16.7 / 83.3	88.9 / 11.1	80.0 / 20.0	93.3 / 6.7	94.4 / 5.6
S1Q1.6	100.0 /0.0	100 / 0.0	83.3 / 16.7	100 / 0.0	90.0 / 10.0	100 / 0.0	91.7/ 8.3
Average	69.5 / 30.5	67.5 / 32.5	27.9 / 72.2	81.5 / 18.5	75 / 25	90 / 10.0	84.2 / 15.7

Table 22: Omanis' responses to questions (S1Q3 & S1Q4), by job title

Ques Codes	GM % SA/Und/SDA	TM % SA/Und/SDA	IT Staff % SA/Und/SDA	Doctors % SA/Und/SDA
S1Q3	33.3/0.0/66.7	45.0/0.0/50.0	16.7/16.7/66.7	0.0/37.5/62.5
S1Q4	50.0/0.0/50.0	50.0/30.0/20.0	66.7/0.0/33.3	37.5/62.5/0.0
Average	41.7/0.0/58.4	47.5/15.0/35.5	41.7/8.4/50	18.8/50/31.3

Table 22: Continued from Table 22

Ques Codes	Sec/Rec % SA/Und/SDA	Nurses % SA/Und/SDA	Others % SA/Und/SDA
S1Q3	22.2/22.2/55.6	30.8/15.4/53.8	38.9/22.2/38.9
S1Q4	44.4/44.4/11.1	13.3/60.0/26.7	38.9/47.2/13.9
Average	33.3/33.3/33.4	22.1/37.7/40.3	38.9/34.7/26.4

Table 23: GPRs' responses to questions (US1Q5.1-6), by job title

Ques Codes	P M % (0 / 1)	Doctors % (0 / 1)	IT Staff % (0 / 1)	Rec/Sec % (0 / 1)	Others % (0 / 1)
US1Q5.1	54.5 / 45.5	44.4 / 55.6	33.3 / 66.7	50.0 / 50.0	0.0 / 100
US1Q5.2	63.6 / 36.4	61.1 / 38.9	66.7 / 33.3	50.0 / 50.0	0.0 / 100
US1Q5.3	72.7 / 27.3	66.7 / 33.3	66.7 / 33.3	50.0 / 50.0	0.0 / 100
US1Q5.4	54.5 / 45.5	50.0 / 50.0	33.3/ 66.7	100 / 0.0	0.0 / 100
US1Q5.5	81.8 / 18.2	88.9 / 11.1	66.7 / 33.3	100 / 0.0	100 / 0.0
Average	65.4%/ 34.6	62.2 / 37.8	53.4 / 46.6	70/30	20 / 80