An Investigation of the Requirements for a Personal Decision Support System For Choosing Among Health Care Financing Alternatives Considered from a Diffusion of Innovations Perspective

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Abstract

An Investigation of the

Requirements for a Personal Decision Support System

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Drawing from the Diffusion of Innovation research tradition, this study investigates the requirements for a Personal Decision Support System for selection among a set of health care financing or insurance options available to the individual. Using the health care insurance decision commonly required of many citizens of the U.S.A. as the focus of study, the study characterizes the requirements as generalized meta-requirements applicable to many systems and functional requirements applicable to a system of a particular type. The argument is also presented that Decision Support Systems used for personal decisions represent a rather specialised case of DSS. This specialised case is characterised as Personal Decision Support Systems or PDSS.

Requirements for a Personal Decision Support System

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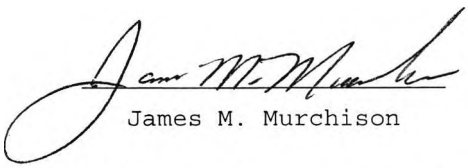


James M. Murchison

November 18, 2003

Date

1 Chapter 1 - Introduction

The primary rationale for the subject matter of this study comes from three points of view. The first is related to the magnitude of the problem of financing health care, both from a macro level and a more micro or individual level. The second influence derives from the importance of and sensitive nature of access to effective health care from the individual perspective. Third is the rather complex and often confusing nature of the decision about health care financing or insurance faced by many citizens of the U.S.A.

The magnitude of the health care financing problem may be recognized from either a social or macro level, or from a more micro or personal level. The scope of the macro or social impact of health care financing in the U.S.A. is demonstrated by data reported by the Centers for Medicare and Medicaid projects suggesting that approximately 16% of the Gross Domestic Product (GDP) of the U.S.A. will be allocated to health care by 2005 (CMS 2000). The impact of health care cost for the individual is suggested by data reported by the American Hospital Association suggesting that the daily cost of a hospital stay has increased from $74 in 1970 to approximately $1,478 in the year 2000 as shown in Appendix II - Selected American Hospitalisation Association Utilisation Statistics.

A second theme of influence on the justification of the study comes from the field of Decision Support Systems, a specialized branch of Information Systems. The traditional emphasis on the study and practice of DSS work has been grounded in support of decision processes in organizational environments. However, the remarkable adoption of personal computer systems, and especially of Internet based information services for personal use argues for investigation of personal versus organisational use of such decision support services. The relevance of an interest in individual decision making about health care financing or insurance is further suggested by

recent papers addressing such issues (Schoenbaum, Spranca et al. 2001, pp. 35-48; Harris 2002, pp. 551-571).

1.1 Aims and Objectives

The overall aim of this study is to satisfy two general purposes:

1 - To identify the requirements for a personal decision support system to support individual choices among a set of health care financing options and

2 - based on the requirements identified in item 1 above, to provide a set of criteria that may be used to guide the development or evaluation of a decision support system for making individual health care financing choices

The more specific objectives of this study are related to the three areas of subject matter that have motivated this particular study and provided the subject matter reference perspectives for the study. These three subject areas include Health Care Financing, Decision Support Systems, and Technology Adoption. These more specific objectives for the study include:

1.1.1 Health Care Financing

Describe and characterize health care financing and insurance as implemented in the U.S.A.

1.1.2 Decision Support Systems (DSS)

Critically review the fundamental nature and a generalized architecture of Decision Support Systems (DSS). This will also describe some essentials of the human decision making process as related to the study of Decision Support Systems.

1.1.3 Technology Adoption

Describe and characterize the processes of Technology Adoption based on a Diffusion of Innovation model.

1.1.4 Data Analysis

Collect and analyse data, to determine the requirements of a Decision Support System to be used by an individual to choose among various financing or insurance plans that may be available to the individual. This data will be based on a survey conducted of individuals representative of persons making this type of health care financing decision.

1.1.5 Stakeholder Identification

After analysis of the data described above, identify the wider set of stakeholder groups with an interest in the design and use of the type of DSS indicated in 1.1.4 above.

1.1.6 Determine Conclusions

Reach appropriate conclusions regarding the requirements for Decision Support Systems to be used for personal health care financing or insurance selection.

1.2 Outline of the Thesis

This study is organised into a structure that gives attention to an initial statement of the problem area under consideration, a review of literature associated with the three primary subject areas related to the study, collection and analysis of data related to the identification of the requirements for the type of Decision Support System (DSS) under consideration, identification of stakeholder groups, and development of conclusions supported by this study. The discussion of the study is presented in a series of chapters that approximately follow these topics in sequence.

1.2.1 Initial Statement of Problem

An initial statement of the problem is presented in Chapter 2. Chapter 3 provides an overview of literature related to the three primary reference subject areas of Health Care Financing, Decision Support Systems, and Technology Adoption. This is followed, in Chapter 4, by brief comments on an overview of the relevant market with an emphasis on three associated markets: the health care market, the health care financing market, and the Personal Decision Support Systems market. Following this market oriented discussion, a restatement and expansion of the problem is presented in Chapter 5.

1.2.2 The Research Methodology

Chapter 6 details much of the research methodology of the project with emphasis on development of a survey instrument, conduct of a pilot survey, revision of the survey instrument, and conduct of the final data collection survey. It is at this point that the clarification of requirements or attributes of the system into meta-attributes or requirements and more detailed, application-specific attributes or requirements, begins to develop. The survey gives primary attention to the meta-attribute type of requirements while analysis of selected sample applications is used as the basis for determination of the functional attribute type of requirements. Chapter 7 supports this discussion of methodology with a review of the results of the analysis of the data generated by the survey process described in Chapter 6.

1.2.3 Stakeholder Group Identification

Chapter 8 presents a different, more qualitative effort to determine needs of various stakeholder groups related to the use of the type of Personal Decision Support System (PDSS) under consideration. A limited number of personal interviews with stakeholder group representatives are presented. However, the primary

concern of Chapter 8 is in the identification of relevant stakeholder groups.

1.2.4 Discussion and Conclusion

Chapters 9 and 10 function very much in coordination with each other. Chapter 9 provides for a discussion of the survey and other data collection efforts described above. Chapter 10 supports this by presenting conclusions supported by the study and suggestions for future research in this and related subject areas.

2 Chapter 2 - Initial Statement of the Problem

The Research Question to be addressed in this study is "What are the requirements for a Personal Decision Support System (PDSS) for choosing among health care financing alternatives?" Although this rather condensed expression of the research question gives attention to two areas of the concern for this study, it does not fully represent the scope of influence on the study. The first two areas of study influencing this study are indicated within the stated question. The first area of concern is that of Personal Decision Support Systems, as a somewhat special case of a more generalised consideration of Decision Support Systems (DSS). The second point of focus is that of Health Care Financing or Insurance and the decisions that may be presented to an individual in the United States health care financing market. The third point of focus, of significant influence on this study even though not expressly identified in the research question, is that of Technology Adoption as considered from a Diffusion of Innovation tradition. These three perspectives on this study may well be considered as:

1. Decision Support Systems. Gives definition and structure to the type of information system under consideration.
2. Health Care Financing. Provides the particular subject area or domain within which the decision is to be made.
3. Diffusion of Innovation. Provides a research tradition of influences on adoption of a particular technology and the diffusion of the technology through a society.

This study is rather exploratory in nature. Given the later development of Decision Support Systems, in contrast to some other categories of information systems such as transaction processing systems, the remarkable increase in the use of the World Wide Web services of the Internet, and the complex nature of the health care financing decision question, this study approaches these issues with

an effort to integrate the subject areas and explore requirements definition. The purpose of this study is directed toward development of an understanding of the specific type of Decision Support System addressed here and the development of more general recommendations for information systems methodology.

Drawing on related research, this study will attempt to identify two general types of requirements. The first type of requirement domain will address generalised attributes of information systems technology that may be relevant to the adoption of many different types of information systems. Given the generalised nature of these requirements, these shall be identified as "meta-attributes" or "meta-requirements." The second domain will address more specific functional requirements of a particular type of Personal Decision Support System (PDSS). These requirements or attributes, focused on the functional nature or purpose of the specific type of information system will be addressed as "functional attributes" or "functional requirements."

The meta-requirements will be developed from the Diffusion of Innovation tradition while the functional attributes will be developed from an analysis of sample decision systems of this type and consideration of the nature of this particular decision process.

3 Chapter 3 - Review of Literature

The review of the literature will be organised into the three focus areas mentioned above: an overview of Health Care Financing in the United States, a summary of the fundamentals of Decision Support Systems, and a review of the fundamentals of the Diffusion of Innovations research. Each of the subject areas will be discussed individually and then an effort will be made to coordinate the relevance of each to the particular study at hand.

With attention to Personal Decision Support Systems (PDSS), one cannot presume the existence of organisation decision processes, or other processes such as management influence or organisational support as providing the guidance for the adoption of such information technologies. The Diffusion of Innovations traditions, which include examples of adoption outside of a clearly defined organisational structure, suggest a relevant framework for the consideration of this type of information system.

The discussion of the tradition of Diffusion of Innovations research presented here has given primary attention to the phases of the innovation-decision process and the attributes of innovations as outlined by Rogers (Rogers 1995, pp. 161-251). The emphasis on the view of Diffusion of Innovations as a process to be addressed from a social system perspective appears to be especially significant since the overall concern of this study is to address Personal Decision Support Systems (PDSS). Most consideration of the adoption of Decision Support Systems technologies has been addressed to the adoption of such technologies within organisations. This should not be taken as a surprise since until fairly recently computer-supported information systems were of primary interest within organisational structures. It is only with the widespread use of the personal computer and especially the dramatic use of the Internet, specifically

the World Wide Web (WWW) services of the Internet, in home use that the concept of a DSS for personal use has developed relevance.

This focus on perceived attributes conforms to the common practices in much of the research effort on diffusion of innovation and seems relevant to the consideration of decision support systems to be used by individuals. However, the appropriate use in the study of personal information systems of the attributes adopted and tested for validity by Moore and Benbasat (Moore and Benbasat 1991, pp. 192-222) remains unresolved for consideration of Personal Decision Support Systems (PDSS).

3.1 Introduction to Health Care Financing in the United States

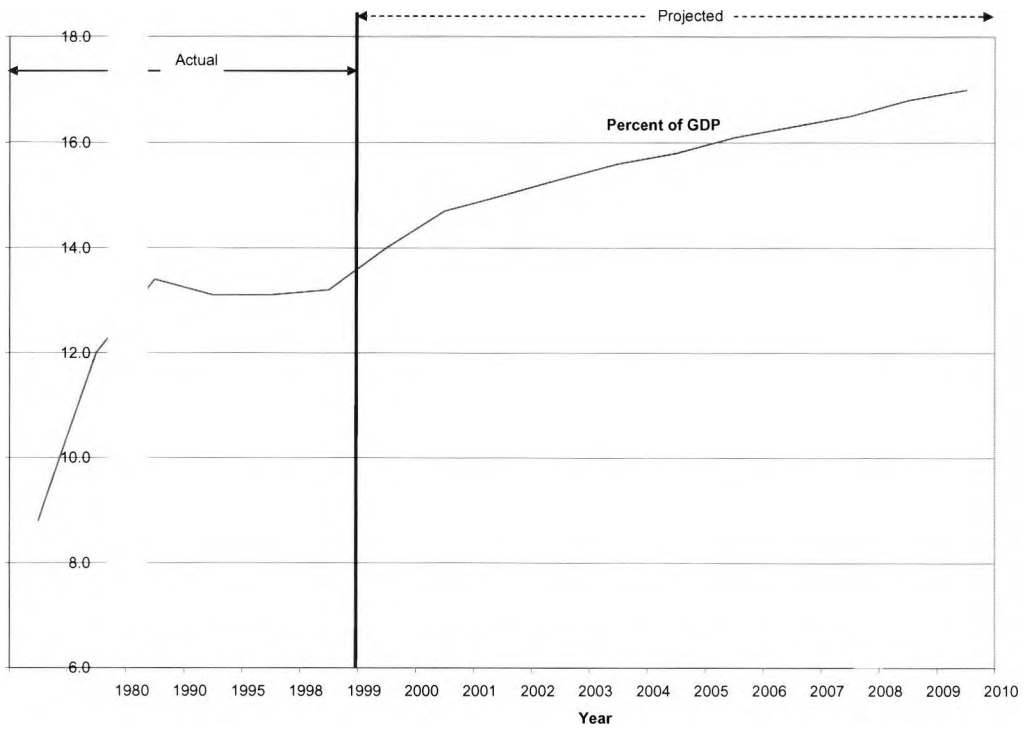
The study of the information systems or informatics of health and health care delivery needs to consider not only information systems that are focused on the diagnosis and treatment of illness or the maintenance of health. Attention also needs to be, and has been on various occasions, directed to aspects of health care administration to include health care financing. Given the variety of health care delivery models and approaches to health care financing in practice within the U.S.A. and other industrialised nations today, this has become a rather sophisticated area of its own. This is especially true on an international basis, with substantially different health care financing models adopted by different countries, but is also quite true in the United States of America (U.S.A.) as this country continues to develop a health care delivery and financing system. This effort continues to attempt to find a balance of health care financing between private sector and public sector roles and between traditional forms of health or health care insurance and newer models of health care financing.

3.1.1.1 Significance of the Health Care Financing Issue

Examples of both the change and uncertainty of this financing, often in anecdotal form, abound. In the 1970's substantial speculation about and congressional interest in some form of national health insurance was exhibited. At that time, U.S. Senator Ted Kennedy, who is still serving in the U.S. Congress in mid 2003, was seen as the likely champion of such a federal program. With experience in the contractual administration of such federal health care financing programs as Medicare, Medicaid, and the military services TRICARE program, organisations such as the Blue Cross / Blue Shield plans anticipated a likely role in the administration of a national program. However, such a national tax-based system of health care financing did not develop during this time period. During the 1970's organisations such as state governments and major corporations moved away from underwritten insurance programs. Organisations of this type often contracted with health insurance organisations for "administrative services only" contracts and underwrote the cost and risk of the health insurance themselves. The 1980's saw the development of major trends to create various forms of "managed care" programs in an effort to contain the high rate of inflation that had come to characterise the cost of health care financing. Taking several forms or models, these managed care programs were and still are characterised by some form of management fee or "capitation fee" rather than tradition reimbursement of the health care provider on a "fee-for-service" basis. During U.S.A. President Bill Clinton's first term of office (1993 - 1997) his wife, Hilary Rodham Clinton, assumed the role of champion of health care financing reform. Her efforts attracted substantial attention in the public press but achieved no substantive changes in the U.S.A. health care financing system. The limited success of these various efforts to control the costs of health care financing is further illustrated in Figure 3.1 - Personal

Health Care Expenditures as a Percent of Gross Domestic Product prepared by the Centers for Medicare and Medicaid (CMS)[1]. The percent of Gross Domestic Product in the U.S.A. allocated to Personal Health Care Expenditures is reported as increasing from approximately 9% in 1980 to approximately 13.2% in 2000 and is projected to reach approximately 17% by the year 2011.

Figure 3.1 - Personal Health Care Expenditures as a Percent of Gross Domestic Product



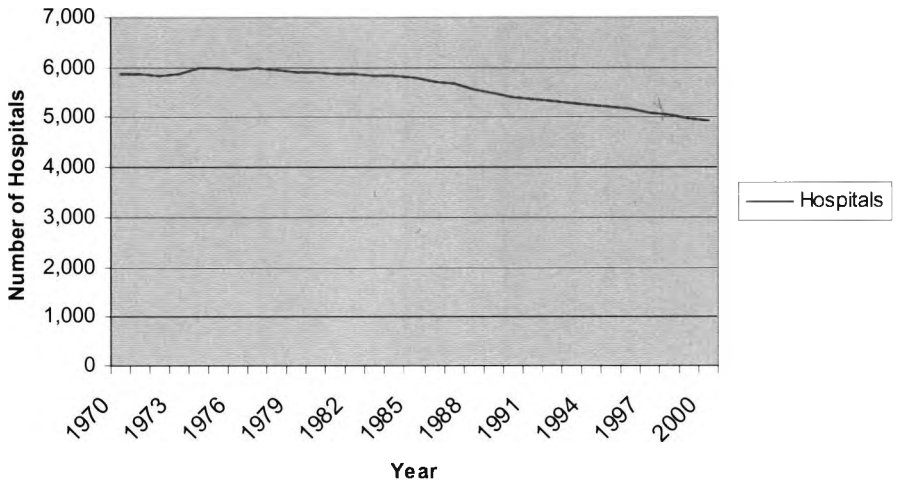
Source: Derived from: Centers for Medicare and Medicaid Web Site; http://cms.hhs.gov/statistics/nhe/projections-2001/proj2001.pdf

Although the data presented by the CMS gives emphasis to the financial trends at a very summary level, a different set of data, presented by the American Hospital Association and presented in Appendix II - Selected American Hospital Association Utilisation

[1] Previously known as the Health Care Financing Administration (HCFA). The change in agency name was effective July 1, 2001. In many cases

Statistics, serves to reinforce the data presented in Figure 3.1. Figure 3.2 - Number of Hospitals by Year shows a general trend for the number of hospitals to decline from 5,895 hospitals in 1980 to 4,934 in 2000. However, the total revenue reported shows a general increase from approximately 19.5 million dollars in 1980 to approximately 357 billion dollars in the year 2000. In Figure 3.2 and Figure 3.3, both taken from the AHA data, the number of hospitals over this time period has actually shown a decline but the total hospital revenue shows notable increase.

Figure 3.2 - Number of Hospitals by Year



Source: (AHA 2002, p. 2)

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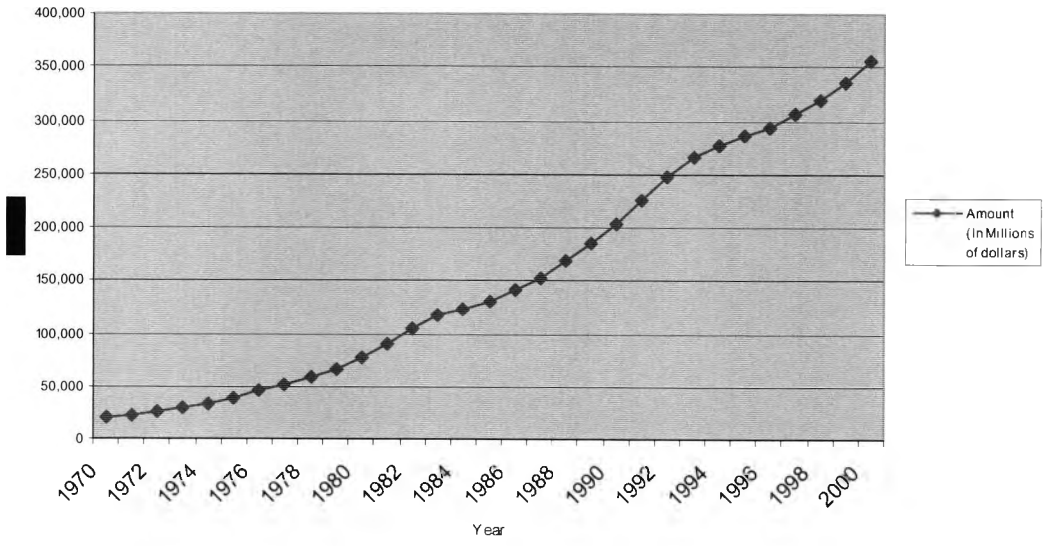
references may still be made to the previous agency name.

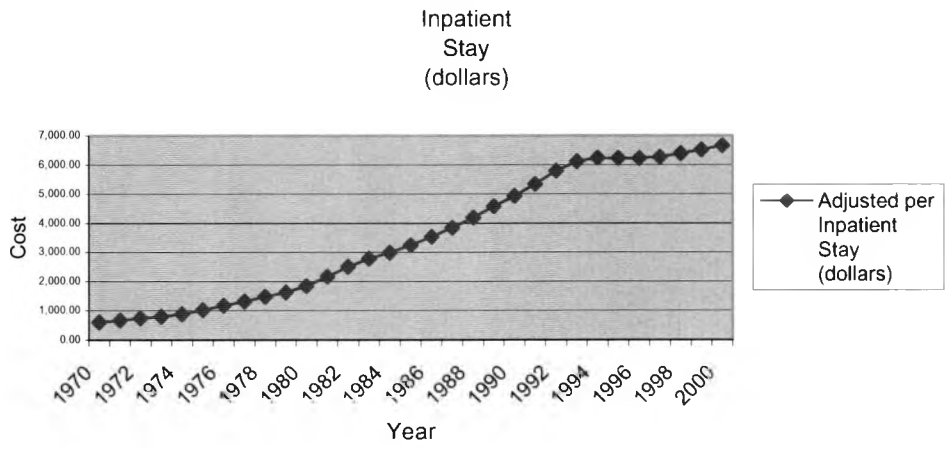
Figure 3.3 - Hospital Revenue by Year



Source: (AHA 2002, p. 2)

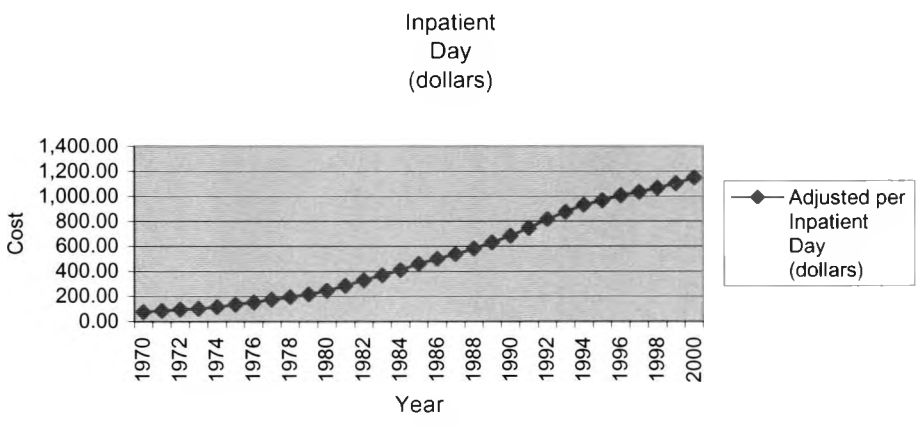
Of perhaps more instructive value regarding individual costs for hospitalisation are the trends suggested by the AHA data presented in Figure 3.4 and Figure 3.5. Figure 3.4 - Cost Per Inpatient Hospital Stay shows an increase in the cost from $604.59 in 1970 to $6,650.68 in 2000 for an average annual increase of 8% (Standard Deviation = .05). The daily costs, as shown in Figure 3.5 - Cost Per Inpatient Hospital Day, increased from $73.73 in 1980 to $1,477.99 in 2000. The average annual increase for this daily cost was 10% (Standard Deviation = .04). Attention to these increases in cost per stay and cost per day may suggest why so much attention was directed to development of various managed care options, versus traditional fee-for-service insurance options, over the past few decades.

Figure 3.4 - Cost Per Inpatient Hospital Stay



Source: (AHA 2002, p. 2)

Figure 3.5 - Cost Per Inpatient Hospital Day



Source: (AHA 2002, p. 2)

In the early 2000's the managed care programs continue to be a major component of the health care financing system in the U.S.A. However, traditional fee-for-service programs still remain a part of the system. Experiments with government programs such as the TennCare program adopted by the State of Tennessee have been developed as an alternative to the traditional provisions of the federally funded Medicaid program. Offering coverage to the poor, disabled, or those

who cannot obtain other health insurance, TennCare was adopted, with the approval of the federal Centers for Medicare and Medicaid (CMS), in 1994. In late 1999 the Tennessee Blue Cross-Blue Shield Organisation created headlines in Tennessee newspapers with threats of withdrawal from the TennCare program. This was especially significant at that time since this organisation enrolled approximately 645,000 persons, approximately one half of the total participants in the entire TennCare program (Cheek and Wissner 1999, pp. 1,5). This suggests impact on the various stakeholders of the TennCare program but especially the enrolees of the program. Likely these enrolees have few alternatives for comparable coverage and likely have limited ability to effectively use information systems to assist in making choices that may be offered should the Blue Cross / Blue Shield plan actually have withdrawn from the program as threatened. As of the summer of 2003, Blue Cross/Blue Shield of Tennessee does continue to offer programs under the TennCare program contract.

3.1.2 Review of Recent History

Given the dynamic and changing nature of the health care financing system(s) in the U.S.A., a need continues to find some sense of order and some basis for decision making by the various participants and "stakeholders" in this industry. The approach of this study will be to consider health care financing as a component of the health care industry. Therefore, a brief history of this industry in the U.S.A. is appropriate. Bourke (Bourke 1994, pp. 7-10) presents such a history and identifies five distinct periods since World War II.

3.1.2.1 Health Care 1945 - 1965

The U.S.A. economy experienced a general expansion with the emergence from World War II. Health care participated in this general economic expansion, developing into a major industry. The expansion

was encouraged by government support of research in medical schools and provision of federal government funding for hospital construction.

3.1.2.2 Health Care 1965 - 1973

With the passage of legislation implementing Medicare and Medicaid in 1965, emphasis was placed on the equitable distribution of health care services through the U.S.A. society. This provision of health care for those unable to make payment increased the demand for health care resulting in further expansion of health care facilities.

Provision of health care benefits by employers, which had begun during World War II and continued through the 1950's, served as a salary substitute in some industries serving to support recruitment and retention of workers. This, combined with the impact of the federal programs, created a market where the direct consumer of health care services often assumed little responsibility for payment of the cost for these services.

Health care began to show some attributes of a regulated industry, relatively free from competition, and with few limits placed on demand. Results included little pressure on hospitals for effective management, limited emphasis on information systems development for such management, and relatively small, unsophisticated in-house data processing staff within the hospital.

3.1.2.3 Health Care 1973 - 1983

Nineteen seventy-three marked a period of disenchantment with the health care system. Two fundamental assumptions came into question: (1) that Americans needed more health care to be provided by the federal government; and (2) whether health care professionals and non-profit hospitals were best qualified to determine how the health care services were to be delivered. The focus of attention shifted from equity of distribution of health care to cost control. Health care expenditures, as a percentage of the national budget, were rising faster than other components. Alternative structures for

delivery of care such as private institutions, investor owned hospitals, alternative delivery systems, and various forms of managed care found increasing acceptance in the marketplace.

3.1.2.4 Health Care 1983 - 1991

This time period was characterized by further development of trends that became apparent during the 1973 - 1983 time period. Two specific, notable trends were the increasing percentage of the population eligible for government supported health care and efforts to control costs. Examples of cost control included implementation of Diagnostic Related Group (DRG) reimbursement by the Medicare program and efforts at cost shifting and new forms of organization. The DRG reimbursement program called for a cap on payments to hospitals for treatment based on the diagnosis of the condition rather than the actual treatment of the patient. Increased costs recognized by insurers and employers encouraged a more active role in cost containment with techniques such as increased use of co-payments and deductibles.

In addition to changes in reimbursement techniques such as the use of DRG's, co-payments, and deductibles; more fundamental organisational structures continued to take place. The use of "administrative services only" contracts which provide only for contract administration not actual underwriting of risk, and development of HMO's and Preferred Provider Organizations (PPO) became more widespread. Such changes began to have impact on the management style of health care organizations such as hospitals. Control of costs became more important and the health care market showed more characteristics of competition. The role of information systems for effective management support assumed a more significant role.

3.1.2.5 Health Care 1991 and Beyond

Effective resolution of the goals of appropriate provision of health care balanced with effective cost control remained elusive.

Health care costs continued to increase, reported by Bourke (1994, p. 10) as reaching 14% of Gross National Product by 1992. Different states attempted alternative techniques to control cost. Minnesota adopted an outcomes-based reimbursement scheme while Oregon and Tennessee applied for waivers to the standard Medicaid reimbursement program to adopt alternative, experimental reimbursement programs. In major cities, employers coordinated efforts to build databases correlating cost, outcome, and satisfaction data for the city hospitals. Companies were required to insure that accounting reports placed future health care expenditures for retirees as a liability on their balance sheets.

Questions regarding availability of coverage continued to present themselves. Much of the attention in this area was directed to the "medically indigent" - people who are employed but still are not able to afford health care. General dissatisfaction with the health care system was evidenced by President Clinton's promise of health care reform. His wife assumed the role of advocate of health care reform at the national level though little actual change occurred as a result of her efforts. Continued attention to health care issues, largely focused on issues of finance, by the general press in the U.S.A. indicates there is still substantial dissatisfaction with the nation's health care system. However, the perception of the nature of the problem has undergone significant change since the post World Ward II period.

3.1.3 Centers for Medicare and Medicaid - An Overview

The Centers for Medicare and Medicaid (CMS), known as the Health Care Financing Administration (HCFA) for most of its history, of the U.S.A. federal government serves as a major source of health care financing throughout the United States of America. The agency reported provision of over $500 billion annually in 2003 (CMS 2003, p. 1) and approximately 41 million citizens covered under the Medicare

program (CMS_Medicare 2003, para. 1) and 36 million covered under the Medicaid program (CMS_Medicaid 2003, para. 2). The roles of CMS are especially significant to the study of decision making in the Health Care Financing arena given the large amounts of funding distributed by CMS and the pervasive impact of this organisation.

3.1.3.1 History

Significant financing of health care for the public non-military sector in the United States predated the creation of CMS, or HCFA, with the establishment of the Medicare and Medicaid programs in 1965. Adoption of these programs at that time represented a major portion of the "Great Society" programs of U.S. President Lyndon B. Johnson. This also represented the first major provision of civilian health care coverage by the U.S. government. Prior to this date health care coverage was only supported for those in military service or very specialised segments of the U.S. population.

The management of these two large Federal health care programs, Medicare and Medicaid, was transferred to the newly created Health Care Finance Administration (HCFA) in 1977. Since that date, the role of CMS has grown to include additional services such as:

- Federal oversight of clinical laboratories under the Clinical Laboratory Improvement Amendments
- Oversight of Medigap insurance
- The Health Insurance Portability and Accountability Act (HIPAA), for individual and small group market health insurance regulation
- The State Children's Health Insurance Program (SCHIP) (CMS_SCHIP 2003, para. 1)

Furthermore, the nature of the coverage provided by both Medicare and Medicaid has evolved significantly since 1977. Table 3.1

- Significant Changes to Medicare and Medicaid Programs Since 1977, provides a brief listing of some of the more significant changes in these programs (HCFA_SP 1999, p. 14).

Table 3.1 - Significant Changes to Medicare and Medicaid Programs Since 1977

Date	Description
1972	**Increased Medicare Eligibility** Extension of Medicare eligibility to individuals under age 65 with long-term disabilities and to individuals with end-stage renal disease.
1982	**Encouragement of HMO's / Peer Review** The Tax Equity and Fiscal Responsibility Act made it easier and more attractive for health maintenance organisations (HMO's) to contract with the Medicare program. By mid-year 1998 approximately 17% of beneficiaries had enrolled in managed care plans. In addition, the act expanded CMS's quality oversight efforts through Peer Review Organisations (PRO's).
1983	**Inpatient Prospective Payment** An inpatient acute hospital prospective payment system, based on patient's diagnoses, was adopted to replace cost-based payments.
1987	**Stronger Nursing Home Protection** The Omnibus Budget Reconciliation Act of 1987 (OBRA87) strengthened the protections for residents of nursing homes.
1989	**New Physician's Fee Schedule** A new fee schedule for physician and other professional services was approved.
1997	**Wide Variety of Changes (BBA97)** The Balanced Budget Act of 1997 contained a variety of changes to the Medicare program including: New Medicare managed care and other private health plan choices for beneficiaries CMS required to develop and implement new prospective payment systems for many Medicare services including home health, skilled nursing facilities, hospital outpatient departments, and outpatient rehabilitation services Extended life of the Medicare Trust Fund on a short term basis and established commission to plan for future of the program Provided a broad range of beneficiary protections Expanded preventive benefits Provided for testing other innovative approaches to payment and service delivery through research and demonstrations
2001	**Agency Name Change** Effective July 1, 2001 the name of the agency was changed from the Health Care Financing Administration (HCFA) to the Centers for Medicare and Medicaid (CMS).

(HCFA_SP 1999. pp. 5-6)

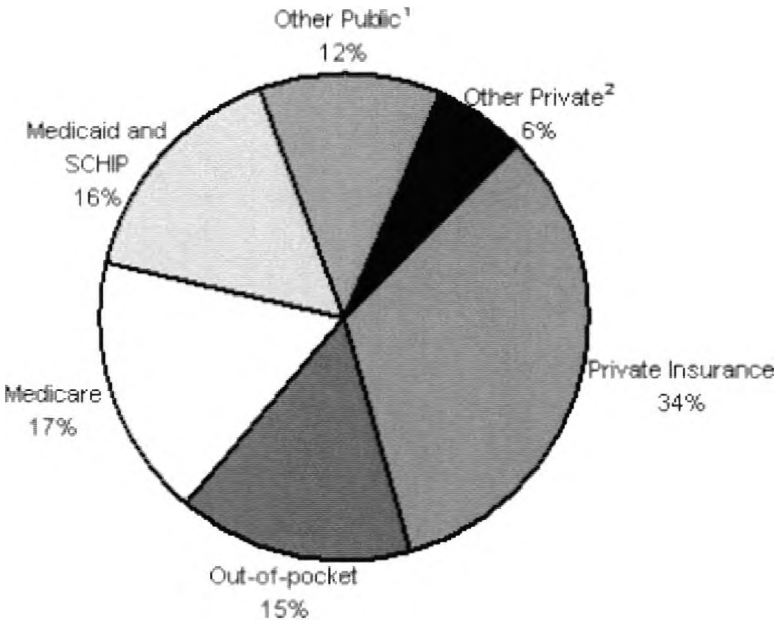
3.1.4 Major Programs of CMS

The three major programs of the Centers for Medicare and Medicaid that directly support the financing of health care are:

1. Medicare
2. Medicaid
3. State Children's Health Insurance Programs (SCHIP)

The impact of these programs, as indicated in Figure 3.6 - The Nation's Health Dollar: 2000 - Where It Came From, (CMS 2000) indicates that the numbers reported for the first two major programs show that in 2000 Medicare and Medicaid funded approximately 34 percent of health care spending in the U.S.

Figure 3.6 - The Nation's Health Dollar: 2000 - Where It Came From



[1] "Other Public" includes programs such as workers' compensation, public health activity, Department of Defense, Department of Veterans Affairs, Indian Health Service, and State and local hospital subsidies and school health.

[2] "Other Private" includes industrial in-plant, privately funded construction, and non-patient revenues, including philanthropy.

Source: Derived from (CMS 2000)

3.1.5 Blue Cross / Blue Shield Overview

Any consideration of health care financing in the U.S.A. must give some consideration to the Blue Cross and Blue Shield (BCBS) system. BCBS has served a significant role in the development of health care financing in the U.S.A. and continues to serve major roles in the delivery and administration of health care financing in various forms. The Blue Cross and Blue Shield Association estimates that approximately one in four U.S.A. residents carries a BCBS card to provide evidence of health insurance coverage (BCBS_Assoc._Know 1999, p. 1).

3.1.5.1 Blue Cross History

The development of the Blue Cross system, oriented toward hospital coverage, is generally traced to Baylor University in Dallas, Texas (BCBS_Assoc._History 2003, p. 1). In 1929 Justin Ford Kimball, an official with the university, introduced a plan to provide for "pre-paid" health care. The first plan guaranteed hospital care of up to 21 days for schoolteachers for a rate of $6.00 per year. Soon other groups of employers in the Dallas area began to join the plan and shortly afterward, national attention followed.

The first actual use of the Blue Cross as a logo to identify such programs occurred in Minnesota in 1933. E.A. Steinwyk, an executive with what was to evolve into Blue Cross and Blue Shield of Minnesota, began to identify his hospital care program with a blue-colour cross symbol. Soon other groups throughout the U.S.A., and later in other nations, adopted the blue cross. In 1939 a commission of the American Hospital Association (AHA) officially adopted the blue cross symbol for plans meeting certain guidelines. In 1960 the Blue Cross Association replaced the commission, which was independent of the AHA. All formal ties between the Blue Cross Association and the AHA were severed in 1972. At that time the AHA symbol was removed as the centrepiece of the Blue Cross logo.

3.1.5.2 Blue Shield History

The development of the Blue Shield concept, provision of coverage for physician's charges, grew out of the lumber and mining camps of the Pacific Northwest at the turn from the nineteenth to the twentieth century. Employers arranged to provide medical care for their workers and contracted with physicians who were paid a monthly fee for their services. These contracts led to the creation of groups of physicians known as "medical service bureaus." Pierce County physicians organised the first of these medical service bureaus in

Tacoma, Washington in 1917. Some of these bureaus, including the Pierce County bureau, still operate today as Blue Shield Plans.

Based on the example of these medical service bureaus, the first modern Blue Shield Plan was founded in California in 1939. In 1948 the Blue Shield symbol had been informally adopted by a group of nine plans known as the Associated Medical Care Plans. In 1951 this group registered the Blue Shield with the federal patent and trademark office and this group eventually became known as the National Association of Blue Shield Plans. In the 1970's, as changes to the Blue Cross logo reflected changes in the Blue Cross / AHA relationship, the logo of the American Medical Association (AMA) disappeared as the centrepiece of the Blue Shield logo. In 1982 a merger of the Blue Cross Association and the National Association of Blue Shield Plans created the Blue Cross and Blue Shield Association (BCBS_Assoc._History 2003, para. 6).

It is worth noting that though the Blue Cross and Blue Shield organisation gives the impression of a national "company", this is not actually true. In fact most of the local Blue Cross and Blue Shield Plans are incorporated as not-for-profit organisations. However, in the market place they give the impression of and compete much as if they were for-profit companies. Even though many Blue Cross and Blue Shield plans developed as separate organisations in earlier years, based on providing hospital payments or physician payments, today many have merged into joint Blue Cross and Blue Shield Plans. Each plan is a separate corporation with separate management, boards of directors, and responsibility for financial stability. Some efforts to function as a national company, such as serving out-of-area claims for subscribers incurring needs for service outside of their plans' geographic area, are supported among the plans. In some cases national programs and contracts such as the coverage for U.S.A. federal government employees have been established. In many ways the

Blue Cross and Blue Shield system presents itself as a national organisation even though it is not truly a national company.

3.1.5.3 Blue Cross / Blue Shield Characteristics

Based on descriptive information on its web site, the Blue Cross / Blue Shield system characterises itself as:

- Composed of 42 different independent Blue Cross and Blue Shield Plans.
- Collectively these plans provide health care coverage for more than 81.5 million people in 50 states, the District of Columbia, and Puerto Rico (BCBS_Assoc._History 2003, para. 3).
- Blue Cross and Blue Shield Plans reported in 1999 that they operated with an average administrative cost of approximately 12% of premium revenue as contrasted to administrative costs of up to 25% incurred by commercial insurance companies (BCBS_Assoc._Facts 1999, pp. 1-2). The plans suggest that this results in the return of a higher percentage of premium payment to the customer in the form of claims payment.
- Blue Cross and Blue Shield report coverage of large numbers of the U.S.A. population. Based on 1998 figures, the latest reported, BCBS reports:
  - Over 46.7 million enrolled in a Blue Cross and Blue Shield managed care plan.
  - Approximately 27.5 million persons enrolled in a BCBS Preferred Provider Organisation (PPO)
  - Approximately 14.2 million persons covered under 94 BCBS Health Maintenance Organisations (HMO's).

- Coverage for some 6.4 million persons under 68 POS organisations.
- Approximately 3.9 million subscribers covered under the Federal Health Benefits program are covered by the BCBS Member Plan coverage. This represents over 46.2 percent of the federal employees and retirees in this program.
- The Member Plans serve as the largest single processor of Medicare claims (both Part A - hospital claims and Part B - doctor claims) in the nation (BCBS_Assoc._Facts 1999, pp. 1-2).

The Blue Cross and Blue Shield system must be considered as having a rather unique role in health care financing in the U.S.A. based on the size and historical role of the BCBS system. Today this role may be considered as focused on serving as:

1. A major provider of underwritten insurance programs and
2. A major administrator of non-underwritten programs such as the federal government programs, both for federal government employees and Medicare and Medicaid programs, and "administrative only" contracts with major private sector employees.
3. Significant provider and advocate for various forms of managed care programs
4. Influencer of health care financing policy at various levels in U.S.A. society.

3.1.6 Insurance and Health Care Financing

Consideration of various issues of health care financing quickly brings to attention issues related to health care insurance as suggested by the significant role of the Blue Cross and Blue Shield

system in the U.S.A. market. This suggests a need to develop a fundamental sense of, "What is insurance?" A complete discussion of insurance programs or even only health care insurance is beyond the scope of this paper. Detailed attention to characteristics of insurance or merely health insurance could distract from the focus of this study on decision support systems. Therefore, only an introductory consideration of the nature and role of health care insurance as related to health care financing is considered.

A quick response to the above question may be given as, "Insurance provides for the pooling of financial risk." Or, in other words, "insurance reduces the variability of the insured's income by pooling a large number of units, and operating on the principle of the law of large numbers" (Folland, Goodman et al. 1997, p. 230). The fundamental purpose of insurance is to share the financial risk of certain types of hazards or perils. For this sharing of risk to have a predictable nature, the population for which the risk is shared must be large enough and homogenous enough for reasonable determination of the probability of the risk or hazard. Without these two characteristics, setting an appropriate premium for the coverage becomes rather impractical.

Several terms, as applied to health insurance, also warrant clarification. *Premium coverage* may be considered to be the amount that a person pays for a certain type and level of coverage. The consumer will commonly pay $*X* premium for $*Y* of coverage. Many health care insurance policies include provision for *coinsurance* and *copayment*. Such provisions require that the insured share in the financial loss when the expected hazard or peril does in fact occur. The percentage of loss that must be paid by the customer, the insured, is referred to as the *coinsurance rate* while the amount of payment is referred to as the *copayment*. Under some insurance programs a fixed copayment is applied to certain charges, such as filling a

prescription or a doctor's office visit, while a percentage coinsurance rate is applied to other expenses such as hospital charges.

Many insurance policies also include provision for a deductible in addition to the coinsurance that may apply. *Deductibles* generally represent "front-end" expenses to the insured. These generally are applied for a specific time period, often one year. "In a sense, the insurance does not apply until the consumer pays the deductible. Deductibles may be applied toward individual claims, or, often in the case of health insurance, they may be applied only to a certain amount of charges in any given year" (Folland, Goodman et al. 1997, p. 231).

Economists do recognise that the perceptions and attitudes of the different stakeholders toward deductibles and coinsurance may be quite different (Folland, Goodman et al. 1997, p. 231). Consumers may feel that these provisions for deductibles and coinsurance are merely provisions for the insurance company to "gouge" the consumer. However, economists and health care financing planners commonly argue that the cost-sharing provisions of deductibles and coinsurance lead to desirable economic consequences. Folland suggests that "the requirement that there be some copayment makes consumers more alert to the differences in the true costs of the treatment they are purchasing. The charging of deductibles discourages frivolous claims or visits, and also makes the insured person more aware of the results of his or her actions. Both may serve to avoid claims and reduce costs" (Folland, Goodman et al. 1997, p. 231).

3.1.6.1 Issues of Risk

Frequently economic models are presented under conditions of certainty. However, the basic purpose of insurance, as we have already mentioned, is to help the customer deal with issues of uncertainty or risk (Folland, Goodman et al. 1997, p. 232).

Therefore, the concept of expected value of a particular event *E* with a given probability *p* and a cost *C* assumes significant. This expected value may be defined as:

Equation 3.1 - Expected Value of an Event

$$E = \sum (p_i x C_i)$$

Where:

E = Expected value

P_i = probability of outcome $_i$

C_i = Cost of outcome $_i$

Source: Derived from (Folland, Goodman et al. 1997, p. 232)

A simple economic view of the issues of insurance introduces the concept of an *actuarially fair* insurance policy. This actuarially fair rate is the rate at which the expected benefits paid out by the insurance company are equal to the premium collected by the company.

Although the concept of an actuarially fair policy may be useful for some forms of analysis, (Folland, Goodman et al. 1997, p. 232) it fails to consider some additional issues of the real world. In addition to the benefits that are paid out, insurance companies will experience administration and transaction costs associated with doing business. For-profit companies will also experience a need to earn a profit. This actuarially fair policy, in a simple form, also ignores much of the issue of risk and the need for the insuring organisation to maintain financial reserves to protect against hazards that occur infrequently but may in fact occur.

3.1.6.2 Marginal Utility of Wealth and Risk Aversion

This consideration of "What is insurance?" as applied to health care insurance does help clarify some basic concepts but does not deal with two fundamental questions that face the consumer:

1. Should a consumer purchase health care insurance?

   If the answer to question 1 is yes, then --

2. How much of such insurance should the consumer purchase?

Folland, et al. (Folland, Goodman et al. 1997, pp. 232-238) present a consideration of these questions from an economics point-of-view summarised here.

This consideration of insurance purchase questions applies the concepts of expected value, described above, and the concept of marginal utility of wealth as an aid in analysing the consumer's behaviour toward risk. Specifically, consider the consumer under conditions of *Risk Aversion* (Folland, Goodman et al. 1997, pp. 232-233) Folland uses the familiar example of flipping a coin as a basis for illustrating a fundamental view of risk aversion. If the coin comes up "heads", the player wins one dollar. If the coin comes up "tails" then the player receives nothing. The expected value of the game is 50 cents, assuming that a fair coin is used. Therefore, the player should be willing to pay any amount up to 50 cents to play the game. The expected return, 50 cents, exceeds the expected cost up to this level.

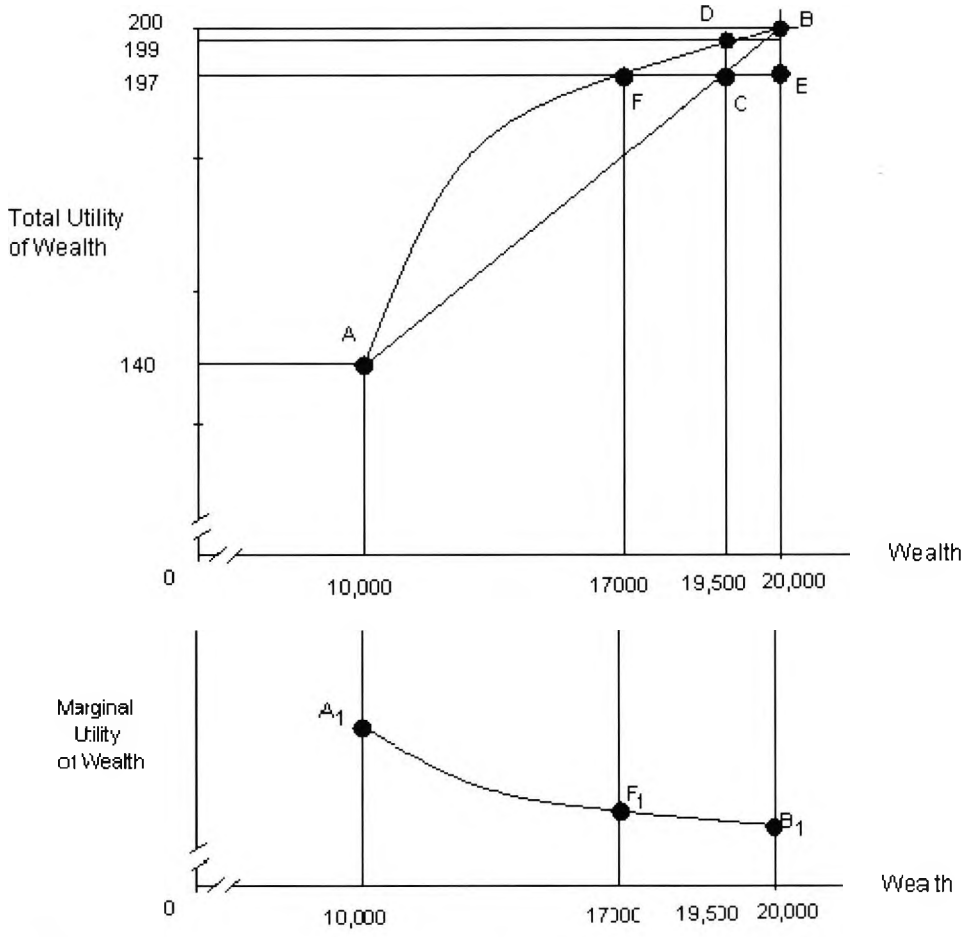
Changing the cost of playing the game and the amount of payoff continues the illustration of risk aversion. Assume that the payoff is changed from $1.00 to $100.00. Our player may have elected to play for a $1.00 payoff at an entry cost of 50 cents but refuses to play at the entry cost of $50.00. The $50 / $100 game is actuarially fair, as was the 50 cents / $1.00 game. However, the player may elect not to play because the risk of losing $50.00 is unacceptable. In this case

the reduction in utility of losing $50.00 is larger than the utility of winning the same amount. The player is adverse to the risk of the loss of $50.00

3.1.6.3 Marginal Utility of Wealth

The concept of "marginal utility of wealth" is used to apply the concept of risk aversion to health care insurance purchase decisions. The idea of the marginal utility of wealth includes the concept that this utility decreases as the level of wealth increases. This is illustrated in Figure 3.7 - Total Utility of Wealth and Marginal Utility Related to the Impact of Insurance (Folland, Goodman et al. 1997, p. 234). In this example a wealth of $10,000 provides a utility level of $U_1 = 140$. However, an increase of wealth to $20,000 only causes the level of utility to increase to level $U_2 = 200$ or an increase of only 60 units of utility. Based on this concept of decreasing marginal utility of wealth between $10,000 and $20,000, each increased dollar of wealth in this range is considered to have a decreasing marginal utility. The marginal utility of wealth is identified as "the amount by which utility increases when wealth is increased by one dollar" (Folland, Goodman et al. 1997, p. 233). However, the decreasing marginal utility of wealth results in a bowed shape of the utility function as plotted between points A and B. This bowed shape represents a slope that becomes flatter as wealth rises, indicating that the marginal utility of wealth is diminishing. This is further represented in the bottom panel of Figure 3.7 as points A_1, F_1 and B_1. When the marginal value of wealth is decreasing in wealth, the consumer is said to be risk adverse. In Figure 3.7 the distance FC is interpreted as the customer's aversion to risk (Folland, Goodman et al. 1997, p. 235).

Figure 3.7 - Total Utility of Wealth and Marginal Utility Related to the Impact of Insurance



Source: (Folland, Goodman et al. 1997, p. 234)

Folland (Folland, Goodman et al. 1997, pp. 233-234) uses the example from Figure 3.7 to illustrate calculation of a customer's *expected utility, E* given the following assumptions:

1. The customer's wealth increases from $10,000 to $20,000.
2. An illness has a probability of occurrence of 0.05.
3. Should this illness occur, the customer's wealth would decline to $10,000.

Under these assumptions:

E = 0.95 x (utility of \$20,000) + 0.05 x (utility of \$10,000)

= 0.95 x (200) + 0.05 * (140)

= 190 + 7

= 197

In this example the expected utility is 197, represented by the point C in Figure 3.7.

The example is expanded further (Folland, Goodman et al. 1997, p. 234) with the suggestion that an insurance policy can be purchased for \$500 per year that guarantees a wealth of \$20,000 regardless of the customer's health. With the purchase of the insurance policy, the customer's wealth is reduced to \$19,500, represented by point D in Figure 3.7. We compare points D, on the bowed marginal utility of wealth function at wealth level of \$19,500, with point C on the straight line-segment AB at the \$19,500 level of wealth. Comparison of points D and C indicates that the customer is better off at point D than at point C, with point D yielding a utility of 199 versus a utility of 197 at point C.

Point F, sometimes referred to as the *certainty equivalent*, the point at which the bowed marginal utility of wealth functions is equivalent in utility to point C, suggests that the consumer could pay up to \$3,000 and still be better off, having higher utility, than not having purchased insurance. This amount of \$3,000 or distance FC is interpreted as representing the customer's aversion to risk. The difference represented by distance FE and the actual amount of the premium (\$500 in this example) represents the consumer surplus from having to pay only \$500 rather than \$3,000 to reduce the risk.

Folland uses this example and Figure 3.7 to propose three conclusions:

1. Insurance can only be sold in circumstances where there is diminishing marginal utility of wealth or income - that

is, when the consumer is risk adverse. It can be seen that if marginal utility were constant, a requirement that the individuals pay an actuarially fair premium for insurance would leave them no better off than if they were uninsured.

2. Expected utility is an average measure; the individual either wins or loses the bet. Although the consumer will have an expected wealth and hence utility as indicated by point C on the graph each period, his actual wealth (utility) will be either $20,000 (utility of 200), or $10,000 (utility of 140). With the former, he would have lost $500 by paying the insurance premium; with the latter, he would get a check from his insurer for $10,000 (after paying the premium of $500).

3. If insurance companies charge more than the actuarially fair premium, people will have less expected wealth from insuring than from not insuring. Even though people will have less wealth as a result of the purchase of insurance, the increased well-being comes from the elimination of risk.

(Folland, Goodman et al. 1997, p. 235)

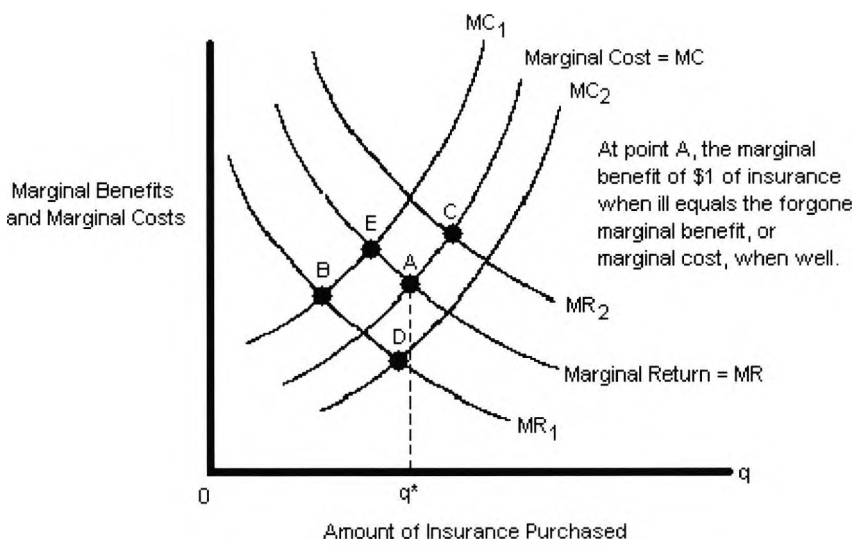
3.1.6.4 Marginal Benefits and Marginal Costs

Folland then extends the graphical presentation of such economic analysis of insurance purchase to address the concepts of Marginal Benefits, or Marginal Return (MR), and Marginal Costs (MC). This analysis, presented graphically in Figure 3.8 - The Optimal Amount of Insurance, identifies point *A* as the point at which the consumer optimises the purchase of insurance given the Marginal Cost curve MC and the Marginal Return to insurance by curve MR. Let q represent the amount of insurance purchased. Then q^* represents the optimal amount

of insurance since it is associated with the intersection of the Marginal Cost and Marginal Return curves. This search for the intersection of the Marginal Cost and Marginal Return curves shares much in common with traditional microeconomic techniques that examine the relationship between Marginal Cost and Marginal Return.

As one considers Figure 3.8, it is noted that Marginal Return is reflected by a negatively sloped curve while Marginal Costs is indicated by a positively sloped relationship. Each of these relationships is reflected by a curve rather than a straight line-segment because of the marginal nature of the relationship expressed. We note that movement to some other point of intersection of the marginal cost and marginal utility curves, represented by points B, C, D, and E occur only if the position of the Marginal Cost or Marginal Return curves are shifted. This is reflected in Figure 3.8 if the Marginal Cost curve is shifted in position to MC_1 or MC_2, or if the position of the Marginal Return curve is shifted to position MR_1 or MR_2.

Figure 3.8 - The Optimal Amount of Insurance



Source: (Folland, Goodman et al. 1997)

3.1.6.5 Relevance of the Model

Despite the apparent rigor and careful graphical presentation of the type of economic analysis presented by Folland, some scepticism is appropriate as to whether these econometric models effectively represent consumer behaviour in the health care insurance market. One may especially question whether the consumer uses information, conducts analysis, and reaches a decision in the manner suggested by such models. Even if such models represent consumer behaviour, do they represent the consumer decision process when faced with questions of purchasing or choosing health care insurance programs? These models may well be valuable to economists or other professionals, such as insurance actuaries, for the study of health care insurance or the setting of rates. There is an uncertainty that the consumer conducts such formal analysis of marginal cost, marginal return, utility, and the formal probability of certain illnesses occurring.

It is likely that, despite the value of such models for economic or academic study, direct application of these models to individual decision making and personal decision support systems should be approached with care for several reasons:

1. The analysis conducted is based on a defined probability of a particular illness and a defined, specific cost of such illness. Most health care insurance decisions, at least from an individual's point of view, are based on far less certain probabilities, attention to a variety of illnesses or health conditions, and rather uncertain costs in treating any specific illness for any specific individual.

2. Such economic analysis makes use of certain fundamental features or assumptions. While these may be valuable for development of the model and for economic study, they may

not effectively represent the information-processing model of the consumer.

In view of item 2 above, consider that early in their text Folland, et al. (Folland, Goodman et al. 1997, p. 9) identify four distinctive features of economic study:

1. The assumption of rationality
2. The use of abstraction
3. The use of marginal analysis
4. The use of models as metaphors.

Again, the use of such models should not be discredited, but given the assumptions and features underlying their use, limits to their application to specific instances of consumer information processing, decision making, and market-place behaviour appear to be appropriate.

3.2 Conceptual Models

Consideration of issues related to the financing of health care suggests the need for a simple conceptual model. This becomes especially important with the recognition that what begins as a rather simple apparent relationship, may quickly expand to a more complex structure. This is especially true when seeking to identify the players and relationships that may develop in an effort to understand the health care patient or the recipient of services, the health care services provider, and the health care financier.

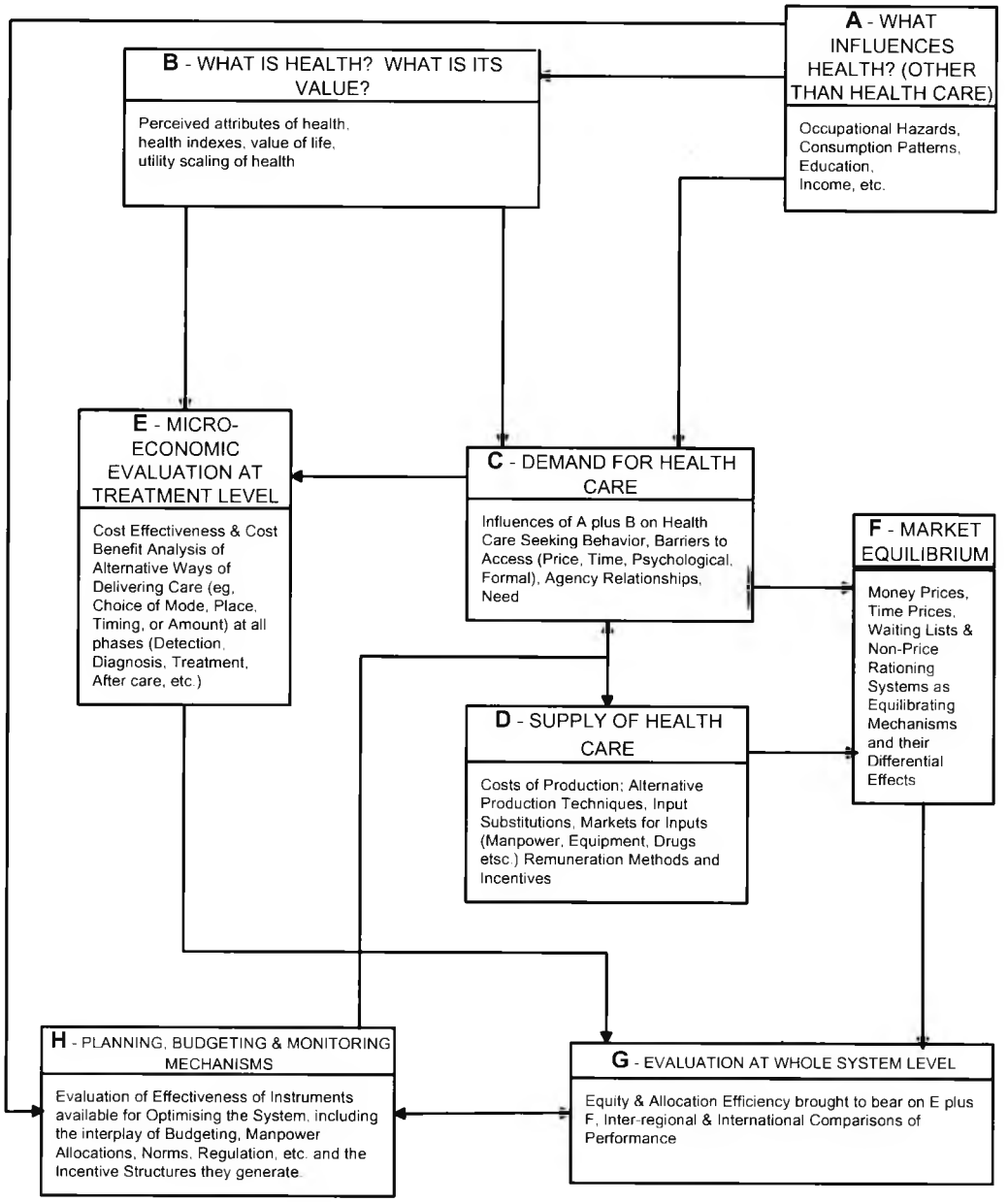
3.2.1.1 Economic Models

In a search for such a model it becomes apparent that economists have proposed models that may be of interest. Alan Williams, a British economist who devoted much of his career to issues of health and health care economics offers several such models, two of which are considered here (Culyer and Maynard 1997). The Williams Schematic Presentation of the Main Elements in Health Economics, Figure 3.10,

presents a reasonably simple model with an emphasis on the planning functions of the health care system. This eight-element model provides for a market-place and systems view of health behaviour. Of special interest are the components that give attention to Market Equilibrium, Planning, Budgeting and Monitoring Mechanisms, and Evaluation at the Whole System Level. However limited attention is given to the roles of the health care provider, the financing organisation, and the health care consumer or patient. The model does appear to be of value when considering the economic view and provides a framework for consideration of governmental policies, an area in which Williams has devoted much of his career.

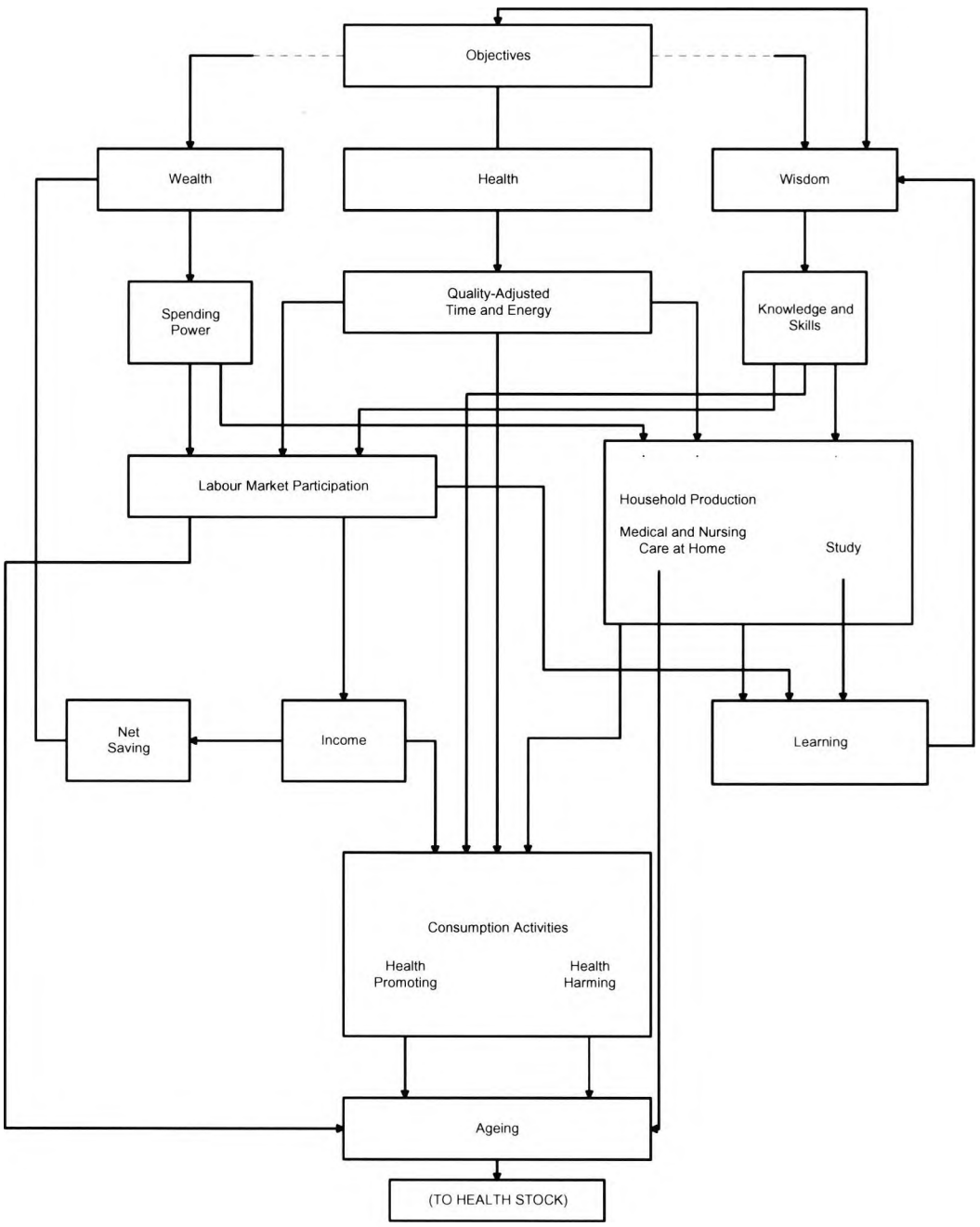
In Williams' work a second model of interest is noted, Figure 3.10 - The Grossman-Williams Model of Health Behaviour. A more detailed model, with fifteen major components, this model gives an expanded view of factors influencing health behaviour. Of special interest in this model are "softer" factors such as Wisdom, Knowledge and Skills, Learning, and Quality-Adjusted Time and Energy. Again, though this model gives valuable insight into factors impacting health behaviour, it does not direct specific attention to the roles of the three major stakeholders of provider, financier, and consumer.

Figure 3.9 - Williams Schematic Presentation of the Main Elements in Health Economics



Source: (Culyer and Maynard 1997, p. 46)

Figure 3.10 - The Grossman - Williams Model of Health Behavior

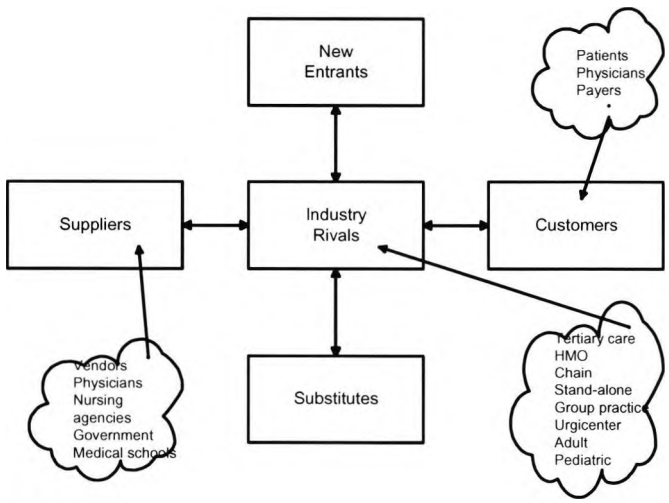


Source: (Culyer and Maynard 1997, p 72)

Bourke uses a different approach to the presentation of a conceptual model for the health care industry. In his text on Strategy and Architecture of Health Care Information Systems, Bourke

(Bourke 1994, p. 13) draws on the work of Porter (Porter 1985, pp. 4-8) in the use of a generalised Five Factors model for consideration of an industry. One adaptation of the model presented by Bourke applies the model to hospitals Figure 3.11 - Five Factors Model. (Bourke 1994, p. 13) In this model the identification of vendors, physicians, nursing agencies, government and medical schools as Suppliers is noted. Examination of the Customers area of the model shows identification of patients, physicians, and payers. This does bring attention closer to the clear identification of these stakeholders but applies their relationship as a whole to the hospital. This suggests a grouping of these three different players together but does not present a conceptual description of the relationships among these groups. To respond to this, a new and rather simplified model of the relationship is proposed that will support a view from an information systems perspective, of the relationships among the health care provider, the health care financier, and the health care consumer or patient.

Figure 3.11 - Five Factors Model for Hospitals



Source: (Bourke 1994, p. 13)

3.2.2 A Proposed Model

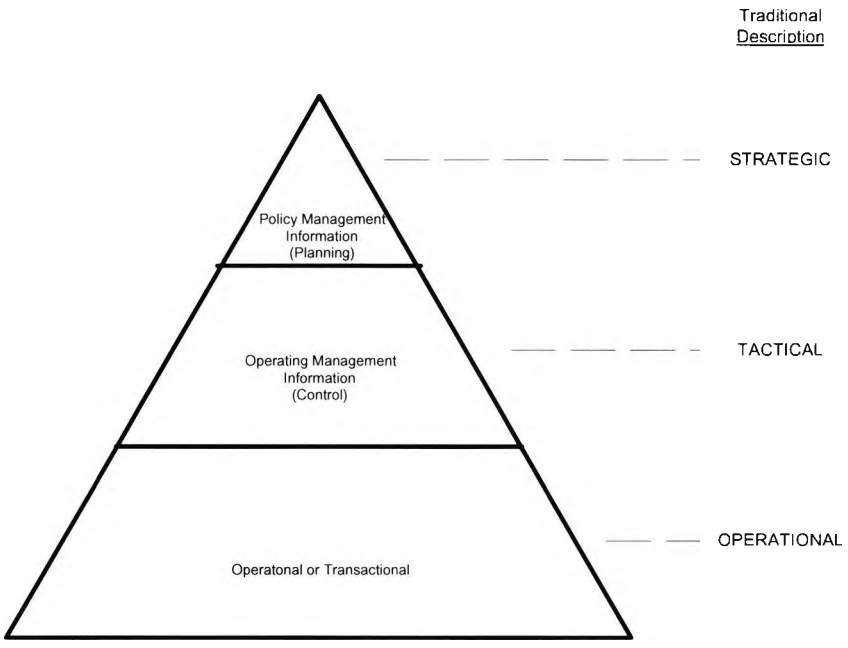
The emphasis on a simple conceptual model does place primary attention on these three fundamental entities in the relationship:

1. Patient (services recipient)
2. Health Care Services Provider
3. Health Care Financier

Inspiration for this three-party model is derived from the work of Robert Head. Head was an early writer in the field of Management Information Systems (MIS) and served as the first president of the Society for MIS in the U.S.A. Head commonly presented a conceptual view of Management Information Systems based on a simple pyramid of levels of management function as illustrated in Figure 3.12. (Head 1972, p. 11) This three level pyramidal view of management certainly was not new with Head, and in fact is still commonly used in introductory text books on business management. However, Head did lead the way in application of this simple, straight-forward view of MIS and applied this basic concept in much of his writing. The three levels of the pyramid are commonly considered to represent Operations, Tactical Management, and Strategic Management. Head did modify the labels that he applied to the pyramid as Transaction or Detail Processing, Operating Management Information (Control), and Policy Management Information (Planning).

This fundamental relationship is illustrated as shown in Figure 3.12.

Figure 3.12 - Head's MIS Pyramid



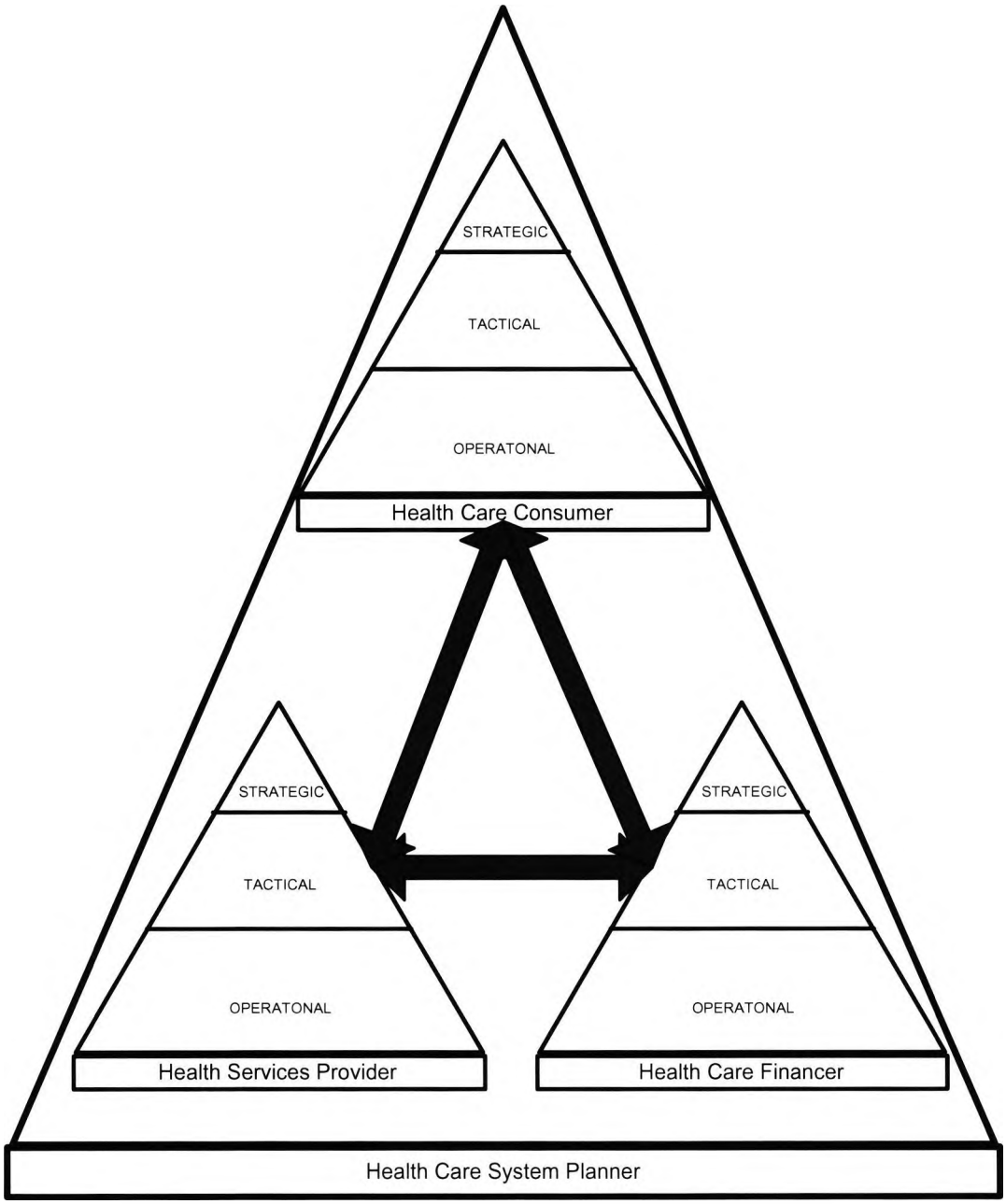
Source: (Head 1972, pp. 11, 29, 34)

Using Head's fundamental pyramidal model, an extension of this model is proposed in Figure 3.13 - The Health Care Consumer - Provider - Financier Model, and shows the three major stakeholders of Health Care Consumer, Health Care Services Provider, and Health Care Financier with each having a potential pyramidal set of information needs. These various information systems for each stakeholder infer relationships with the other two primary stakeholders of the relationship. However, this makes the overly simple assumption that there exist only the relationships between the entities shown at the vertices of the triangle. In reality the patient may well have more than one Health Care Service Provider and may also have more than one Health Care Financier. Therefore, each of these entities may be more properly considered as a set or domain of entities rather than a single item.

A fourth pyramid appears in the background of the diagram as a representation of the health care system planners. This may include professional associations, such as those of doctors and hospitals, commercial hospital management companies, and various government agencies. This model is presented to emphasise that:

1. Each stakeholder has different information needs and therefore different requirements for appropriate information systems.
2. Information needs are likely present at different levels of management or decision making for each stakeholder to include the health care consumer.
3. The various stakeholders have strong relationships with each other and therefore we may suspect that relationships of the information systems may well exist.
4. The role(s) and information systems needs of the health care system planners should not be overlooked.

Figure 3.13 - The Health Care - Consumer/Provider/Financier Model



3.2.3 Classification of Models and Techniques: An Economics Overview

A consideration of methods of analysis and evaluation of issues related to health care and health care financing not only draws on techniques of analysis from a variety of disciplines but is subject to becoming focused on the different techniques endorsed by these

disciplines. Even though a variety of techniques or methodologies of analysis may be identified, a need to adopt some scheme of classification to help the effort of comparison and contrast of the techniques does develop. The approach taken here is to classify such techniques based on their functional objectives, not merely on the methodology underlying any particular form of analysis or decision support system. Traditional economic analysis offers us a simple form of functional classification based on Cost Benefit Analysis (CBA) and Cost Effectiveness Analysis (CEA). Furthermore, economists who have given emphasis to health and health care economics have identified some of the specific issues that are relevant when attempting to apply CBA and CEA to issues of health care economics.

Many projects related to the public sector present a problem to traditional economic evaluation since traditional economic analysis based on supply and demand may not be relevant. This is true of many projects financed and supported by the public or government sector such as the decision to build particular highways, bridges, or parks. Many decisions related to the public sector share this difficulty of analysis and evaluation based on market place factors. This is especially true since public sector or government financing of health care is based on the concept of social benefits that accrue to society as a whole based on such public financing.

3.2.3.1 Cost Benefit Analysis

Cost Benefit Analysis (CBA) is one technique selected by economists to assist in analysis when these market-place factors of supply and demand may not provide a basis for the analysis. A fundamental premise underlying such CBA analysis is that "a project or policy will improve social welfare if the benefits associated with the project or policy exceed the cost" (Folland, Goodman et al. 1997, p. 222). Traditional economic analysis looks to the point at which a supply curve and a demand curve cross to set the price and volume of a

product and or service under market-place conditions. Based on the concepts of Marginal Costs and Marginal Benefits (or Marginal Return), Folland modifies these somewhat from a health care system perspective to introduce concepts of Marginal Social Benefits (MSB) and Marginal Social Costs (MSC). These benefits and costs are considered to be benefits and costs to the society that is addressing the issues of health care. As before, Folland uses the concepts of changing rates of the marginal benefits and costs to produce curves, graph them, and look for the points of intersection of these curves (Folland, Goodman et al. 1997, p. 564-566).

Regardless of how the conceptual graphs are presented, Folland does admit difficulties in the application of Cost Benefit Analysis in the evaluation of health care:

1. Which benefits and costs are to be considered?
2. How are monetary values to be assigned to the various benefits and costs?
3. What is the life of a project and what financial discount rate should be applied?
4. How is a value of human life to be determined?

(Folland, Goodman et al. 1997, pp. 575-577)

Item four presents a special difficulty. To a great degree the health care community has resisted placing dollar values on the benefits of health care. One effort to deal with this is the calculation of quality-adjusted life years (QALY) (Folland, Goodman et al. 1997, pp. 575-577). This approach attempts to develop a quantified measure of the QALY by applying different weighted values to different years of projected remaining life. Folland provides the following example:

> Consider a man at age 70 who may be expected to live 20 more years. From age 70 to 80, we expect his health to be perfect, but due to a variety of illness possibilities

> between the ages of 80 to 90, we expect each of these years to provide only half the quality of life of the previous ten. Thus, although he will be expected to live for 20 more years, he has only 15 QALY's left (Folland, Goodman et al. 1997, pp. 575-577).

Folland extends his discussion of the role of QALY concepts to a graphical presentation. He also admits to criticism of the QALY method, among the chief is the practice of assigning the same quality-of-life scores to everyone. From an economic perspective this tends to ignore marketplace influences.

3.2.3.2 Cost-Effectiveness Analysis

Cost-Effectiveness Analysis (CEA) provides an alternative approach to economic analysis that side-steps the issues often related to the determination of hard or difficult to determine benefits. Rather than attempting to compare costs and benefits to evaluate approaches, Cost Effectiveness Analysis seeks to determine the most cost effective means to achieve a defined goal. Folland comments that, "when a program has widespread third-party benefits that are largely in the form of intangibles, cost-effectiveness analysis (CEA) represents a more modest approach to program evaluation. The goal of CEA is to minimise costs in achieving a particular objective" (Folland, Goodman et al. 1997, p. 578).

The task undertaken with CEA may be compared to the production decision to be made by a manufacturing firm, which is to produce a given level of output from among alternative production methods. The wide spread use of cost effectiveness analysis by the U.S.A. military structure may be taken as an example of comparing alternative approaches to a given objective even without quantitative evaluation of the benefits of the objective. Cost effectiveness analysis may be applied to different approaches to reaching a certain level of military preparedness. However application of CBA may be difficult since the benefits of the military capability cannot be readily evaluated in monetary terms (Folland, Goodman et al. 1997, p. 578).

In a similar manner, we may find it difficult to determine many of the benefits of various approaches to health care but may be able to apply CEA to choose between alternative approaches to a defined objective. The fact that CEA gives less concern to many of the thorny issues of Cost Benefit Analysis may make such an approach attractive either as an alternative to CBA techniques or as a preliminary step before undertaking a complete CBA study.

3.2.3.3 Additional Health Care Economics Considerations

The sample conceptual models of health care and health care systems presented in the previous section provide a helpful conceptual overview. However, consideration of these general, conceptual models alone fails to properly describe the variety of attention given to health care and health care financing by the discipline of economics. The discipline of economics in general, and the sub-discipline of health care economics more specifically, have addressed substantial attention in the research literature to the financing and insurance of health care. Examples of subject areas that have been addressed include: the nature and role of health insurance, different reimbursement schemes, decision processes related to health care and health care insurance, and the role of information in a number of these processes.

3.2.3.3.1 Introduction

One introduction to examples of research from the discipline of health care economics is a 1986 study by Ellis and McGuire (Ellis and McGuire 1986, pp. 129-151). This study introduces itself with attention to the concept of prospective reimbursement schemes such as payment based on Diagnostic Related Groups (DGR's) as adopted by the U.S.A. Medicare program in the mid 1980's. This scheme of hospital reimbursement based on the diagnostic related group (DRG) causes the hospital reimbursement to be based on the diagnosis, with some

exceptions, rather than actual costs. Ellis and McGuire note that this scheme serves to move the cost-control efforts away from the traditional "demand-side interventions, such as deductibles and coinsurance, to cost sharing on the supply side". This is achieved by the requirement that the hospital or other provider bear the marginal costs of treatment (Ellis and McGuire 1986, 129-130). In their development of models of physician decision behavior under traditional cost-based reimbursement versus the prospective reimbursement schemes three "actors" in the process were identified:

1. Patients, who are assumed to be fully insured and accept the prescribed treatment
2. Physicians, who make the decisions about levels of treatment
3. Hospitals (Ellis and McGuire 1986, p. 132)

A fundamental assumption made by Ellis and McGuire in this study of is an assumption of fully insured patients. They also give substantial attention to the dual "agent" role of the physician of serving both the patient and the hospital. They both identify these roles of dual agent responsibility and identify conflicting objectives of the roles that may be present as the physician attempts to serve as the patient agent for good care and also serve as the hospital agent for management of costs. In the conclusion to the study, Ellis and McGuire note that, "If, as appears likely, physicians are induced to place more importance on hospital profits than on patient benefits, incentives in a prospective payment system will lead to an undersupply of services" (Ellis and McGuire 1986, p. 148). They further conclude with an argument for a mixed system of reimbursement suggesting that, "Imperfect agency is our main argument for a mixed system of reimbursement, combining a prospective component and a component proportional to resources used" (p. 148).

Specifically, this study seeks to identify physician behavior but in more general terms demonstrates attention to the roles of the physician, insurance, and decision processes. These roles are easily recognized as subjects to which the discipline of economics and the sub-discipline of health care economics have directed a variety of research efforts.

3.2.3.3.2 Insurance

One of the most generalized topics related to the goals of this study addressed by health care economics is the general nature of health insurance and the associated topic of why people buy health insurance. Previously, in section 3.1.6 - Insurance and Health Care Financing, the purpose of health insurance was identified as the pooling or sharing of risk or more specifically, reducing "the variability of the insured's income by pooling a large number of units, and operating on the principle of the law of large numbers" (Folland, Goodman et al. 1997, p. 230). Stated in a slightly different manner, this supports the argument that the reason that people buy health insurance is to avoid the risk of financial loss (Nyman 1999, p. 142). While supporting this motivation for the purchase of health insurance, Nyman identifies an "access motive" that also serves as a reason for the purchase of health insurance. The access motive to which Nyman gives attention is oriented toward the recognition that many people will have access to expensive medical care, if needed, through insurance even though they do not have adequate resources to pay for the health care with direct payment. He argues that in cases of expensive procedures, avoidance of financial risk is not the issue since even with use of all of available personal assets it would not be possible to pay for the health services. That is to say, "the benefits from health insurance are not limited to the gain from avoidance of financial risk by the risk adverse purchaser. Additional benefits are derived from insurance's ability to make

available medical care that would not otherwise be affordable" (Nyman 1999, p. 142). In this study he presents the case for recognition of this motive for health insurance purchase, develops general models for estimating the prevalence of the motive, discusses estimation of the access value of such insurance, and discusses the role of charity in providing for access when neither insurance nor personal assets are available to pay for the health care services. Nyman recognizes that this access motive is not new, the affordability of health care has long been recognized in the research literature, but he suggests that previous studies have not given this motive appropriate consideration in determination of the value of health insurance (Nyman 1999, p. 150). In a later paper, he returns to the issue of the access motive and suggests that a health insurance experiment conducted by the Rand Corporation "does not capture the information necessary to estimate the access value of insurance" (Nyman 2001, p. 296).

3.2.3.3.3 Decision Processes

In addition to attention to the general nature of health care financing and motivations for purchase of health insurance, the field of health care economics has directed research attention to various aspects of the decision processes and resulting behaviors associated with choice of a health insurance program. A study published in 2000 by Short, et al, titled "Similarities and Differences in Choosing Health Plans" addresses several topics associated with the current study (Short, McCormack et al. 2002, pp. 289-302). The authors sought to identify differences in how participants in publicly and privately supported insurance programs make their decisions and how decision support materials were used. Similarities reported between those in private insurance programs and public programs such as Medicare and Medicaid included: recognition of the importance of the health insurance plan choice, consultation of multiple sources of information, and a tendency to spend about the same amount of time

with a particular information source. The authors report that, "Across all types of insurance, readers most commonly spend 15 to 30 minutes with the CAHPS (Consumer Assessment of Health Plans Study) report" (Short, McCormack et al. 2002, p. 298). The conclusions to this study suggest that there are also differences in decision processes. More Medicare and Medicaid participants indicated that the process of choice was "hard", with Medicaid recipients expressing uncertainty about whether they chose the "right" plan. The authors suggest that Medicaid recipients were commonly making such a choice for the first time as they entered the Medicaid program. It was also noted that Medicare and Medicaid recipients gave more emphasis to convenience and access to care in contrast to the privately insured who gave more emphasis on the personal relationship with the doctor and out-of-pocket costs. The fact that Medicaid recipients did not face premiums and out-of-pocket costs was noted. Of special relevance to the current study is the fact that Short, et al., gave particular attention to the role of information sources and how participants in the study used these information sources in making a decision. However, these sources were apparently prepared in traditional printed forms and no use of computer based information services was reported.

Another example of a study from the field of health care economics regarding individual decision processes is by Long, et al., from 1998 that indicates that people do not deliberately shift their consumption of health services to time periods in which they have more generous health insurance coverage. The study notes that, despite common presumptions to the contrary, participants from the RAND Health Insurance Experiment (HEI) did not appear to practice "catching-up" on health care services as they moved into more generous health insurance nor did they find evidence of "stocking-up" by people who were moving off of the experiment to less generous coverage. Despite some evidence of such practices in dental coverage, the hypothesis of such

actions related to general health care was not supported. This indication was supported by further analysis conducted as part of this study. It is also interesting to observe that the original trend of not adjusting the consumption of health care services was noted based on the RAND Health Insurance Experiment (HIE). This source of data is worth attention, even though it now is somewhat dated, as it represents a fifteen year, longitudinal study regarding use of health care services and effects of patient cost-sharing conducted in the U.S. beginning in 1971. The HIE study has been described by RAND as "a 15-year, multimillion-dollar effort that to this day remains the largest health policy study in U.S. history" (RAND 2003, para. 3). This source of data has been frequently referenced in a number of studies addressing health insurance use and consumption in the U.S.A. The further analysis for this study by Long, et al., was conducted based on data collected as part of the 1984 to 1987 panels of the Survey of Income and Program Participation (SIPP) (Long, Marquis et al. 1998, p. 108), a data collection project whose development was supported by the U.S. Department of Commerce (ICPSR 1999, para. 4).

The discipline of health care economics has addressed a number of more specific decision oriented processes related to health insurance coverage. For example, a study published in 2000 by Rogowski and Karoly indicates that access to post-retirement health insurance does have a "large" effect on retirement (Rogowski and Karoly 2000, p. 529). The study suggests that availability of post-retirement health insurance does encourage retirement at an earlier age. The study further proposes that by not considering retiree health benefits the impact of pension coverage may have been overestimated in previous studies of retirement decision processes.

Another study directed toward a specific population addresses choice of health insurance programs by "managed care experts." Studdert, et al., noted an aversion to enrollment in HMO plans by

physicians. In this study physician experts were identified as half as likely (14.9%) as controls (26.6%) or non-physician experts (27.6%) to enroll in HMO plans (Studdert, Bhattacharya et al. 2002, p. 375). The conclusion to the study includes the suggestions that, "The aversion of physician experts, and non-physician experts with moderate income, to HMO plans may be caused by their stronger distaste for the constraints on choice and access that typically accompany HMO coverage. Alternatively, it may be explained by their superior ability to absorb, understand, and use information about available insurance options" (Studdert, Bhattacharya et al. 2002, p. 375).

3.2.3.3.4 Information - Nature and Role of

Decision processes, and the study of these processes and resulting behavior, have commonly recognized the importance of information in the decision processes as suggested by the previously identified study by Short, et al. (Short, McCormack et al. 2002, pp. 289-302). The significance of the role of information in the decision processes is further suggested by the specific attention to information issues in studies from areas of health care economics and closely associated disciplines.

In general two major roles of information that are of interest here can be identified as information related to direct health care decisions such as whether to pursue a specific therapy or how to treat a particular illness. A second type of information of more direct relevance to the current study is information associated with the health insurance or finance decision. An example of investigation of the first type of information role is a 2001 study by Wagner, et al., addressing the demand for consumer health information (Wagner, Hu et al. 2001, pp. 1059-1075). The authors note that use of consumer oriented health care information has received a resurgence of interest with the widespread adoption of the Internet and suggest that, "Interest in health information is also growing among researchers"

(Wagner, Hu et al. 2001, p. 1059). The study did give attention to the use of the Internet for access of health information but noted that only 3.5% of the study participants who did not own a computer did use a computer or the Internet for access of health information when such use required travel to a public facility. Furthermore, the inconsistent quality of such Internet based information was noted. One response to such quality issues was to seek health care information directly from a physician. However, the study does state that this "raises a question about the appropriate use of physicians for health information. Health insurance subsidizes the cost of communicating with a physician. Therefore, consumers may seek information from physicians when the marginal value is below the true marginal cost" (Wagner, Hu et al. 2001, p. 1073).

A different perspective regarding information services, and especially "decision aids", is presented not from an economics perspective but from the perspective of a medical doctor by Dr. Peter A. Ubel, MD. Ubel presents not so much a report on results of research but rather a call to alertness to possible problems in assisting patients in making appropriate health care decisions. He identifies potential problems of emotional impact, ethical issues, cognitive errors, and hazards of eyewitness accounts that may be associated with health care decisions. Again, Ubel's paper does not present research data and associated conclusions but appears to seek to raise awareness of potential information processing and decision processes with an alertness to the use of "decision aids".

The role of information that is more directly related to this study is characterized by research focused on information roles in the health insurance decision process. One example of such a study was presented in 2002 by Wedig and Ming (Wedig and Tai-Seale 2002, pp. 1031-1048). The study was based on the use of consumer oriented "report cards" on health care plan choices available to certain U.S.

federal government employees in 1995 and 1996. In introducing the study, Wedig and Ming suggest, "Several studies also indicate that consumers find process measures of consumer satisfaction to be the most useful, largely because they can easily infer the meaning of measures such as overall satisfaction, time spent with the physician, etc. Measures of health outcomes (e.g. mortality rates) are assigned less value by consumers" (Wedig and Tai-Seale 2002, p. 1033). The conclusions to this study suggest that the use of such report cards did influence choice of health care plans. It was also noted that this influence was greater with new hires than with existing employees and that the report card use did increase the elasticity of demand for health insurance. This study supports the argument that consumer oriented information, in an appropriate format, did influence consumer decisions in this particular market.

Another example of the role of information in such decision processes is presented in a 2002 study reported by Beaulieu (Beaulieu 2002, pp. 43-63). Based on the study of patterns of switching among health care plans by Harvard University employees between 1994 and 1997 the study seeks to identify the role of information regarding health care plan quality. The issue of quality addressed by this study was quality of the health plan, not quality of the information provided. The study indicated that approximately 11,500 Harvard employees were eligible for health care benefits during this time period with the reported enrollment varying between 9,713 and 10,002. In the introduction to the study the observation is made that, "Very few studies have attempted to quantify the effects of other non-price characteristics on health plan choice" (Beaulieu 2002, p. 48). However, an increasing amount of information about health care plan performance or quality has become available to consumers. "Employers frequently gather or purchase health plan performance data to distribute to their employees during the health plan selection period.

The federal government now collects and distributes health plan quality data (HEDIS measures and patient reports of quality through the CAHPS survey) on Medicare managed care plans to Medicare beneficiaries. The Consumers Checkbook publishes a guide to health insurance plans for federal employees that lists enrollee plan ratings on multiple dimensions of quality of care and customer service" (Washington Checkbook, 1997). Other sources such as the National Committee on Quality Assurance (NCQA) and national publications such as *U.S. News and World Report*, *Consumer Reports*, and *Newsweek* are identified as additional sources of information (Beaulieu 2002, p. 44). The study concludes that, "Analysis of plan switching behavior suggests that the provision of quality information has a small, but significant effect on consumer plan choices" (p. 44). Three more specific findings were reported in the conclusion:

1. Individuals enrolled in plans with lower reported quality were more likely to switch health plans than individuals in plans with higher reported quality.
2. An analysis of cross-sectional plan choices indicates that a higher quality of care rating was positively related to the probability of plan choice after controlling for other plan characteristics.
3. Some employee characteristics appear to be related to plan switching costs and the relative importance of different plan characteristics (Beaulieu 2002, p. 60).

Examples of the employee characteristics referred to in item three include age or whether the participant represented a family or an individual.

For the current study, the point that research from health care economics has directed attention to information services as related to the decision processes of interest is more important than the identification of the specific influences identified by a particular

study. However, this theme of research addresses the role of information in the decision process. It does not address the question of the quality or the investigation of the quality of the information.

Two examples of research oriented toward an investigation of the quality and the perceptions of quality of information used in these decision processes are presented in Health Care Financing Review in Fall 2001. However, it should be noted that both papers were prepared by representatives of the Research Triangle Institute, Inc. (RTI) and were supported by the same contracts or agreements. Furthermore, these papers are presented with a focus on the relevance and use of the information rather than from a clearly defined economics perspective.

In the introduction to the study by Harris-Kojetin, et al., note is made of the increasing complexity of the decision process presented to the Medicare health plan participant. It is also noted that this increasing complexity is present when "Medicare beneficiaries do not understand:

1. Today's current health care system
2. The differences between managed care (e.g. network) and fee-for-service insurance options
3. That managed care plans are both insurer and care deliverer
4. That plans play a role in access to and quality of care" (Beaulieu 2002, p. 21)

The evaluation of informational materials available to Medicare beneficiaries was conducted with focus groups addressing five primary research questions:

1. What are beneficiaries' overall impressions of the *Medicare & You* handbook and the *Medicare CAHPS®* survey report?

2. Do beneficiaries understand the purpose and intent of each booklet?
3. How useful do beneficiaries find each booklet and how would they use each booklet?
4. How much do beneficiaries trust the information in the booklets?
5. Are there any aspects of the booklets that are problematic for beneficiaries or sub-groups of beneficiaries? (Beaulieu 2002, p. 22)

Two concepts given specific attention in the conclusion to the study were usefulness or "perceived utility" of the materials and trust in the materials. The study reports generally positive response to the use of the booklets with the feeling that both booklets needed to be used together as they were seen as serving different purposes. The handbook was perceived as a reference tool while the Medicare CAHPS® booklet was identified as more of a short easy-to-read document. The study reports that, "While more group participants trusted the handbook and the *Medicare CAHPS®* survey report than did not, some tempered their trust with skepticism." The fact the materials were provided by the government both served as a basis of trust for some beneficiaries and a basis for suspicion by others. The study presented several reasons for possible mistrust such as unfamiliarity with statistical issues presented in the material or the feeling that there was an effort to "push" or "sell" the use of HMO's. (Beaulieu 2002, p. 31)

A second study presented in the same issue of the Health Care Financing Review by McCormack, et al., also addressed the value and use of the informational materials (Beaulieu 2002, p. 37). This study also finds the Medicare materials to be favorably reviewed and perceived as useful. Though the study focused on the print materials used as the primary information source, note was made that the education program initiated by the Center for Medicare & Medicaid

Services (CMS) and identified as the National Medicare Education Program (NMEP) included other resources such as "telephone help-lines, an Internet information database called Medicare Compare, training and support for intermediaries, enhanced beneficiary counseling services, and state and community-based outreach and education efforts" (Beaulieu 2002, pp. 37-46).

3.2.3.3.5 Asymmetric Information Issues

Another theme regarding information and information use issues that warrants comment and that has received attention in research from the field of health care economics is the concept of asymmetric information. The fundamental concept of asymmetric information is rather straightforward as defined in Appendix I - Selected Economic Definitions, "When somebody knows more than somebody else" (Economist 2003). A likely application of the concept to the issues of health care insurance is represented by Cardon and Hendel in their discussion of "adverse selection." Adverse selection may be considered as, "When you do business with people you would be better off avoiding" (Economist 2003, no page number). The frequent application of the concept is health care insurance is the effort of someone in a high risk class to be included in a lower risk class, resulting in either better coverage or a lower premium. The "adverse" nature of the business contract or relationship is to the insurance underwriter since coverage is underwritten at a level of risk that is adverse for the actual level of risk represented by the beneficiary. In this example, the information asymmetry involved is the presumption that the individual beneficiary knows more about his or her health condition than the underwriting company. The 2001 study reported by Cardon and Hendel addresses this type of information asymmetry although the study reports finding no evidence of such informational asymmetries (Cardon and Hendel 2001, p. 425). Another application of the concept of information asymmetry is presented by De Fraja in a

study of contract activities between a purchaser, the National Health Service (NHS) and a provider (hospitals, GP's) in the UK health care system (De Fraja 2000, pp. 661-677). In this study the asymmetry is taken to be represented by the fact that the purchaser has limited information about the provider's costs and the contract specifies the payment as based on the number of cases treated. A third example of the application of asymmetric information from health care economics is given by Chou in a study of differences in quality of care provided by for-profit versus nonprofit nursing homes (Chou 2002, p. 293-311). In this example, the information asymmetry is considered to exist when the, usually elderly, resident of the nursing home does not have a family member or other advocate to monitor and advocate for a high quality of care. As this is expressed in the study, "When the residents lack family members to monitor the service, the for-profit homes will have less incentive to maintain the quality of care" (Chou 2002, p. 307).

The relevance of the concept of asymmetric information, as used by economists, to the current study is oriented both toward an asymmetry of information and an asymmetry of information systems. As suggested by studies such as the Harris-Kotjen study related to information materials, (Harris-Kojetin, McCormack et al. 2001, pp. 21-34)the choice of health care plans is perceived as a complex decision. Given the history of computer information systems use by health insurance and finance organizations, one may well suspect that such organizations would have more effective computer-based decision support systems to provide focused relevant information than the consumer would have available. The increased use of the personal computer and the Internet now suggests that improved decision support systems may be available to serve the consumer, thus serving to reduce the probability of such an asymmetry. However, the purpose of this study is not to investigate such a potential asymmetry but to remain

Requirements for a Personal Decision Support System focused on the requirements for a personal decision support system to be used in the consumer decision process.

3.2.3.3.6 Summary

The general discipline of economics and the more specific sub-discipline of health care economics have addressed substantial research attention to issues related to the purpose of this study. This attention serves as encouragement that the subject areas of health care insurance and financing, decision processes in these areas and the use of information in these decision processes do warrant research attention. The research gives this general guidance and does provide help in understanding a number of specific areas of investigation. However, despite the emphasis on information and the efforts to determine the value of some specific information tools, no effort was identified to address requirements for a computer-based decision support type of system to aid the consumer in these decision processes. The commitment to this area in general combined with a limited attention to computer decision support roles for this specific purpose serve to justify this study in this subject area.

The introductory attention devoted here to health care economics recognizes the evaluation of various aspects of health care, health care decision processes, and health insurance from the field of economics. However, the main emphasis of this study is to apply an information systems perspective to the defined research question to define requirements of a particular type of PDSS. The topics suggested could be addressed from a more clearly established economics perspective, such as analysis of risk, but would likely result in rather different emphasis and findings. Likely such an approach should return to the fundamental assumption of rationality, use of abstraction, use of marginal analysis, and use of models identified by Folland and Goodman (Folland, Goodman et al. 1997, p. 9). This would likely result in more direct attention to the consumer decision

processes and perceptions of economic concepts of risk and expected value than the attributes taken from the Diffusion of Innovations tradition identified as the orientation of this study.

3.2.4 Summary - Health Care Financing

In this section the centre of attention has been directed to presentation of an overview of Health Care Financing or Insurance as characterised by the United States market. Some attention has also been given to the issue of what is health insurance, are all health care financing alternatives properly identified as insurance, and some fundamental perspectives related to health care insurance. Given this summary of the subject area of health care insurance, the focus of this study is redirected in the next section to the decision process. However, this attention is rather specifically focused on the decision process as characterised by use of Decision Support Systems.

3.3 Decision Support Systems

In the previous portion of this study, attention was given to the general structure of Health Care Financing or Insurance in the United States. This has included the evolution of private or non-governmental systems of health care financing, such as characterised by the Blue Cross / Blue Shield system as well as governmental programs. Primary examples of governmental programs are Medicare and Medicaid and some special alternative or demonstration programs such as the TennCare program implemented by Tennessee as an alternative to Medicare. This has established the subject area or domain of the decision processes to be addressed by this study. The focus of the study now turns from consideration of this subject area to the decision process itself. As a primary part of this consideration of decision process, attention is directed to Decision Support Systems (DSS). In this section attention will be devoted to definition of Decision Support Systems, identification of a generalised architecture

of such systems, and then consideration of the application of these concepts to a more specific category of such systems, a Personal Decision Support System (PDSS).

Given the institutional and professional nature of the health care provider and heath care financier, it seems likely that they are much more effectively equipped with relevant decision support systems than are health care consumers. Or at least, whether actually equipped with such decision support systems, such systems are readily available to these institutional stakeholders.

The purpose of the further research to be presented by this study will seek to answer two research questions:

1. Are decision support systems available to the consumer in the health care market in the U.S.A.?
2. What are the issues, from a technology adoption point-of-view, that influence the adoption of such consumer-oriented decision support systems?

To a significant degree, question number one must be addressed before serious consideration of question number two can be addressed. Only a few years ago the idea of a computer-supported information system oriented toward customer use for consumer decisions in this area would have seemed rather far-fetched. However, the wide-spread use of personal computers in the home and for personal use combined with the rapidly increasing use of the Internet makes the development and adoption of such customer, consumer oriented information systems seem quite plausible. One indicator of this is a simple, interactive Internet-accessible system available on the "BlueCares" Web site of the Blue Cross and Blue Shield Association in 1999. Titled "Choosing the Plan That's Right for You", this WWW based service provided a simple user-oriented interface with eight questions (BCBS_Assoc._Choose 1999, pp. 1-3). This system used a simple numeric

scoring system to present recommendations to the user regarding the choice of a traditional HMO, an HMO with POS options, a PPO or a fee-for-service plan.

Curiously, though this system was identified as an example of the type of PDSS of interest to this project in 1999, this service is no longer available. In July 2002 the system was no longer provided on the "BlueCares" site. A form of PDSS providing assistance in locating medical services based on geographic criteria, primarily for plan members when travelling, was provided but not selection among various types of plans as supported by the previous PDSS example (BCBS_Assoc._Travel 2003, no page number).

This rather simple, easy-to-use, Internet based system was interesting when compared to changing trends in retirement planning options offered to employee groups in the U.S.A. over the past few years. Only a few years ago, commonly only one or a very limited number of retirement options were offered to most employee groups in the U.S.A. Now, with a wide variety of tax deferral investment options such as several different types of Investment Retirement Accounts (IRA), supplemental retirement accounts, and other investment instruments; the need for decision support systems to assist in retirement planning has increased. Choices available to the consumer regarding income tax treatment, type of investment instruments, and level of risk for the investments have increasingly been thrust on the consumer in the past few years. This increase in factors has not only impacted the consumer but frequently has influenced the sales approach and style of the marketing of various financial services and retirement programs. Sales representatives of many of the investment management companies or financial services organisations available now frequently are equipped with interactive personal computer software designed to assist the consumer in the decision processes. These are not the only sales staff seeking to market such services to the

consumer. In fact many banks are offering an increased variety of financial services, to include various investment management services. For U.S.A. banks, the move to an increased variety of financial services that may be offered was encouraged by the recently passed federal Gramm-Leach-Bliley Act (Hines 1999). These services are available from the bank, brokerage house, or insurance salesperson. Now they are also offered as part of or an adjunct to personal computer financial management software packages, or as Internet based services provided by insurance companies, investment houses, or other financial services organisations. Today a variety of health care financing alternatives may be available to include various forms of managed care, traditional fee-for-service health care insurance, or other forms of "cafeteria" plans which offer tax incentives to set aside a portion of income on a tax sheltered basis on a "spend it or lose it" basis. When one then adds the availability of special coverage for nursing home care for senior citizens, the variety of decisions of a strategic and tactical nature, based on the pyramid suggested by Head, becomes almost overwhelming.

If such decision support systems are available to the U.S.A. citizen, then the discussion may address the second of the research questions, "What are the issues, from a technology adoption point-of-view, that influence the adoption of such consumer-oriented decision support systems?" Even if the answer to the first question suggests that such systems are not widely available, then the question becomes, "What conditions are necessary to make such information systems available?"

3.3.1 Introduction to Decision Support Systems - Seeking a Definition

As with many information systems concepts, it is appropriate to present the caution that it is rather difficult to agree on an "approved" definition for the term Decision Support Systems (DSS). This is especially true because many of the commonly recognised

attributes of a DSS are also characteristic of, at least to some degree, many other types of computer supported or Computer Based Information Systems (CBIS). In fact it is improbable that the concepts of DSS, as evidenced today, would be presented as they are without the influence of some of these precedent types of information systems. Two categories of information systems that may almost be considered as "prerequisite" to DSS are transaction processing systems and the focus on MIS.

In their development of a definition of the term DSS, Turban and Aronson (Turban and Aronson 1998, p. 76) present a summary of certain comparisons between a DSS and more traditional forms of Electronic Data Processing (EDP) systems as represented in Table 3.2.

Table 3.2 - DSS Versus EDP

Dimension	DSS	EDP
Use	Active	Passive
User	Line and staff management	Clerical
Goal	Effectiveness	Mechanical efficiency
Time horizon	Present and future	Past
Objective	Flexibility	Consistency

Source: (Turban and Aronson 1998, p. 76)

Turban and Aronson furthermore identify the points of emphasis addressed by the definition adopted by a number of contributors to the literature of DSS. These points of emphasis are identified in Table 3.3 - Concepts Underlying DSS Definitions.

Table 3.3 - Concepts Underlying DSS Definitions

Source	DSS Defined in Terms of
(Gorry and Morton 1971)	Problem Type, system function (support))
	System function, interface characteristics
(Alter 1980)	Usage pattern, system objective
(Moore and Chang 1980)	Usage pattern, system capabilities
(Bonczek, Holsapple et al. 1980)	System components
(Keen 1980)	Development Process

Source: (Turban and Aronson 1998)

After consideration of the approaches of such contributors, Turban and Aronson present a rather lengthy working definition of Decision Support Systems:

> A DSS is an interactive, flexible, and adaptable CBIS specially developed for supporting the solution of a non-structured management problem for improved decision making. It uses data, provides easy user interface, and can incorporate the decision maker's own insights. In addition, a DSS may use models, is built by an interactive process (often by end-users), supports all phases of

decision making, and may include a knowledge component (Turban and Aronson 1998).

However, the purpose of this current study is well served by a shorter version of this definition presented by these authors in the glossary of their text, "Decision Support Systems (DSS) - Computer-based information systems that combine models and data with an attempt to solve non-structured problems with extensive user involvement" (Turban and Aronson 1998, p. 865).

In considering this definition and its relevance, the following major points asserted within the definition deserve consideration:

1. Reference to a computer-based information system
2. The role of models
3. The role of data
4. A mention of "attempted" solution
5. A mention of non-structured problems
6. The use of extensive user involvement

Even though this definition includes some issues of system structure or architecture, significant attention is given to functional purpose with the phrase "an attempt to solve non-structured problems" and mention of non-architectural issues such as "with extensive user involvement".

Review of this definition encourages the view that the fundamental issue of definition of the term DSS is and should be more affiliated with the functional purpose or use of the system rather than specific issues of design technique, system structure, or architecture. This perspective, adopted by this study, suggests that it should be the functional use to which the system is applied that is the basis for recognition as a DSS. Techniques of systems design or characteristics of development methodology should not be the proper

basis for identification of a DSS. Furthermore the suggestion of the word "support" in the DSS term suggests a contrast with decision making systems.

The general view here will be to consider a specific DSS as an advisor or consultant rather that an automated, independent, decision making system or operational aid. For example, an automated monitoring system in a manufacturing process or a transportation system that controls the operation of components of the system may also include safety features with "fail-safe" provisions. If the system determines a condition as "unsafe", certain components of the system may be shut off or set to a special state. This decision may be programmed into the system and the actions implemented directly by the system rather than presenting a recommendation to a human operator in the system. This example gives evidence of "decision making" and should not be characterised this as a Decision *Support* System.

Extending this attention to a definition of DSS also suggests consideration of common characteristics and capabilities of such systems. Once again Turban and Aronson offer guidance in this area:

1. Semi-structured programs
2. For managers at different levels
3. For groups and individuals
4. Interdependent or sequential decisions
5. Support intelligence, design, choice
6. Support variety of decision styles and processes
7. Adaptability and flexibility
8. Interactive ease of use
9. Effectiveness, not efficiency
10. Humans control the machine

11. Ease of construction by end-users

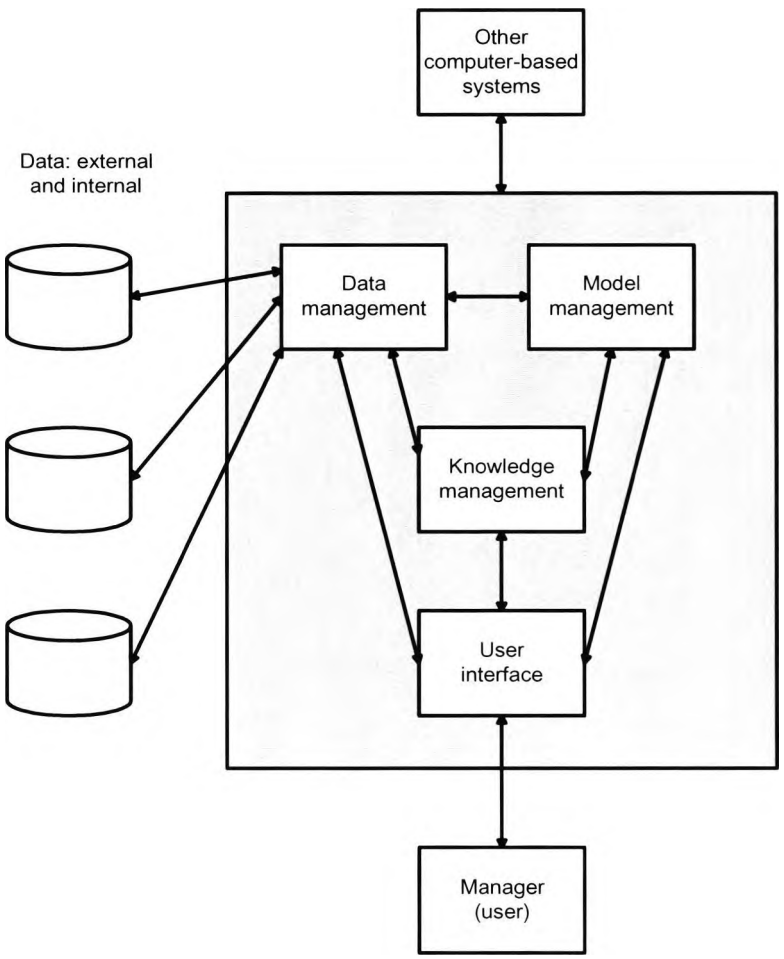
12. Modelling and analysis

13. Data access

3.3.2 Architecture

Despite the fact that the argument has been presented that the structure or architecture of a system should not be the basis for classification of the system as a Decision Support System, it is appropriate to give some consideration to a model of a generalised architecture common to DSS. Turban and Aronson, as shown in Figure 3.14, suggest the following generalised structure.

Figure 3.14 - Schematic Structure for a Decision Support System (DSS)



Source: (Turban and Aronson 1998, p. 79)

Consideration of this generalised DSS schematic model does require a view of this model as descriptive and not definitive. Most of the components may be present to varying degrees in any specific DSS system. In fact, it could be argued that the only component of the schematic that must be present is the user interface. All other components may or may not be present in a specific DSS. The case could also be supported that any DSS must also include some form of model, and therefore the model management component of the schematic must be present in some form. However, some specific DSS's may place emphasis on the support of the decision process from a data management or Data Base Management System (DBMS) component and may not require any further modelling capability beyond that supported by the DBMS component of the system. However, these various components do warrant some further consideration.

Data Management Subsystem. The Data Management subsystem presented by Turban and Aronson can be described as being composed of four primary elements:

- DSS database
- Database management system
- Data directory (or dictionary)
- Query facility

In most cases all four of these components are provided by modern Generalised Database Management Systems (GDBMS) whether on personal computers, minicomputer, or mainframe systems. These systems may vary greatly in the capability of their data directory or data dictionary facility. Today it is likely that many GDBMS systems in use will use Structured Query Language (SQL) as their query language. This query language, developed to support operations against database structures implemented with the relational database model, has been

implemented by a number of database management system vendors, and provides a non-proprietary language interface tool with database systems from a variety of vendors.

Of perhaps more concern for the design of any specific DSS are issues related to the choice of which databases are appropriate for use. This becomes more challenging given the possibility of access of both internal databases, those owned and maintained by the organisation, and the external databases owned and maintained outside of the organisation. A wide variety of external databases supported by government agencies or professional organisations, as well as proprietary databases available for access on a fee basis, are available online today. Access of the database may also need to accommodate a "data warehouse" approach. We will consider that a data warehouse approach uses database techniques to organise a special data structure that has had the data "cleaned" or "scrubbed" to improve validity, likely has summarised the data from the original level of detailed data capture, and usually is not used to support operational transaction processing for the organisation. The subjects of both database management and data warehousing have been widely addressed in the textbooks and professional literature of information systems disciplines and, therefore, receive limited attention here.

Model Management Subsystem. This component of the generalised DSS structure provides specific models to a DSS and makes more general provision for management of the various models that may be used within the DSS structure. These models may be categorised based on several different schemes such as level of organisational impact, functional areas of the organisation (perhaps financial or production models) or by underlying academic discipline.

Of perhaps more significance than any individual model is the concept of model management or of a Model Base Management System (MBMS). This is especially true since widespread acceptance of the

concept of a MBMS is not found in other types information systems as with data base management systems (DBMS). Turban and Aronson suggest the following functions of such a MBMS:

1. **Create Models.** Creates models easily and quickly, either from scratch or from existing models or from the building blocks.
2. **Allow Model Manipulation.** Allows users to manipulate the models so they can conduct experiments and sensitivity analyses ranging from what-if to goal seeking.
3. **Model Management.** Stores, retrieves, and manages a wide variety of different types of models in a logical and integrated manner.
4. **Use Model Building Blocks**. Accesses and integrates the model building blocks.
5. **Support Multi-User Model Use.** Catalogues and displays the directory of models for use by several individuals in the organisation.
6. **Track Usage.** Tracks model data and application use.
7. **Support Model/DSS Integration.** Interrelates models with appropriate linkages with the database and integrates them within the DSS.
8. **Provide Model Base Management.** Manages and maintains the model base with management functions analogous to database management: store, access run, update, link, catalogue, and query.
9. **Support Multi-Model Problem Solving.** Uses multiple models to support problem solving.

The concept of a model or the use of the MBMS component of a DSS does not presume the use of any specific modelling technique. The

models may vary greatly in complexity and may be developed with a variety of techniques. In some cases widely used general-purpose software, such as a personal computer spreadsheet, may be used as the basis of the model while in other cases programming languages or special modelling software may serve as the basis of model development. The concept of a model, and a set of models, as considered here is very general and makes no presumptions regarding modelling subject matter, modelling technique, complexity, or software development tool. As previously suggested, in some cases the modelling capability may be provided by other components of the DSS such as the DBMS component.

Knowledge Management Subsystem. Knowledge Management is to be distinguished from the data base management component of the DSS structure. In fact the concept of knowledge, as considered here, should be distinguished from the concept of information even though the knowledge may be based on or associated with data and information managed within the scope of the DSS. Turban and Aronson's definition of knowledge is, "Understanding, awareness, or familiarity acquired through education or experience. Anything that has been learned, perceived, discovered, inferred, or understood. The ability to use information" (Turban and Aronson 1998, p. 862).

The last simple sentence, "The ability to use information" provides a phrase to describe knowledge but does not really clarify the concept of knowledge in relationship to the concept of information. To achieve this goal of "using information" a process is needed by which the information may be evaluated to achieve knowledge. Given the above definition a simple hierarchy to characterise the relationship of data, information, and knowledge is proposed.

Table 3.4 - Data, Information, and Knowledge Hierarchy

Concept	Identifying Characteristic	Example	Comment
Data	Records fact(s)	8.2	Records the fact.
Information	Gives meaning to the Data	It is 8.2 miles from my home to my office.	Gives the fact "meaning" by placing the data "in context". Identifies the unit of measure (miles) Identifies the data as representing the distance from my home to my work.
Knowledge	Provides for evaluation of the Information	The shortest route from my home to my office is 8.2 miles long.	Provides for a standard of evaluation: Shortest distance Conducts the evaluation: This is the shortest distance.

Further consideration of the definition provided above suggests that it gives guidance with a consideration of several of the traditional "reporter's questions" as suggested in Table 3.5 - Knowledge: What, How, and Why.

Table 3.5 - Knowledge: What, How, and Why

What

Understanding
Awareness
Familiarity

How

Acquired through
Education -- Experience
Learned
Perceived
Discovered
Inferred
Understood

Why

Ability to use information

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Frequently the knowledge management aspects of an information system may be considered as within the domain of an expert system (ES) which may be a component of or interfaced with the DSS. Such expert systems commonly make use of artificial intelligence techniques. As with many of our information systems techniques, the term Artificial Intelligence presents problems with definition. The definition of Artificial Intelligence chosen for this study is rather simple, "The sub-field of computer science that is concerned with symbolic reasoning and problem solving", but this definition does need to be supplemented to clarify the points of concern.

The overall field of Artificial Intelligence has addressed such a wide range of subject matter such as expert systems, robotics, machine vision, natural language processing, neural networks, and voice or speech processing that focus needs to be directed within the field. The domain of AI that usually offers the most direct relevance to support of DSS is the field of expert systems. Again, even this term presents difficulty in terms of specific definition. Rather than choose a formal definition in this case it will noted that Turban and Aronson suggest that most expert systems commonly include, as a minimum, a knowledge base, an inference engine, and a user interface. More broadly, they identify the following components are frequently found in expert systems:

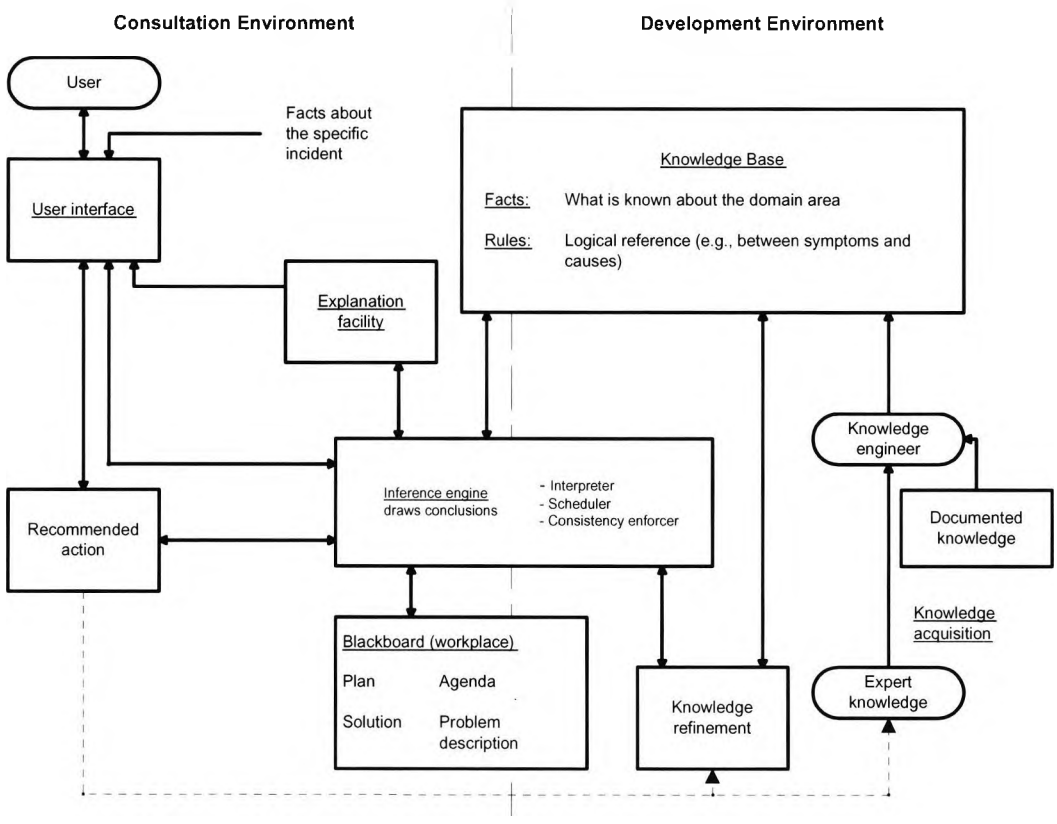
- Knowledge acquisition subsystem
- Knowledge base
- Inference engine
- User
- User interface
- Blackboard (workplace)
- Explanation subsystem (justifier)

- Knowledge refining system

(Turban and Aronson 1998, pp. 446-447)

Some special note is given to the role of knowledge management, to include techniques for knowledge representation and knowledge acquisition that is suggested by these characteristics. The provision for an Explanation or Justification subsystem, that such an expert system may provide, may also be significant to certain DSS. Though various techniques for representation of knowledge have been researched and implemented, many of these make use of some form of rule-based structure. Commonly these rules may be represented in terms of the traditional "IF … THEN … ELSE … END-IF" logical construct.

Figure 3.15 - Structure of an Expert System



Source: (Turban and Aronson 1998, p. 446)

Specific interest in AI and expert systems remains focused on the functional role of knowledge management rather than the specific techniques of expert system implementation. This attention to the role of knowledge management remains much the same regardless of whether one considers a DSS that interacts with a true expert system or whether some of the techniques are derived from the field of expert systems and are included directly in the DSS system itself. A good example of the close relationship between these two system areas and likely architecture is suggested by a review of Figure 3.15 - Structure of an Expert System. A comparison of this diagram with Figure 3.14 - A Schematic Structure of DSS, indicates a number of components likely to appear in either a DSS or an expert system. Specifically noted are the Knowledge Base, Knowledge refinement, Knowledge engineer, Expert knowledge, Recommended action, and User interface components.

3.3.2.1 User Interface (Dialog) Subsystem

The importance of recognizing the user interface as a component of the information system is suggested by the fact that the conceptual, schematic diagrams for both DSS (Figure 3.14) and for expert systems (Figure 3.15) include the user interface as a system component. This importance is also supported by the recognition that to many users the system interface is "the system". The user interface is often described as a "surface" through which the data are passed back and forth between the user and the computer. This interface or surface is also recognised as a dialog emphasizing the two-way nature of the communications that take place between the user and the computer-based components of the information system.

One discussion of the dialog or two-sided nature of this communication process identifies six major components of this dialog:

- *Knowledge.* Knowledge is the information the user must have to communicate with the computer. The knowledge may be the user's expertise included in a reference card, or in an online help system.

- *Dialog.* Dialog is an observable series of interchanges or interactions between the user and the computer.

- *Action language.* A user's action language can take various forms, ranging from selecting an item from the menu (with a keystroke or mouse click), to answering a question, moving a display window, or typing in a command. Input devices are used to execute actions.

- *Computer.* The computer interprets the user's action (input), executes a task (such as computation or data access), and generates a display (the presentation language or the output of the computer).

- *Presentation language.* Presentation language is the information displayed to the user via output devices. Such information can be shown as display menus, windows, or text. It can be static or dynamic, numeric or symbolic. It can appear visually on the monitor, presented as voice or a printout.

- *User's reaction.* The user interprets the display, processes the content, and plans actions (Turban and Aronson 1998, p. 230).

In addition to these major components of the user interface some consideration is given to the primary factors to be considered in the design of the interface. Larson has suggested the following factors:

- *Time.* How long does it take for the end user to perform his or her task?

- *Learning.* How long does it take a novice to learn the system?
- *Recall.* How easy is it for an end user to recall how to use the system after he or she has not used it for some time?
- *Versatility.* Can the system be used to perform a variety of end-user tasks?
- *Errors.* How many errors does the end user make, and how serious are those errors?
- *Help.* Does the system provide help when the end user has trouble?
- *Adaptability.* Does the system adjust to the end user's level of competence, as he or she becomes more experienced? Does it tailor itself to the habits and styles of different users?
- *Concentration.* How many things must an end user keep in mind while using the system?
- *Fatigue.* How quickly does the user tire while using the system?
- *Uniformity.* Are the commands of this system identical to equivalent commands of other systems?
- *Fun.* Does the end user enjoy the system? ((Larson 1982)as referenced by Mallach (Mallach 1994, pp. 147-150))

3.3.2.2 The User

To some extent it could argued as to whether the user should be identified as a component of the DSS or not. However, writers in the field do commonly identify the user in such a manner and two primary points are presented to argue that this is an appropriate view:

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1. The needs of the user must be met before one can assume satisfactory performance of the DSS and
2. The fact that the DSS is perceived as a decision *support* system with substantial user/system interaction involved with the use of the system. In most cases the DSS software components do not "make" a decision but guide or support the user in exploring and making this decision.

Of course point one above, the satisfaction of user needs, is to be expected of information systems of various types and is not restricted to DSS. However, it is likely that the two points are inter-related and that the interactive use of the system suggested by point two makes special demands on the design of the system and the manner in which point one is satisfied.

The point could also be argued that inclusion of the user as a system component introduces a component of extraordinary complexity. This component, the human user, may dominate and confuse the view of the entire system. Indeed consideration of the human issues related to the system design and use could overwhelm the study of the DSS and distract from an overall view of DSS. In an attempt to respond to this potential problem, this study will direct its focus on the user as a system component with an overview of two primary issues: 1 - how managers make decisions and 2 - influences of psychological type on decision making.

When considering how managers actually make decisions, one researcher has suggested that the various methods used for decision making can be categorised along three dimensions: rationality, politically, and flexibility. Mallach presents definitions of these terms in this context:

Rationality in decision making is the extent to which the decision makers collect and analyse information

objectively and choose among the alternatives on the basis of these alternatives' relationship to predetermined objectives.

Politicality is the extent to which a decision involves competition among decision makers and the extent to which the decision depends on the distribution and use of organisational power.

Flexibility is the extent to which decision makers free themselves from tradition and structure, potentially making choices that "break the mold"

(Mallach 1994, p.36).

Regardless of how any specific decision making technique might be characterised, it does not always require a truly optimum solution to the problem. Various methods of decision making may accept the concept of "satisficing" in the decision making process. The term satisficing has commonly been used in studies of decision making to describe a decision or solution that is "good enough." In other words, the decision maker may settle for selection of an alternative that is satisfactory rather than an alternative than can mathematically be proved to be optimum. The acceptance of a satisficing solution may be especially appropriate if the model or algorithm that yields the solution is not a formal optimising algorithm or formula.

When considering the user as a component of the DSS, it is appropriate to recognise that a person's nature or psychological type influences his or her approach to decision making. One widely used description of different psychological types is the Myers-Briggs Type Inventory (Briggs-Myers and Briggs 1957). The Myers-Briggs Type Inventory suggests four preferences that determine personality type:

1. ***Introversion (I)/Extraversion (E).*** This preference suggests whether individuals prefer to direct their energy toward the outer world (E) or the inner world (I). Extraverts understand the world through acting and reacting to it; they need to externalise things to understand them. Introverts understand their world through careful contemplation. They prefer to act or respond after thoughtful consideration of an issue.

2. ***Sensing (S)/Intuition (N).*** This function refers to a person's preferred perception process. It indicates how people take in information and become aware of things, people, events, and ideas. Sensing means finding out about things through the senses and through careful, detailed observation. People who prefer intuition perceive patterns or relationships among ideas, people, and events. Intuitive people trust perception based on intuitions and reading between the lines, while sensors confine their attention to what is real and verifiable.

3. ***Thinking (T)/ Feeling (F).*** This function refers to a person's preferred judgment process. It describes how people prefer to come to conclusions or make decisions about what they have perceived. Thinking means considering pros and cons or consequences and coming to a logical choice, decision, or conclusion. Feeling involves weighing personal values and others' reactions: Will there be conflict or harmony, approval or disapproval? Those with a feeling preference often neglect logical reasoning and fail to consider consequences. Those with a thinking preference often neglect taking other people's reactions - even their own emotional responses - into account.

4. ***Judgment (J)/ Perception (P).*** This is a "lifestyle" preference. It describes whether one tends to let a perception process or judgment process run one's outer life. People who have a judging preference want to have things settled, decided, planned, and managed to the plan. They are often seen as decisive and organised, and they enjoy working in structured organisations. People with a perception preference are often seen as flexible, spontaneous, and uncomfortable with much structure and planning. They want to keep plans to a minimum to be able to adapt flexibly to new situations.

In the literature associated with the Myers-Briggs Type Inventory, substantial attention is directed to classification of combinations of "personality type" based on the sixteen possible combinations of the different values for the four key behavioural characteristics, identified as "scales" by Myers-Briggs. Of more interest in the domain of decision making is the influence that the Myers-Briggs personality may have on preferred decision making techniques.

Table 3.6 - Myers-Briggs Personality Types and Decision making Techniques

Scale Type	Preferred Techniques
Energizing Scale	
Extravert (E)	Brainstorming in group Outcome psychodrama (evaluating scenario through role playing) Thinking aloud
Introvert (I)	Brainstorming privately Incubation (doing something else as subconscious works on problem)
Attending Scale	
Sensing (S)	Share personal values, ideas Overload (deliberately considering too many facts to see individually) Inductive reasoning (developing rules from specific instances) Random word technique
Intuitive (N)	Classify, categorise Deductive reasoning (applying rules to specific instances) Challenge assumptions Imaging/visualisation Synthesizing
Deciding Scale	
Thinking (T)	Classify, categorise Analysis Network analysis (e.g., critical path method, PERT) Task analysis
Feeling (F)	Share personal values Listen to others' values Values clarification

Living Scale	
Judging (J)	Evaluation (comparison with a standard or pre-established norm) Plus-minus-interesting technique (for evaluating alternatives) Backward planning (identify conditions needed to reach goal)
Perceiving (P)	Brainstorming Random word technique Outrageous provocation (absurd statement as bridge to idea) Taking another's perspective

3.3.3 A Decision Making Method

In addition to the types of human characteristics suggested above, the very process of decision making itself, with or without computer based support, is a part of investigation of DSS. Many writers and organisations have attempted to define a decision making process. Commonly these approaches to decision making have been based on a rather common-sense approach that suggests several steps:

1. Define the problem (or opportunity)
2. Identify the alternative solutions or approaches
3. Evaluate these alternatives
4. Select an alternative
5. Implement the alternative
6. Evaluate the result (and perhaps the process)

A more formalised approach based on this general approach has been presented by Kepner-Tregoe (Kepner and Tregoe 1965). The steps of their methodology are defined as:

- State purpose of decision
- Generate alternatives

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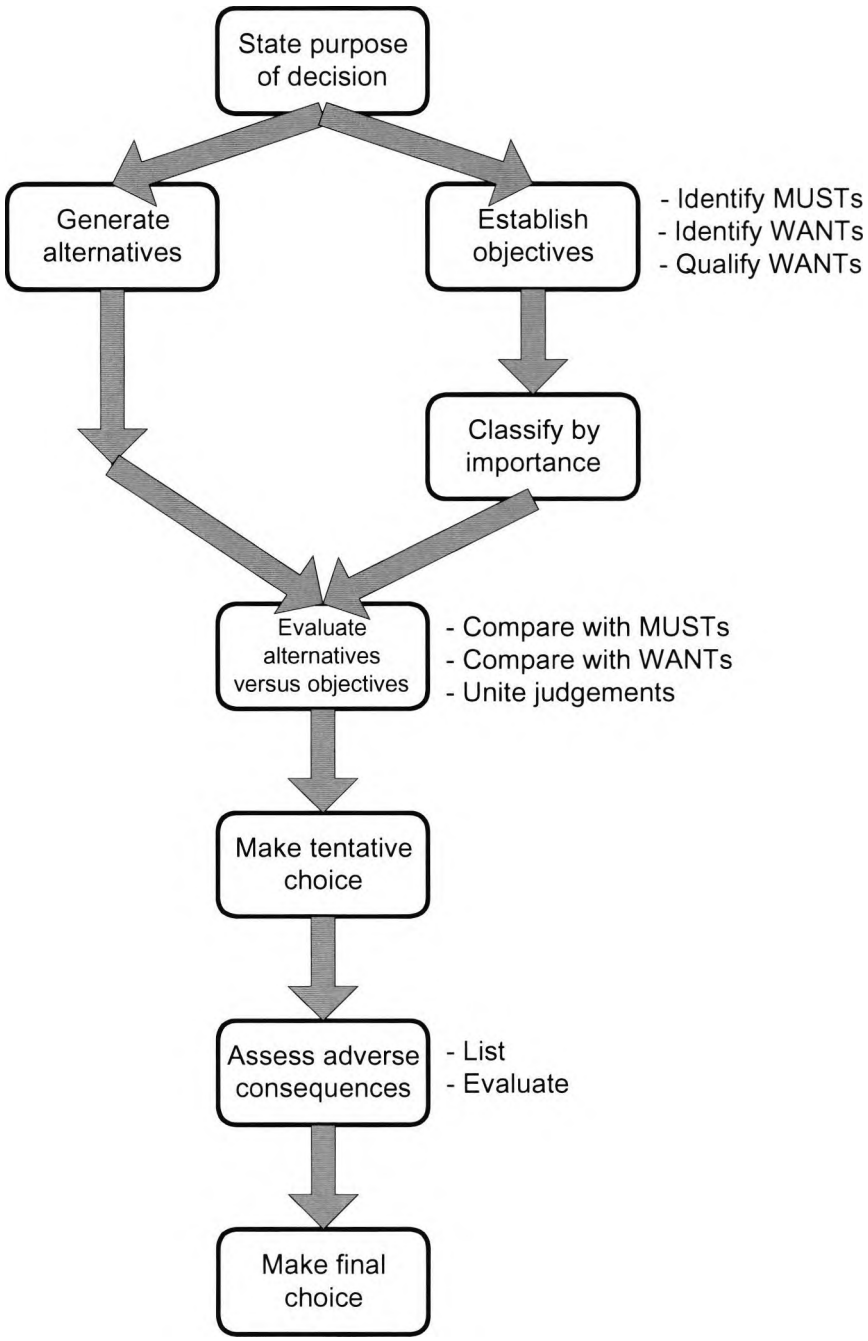
- Establish objectives
  - Identify MUSTs
  - Identify WANTs
  - Qualify WANTs
- Classify by importance
- Evaluate alternatives versus objectives
  - Compare with MUSTs
  - Compare with WANTs
  - Unite judgments
- Make tentative choice
- Assess adverse consequences
  - List
  - Weigh
- Make final choice

Since some of these steps may be addressed in parallel, and by inference some steps may be iterative, the steps may be considered in a diagram form as Figure 3.16 - Graphical Representation of Kepner-Tregoe Decision Steps.

Figure 3.16 - Graphical Representation of Kepner-Tregoe Decision Steps



Source: (Turban and Aronson 1998, p. 446)

3.3.4 Decision Structure

A classic issue addressed when considering decision making, or at least when considering DSS, is the question of decision structure. The definition of DSS applied here includes reference to the application of DSS to non-structured decision making. The general

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view is that decision making falls along a continuum ranging from highly structured or programmed decisions to highly unstructured or non-programmed decisions. Commonly this type of decision structure is associated with the organisational level or type of control as we note in Table 3.7 - Decision Support Framework.

Table 3.7 - Decision Support Framework

Type of Control	Operational Control	Managerial Control	Strategic Planning	Technology Support Needed
Type of Decision				
Structured	Accounts receivable, order entry	Budget analysis, short-term forecasting, personnel reports, Make-or-buy	Financial management (investment), warehouse location, distribution systems	Management information system, operations research models, transaction processing
Semi-structured	Production scheduling, inventory control	Credit evaluation, budget preparation, plant layout, project scheduling, reward system design	Building new plant, mergers and acquisitions, new product planning, compensation planning, quality assurance planning	DSS
Unstructured	Selecting a cover for a magazine, buying software, approving loads	Negotiating, recruiting an executive, buying hardware, lobbying	R & D planning, new technology development, social responsibility planning	DSS, ES, neural networks
Technology Support Needed	Management Information System, Management science	Management science, DSS, ES, EIS	EIS, ES, neural networks	

Source: (Turban and Aronson 1998, p. 11)

3.3.5 Relationships with Other Systems

A consideration of Decision Support Systems should recognise that DSS represents only one category of information system that has attracted attention both in information systems practice and the

research literature. This tendency to define an increasing number of categories of information systems has led to a rather remarkable collection of acronyms in what appears to be the alphabet soup oriented study of information systems. We may suspect that this increasingly large set of categories of information systems is a result of both the maturation of the experience with Computer Based Information Systems (CBIS) as well as the difficulty of achieving a number of the objectives of Management Information Systems (MIS).

The concept of MIS as introduced in the early 1970's suggested an integrated, rather comprehensive view of the information resources within an organisation. "The idea behind an MIS was to store all the firm's data: customers, orders, inventory, production schedules, suppliers, employees, payroll, and so forth for access and correlation on demand by non-technical managers." However, many organisations were unable to achieve the rather lofty goals of MIS as then suggested in the information systems literature. This difficulty of achieving a comprehensive MIS somewhat paralleled the experience with implementation and use of Data Base Management Systems (DBMS) or Generalised Data Base Management Systems (GDBMS). At first DBMS was frequently described as an approach to the organisation and management of the data within an organisation to assist in effective management and reduction of data redundancy. At the present time DBMS techniques are in widespread use but frequently the use of a DBMS has not strongly influenced the overall organisation view of the data resources, but rather has only been implemented as a somewhat enhanced file access method within the computer based systems.

The term MIS continues in use at the current time but may vary greatly in terms of what is suggested. In some cases it may still be used to suggest an overall, comprehensive view of an organisation's information systems. In other cases it may be used to describe the information reporting functions, especially those of selection,

formatting, and delivery of rather traditional reports of the computer-based system(s). The concern here, however, is to recognise the difference between the Transaction Processing Systems (TPS) of an organisation and what has become known as the Management Support Systems (MSS). The Transaction Processing Systems of an organisation may generally be considered as operational level systems that process common recurring types of activity such as requests for payment, the actual payments, circulation of a library book, registration of a student in a class, etc. In contrast, MSS of whatever type may be generally viewed as focused on higher-level management functions within the organisation. Likely the subject matter addressed by the MSS is less recurring in nature, at least within this organisation, and less likely to have a structured or fully programmed decision process.

One writer (Turban and Aronson 1998, p. 22) has identified some major categories of information systems as:

1. Transactions Processing Systems (TPS)
2. Management Information Systems (MIS)
3. Decision Support Systems (DSS)
4. Expert Systems (ES)
5. Executive Information Systems (EIS)
6. Neural Computing

Despite the presentation of these categories of systems as clearly defined and discrete categories, this simply structured categorisation may not be completely accurate. This categorisation might serve more for convenience than proper description of the relationships that may occur between the different categories. In many cases there may be substantial interface or integration between systems of the different categories. In other cases it may be likely

to find techniques commonly associated with systems of one category implemented in any specific system associated with a different category. For example, DSS commonly borrows techniques from the various other system categories identified above.

One view of decision capabilities found in the different system categories as suggested by Turban and Aronson is given in Table 3.8.

Table 3.8 - Decision Capabilities by System Category

System Category	Decision Capabilities
Transaction Processing Systems (TPS)	No decisions
Management Information Systems (MIS)	Structured routine problems using conventional management science tools
Decision Support Systems (DSS)	Semi-structured problems, integrated management science models, blend of judgment and modelling
Expert Systems (ES)	System makes complex decisions, unstructured; use of rules (heuristics)
Executive Information Systems (EIS)	Only when combined with a DSS
Neural Computing	Mainly predictions, based on historical cases

Source: (Turban and Aronson 1998, p. 22)

3.3.6 Cognitive Style Issues

While considering Decision Support Systems within the organisation, it is also appropriate to give some attention to the continuing controversy that has been addressed in the information systems research literature regarding the significance of cognitive style issues in such research and practice. It appears that initiation of this controversy may be associated with two articles published in the research literature in the early 1980's. The first article by Robe and Taggert in 1982 gave attention to the role of hemispheric lateralisation of the brain in influencing management and

decision style. The second article is credited to George Huber as published in Management Science in 1982. In this article Huber proposes four reasons why cognitive style research will not lead to operational DSS design guidelines. One of the reasons was that "we do not know if DSS designs should (1) conform to the user's cognitive style or (2) complement the user's cognitive style"

The discussion of the relevance of cognitive style as an issue of concern to DSS research and design seems to have focused on two fundamental questions:

1 - Can hemispheric asymmetry and hemispheric specialisation of the human brain explain differences of cognitive style in a manner to have implications for DSS and human-machine interface design?

2 - Should differences in cognitive style be considered in the design of such human-machine interface regardless of the cause of such issues of cognitive style?

These two themes were revisited approximately ten years later in work published by Rao and Jacob that questions the validity of the application of research from medical and clinical research while noting that such research was based on studies with split-brain patients (surgically split or brain-injured patients). Noting "These were abnormal subjects on whom experiments were conducted in highly unnatural and constrained conditions" they then propose some seven reasons why results from such a sample should not be used to predict corresponding functional hemispheric differences in normal people in everyday life (Rao and Jacob 1992, p. 146).

In a published response to the paper by Rao and Jacob, Robey proposes that the view of such hemispheric specialisation (more popularly referred to as the "right-brain" versus "left brain" emphasis) should be taken as a metaphor for consideration of the balance of analytic versus intuitive problem solving and decision

making. In support of consideration of this dichotomy as a metaphor of behaviour and decision making style, Rao and Jacob note a basis for this dichotomy in Jungian psychology and in the design and application of instruments such as the Myers-Briggs Type Indicator (MBTI).

As to perhaps the greater question, at least in terms of DSS research and design, Huber claims that "We are no more enlightened now about whether, when, or how we should facilitate, complement, or curtail users' biases than we were then, and it seems both risky and unethical to implement a DSS that could lead the user astray by either reinforcing a task-inappropriate style or interfering in an unexplained and unsanctioned way with the user's intentions." Huber further gives support to the concept that practitioners seeking to implement DSS may achieve more than researchers seeking to develop a cognitive style literature:

> ... In the race between (1) management scientists aspiring to develop a cognitive style literature that is a satisfactory basis for deriving operational DSS design guidelines, and (2) management scientists working together to develop DSS generators and data accessing technology … (that users could manipulate and alter) according to their weekly whims and needs … a person would be well advised to bet on the latter (Huber 1983, pp. 567-579).

In concluding his response to the Rao paper, Robey argues for an integrated view of the analytic-intuitive dichotomy by noting that:

> In conclusion, the quest by Rao and his colleagues for a rationale to support research that links cognitive style with DSS design is not served by the recent neurological finds they cite. Rather, these findings more closely support the notion of integrated, whole-brained cognitive processes. Researchers adopting an integrated, organic view of human information processing, in place of the analytic-intuitive dichotomy, should discover more challenges and more rewards in their efforts (Robey 1992, pp. 151-152).

The perception of this study will be that rather than debating the validity of the application of research from medical fields, we will consider the analytic-intuitive dichotomy as a metaphor of value and recognise that the implementation of a DSS should present itself

in use so as to assist the user in the integrative process of resolving issues of this dichotomy. The DSS system should help the user to "put it all together".

3.3.7 Personal Decision Support Systems

Most of the professional and research literature devoted to Decision Support Systems, and this discussion so far, make the assumption, often implicitly, that the study of DSS is limited to DSS within organisations. Commonly this will be the same organisation that develops or purchases the DSS and commonly the DSS will be used to meet managerial and organisational decision needs. However, increasingly Decision Support Systems designed to support individual decisions are evolving. The individual decisions considered here are not just decisions to be made by an individual within an organisational structure impacting a portion of the organisation. Rather, they are decisions to be made by the individual whose results will have impact on that person in his or her personal or private life apart from the organisation. For this study such Decision Support Systems will be referred to as a Personal Decision Support System or PDSS.

It should also be noted that increased development and use of such computer supported PDSS's have been encouraged by two primary influences: 1 - the widespread use of personal computers and 2 - the widespread use of the World Wide Web (WWW). These two phenomena have resulted in rather powerful general purpose computing capability being available to individuals and families. The popular use of the WWW has provided a widely available mechanism for delivery of information systems to the individual, even if the individual only has an infrequent need for such information services. These services may be available even if the individual does not make a specific purchase decision to build or buy the DSS.

Requirements for a Personal Decision Support System

Various types of financial services marketed to individuals offer examples of information services comparable to personal decision support services. Examples from three categories in the Appendices are:

1. Appendix III -Information Services for Retirement Planning - Examples from the World Web
2. Appendix IV - Information Services for Life Insurance - Examples from the World Wide Web
3. Appendix V - Information Services for Health Insurance - Examples from the World Wide Web

Services for each type of financial product are offered by a number of organisations on the World Wide Web. Commonly these web-based services offer:

1. Directory of services or companies providing services
2. Guidance in choice of type of product
3. Rate quotation
4. Glossary of terms

An example of a PDSS related to health care coverage is presented in Appendix VI - BCBS Association PDSS for Health Care Financing Example. The need for such decision support is reinforced when considering the choices for health care financing offered by one Blue Cross / Blue Shield plan as illustrated in Appendix VII - BCBS of Tennessee Health Plan Options.

Another area of personal financial planning that provides good examples of PDSS for U.S.A. citizens is the preparation of the Federal Income Tax. In the United States the preparation of the Federal Income Tax return, due by April 15 of each year, is an unpleasant, onerous task. For many years, a substantial industry has existed in the U.S.A. in income tax preparation. However, several personal

computer software products have been offered for some years now to assist the individual in the preparation of his or her income tax return or form. The product Turbo Tax appears to be the market leader in this market niche. Even if not the market place leader, Turbo Tax may be taken as characteristic of products marketed for this purpose. Products such as Turbo Tax have evolved from not only assisting in the preparation of the current income tax return but to offering advice or "tax strategies" for reduction of taxes in years to come. This analysis of the current year and proposal of strategies for the future may well be considered to be a PDSS example.

Retirement planning for most U.S. citizens is closely related to income tax planning since a number of plans for "tax deferred" investments have been developed and endorsed by the U.S. government. One of the appeals of such investment programs is that money invested is on a "pre-tax" basis and not subject to income tax until withdrawn from the investment program. One of the fundamental assumptions is that many retirees will be subject to a lower tax rate at retirement given the progressive income tax rate characteristic of the U.S. federal income tax. Another distinct advantage of this tax-deferral approach to retirement planning is to provide a substantial increase in the amount of principle available to earn interest on the investment. Given current tax rates, many middle income Americans will experience approximately a 30% "return" during the first year on money committed to such pre-tax investment programs. However, substantial restrictions and financial penalties apply to withdrawals from such programs before certain ages. The concern about the long term financial or actuarial stability of the U.S. Social Security Trust fund, a federal program providing retirement income for most U.S. citizens, has likely given further encouragement to many citizens to commit to personally funded retirement programs. A number of information services that can be considered a PDSS are currently

available to individuals through the WWW services of the Internet to assist in retirement planning and investment management. However, financial services companies or organisations marketing various investments or investment services offer many of these WWW services. In these cases some questions may develop as to the validity of the advice offered by these services. Is the advice being offered in the best interest of the investor or the company marketing the investment? It can be noted that that some other, apparently more independent services, not directly associated with companies marketing investments or investment services are available on the World Wide Web.

However, availability of these services does little to describe how widely used such services are, or to help us understand what factors encourage the use of these services. Since much of the history of DSS is oriented toward organisational information systems, do all of the lessons learned here apply to more personal Decision Support Systems?

3.3.8 PDSS for Health Care Financing Choices

With the clarification that PDSS, or Personal Decision Support Systems, may warrant consideration as a type of DSS that may have different characteristics than more traditional organisational DSS, then the issue of what does this mean regarding PDSS's related to choices of health care financing presents itself. This becomes an area of interest because of the complexity of choosing a health care financing program, limited experience of the individual as a decision maker in this area, the changing nature of health care financing options likely available to the individual in many cases, and the financial significance of such decisions.

A trend in the U.S.A. economy and workplace has been to provide the employee with more options in the choice of health care financing over the past few years. Part of the motivation for offering

employees more choice, and decision making responsibility, in this domain may have been to truly make more relevant options available to the employee. But it also seems likely that part of the motivation for providing such choice may have been to encourage employees to select some form of managed care program rather than more traditional fee-for-service coverage. The differences in employee participation in premium payment, deductible and coinsurance amounts, and prescription coverage suggests that employees are being encouraged to "voluntarily" elect some form of managed care program, often with the forfeiture of some freedom to make later choices regarding service provider or location in which service is received.

The changing nature of the health care financing market, to include the motivations of the employer and the health care financing organisation, suggests that PDSS services in this area have increased in relevance to the individual in these recent few years. Such PDSS's, related to health care financing, take on attributes that more clearly distinguish them from more general PDSS services such as general personal financial planning or federal income tax planning. Health Care Financing PDSS's are likely to address selection among such choices as:

1. Self Financing
2. HMO participation
3. PPO participation
4. POS participation
5. Participation in federal tax alternatives commonly offered as part of "cafeteria plan" options by the employer.

Of course, these choices are based on the U.S.A. market. Since various industrialised nations have taken such varied approaches to providing and financing health care, it seems unlikely that products or services would evolve for general markets that address more than

one national economy. It may be that exceptions to this generalised statement could develop for some multi-national organisations.

Recognizing that a PDSS for Health Care Financing decisions will likely have different requirements than other more generalised personal financial planning PDSS's, at least in the U.S.A., raises the question of what are these system needs or system requirements. This is the area of question that this study addresses. However, before attempting to define specific system needs, a plan is proposed for categorising such requirements into the following categories:

1. **Functional Subject Area Domain.** What information specifically related to the domain under consideration (Health Care Financing) needs to be addressed?

2. **Level of Help and/or Justification.** Given that this may represent a decision domain in which many users may feel limited expertise, what ancillary services such as Help services for definition of terms or Justification services for explanation of a system response may be significant?

3. **Delivery Mechanisms.** How is the PDSS service provided to the user? Through the WWW services of the Internet, as part of some other software package or service, or through some other technique?

4. **Recurrence / Frequency of Decision.** Is the decision to be treated as a one-time decision or does it recur on some interval or based on some event, such as a change of employer, and what influence on the system and its use does this have?

5. **User Acceptance of System Output.** How does the user of the system accept the output, such as recommendations or proposed actions, of the system? Is the user behaviour influenced by the output of the PDSS adoption / acceptance

of the technology? Are issues of technology adoption the same as for other forms of information technologies, especially as for DSS of a more organisational nature?

Of these various categories of requirements that are proposed here, the primary research interest will address the category of functional subject area domain. An attempt shall be made to address the question, "What are the functional requirements of a Personal Decision Support System for making choices of health care financing?"

3.4 Introduction to Technology Adoption and Diffusion of Innovation

In previous portions of this study, consideration has been given to the topics of Health Care Financing and Decision Support Systems (DSS) as two topics to be considered as part of a multi-topic research project. To add the third leg to the "three-legged stool" of the project's subject matter domain, the subject under consideration now transitions to the topic of Technology Adoption. Actually it is more appropriate to suggest that the discussion transitions to the consideration of Technology Adoption and the Diffusion of Innovations. The consideration of Technology Adoption, whether an Information Systems technology or other types of technology, may well be addressed as a sub-topic within the research tradition of the Diffusion of Innovations (DI).

3.4.1 Behavioural Beliefs in Technology Adoption - An Example

Early in an investigation of the research literature associated with the adoption of information systems technologies, two notable points begin to present themselves:

1. Not all factors contributing to the adoption of an information technology may be discovered by an examination of the technology itself, and
2. Previous application of the Diffusion of Innovation research literature to the study of technology adoption of information systems suggests a relevant relationship between these two areas (Moore and Benbasat 1991, pp. 192-223).

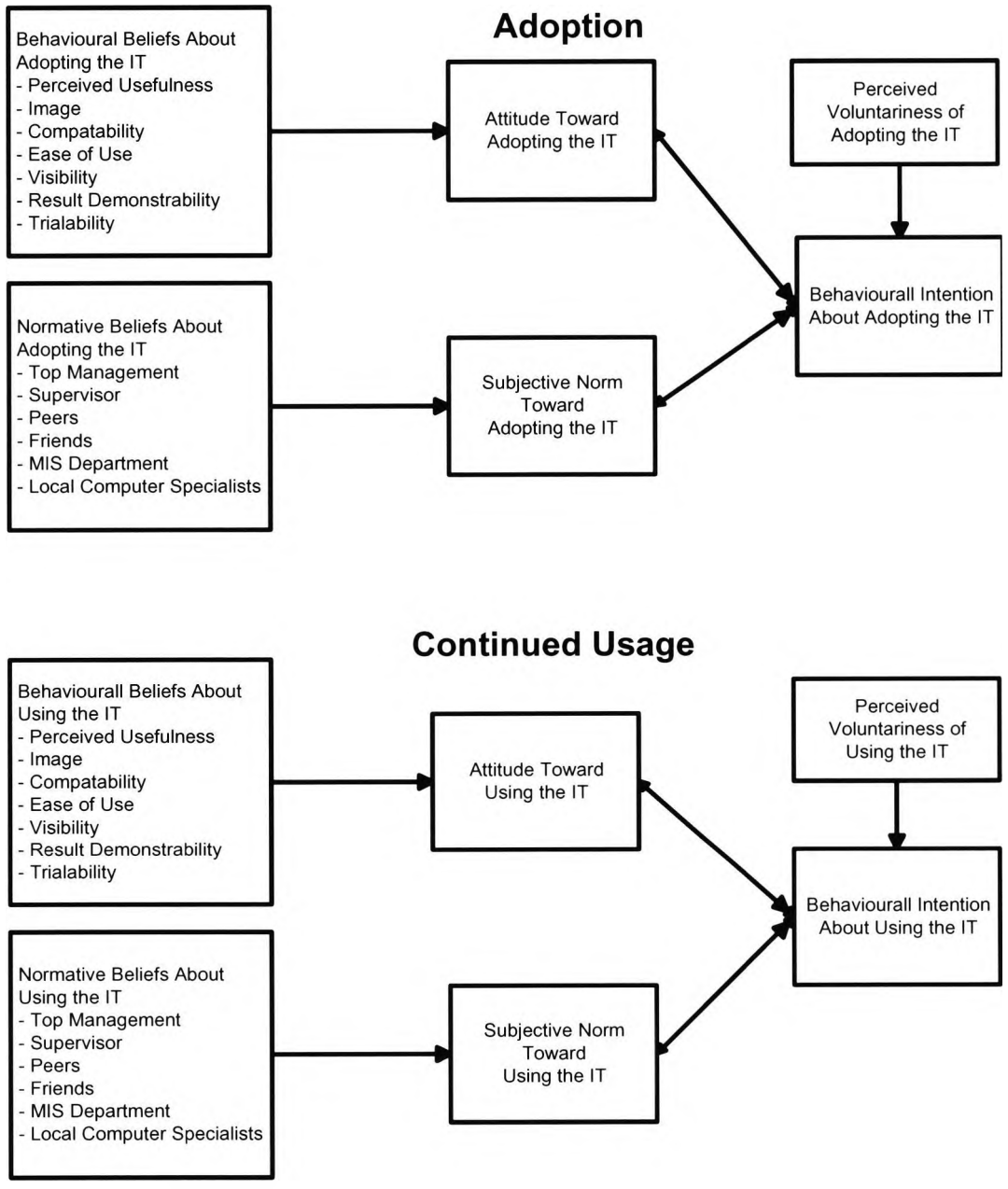
An awareness of these two basic issues serves as the basis for the overview of fundamental issues of information systems to be addressed here. In fact, it is the second of these two issues that will serve as the basis of the concepts to be developed. The perspective of this discussion is that the more comprehensive study of

the Diffusion of Innovations can serve as a valuable framework for a more focused investigation of Technology Adoption.

An effective introduction to this proposition, viewed from an Information Technology perspective, is provided by a study of beliefs related to information technology adoption with an emphasis on pre-adoption versus post-adoption beliefs (Karahanna, et al., p. 99). This study is instructive not only for the specific answers to the research questions that are provided, but also for a number of other reasons. Reasons for interest include: the attention to pre-adoption versus post-adoption beliefs, the attention given to beliefs rather than characteristics of the technology (even though the study was based on the adoption of a specific information technology within a specific organisation), and references to the diffusion of innovations literature found within the Karahanna paper ((Rogers 1983, pp. 210-240) as referenced by (Karahanna and Straub 1999, p. 186)).

The focus of this study is clarified and given structure by Karahanna's Figure 3.17 - Theoretical Models (Karahanna and Straub 1999, p. 187). Consideration of this figure draws attention to the pre-adoption phase versus the continued phase as discussed in this study. One also notes that the conceptual model presented directs attention toward a set of behavioural beliefs. These are beliefs that are directed toward: 1) influences on attitudes toward adopting or continuing use of an information technology and 2) the influence of normative beliefs directed toward influences on the subjective norms influencing the adoption / continued use of the information technology under consideration.

Figure 3.17 - Theoretical Models - Beliefs about Adoption / Continued Usage



Source: (Karahanna and Straub 1999, p. 187)

The study emphasises constructs such as behavioural beliefs and normative beliefs, the influence of these on attitude and subjective norms, and the resulting impact on behavioural intention. This study, though oriented toward Information Technology, is a study of

behaviour, not the technology itself. All of these constructs represent issues more in the domain of students of human behaviour such as sociologists or psychologists, or perhaps market researchers, rather than developers of the technology such as computer scientists, programmers, or engineers. Only with identification of some of the constructs associated with behavioural beliefs, whether beliefs associated with adoption or continued usage, does identification with subject areas likely to be within the domain of the technology designers evolve. Likely the subject domains of Perceived Usefulness, Compatibility, and Ease of Use fall within this area. Perhaps an argument could be made that issues of Result Demonstrability and Trialability may be within the subject domain of the technology developers such as the computer scientists, programmers, or engineers.

The constructs such as Relative Advantage, Image, Compatibility, etc. are given further definition by the authors as shown in Table 3.9 - Perceived Innovation Attributes (Behavioural Beliefs). Not only are the definitions of the terms by the author useful, but also the very choice of the captions of the table is instructive. The designation of Perceived Innovation Attributes reinforces the point that it is the consideration of the perception of these attributes, which may or may not be the true attributes that are under consideration. Again, the issues being addressed appear to have more of a reference discipline in areas such as sociology or psychology. From a slightly different perspective, one may merely be faced with a different example of the classic question about sound produced by the falling tree in the lonely forest.

Table 3.9 - Perceived Innovation Attributes (Behavorial Beliefs)

Perceived Innovation Attributes	Definition
Relative Advantage (Perceived Usefulness)	The degree to which adopting/using the IT innovation is perceived as being better than using the practice it supersedes.
Image	The degree to which adoption/usage of the innovation is perceived to enhance one's image or status in one's social system.
Compatibility	The degree to which adopting the IT innovation is compatible with what people do.
Complexity (Ease of Use)	The degree to which using a particular system is free of effort.
Trialability	The degree to which one can experiment with an innovation on a limited basis before making an adoption or rejection decision.
Visibility	The degree to which the innovation is visible in the organisation.
Result Demonstrability	The degree to which the results of adopting/using the IT innovation are observable and communicable to others.

Source: (Karahanna and Straub 1999, p. 180)

Another example of an emphasis on perceived attributes of the innovation versus the inherent attributes of the innovation itself is found in the work of Moore and Benbasat. In reporting on their work to develop a validated instrument for the investigation of Technology Adoption, Moore and Benbasat (Moore and Benbasat 1991, p. 196)address the role of perceptions in the construction of their instrument and their associated scales. They draw heavily on Rogers in the development of their work (Rogers 1983, pp. 210-240). In addition to recognizing the attention to perceptions rather than the inherent attributes of the innovation itself, Moore and Benbasat recognise the difference between the perceptions of the innovation and the perceptions of the use of the innovation:

> Thus, it is not the potential adopters' perceptions of the innovation itself, but rather their perceptions of using the innovation that are key to whether the innovation diffuses. Unfortunately, however, within diffusion research, perceptions have traditionally been defined with

> respect to the innovation itself as evidenced by Rogers' definitions (Moore and Benbasat 1991, p. 196).

After recognition of this difference, Moore and Benbasat then make simple changes in the definitions presented by Rogers to recast them with an attention to the perceptions of using the innovation. For example, "the definition of Relative Advantage needs only simple revising to be defined as 'the degree to which **using** the innovation is perceived as being better than **using** its precursor'" [emphasis by original authors] (Moore and Benbasat 1991, p. 196).

An alertness of this attention to perceptions in both the Information Systems and Diffusion of Technology research literature prepares one for a transition of attention to the more general case addressed by the Diffusion of Innovations literature. A remarkable guide to this literature and its progression over the past several decades is provided by Rogers. An indication of the progression or research work in this field is suggested by the recap of the number of publications in this research area as presented by Rogers in the preface to his 1995 edition: (Rogers 1995, p. xv).

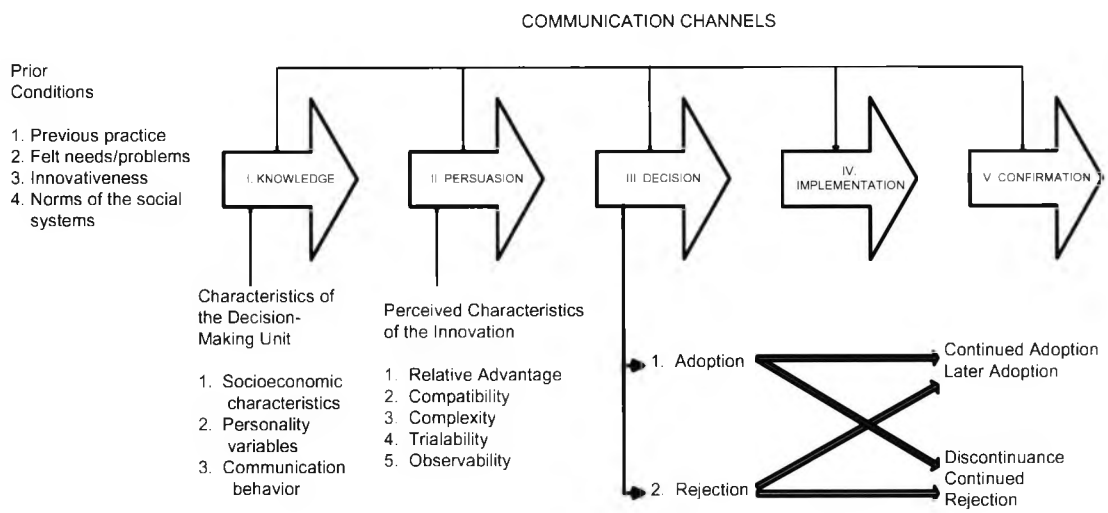
Table 3.10 - Editions of 'Diffusion of Innovations' and Number of Research Publications

Publication Title	Year of Publication	Number of Related Research Publications
Diffusion of Innovations	1962	405
Communication of Innovations: A Cross-Cultural Approach	1971	1,500
Diffusion of Innovations	1983	3,085
Diffusion of Innovations	1995	4,000

3.4.2 A Diffusion of Innovation Model

Not only does the Diffusion of Innovations as presented by Rogers provide a helpful categorisation of constructs related to adoption as we have seen above, but Rogers has proposed and defended the validity of a conceptual model of the Innovation-Decision Process (Rogers 1995, p. 163). Rogers presents a five stage model that provides a picture of the different stages from a temporal perspective and permits identification of the specific process of the technology adoption decision as one of a number of events in this process as indicated in Figure 3.18.

Figure 3.18 - Rogers' Model of Stages in the Innovation-Decision Process



Source: (Rogers 1995, p. 163)

From the consideration of a single Technology Adoption decision, one might well suspect that the Adoption/Rejection decision indicated within Stage III - Decision is the fundamental issue that warrants consideration. A somewhat more expanded view might recognise the relevance of the decision for continued adoption, rejection, or discontinuance of use. However, Rogers' model of stages encourages a broader view and emphasises that his model focuses on a more comprehensive social process not just the attributes of the innovation under consideration. Rogers, in Table 3.11, gives a brief definition of each of these phases.

Table 3.11 - Definition of Stages of Rogers' Innovation-Diffusion Process Model

Stage	Definition
1. Knowledge	Occurs when an individual (or other decision making unit) is exposed to an innovation's existence and gains some understanding of how it functions.
2. Persuasion	Occurs when an individual (or some other decision making unit) forms a favourable or unfavourable attitude toward the innovation.
3. Decision	Occurs when an individual (or other decision making unit) engages in activities that lead to a choice to adopt or reject the innovation.
4. Implementation	Occurs when an individual (or other decision making unit) puts an innovation into use.
5. Confirmation	Occurs when an individual (or some other decision making unit) seeks reinforcement of an innovation-decision already made, or reverses a previous decision to adopt or reject the innovation if exposed to conflicting messages about the innovation.

Source: (Rogers 1995, p. 162)

Given both the comprehensive nature of this model and the relevance of the model to this study, more attention to Rogers' comments regarding the various phases is justified.

3.4.2.1 Knowledge Stage

Rogers recognised that some difference of opinion exists as to how active an individual is, or can be, in seeking initial awareness or knowledge of an innovation. This "chicken or egg" puzzle is characterised by noting that "It is argued that an individual becomes aware of an innovation by accident, since the individual cannot actively seek an innovation until he/she knows that it exists" (Rogers 1995, p. 162). One response to this point that Rogers presents is consideration of the tendency toward "selective exposure". Defined as "the tendency to attend to communication messages that are consistent with one's existing attitudes and beliefs", (Rogers 1995, p. 164) Rogers suggests that individuals tend to avoid messages that conflict with their predispositions. Rogers gives credence to the arguments presented in earlier work by Hassinger (Hassinger 1959, pp. 52-53)

presenting the case that the importance of selective exposure and selective perception suggest that "individuals will seldom expose themselves to messages about an innovation unless they first feel a need for the innovation, and that even if such individuals are exposed to these innovation messages, such exposure will have little effect unless the innovation is perceived as relevant to the individual's needs and as consistent with the individual's attitudes and beliefs" (Rogers 1995, p. 164).

Having introduced the issue of needs in the above comment, Rogers does give some attention to this concern with needs. He presents a rather straightforward definition of a need as, "a state of dissatisfaction or frustration that occurs when one's desires outweigh one's actualities, when 'wants' outrun 'gets'" (Rogers 1995, p. 165). However, he does not come to a clear clarification of the issue of time-sequence precedence in the issue of whether recognition of a need precedes knowledge of an innovation or whether the knowledge of the innovation precedes the need. He does generally conclude that this may differ from circumstance to circumstance. He suggests that in the case of an agricultural innovation to protect farmers' crops, the need may occur first; while in some other type of consumer innovations, such as clothing fashions, the innovation may well occur first.

In further development of the characteristics of this knowledge stage of the Innovation-Decision Process, Rogers characterises several different types of knowledge as software information that serves to reduce uncertainty about the cause-effect relationships involved in achieving a desired outcome. Rogers' use of the term software in this context is not in reference to computer programs but in a more general reference to information in contrast to the hardware or equipment related to an innovation. Such information may likely include questions such as "What is the innovation?", "How does it work?", and "Why does it work?".

1. **Awareness Knowledge**. This type of knowledge tends to be concentrated at the knowledge stage of the overall innovation-decision process but may also occur at the persuasion and decision stages. It commonly leads one to seek both "how-to" knowledge and principles knowledge.

2. **How-to Knowledge**. This type of knowledge consists of the information necessary to use an innovation properly. The amount of how-to knowledge may vary greatly depending on the complexity of the innovation. Rogers also suggests that acquisition of proper how-to knowledge is important to the adoption and continued adoption of an innovation. "When an adequate level of how-to knowledge is not obtained prior to the trial and adoption of an innovation, rejection and discontinuance are likely to result" (Rogers 1995, p. 166). He also notes that few diffusion research projects have dealt with this how-to knowledge.

3. **Principles-Knowledge**. This category of knowledge deals with the functioning principles underlying how the innovation works. Rogers argues that such principles-knowledge may be influential in continued use of an innovation and solving problems that may occur in the use of an innovation.

Rogers also identifies a number of generalisations regarding those in a social group who possess early knowledge about an innovation. These generalisations, which strongly parallel Rogers' generalisation of characteristics of innovators, are summarised in the Chapter 5 portion of Appendix VIII - Rogers' Generalisations.

3.4.2.2 Persuasion Stage

In the second stage of the innovation-diffusion process, the individual forms a favourable or unfavourable attitude toward the innovation. Rogers notes that the "mental activity at the knowledge

stage was mainly cognitive (or knowing), the main type of thinking at the persuasion function is affective (or feeling)" (Rogers 1995, p. 168). As the individual develops a favourable or unfavourable attitude toward adoption of the innovation, he or she is likely involved in a vicarious trial of the innovation. Likely the innovation will be mentally applied to the individual's current or anticipated situation as a precursor to deciding whether to try the innovation or not.

Rogers further notes "all innovations carry some degree of uncertainty for the individual, who is typically unsure of the new idea's results and thus feels a need for social reinforcement toward the new idea" (Rogers 1995, p. 168). This attention to the search for social reinforcement in dealing with uncertainty reminds one of the attention to reduction of uncertainty introduced in the previous stage. In Rogers' discussion of the different types of knowledge, as addressed in the knowledge stage, he comments on the role of knowledge or information in reducing uncertainty. This reduction of uncertainty through information is a rather classic view of a role of information. Of additional interest is the observation that Rogers makes regarding the evaluation of sources of information as the individual seeks innovation-evaluation information in the persuasion stage and later in the decision stage. Rogers notes that, "This type of information, while often easily available from scientific evaluations of an innovation, is usually sought by most individuals from their near-peers whose subjective opinions of the innovation (based on their personal experience with adoption of the new idea) is most convincing. When someone who is like us tells us of their positive evaluation of a new idea, we are often motivated to adopt it" (Rogers 1995, p. 169).

3.4.2.3 Decision Stage

This stage in the innovation-decision process occurs when an individual (or other decision making unit) engages in activities that

lead to a choice to adopt or reject an innovation. The two alternatives may be defined as:

- Adoption - a decision to make full use of an innovation as the best course of action available.
- Rejection - a decision not to adopt an innovation (Rogers 1995, p. 171).

Rogers does treat the Decision Stage as somewhat more straightforward than the other phases of the decision-innovation process. However, he does discuss specific characteristics of this phase influencing the decision process. The fact that "innovations that can be divided for trial are generally adopted more rapidly," (Rogers 1995, p. 171)leads to the attribute of "Trialability." The fact that an innovation can be adopted on a probationary and /or a small-scale trial basis may be significant at this decision phase. This is often implemented in rather obvious ways such as the provision of free samples of a product.

The role of "trial-by-others" is also discussed. The trial of a new idea by a peer like themselves may influence a number of individuals toward adoption of some innovations. This is especially true if the demonstrator of the innovation is an opinion leader in the social group.

Of course no assumption should be made that the decision process will lead to adoption of an innovation. In fact, Rogers notes that each stage in the decision-innovation process offers an opportunity for rejection of an innovation. The potential adopter may reject the innovation at the knowledge stage merely by forgetting about the innovation after an initial awareness of the innovation (Rogers 1995, p. 171). It is also possible for an innovation to be rejected in later stages, even after a decision to adopt has been made. The

choice to reject an adoption in the later phases is often referred to as *discontinuance* of the adoption.

Rogers further notes that two different types of rejection that warrant more special attention by diffusion researchers:

1. *Active Rejection*, which consists of considering adoption of the innovation (including even its trial) but then deciding not to adopt it.

2. *Passive rejection* (also called *nonadoption*), which consists of never really considering the use of the innovation (Rogers 1995, p. 172).

Rogers states that the pro-innovation bias that pervades diffusion research may have served to reduce attention to the processes of rejection. He also notes that the assumption of a linear sequence of knowledge-persuasion-decision for the first three phases of the innovation-decision process may not always be valid. He argues that in some cases the sequence may be more that of a knowledge-decision-persuasion sequence. Furthermore he suggests that such a change in this sequence may well be culture-bound (Rogers 1995, p. 172).

3.4.2.4 Implementation Stage

The implementation stage, which occurs "when an individual (or other decision making unit) puts an innovation into use" represents a change from mental or cognitive processes to physical or behaviour-oriented change (Rogers 1995, p. 172). It is during the implementation phase that overt behaviour change occurs as the new idea is actually placed into practice.

This phase may also be characterised by substantial information gathering to answer questions such as "Where do I obtain the innovation?", "How do I use it?", "How does it work?", "What operational problems are likely to develop and how may they be

solved?". Often a change-agent may provide technical assistance to the client as these questions develop during this phase.

Of special interest to this study is the observation that, "Problems of implementation are much more serious when the adopter is an organisation rather than an individual" (Rogers 1995, p. 173). This point is of relevance to the current study since the category of information systems under study is that of individual information systems. It seems likely that such systems will have rather different characteristics at both the decision and implementation phases than organisational information systems.

Rogers further notes that it may be difficult to determine the end of the implementation phase, depending on the nature of the innovation. The end of this phase, though it may vary widely in terms of period of time, is generally considered to take place when the innovation becomes routine or institutionalised and loses the quality of a separate identity. In some cases completion of the implementation phase may represent the termination of the innovation-decision process. However, as discussed below, a further phase of confirmation may occur.

Regardless of whether the later phase of confirmation takes place or not, a process of re-invention is likely to occur in the implementation phase. Rogers defines such re-invention as, "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation" (Rogers 1995, p. 174). Not only should one recognise that re-invention is likely to occur, it can be argued that such alertness to re-invention may influence the point at which we measure adoption of a innovation. Rogers suggests that, "the fact that re-invention often happens is a strong argument for measuring adoption at the implementation stage, and as action by the adopter, rather than just as an intention to act" (Rogers 1995, p. 174).

While considering the concept of re-invention, Rogers notes that past scholarship has given attention to the difference between invention and the innovation that commonly occurs with the adoption of an idea or technique:

- *Invention* is the process by which a new idea is discovered, while
- *Adoption* is a decision to make full use of an innovation. Thus adoption of an innovation is the process of *using* an existing idea, which may have been previously invented by someone else (Rogers 1995, p. 174).

After making the case that some form of re-invention is common, Rogers then addresses the issue of the merits of re-invention. His general conclusion is that "re-invention is not necessarily bad" (Rogers 1995, pp. 176-177). Of special interest here is Rogers' discussion of the reasons that re-invention occurs. Rogers presents six such reasons:

1. ***Complexity of the Innovation.*** Innovations that are relatively more complex and difficult to understand are more likely to be re-invented.
2. ***Limited Knowledge.*** Re-invention can occur because of an adopter's lack of full knowledge about the innovation, such as when there is relatively little direct contact between the adopter and the change agents or previous adopters.
3. ***Abstract Concept / Varied Application.*** An innovation that is an abstract concept or that is a tool (like a computer software program) with many possible applications is more likely to be re-invented. Rogers also notes here that the manner in which elements of the innovation are tightly or loosely bundled together may impact re-invention of

innovations with a higher degree of bundling generally discouraging re-invention.

4. ***Range of User Problems.*** When an innovation is implemented in order to solve a wide range of users' problems, re-invention is more likely to occur. A basic reason for re-invention is that one individual or organisation applies the innovation to a different problem than does another.

5. ***Local Pride of Ownership.*** Local pride of ownership may also be a cause of re-invention. In some cases these modifications may be minor or cosmetic in nature so as to create the impression of a local product. In fact the re-invention process may become "pseudo-re-invention", such as the assignment of a new name to the innovation.

6. ***Change Agency Encouragement.*** Finally, re-invention may occur because a change agency encourages its clients to modify an innovation

(Rogers 1995, pp. 178-179).

In his conclusion of the discussion of re-invention, Rogers notes:

> Instead of simply accepting or rejecting an innovation as a fixed idea, potential adopters on many occasions are active participants in the adoption and diffusion process, struggling to give their own unique meaning to the innovation as it is applied in their local context. Adoption of an innovation is thus a process of social construction. This conception of adoption behaviour, involving re-invention, is more in line with what certain respondents in diffusion research have been trying to tell researchers for many years (Rogers 1995, p. 179).

This comment on re-invention as a process of "social construction" is not unique to Rogers' observations at this point. In fact, a pervasive concept throughout his work is the fact that the diffusion of innovations is a social process. Here he gives emphasis to this issue in terms of the re-invention process. This emphasis is

a reminder that the adoption of a technology is commonly less a technological issue and more of a social issue. Furthermore, this may be an idea that may be offensive or at least unsettling to many designers and champions of a particular technology.

The issues of re-invention warrant special attention when applied to consideration of computer programs or software systems. This concern for special attention appears to be particularly relevant to the contemporary world of very general-purpose software and software systems that are highly parameterised in their design. General-purpose software packages such as word processing, electronic spreadsheets, and general-purpose database packages tend to be at one end of the spectrum. By the design of the products, they are marketed to a wide variety of industries and professions for an assortment of applications. In fact, such products have become so general purpose in nature that a great number of "templates", "skeletons", "wizards", or "themes" are often distributed with a product to help adapt the general-purpose nature of the fundamental product to particular uses. For example, a contemporary version of the Microsoft Word word processing program includes no less than 203 "document templates" with the product, with more templates available for purchase from other vendors (Microsoft 1999, no page number). In this case it seems inappropriate to consider the development of a particular document, use of distributed template, or even development of a locally developed custom template, to represent re-invention. All of these processes appear to be envisioned within the general design of the fundamental word processing software product. However, the inclusion of a high-level scripting language or programming language within the product suggests that applications may be developed within the scope of the word processing product that likely go beyond the common scope of the word processing task. In fact recent versions of the Microsoft Word product do include VBA (Visual Basic for Applications), a version

of the Microsoft Visual Basic programming language. With the use of such programming language features, should applications such as a short story generation system or a student writing assignment-grading application be identified as a case of re-invention? Given the extension of the scope of the fundamental word processing functionality, the answer would likely be "yes."

Other computer software applications, which by their design are prepared as general-purpose applications, may also be subject to questions as to when re-invention takes place. Modern electronic spreadsheet systems such as Microsoft Excel or Lotus 1-2-3 provide excellent examples. Development of specific spreadsheet applications, even when rather complex or sophisticated, is likely not an example of re-invention. However, it might well be considered that the use of the VBA programming techniques, also available in the Microsoft Excel product, to implement applications requiring the use of database access techniques could be defined as examples of re-invention.

The question of when does re-invention occur may be somewhat difficult to answer with other categories of software products as well. In addition to products designed to be very generalised applications, such as the examples of word processing and electronic spreadsheets mentioned above, other products may be designed to be quite modifiable at the local level upon installation. Accounting systems offer a good example. Such systems are usually not as general purpose in nature as the electronic spreadsheets that may also be used within an accounting department, but may include many features that encourage different practices within one organisation than another. These features almost certainly would include the ability to implement a specific organisation chart of accounts and may extend to the ability to modify report formats or create new, previously undefined reports with a report generator facility. Choices about different types of accounting practice such as techniques for inventory

evaluation or depreciation techniques may also be included within the function of the product.

Another example of computer software use that may present uncertain questions regarding re-invention may be use of a software application in a different manner or for a different purpose than for which it was initially developed or marketed. Does the application of a software package designed for landscape architecture to problems of interior design suggest re-invention? Today software is available to model railroad hobbyists for the design and evaluation of model railroad layouts. Would the application of such software for the design of a new actual railroad-switching yard be a case of re-invention? Would the application of such software for on-ground traffic management at a major airport or the planning of access by boats in a marina be an example of re-invention?

The nature of computer software and the inclinations of software workers may serve to encourage re-invention action. Rogers, while discussing use of computer software in local government agencies notes,

> A high rate of re-invention occurred when twelve cities and counties adopted the innovation of computer data processing (Danziger 1977, p. 35). Computer programmers working for a local government viewed such modifications of software packages as a challenging and creative task. It was more fun to re-invent a computer software program than simply to transfer it from another local government or to purchase it from a commercial supplier, which was viewed as un-stimulating drudgery. Further, Danziger found that local government officials emphasised their degree of re-invention, stressing the uniqueness of their adoption. The relatively petty "bells and whistles" that the adapters had re-invented appeared to them to be major improvements (Rogers 1995, p. 179).

What then is concluded regarding re-invention and computer software practice? Perhaps little more conclusion is necessary than to suggest that the practices within this field confirm the suggestions regarding re-invention that Rogers presents.

3.4.2.5 Confirmation Stage.

In some cases, as suggested above, the adoption process is not completed with the implementation phase. In such cases it is appropriate to consider a final, confirmation phase. Perhaps the most obvious example suggesting the need for this phase is the very real chance that, after an initial decision to adopt and during implementation, the adopter may elect to reject or discontinue use of the innovation. Rogers also suggests that further innovation-decision actions may take place in a post-implementation phase by noting that in some cases the adopter seeks additional information after the adoption of an innovation (Rogers 1995, p. 180). Rogers suggests that two primary activities occur in this confirmation stage:

1. The individual (or some other decision making unit) seeks reinforcement of the innovation-decision already made or reverses a previous decision to adopt or reject the innovation.
2. The individual seeks to avoid a state of dissonance or to reduce it if it occurs (Rogers 1995, p. 181).

The concept of *dissonance* is defined by Rogers' with reference to Festinger. Festinger, in discussing the concept of dissonance observes that, "Two elements are dissonant if, for one reason or another, they do not fit together" (Festinger 1957, p. 12). Rogers further suggests that the individual serves to reduce this condition of dissonance by changing his or her knowledge, attitudes, or actions when:

1. When the individual becomes aware of a felt need and seeks information about an innovation to meet this need. This behaviour is characteristic of that occurring at the knowledge phase of the innovation-decision process.

2. When the individual knows about a new idea and has a favourable attitude toward it, but has not yet adopted. Such dissonance may be associated with the decision and implementation stages of the innovation-decision process.

3. After the innovation-decision to implement the innovation, when the individual secures further information that persuades him or her that he or she should *not* have adopted. These behaviours (discontinuance or later adoption) represent the type of dissonance associated with the confirmation stage of the innovation-decision process (Rogers 1995, p. 181).

Though dissonance may be exhibited in various phases of the innovation-decision process, it may play a rather special role in the confirmation stage as in this phase it may cause reversal of previous decisions regarding innovation adoption. As illustrated in Figure 3.18 - Rogers' Model of Stages in the Innovation-Decision Process, such changes may cause a decision of adoption to change to a condition of *discontinuance* while it is also possible that the previous decision of rejection may transition to a decision of *later adoption*. Rogers gives special attention to the change to discontinuance with the identification of types of discontinuance:

1. Replacement Discontinuance. Such discontinuance is described as, "a decision to reject an idea in order to adopt a better idea that supersedes it."

2. Disenchantment Discontinuance. Discontinuance based on such disenchantment is described as, "a decision to reject an idea as a result of dissatisfaction with its performance". Such dissatisfaction may come about because the innovation is inappropriate for the individual and

> Requirements for a Personal Decision Support System does not result in an adequate relative advantage over alternative practice (Rogers 1995, p. 182).

Rogers gives special attention to discontinuance, noting that later adopters often experience disenchantment and are more likely to discontinue use of an innovation than earlier adopters. In fact, Rogers concludes that laggards, or later adopters, and discontinuers share common attributes such as less formal education, lower socio-economic status, less change agent contact, etc. which are the opposite of characteristics of innovators (Rogers 1995, p. 183). However, it is prudent to keep in mind that the two types of shifts may occur during this confirmation phase, the transition from adoption to discontinuance or from rejection to later adoption.

3.4.3 Do the Stages Truly Exist?

The presentation of Rogers' five stages of the innovation-decision process, though presenting a somewhat attractive model of such a process, does raise the question, "Are these stages really present in this process?" Rogers does speak to this question with comment on research approaches applicable to this question and by comparison of his five phases to other time-oriented sequences.

After noting that limited research has been conducted to demonstrate the actual existence of such stages, Rogers does comment on a small number of studies from disciplines such as agriculture, medical practice, and education that give some suggestion of stages such as those that he proposes. He further suggests that most diffusion research has applied techniques of *variance research* in contrast to *process research* and, as such, has not given focus to the definition of the stages or even clarification of whether stages exist. Rogers defines these two types of research as:

1. ***Process research***, defined as a type of data gathering and analysis that seeks to determine the time-ordered sequence of a set of events.

2. ***Variance research*** is a type of data gathering and analysis that consists of determining the co-variances among a set of variables, but not their time-order (Rogers 1995, p. 188).

Rogers observes that most social science research in general, and most diffusion research more specifically, has been variance research. In such research, highly structured data gathering and analysis techniques are applied. However, they are applied in a cross-sectional manner that only considers data from one point in time limiting the ability to support an understanding of the time-sequenced events and of the process. Rogers does suggest that further process research is appropriate for the understanding of the innovation-decision process.

Rogers notes the close parallel between his five phases and a five-stage model, based on research in public health, of how individuals change an addictive behaviour (Prochaska, DiClemente et al. 1992) proposed by Prochaska. The five stages proposed in this model are defined as:

1. ***Precontemplation,*** where an individual is aware that a problem exists and begins to think about overcoming it.

2. ***Contemplation***, when an individual is aware that a problem exists and is seriously thinking about overcoming it, but has not yet made a commitment to take action.

3. ***Preparation,*** the stage at which an individual intends to take action in the immediate future, but has not yet done so.

4. ***Action***, when an individual changes behaviour or the environment in order to overcome the problem

5. ***Maintenance***, the stage at which an individual consolidates and continues the behaviour change that was made previously (Rogers 1995, pp. 189-191).

Rogers' comparison of these two approaches to the process of change are presented in Table 3.12 - A Comparison of Rogers and Prochaska's Stage Models

Table 3.12 - A Comparison of Rogers' and Prochaska's Stage Models

Stages in the Innovation-Decision Process	Hierarchy of Effects	Porchaska's Stages of Change
I.	Knowledge Stage Recall of information. Comprehension of messages. Knowledge or skill for effective adoption of the innovation.	I. Precontemplation
II.	Persuasion Stage Liking the innovation. Discussion of the new behaviour with others. Acceptance of the message about the innovation. Formation of a positive image of the message and the innovation.	II. Contemplation
III.	Decision Stage Intention to seek additional information about the innovation. Intention to try the innovation.	III. Preparation
IV.	Implementation Stage Acquisition of additional information about the innovation. Use of the innovation on a regular and continued basis.	IV. Action
V.	Confirmation Stage. Recognition of the benefits of using the innovation. Integration of the innovation into one's ongoing routine. Promotion of the innovation to others.	V. Maintenance

Source: (Rogers 1995, p. 190)

Recognizing that Rogers has noted that only limited research suggests validation of his model, we acknowledge the widespread use of this

model and relevance to a view of a logical development in the innovation-decision process.

3.4.4 Attributes of Innovations

Consideration of the stages of the Innovation-Decision process presented by Rogers does assist in the study of the time-oriented events in innovation diffusion research. This view also supports the recognition of the diffusion of innovations as a social process. However, this gives little attention to the characteristics or attributes of the innovation itself. Again we turn to Rogers and consider his Attributes of Innovations. Even in this, the point is made that consideration of these attributes is not an outline for technical specifications for any specific technology. Rather, Rogers' attributes are more generalised and once again give focus to the attributes of an innovation as considered from a social system perspective. In fact the Perceived Attributes of Innovations is only one of five characteristics given by Rogers by which an innovation may be described that Rogers identifies as influencing the Rate of Adoption of Innovativeness (Rogers 1995, p. 204). These five characteristics of Perceived Attributes of Innovation, Type of Innovation-Decision, Communication Channels, Nature of the Social System, and Extent of Change Agents' Promotion Efforts are summarized in Table 3.13 – Variables Determining the Rate of Adoption of Innovations. However, the focus here will be on the often referenced Perceived Attributes of Innovations. These five attributes, as proposed by Rogers, provide a basis for examination of attributes of an innovation in relationship to their influence on the rate of adoption of the innovation.

Table 3.13 - Variables Determining the Rate of Adoption of Innovations

Variables Determining the Rate of Adoption	Dependent Variable That is Explained
I. Perceived Attributes of Innovations 1. Relative Advantage 2. Compatibility 3. Complexity 4. Trialability 5. Observability II. Type of Innovation-Decision 1. Optional 2. Collective 3. Authority III. Communication Channels (e.g., mass media or interpersonal IV. Nature of the Social System (e.g., its norms, Degree of network interconnectedness, etc.) V. Extent of Change Agents' Promotion Efforts	RATE OF ADOPTION OF INNOVATIONS

Source: (Rogers 1995)

3.4.4.1 Perceived Attributes of Innovations - Definitions

Rogers has defined these attributes as:

- *Relative Advantage* is the degree to which an innovation is perceived as being better than the idea it supersedes. The degree of Relative Advantage is often expressed as economic profitability, social prestige, or other benefits (Rogers 1995, p. 212).

- *Compatibility* is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters. An idea that is more compatible is less uncertain to the potential adopter, ... (Rogers 1995, p. 224)

- *Complexity* is the degree to which an innovation is perceived as relatively difficult to understand or use (Rogers 1995, p. 242).

- *Trialability* is the degree to which an innovation may be experimented with on a limited basis (Rogers 1995. p. 243).

- *Observability* is the degree to which the results of an innovation are visible to others (Rogers 1995, p. 244).

In presenting both the more general characteristics that influence the rate of adoption and the attributes of innovation given above, Rogers identifies the need for a standard classification scheme for describing the perceived attributes of an innovation. Noting that "such a general classification system is an eventual objective of diffusion research on innovation attributes", (Rogers 1995, p. 208) Rogers observes that the five attributes of innovation that he presents have been used for some thirty years or so. Therefore, based on the history of use of these attributes and the common reference to Rogers' system in the research literature, the discussion here will be based on these attributes.

The attributes presented by Rogers are based on perceptions of these attributes rather than the actual attributes of the technology. Such emphasis on the perception as is characteristic of much social science research. An early dictum of the Chicago School of Sociology states, "If men perceive situations as real, they are real in their consequences", serves as a foundation for this focus on the

perceptions of the attributes (Thomas and Znaniecki 1927, p. 81). Put somewhat more succinctly, "perceptions count". Or, as Rogers concludes, "The receivers' perceptions of the attributes of an innovation, not the attributes as classified by experts or change agents, affect its rate of adoption" (Rogers 1995, p. 209). In further support of this classification of attributes, Moore and Benbasat (Moore and Benbasat 1991, pp. 192-222)developed a set of general scale items to measure each of the five main attributes of innovations that may be applied to any particular innovation.

Rogers also draws attention to the notion that the trend of research has been to measure the attributes in the recent past and therefore should not be supportive of the prediction of the rate of adoption of an innovation in the future. In doing so, he notes the difference between the postdiction versus the prediction orientation of such research. After presenting some brief observations regarding predictive research, Rogers remarks, "Research on predicting an innovation's rate of adoption would be more valuable if data on the attributes of the innovation were gathered prior to, or concurrently with, individuals' decisions to adopt the innovation" (Rogers 1995, p. 211).

3.4.4.2 Relative Advantage

Given these introductory caveats regarding the use of his proposed attributes, Rogers then proceeds to present some further observations on the perceived attributes. Relative Advantage, defined previously as the "degree to which an innovation is perceived as better than the idea it supersedes", may present a relative advantage that is expressed as an economic advantage, social prestige or other benefit. Although economic advantage is a commonly sought advantage, both characteristics of the innovation itself and of the potential adopters may serve to influence which sub-dimensions of relative advantage are most important. A comment on this balance is taken from

Gilriches, "It is my belief that in the long run, and cross-sectionally, [sociological] variables tend to cancel themselves out, leaving the economic variables as the major determinants for the pattern of technological change" (Gilriches 1957, pp. 501-522). However, one may wish to note the date of Gilriches' observation and that it was related to the adoption of hybrid corn in the agricultural industry.

Despite the suggestion by Gilriches that the economic advantages have the greater influence on the rate of adoption, it is likely unwise to overlook the impact of non-economic advantages such as the influence on social status. One example presented by Rogers is the example of fashion, such as fashion of clothing, which assumes the characteristics of a fad. Rogers defines a fad as, "an innovation that represents a relatively important aspect of culture, which diffuses very rapidly, mainly for status reasons, and then is rapidly discontinued" (Rogers 1995, p. 214). Examples such as certain clothing fashions, hula hoops, mood rings, or lava lamps are relatively easy to identify as fads. Some other more technological examples, such as the use of CB radios in automobiles or use of cellular telephones may be more difficult to characterise as fads. It is also interesting to note that Rogers comments that, "status motivations for adoption seem to be more important for innovators, early adopters, and early majority, and less important for the late majority and laggards" (Rogers 1995, p. 214).

Such non-economic advantages may be a major contributor to the phenomena that Rogers describes as *overadoption*. "Overadoption is the adoption of an innovation by an individual that experts feel that he or she should reject" (Rogers 1995, p. 215). Such overadoption leads to the concept of rationality. Defined by Merton as "the use of the most effective means to reach a given goal" (Merton 1968)is commonly

seen as the basis of adoption decisions by most individuals. Rogers further suggests that,

> Overadoption sometimes happens when some attribute, or sub-attribute, of an innovation is perceived as so attractive to an individual that it overrules all other considerations. For example, the status-conferring aspect of a consumer innovation may be so important to an individual that adoption occurs, even though other perceptions of the new idea would lead one to expect that the innovation might be rejected. (Rogers 1995, p. 217.

Recognizing that the attribute of relative advantage is one of the best predictors of the rate of adoption, Rogers notes several sub-dimensions of such relative advantage:

- Degree of economic probability
- Low initial cost
- Decrease in discomfort
- Social prestige
- Savings in time and effort
- Immediacy of the reward

(Rogers 1995, p. 216)

3.4.4.3 Compatibility

The second of the attributes presented, *compatibility*, is defined as "the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (Rogers 1995, p. 224). This attribute is strongly related to the cultural values and beliefs of a social system. However, compatibility is also closely associated with previously introduced ideas. In fact, the old ideas are the "main mental tools" by which new concepts are evaluated. Rogers suggests the relationship to old ideas is so important because, "One cannot deal with an innovation except on the basis of the familiar, with what is known"

(Rogers 1995, p. 225). This does, of course, contrast with the fact that if the old idea is too compatible with the new idea to be introduced there is in reality no innovation, at least in the minds of the potential adopters. Generally a high degree of compatibility between the new and old ideas leads to a faster rate of the diffusion of the innovation. Rogers does make note of the importance of some cases in which a high degree of compatibility discourages the diffusion of an innovation. He presents the field of art as an example of this phenomenon with the observation that, "artworks must be somewhat radical if they are to diffuse rapidly" (Rogers 1995, p. 227).

A third area of compatibility to be considered is that of compatibility with needs or at lease felt needs. This may present somewhat of a quandary in that the potential innovator may not recognise the need until he or she becomes aware of the innovation. So, in at least some cases, knowledge of the innovation, the first of Rogers' phases, must develop to some extent before recognition of the need develops. However, in general, Rogers concludes that the perceived compatibility of an innovation is positively related to the rate of adoption. A number of the issues of compatibility have suggestions for the techniques to be adopted by the marketers of an innovation or by other change agents serving the innovation.

Strongly associated with these issues of compatibility is the issue that Rogers describes as the "empty vessels fallacy." Frequently an assumption is made that potential adopters are a blank slate without relevant previous knowledge to be used in the evaluation of a potential innovation. This may be especially significant when introducing innovations in various cultures. Care should be directed to the fact that "almost every innovation is evaluated by clients in terms of their prior experience with something similar" (Rogers 1995, p. 241).

3.4.4.4 Complexity

Complexity, the perception of difficulty of understanding or use, is considered as negatively related to the rate of adoption of an innovation. Rogers' example in this case is of special note. He states that the early wave of adoption of the first round of personal computers, such as Apple, Tandy, Radio Shack, etc., in the late 1970's was largely by individuals who had substantial experience with larger mainframe computer systems. However, many adopters of personal computers in the early 1980's (the first IBM personal computer was introduced in 1981) did not have this previous technical experience. As a result, many of these adopters were confused and frustrated and found little help in the intense technical jargon of the computer manuals or the computer sales staff available to them. One study suggests a period of six to eight weeks of intense frustration by many adopters of home computers in this later time period (Rogers 1995, p. 243). In this case the change in the characteristics of the people affecting the adoption changed in a significant manner over several years leading to a rather different perception of complexity.

3.4.4.5 Trialability

New ideas that can be adopted bit by bit, or on the instalment plan, have a faster rate of adoption than innovations that require initial adoption as a whole. The role of even obvious marketing techniques, such as free samples, a defined return period, or the ability to "test drive" the innovation in some manner may become important. To a great degree such a provision for trial serves to reduce the uncertainty regarding the adoption of the new innovation. Rogers suggests that this attribute is more important to the earlier adopter as they have no peer based precedent available to aid in evaluating the impact of the innovation. Later adopters or laggards have the examples of their peers who were earlier adopters to provide a form of vicarious trial.

This attribute of trialability may be considered as quite relevant to information systems innovations such as offering free trial periods, or versions of a software product that may only be used for a limited period of time or a certain number of uses. The evolution of the "shareware" form of alternative marketing for personal computer shareware may be considered to be a form of encouraging trial usage before a purchase decision. The offer of a widely promoted low cost 30 day trial version of a new version of the Microsoft Office software product suite in the late spring of 2001 by Microsoft Corporation presents another example of encouragement of trialability as a marketing technique. This marketing approach may be considered an effort to enhance the trialability attribute of the product since the relative advantage may be hard to identify for many customers. This particular software product had already included such a wide range of functionality before the new version was introduced that many customers may be reluctant to purchase a new version based on the attribute of relative advantage.

3.4.4.6 Observability

The attribute of observability has previously been defined as based on how visible the results of the use of the innovation are to others. One notes this is based on the observation of the results not the actual implementation of the innovation itself. When considering this attribute, Rogers notes that technological innovations have two components:

1. A *hardware* aspect consisting of the tool that embodies the technology as material or physical objects and
2. A *software* aspect that consists of the information base for the tool (Rogers 1995, p. 244).

Despite the use of the term *software*, it is important to note that Rogers does not use this as descriptive of computer programs as

is commonly done. Rather Rogers' use suggests a wider range of information services associated with the innovation of which the computer programs may be one component. The relevance of the hardware and software components is significant to innovations based on computer programs since Rogers argues, "innovations in which the software aspect is dominant possess less observability, and usually have a relatively lower rate of adoption" (Rogers 1995, p. 244). Since so many of the information systems or information technology innovations that may be of interest are based on computer programs, a software component, the influence of observability may differ for such innovations from other types of innovations.

3.4.5 Measuring Innovation Perceptions

In a previously referenced paper by Moore and Benbasat further support for the approach to the study of the Diffusion of Innovation advocated by Rogers is found. Starting with Rogers' five attributes, Moore and Benbasat use these attributes as the basis of building a survey instrument and scale for the study of Information Technology innovations within organisations (Moore and Benbasat 1991, pp. 192-233). The paper provides value both in the analysis of the attributes as characteristics of IT innovation and in the presentation of a methodology for the development of such an instrument.

Based on a clearly defined multi-step process, the five attributes presented by Rogers are adapted somewhat to produce a set of eight constructs for measurement as presented in Appendix IX - List of Moore and Benbasat's Scale Items By Construct. The adaptation of the original attributes is based on the analysis presented by Moore and Benbasat as well as a Technology Acceptance Model proposed by Davis (Davis 1986). This model is rather similar to Rogers' model but includes two constructs, "perceived usefulness" and "perceived ease of use" that have strong parallels with the Relative Advantage and Complexity attributes of Rogers but have slightly different

definitions. The final set of eight constructs adopted by Moore and Benbasat are presented in Appendix IX - List of Moore and Benbasat's Scale Items by Construct along with the items developed by Moore and Benbasat for their instrument. The survey was developed based on the study of the adoption of a specific information technology, Personal Work Stations (PWS). However, one of the design objectives of the instrument and the scale was to provide items that could be adopted to be relevant to various information technologies. However, it should be noted that there is a built-in assumption of information technologies as applied within organisations as evidenced by such constructs as *voluntariness*.

The attention focused on perceived attributes, in contrast to actual attributes of the innovation, found in other related work continues in this work by Moore and Benbasat (Moore and Benbasat 1991, p. 194). In fact, they do give some attention to justification of why perceived characteristics are used in the study.

4 Chapter 4 - Overview of the Market

Efforts to address the markets related to this study actually could be addressed to three different markets:

1. The market for Health Care
2. The market for Health Care Financing or Insurance
3. The market for Personal Decision Support Systems (PDSS) for Health Care Financing Selection

Of course each of these is a separate market and differs greatly in terms of size, number of players, and services offered. Furthermore, other related markets can be identified such as the market for health care information services. This market itself is quite diverse, ranging from vendors of hospital information systems software products to personal or family health publications or advisors.

4.1 Market for Health Care

The market for health care services, in the United States at least, has been addressed in a summary fashion in an earlier portion of this paper. The health care delivery market or system in the United States is, to a large degree, a diverse, fragmented, market-driven system. The provider of health care to a typical citizen may be a single physician practice, a multiple physician practice, a specialised clinic, a community owned hospital, a for-profit hospital, a member of a for-profit hospital system, some form of managed care organisation or some form of public health service. The need for health care forms the underlying demand and this market creates a derived demand for the specialised information services addressed by this study.

4.2 Market for Health Care Financing

Again, the fundamental nature of the Health Care Financing market in the United States has been summarised in previous sections of this paper. This discussion identified the U.S. market or system as dominated by Federal Government financing, employee provided health insurance coverage, participation by the Blue Cross / Blue Shield system, and involvement of a number of commercial insurance companies. A representative of the Health Insurance Association of America indicates that approximately 900 commercial insurance companies and 43 Blue Cross / Blue Shield plans underwrite health insurance in the U.S.A. (Musco 2002, personal e-mail - no page number).

4.3 Market for Personal Decision Support Systems

Much as the market for Health Care Financing or Insurance is based on a derived demand generated by the more fundamental, underlying market for health care, the market for personal decision support services for making choices of financing or insurance, may be viewed as a third level market that is derived from the second level financing / insurance market. Without the financing / insurance market, and the issues of choice presented by this market, it is difficult to see how a demand for any decision support services would develop.

In fact it is difficult to determine if a market for such personal decision support services truly exists. Review of Appendix V - Information Services for Health Insurance - Examples from the World Wide Web indicates twenty-four examples originally identified in 1999. In July of 2002, twenty-two of these sites could still be located on the World Wide Web. However, all sites except for two were identified as offering no PDSS services. Of the two offering such services, both were characterised as offering only limited services. Often the sites make provision for obtaining quotes for health insurance but very

limited assistance is offered for selection of the most appropriate type of coverage. When some form of decision support is offered beyond rate quotation, it usually is in the form of a glossary or a report describing the fundamental differences between the types of programs commonly available in the U.S. market such as fee-for-service, HMO, POS or PPO type of programs.

The employer-sponsored nature of much health care financing, at least in the U.S. market, may contribute to the difficulty in defining players in the information services market. In this common case, a two-step or two-phase market process may be considered:

1. Selection of the financing or insurance vendor(s) by the employer
2. Selection of types of coverage by the employee

The first of these two steps perhaps has more of a marketplace orientation. In this step the employer may consider acquisition of services from a number of different providers and vendors and may elect which types of coverage program to offer. In the second step or phase the employee may only choose among the options selected for purchase from the first phase. The employee typically does not have the choice from several different vendors of the same type of coverage. Rather, the employee commonly may only choose among the pre-determined types of coverage such as fee-for-service, HMO, PPO, etc.

This limited or constrained set of choices presented to the employee may well impact the nature of the information services indicated in this case. In many cases any information services provided to the employee will be prepared by the vendor selected in the first phase of this two-phase marketing process and these materials may be tailored for this particular employer/employee set. Therefore, the information services of interest to this study may be

difficult to identify in the marketplace because most true marketplace activity has already taken place by the time such services would become relevant or have true value.

5 Chapter 5 - Restatement of the Problem

In chapter 2 the original statement of the problem to be investigated by this study was given as, "What are the requirements for a Personal Decision Support System (PDSS) for choosing among health care financing alternatives?" After completion of the review of related literature presented in Chapter 3, and note of the marketplace characteristics described in Chapter 4, it becomes appropriate to give some more specific structure or restatement to this generalised problem. Three specific issues or sub-problems have been defined:

1. What are the meta-attributes or requirements for a PDSS for choosing among health care financing alternatives?
2. What are the functional attributes or requirements for a PDSS for choosing among health care financing alternatives?
3. What are the associated stakeholder groups related to development and use of a PDSS for choosing among health care financing alternatives?

5.1 Meta-Attributes or Requirements

As the various requirements for the type of system under consideration are identified, the question of how to categorize these requirements presents itself. For the purposes of this study, the first category of attributes or requirements of the system will be categorized as those applicable to many types of information systems, identified here as meta-attributes or meta-requirements. The second category will be the more specific functional capabilities required of the specific type of system under consideration.

The identification of the general, meta-requirements is based on the Diffusion of Innovation research literature, with special attention to the work of Rogers (Rogers 1983, 1995). Rogers' work

gives attention to innovations in general, rather than being directed specifically toward information systems technologies. Rogers considers adoption of an innovation from a rather general, social and perceptual point of view rather than evaluation of specific technical attributes of an innovation.

The influence taken most directly from Rogers for use in this study is the identification of a set of Perceived Innovation Attributes. The set of such attributes identified by Rogers includes: Relative Advantage, Image, Compatibility, Complexity, Trialability and Result Demonstrability. This preliminary list of attributes was modified somewhat for the current study as discussed in Chapter 6. One significant influence on this modification was the set of "prerequisite requirements" identified by Carson, et al. (Carson, Cramp et al. 1998, p. 86).

5.2 Functional Attributes or Requirements

The generalized meta-requirements category identified above is helpful but is too generalised for categorization of all potential requirements that may warrant consideration. These meta-requirements may be considered as necessary but not sufficient for the purposes of this investigation.

To supplement the meta-requirements, a set of more system-specific group of functional requirements was also addressed. These functional requirements were based on the specific subject domain of the particular type of system under consideration. As previously described, this subject domain has been identified as a system supporting choice of a health care financing or insurance system.

As described in Chapter 7, a set of functional requirements for this type of PDSS was identified. These requirements address such attributes as amount of premium, amount of co-insurance payment

required, types of coverage, and freedom of choice of health care provider.

5.3 Stakeholder Groups

The primary data collection and data analysis for this study are based on a survey of individuals and their attitudes about the use of a PDSS for selection of health care insurance or financing. However, this consideration alone provides a rather limited view of the requirements for such a system. Based on a review of the data provided by the sample of individuals, and the suggestions of the Diffusion of Innovation research, some further attention was given to the impact of various stakeholder groups likely to have an interest in such systems. A number of different stakeholders, such as insurance organisations, health care providers, employers, and consumer advocates may also have a stake in the design and use of such systems. Therefore, after completion of the primary data collection and analysis, some supplementary analysis will be directed to these stakeholder groups. The primary focus of this analysis will be the identification of likely stakeholder groups.

5.4 Summary

This reconsideration of how to characterise the requirements has led to a restatement of the original objective to include the identification of three more specific requirements topics as identified at the beginning of this section. These topics include:

1. Meta-Requirements
2. Functional Requirements
3. Stakeholder Identification

The details of how these topic domains are investigated are given more detailed attention in Chapters 6, 7 and 8.

6 Chapter 6 - Research Methods

6.1 Design of the Research

Previous chapters have defined the research question to be addressed by this study and identified the three subject areas of health care financing, decision support systems, and diffusion of innovations approaches to investigating issues of technology adoption. This chapter builds on these areas of background reference but turns attention to the specific research methodology applied in this study. This will discuss development and planning for the use of a survey instrument to address the meta-requirements mentioned in the previous chapter. The following chapter will address administration, data collection and data analysis of the survey.

6.1.1 Developing the Constructs

In previous sections of this study, the three primary subject areas of health care financing, decision support systems, and technology adoption have been identified as the focus of interest in this research effort. Not only have these areas of emphasis been identified, but also attention has been given to the discussion of their nature and the perspective to be taken in this work. For example, effort has been directed to clarifying basic characteristics of the research area of Diffusion of Innovations and defining this as the basis for a view of technology adoption issues.

In addition to the identification and discussion of the three subject areas of focus, the research question, "What are the requirements for a decision support system for the selection of a health care financing option?" has been identified. As a further clarification of this fundamental research question, a comment may be added to clarify that this research question will be considered from a technology adoption (or diffusion of innovations) perspective. Actually this attention to the "requirements issue" tends to present

itself as at least two fundamental questions, "What is meant by the term requirements?" and, "How is the range or domain of requirements identified?" This presents the rather classic issues of both *what* and *how* that the practicing systems analyst addressing information systems development must wrestle with during a systems development project.

6.1.2 Considering the Domain of the Subject Matter

As a first effort in addressing the "what" question, a review of techniques suggested by textbooks directed to Systems Analysis and Design education appears to be warranted. On first consideration, this would seem to present a reasonable starting point given that systems development projects are commonly undertaken to solve specific problems; and these problems are commonly presented in terms of requirements for solution of some problem by the system under consideration. However, a review of a selected set of such textbooks by academic publishers, (Burch 1992, pp. 115, 116, 149-145), (Coad and Yourdon 1990, pp. 213-215), (Whitten, Bentley et al. 1989, pp. 90 - 91, 162; Edwards 1993, pp. 16, 145-160) proves somewhat disappointing regarding this point. Almost all such authors present the definition of requirements as an activity to be addressed in a very early phase of a systems development project. However, the emphasis is on the requirements definition, and subsequent specifications development, as part of a Systems Development Life Cycle (SDLC) with very little guidance as to how to actually identify the requirements. Especially noted is the limited guidance as to definition of the scope, range, or domain of the requirements.

6.1.3 System and Software Engineering Perspectives

This characteristic recognition of need for requirements definition, accompanied by limited guidance of how to actually achieve the definition, is suggested by other efforts oriented toward systems development. This may even be true when the effort claims a focus on

the requirements definition process. One example of a declared emphasis on requirements with limited attention as to how to approach the actual definition of requirements is seen in a 1990 collection of papers on "System and Software Requirements Engineering" presented by IEEE. (Thayer and Dorfman 1990, all pages - pp. 1-719). With some forty-five papers, organised into eight topic areas, this collection still tends to provide limited attention to generalised guidance to issues of requirements definition. A number of the papers give special emphasis to the role of how requirements will fit into the remaining phases of a SDLC or may focus on an area of special emphasis such as "traceability" of requirements through these phases to delivery of the final product. Despite the persistent theme of requirements, this collection of papers still fails to provide specific guidance on techniques of how to actually define the requirements (Thayer and Dorfman 1990, pp. 1-718).

Frequently, arguments are presented to suggest that errors that occur early in a systems development process have substantially higher corrective and remedial costs than errors occurring in later phases of development. Since the general definition of requirements commonly occurs in early phases of systems development, it may be suspected that weakness in requirement definition may well contribute significantly to increased cost, or lower user or customer satisfaction, in a systems development project. Of course this argument presumes that these "early errors" are not detected through the SDLC and quality controls that exist as a part of the systems development process. The assumption is that these errors remain present in the development effort through the development and possibly the implementation of the system. The argument may well be presented that an effective SDLC with appropriate checkpoints should identify such "early error" problems. Nonetheless, the relevance and impact of this issue have been commonly addressed in the Information Systems

literature. Though the "early error problem" has been identified by a number of writers, focus on the requirements error problem is addressed specifically by writers such as Roman:

> The economic realities of large systems development, in particular, are such that discrepancies between the delivered system and the needs it must fulfil may cost in excess of 100 times what would have been required if the errors were discovered during the initial problem definition; in some cases discrepancies may make the entire system useless. For this reason, recent years have been marked by an increased general interest in requirements specification (Roman 1985, pp. 14-22).

In addition to recognition of the requirements error problem, Roman does give suggestions regarding a generalised view of requirements definition. Influenced by Yeh, (Yeh 1982, pp. 41-46)the case is presented for viewing requirements as falling into two generalised categories, functional and non-functional. These non-functional requirements may also be described as the constraints on the system design.

The functional requirements may be seen as capturing "the nature of the interaction between the component and its environment" (Roman 1985, p. 24). This emphasis of the relationship between the subject component and the environment reinforces the observation that, "if the environment is not well understood, it is unlikely that the requirements, as specified, will reflect the actual needs the component must fulfil" (Roman 1985, p. 34). Roman's discussion of non-functional requirements does recognise that determination of such requirements may be difficult, but proposes a taxonomy of such requirements including:

1. **Interface constraints** that define the way the component and its environment interact and serve as constraints that should not affect what the program does, but the way it does it.

2. **Performance constraints** that may impact a broad range of issues dealing with time/space bounds, reliability, security, and survivability. The reliability constraints deal with both the availability of physical components and the integrity of the information maintained or supported by some component.
3. **Operating constraints** include physical constraints, personnel availability, skill level considerations, and accessibility for maintenance, environmental conditions, and spatial distribution of components.
4. **Life-cycle constraints** are described as in two major categories: those that pertain to the qualities of the design and those that limit the development, maintenance, and enhancement process. The first group includes such attributes as: maintainability, enhanceability, portability, flexibility, reusability components, expected market or production life span, upward compatibility, integration into a family of products, etc. In the second group are placed such factors as development time limitations, resource availability, and methodological standards.
5. **Economic constraints** represent considerations relating to immediate and long-term costs.
6. **Political constraints** deal with both policy and legal issues.

After giving these views, Roman seeks to generalise guidelines regarding the properties of a good specification. His result, admitted as being presented from a functionalist viewpoint, suggests, "A property of a requirements specification is desirable if it satisfies some identifiable need of the design process" (Roman 1985, p. 25). As previously suggested, this functionalist view uses the

remaining activities and phases of the project systems development process as the standard to be used in the determination of requirements to be identified for the component or project.

6.1.4 Soft Systems Methodology Influences

This tendency to develop a rather restricted and constrained view of requirements, based either on the systems development methodology or the anticipated problem solution techniques, has previously been noted. In fact a case may be presented that this was a significant factor in the derivation of Soft Systems Methodologies (SSM) from the Systems and Software Engineering disciplines.

In the preface to his retrospective work that reviews some thirty years of Soft Systems Methodologies, Checkland notes that,

> SSM was developed in the 1970s. It grew out of the failure of established methods of 'systems engineering' (SE) when faced with messy complex problem situations. SE is concerned with creating systems to meet defined objectives, ...
>
> Not many human situations are as straightforward as this, however, and SSM was developed expressly to cope with the more normal situation in which the people in a problem situation perceive and interpret the world in their own ways and make judgments about it using standards and values which may not be shared by others (Checkland 1999, preface).

Checkland's further observations regarding the nature of an interpreted versus an experienced world and that "human beings cannot help attributing meaning to their experienced world" (Checkland 1999, p. 2) suggests that SSM attempts to encourage a somewhat different view of the requirements definition processes than suggested by the Systems Engineering and Software Engineering disciplines. This acknowledgement of intention in human decision making and the role of purposeful action in the decision process further suggest that Soft Systems Methodologies, or at least the perceptions encouraged by such methodologies, will provide useful lessons. The subject of Soft Systems Methodology is one to which attention will return somewhat

later. However, the influence of Soft Systems Methodology on this study is more in the form of inspiration that specific methodology. The goals and purposes of SSM are seen to be more of the issue than the specific details of the methodology.

6.1.5 Beginning the Quest

How then should the effort to define the requirements for a PDSS used for selection of a Health Care Financing option as suggested by our research question begin? The quest begins not by looking at any particular system development methodology or techniques that are used to implement the system. Rather, the quest begins by seeking inspiration from appropriate reference disciplines and seeking refuge in methodology.

6.1.6 The Carson-Cramp-Morgan-Roudsari (CCMR) Prerequisite Criteria

In the search for standards or a reference point for the definition of system requirements, note is also made of the identification of four "prerequisite" requirements presented by Carson, Cramp, Morgan, and Roudsari (Carson, Cramp et al. 1998, p. 87). In this paper, and in a personal interview, Carson and Cramp present the four attributes of "safety", "reliability", "acceptability", and "usable" as of such a critical nature as to be prerequisite in the evaluation of an information system. The suggestion is that unless a system under consideration satisfies these fundamental requirements, the system does not warrant further evaluation. Only if these prerequisite requirements are satisfied is it necessary to proceed to evaluation of further criteria such as cost or efficiency. Although Carson and Cramp have referred the fourth of these attributes as "usable", this study will use the term "usability" on conform with rather common usage and to be compatible with the reference to the other three attributes.

6.1.7 The Survey Methodology - Administration of the Survey

Although significant emphasis was placed on the research methodology in this project, it followed a rather traditional plan. Based on a written survey of a carefully selected sample, fundamental descriptive statistics were developed in an effort to respond to the research question. The various steps for the study included:

1. Review appropriate research literature
2. Identify reference disciplines
3. Plan for preliminary telephone interviews
4. Conduct preliminary telephone interviews
5. Review results of preliminary interviews
6. Draft survey instrument
7. Review of survey instrument
8. Administer survey as pilot project
9. Prepare statistical analysis of pilot project
10. Review pilot project
11. Revise survey instrument
12. Identify survey sample
13. Administer survey
14. Prepare statistical analysis of survey
15. Review survey
16. Document the review
17. Compare selected existing PDSS systems to requirements
18. Define and document conclusions
19. Prepare recommendations

Based on the nineteen steps identified above, it seemed appropriate to structure these steps into a smaller subset of more generalised phases. To support such a simplified, more general view, these tasks were organised into five phases:

1. Preliminary Planning and Interviewing
2. Pilot Survey Development and Administration
3. Primary Survey Development and Administration
4. Survey Analysis and Review
5. Preparation of Conclusions and Recommendations

The final phases of the research work will give attention to the preparation of recommendations regarding future research work.

Figure 6.1 - Context Map - Level 1 - Health Care Financing PDSS

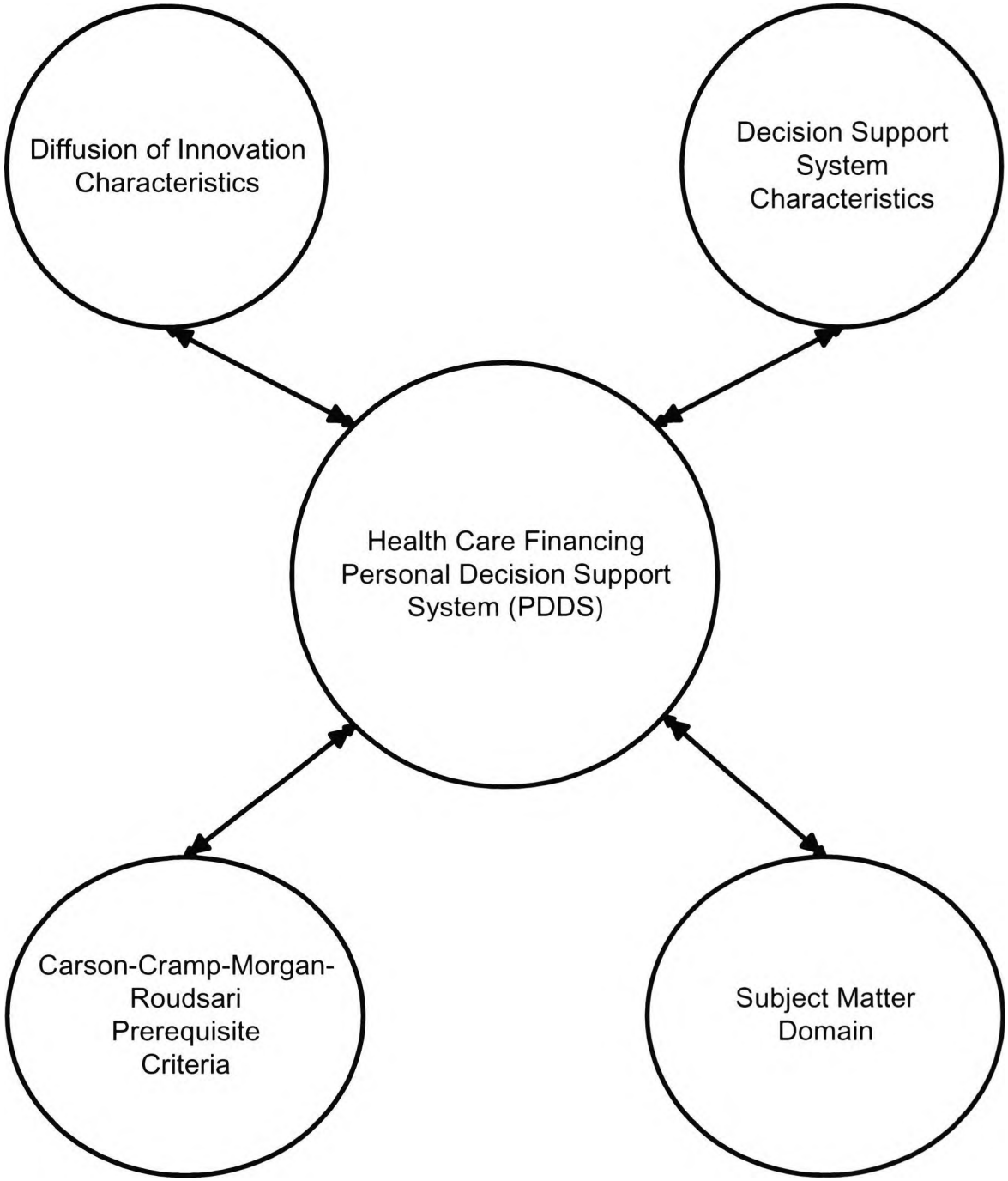
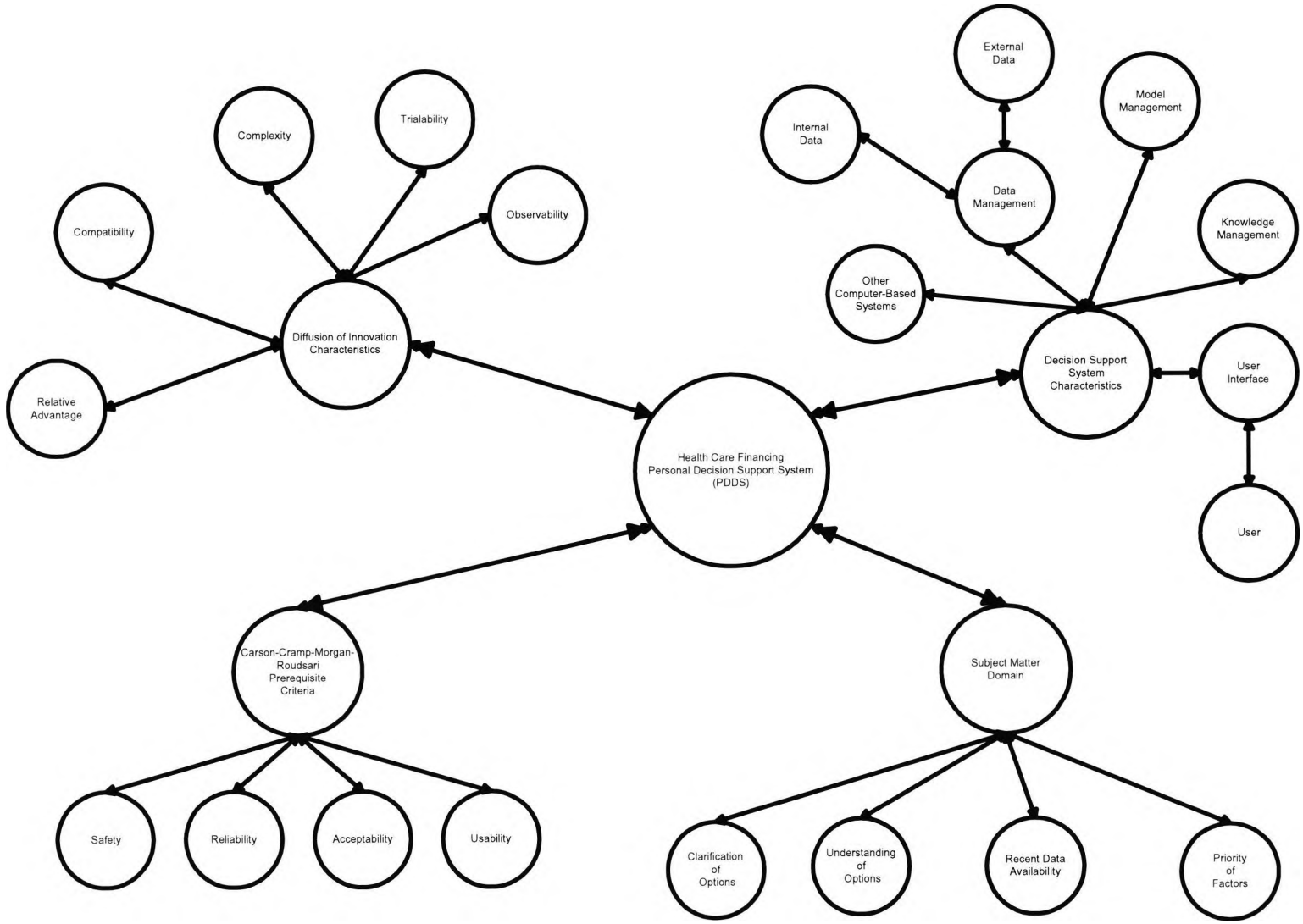


Figure 6.2 - Context Map - Level II - Health Care Financing PDSS



6.1.8 Preliminary Planning and Interviewing

After consideration of the reference domains identified in Figures 6.1 and 6.2, a Telephone Interview Worksheet as shown in Appendix X - Health Care Financing Decision Factors Interview Worksheet was prepared as a guide for the conduct of these preliminary telephone interviews. Objectives for this worksheet were to permit the telephone interview to be conducted in a reasonably informal manner, to allow completion of the interview in less than ten minutes, and to minimise the number of refusals to respond either to the interview process as a whole, or to individual items. Collection of actual data for formal analysis was not an objective of this phase. The responses were reviewed as a guide in the development of the survey instrument to be used in the pilot survey phase of the project. The final form of this worksheet included thirty two questions organised into categories of Introduction, Demographic Information, Health Care Financing Overview, Computer / Internet Use, Reaction to Computer System PDSS, and a Conclusion. Question 1 allowed for a sequential identifying number for each interview and was automatically generated by the database management system used as a basis for data entry.

The primary researcher contacted sixteen subjects by telephone during the conduct of the preliminary telephone interviews. This was a sample of convenience selected from members of a Columbia, Tennessee civic club and selected personal acquaintances. The subjects did not include anyone who would be a candidate for inclusion in the pilot survey activity or the final survey planned for later phases of the study. Only employed persons were included since the majority of U.S. citizens obtain their health financing as an employment benefit.

6.1.9 Introduction and Demographic Information

The Introduction portion of the worksheet served only to provide a brief introduction to, and explanation of the purpose of the

interview, assurance regarding privacy of responses, and assurance that the interview process would not exceed ten minutes. Permission to record the interview was also requested but no actual data to be evaluated was collected at this point. During the Demographic Information portion of the interview, a data element of specific concern collected was Employment Status and, if volunteered by the respondent, the name of the employer. Inclusion of a question about employment status, along with question 7 in the next section asking if health care financing or insurance was provided as part of employment or retirement benefits, proved to be of unexpected value.

One respondent was employed as the owner of an independent retail business but indicated that he did not have health care financing provided as a result of his health conditions. This respondent volunteered the fact that he had chronic diabetes and had been unable to obtain commercial health care financing or insurance. In his case he did have coverage through the TennCare plan, which includes provision for "uninsurable" citizens of the State of Tennessee. In another case the respondent was in a "semi-retired" status but still working with his former employer, and did have health care coverage provided. Interestingly, in this case, based on years of service in the military reserve component, the respondent was also eligible for coverage through his military retirement benefits but volunteered that he had never exercised such an option. In a third case, the respondent indicated that she was employed, had health care financing available through her employer but was also covered as a spouse through her husband's employment program. In this case she elected to use the program offered through her spouse's employment benefit program because it "provides better coverage." The unanticipated result was that the combination of responses to this employment question and question 7 later in the interview suggested an

influence on the final survey form to accommodate some of these special cases of health care coverage.

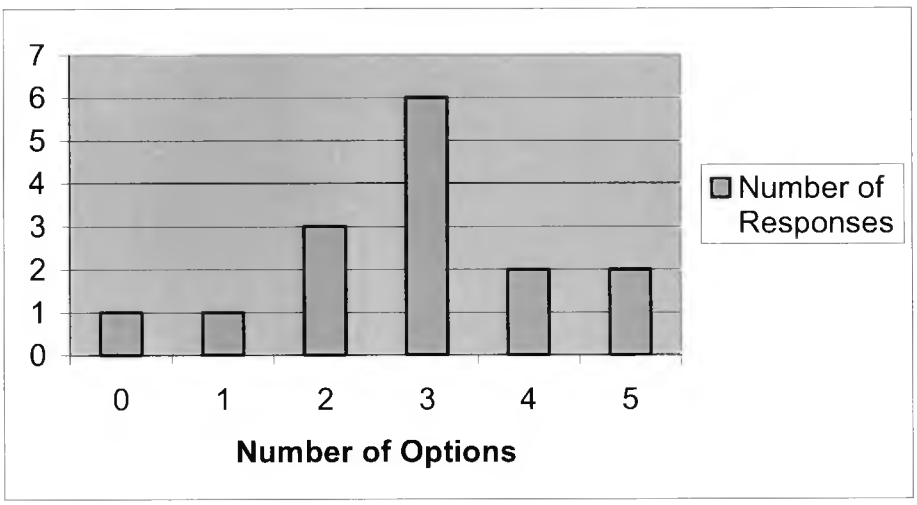
6.1.10 Health Care Financing Overview

The majority of respondents did have health care financing or insurance provided as part of their employment benefits program. As mentioned above, several unanticipated cases regarding employment and the availability and use of such benefits were identified. Of the sixteen respondents only one did not have health care financing provided by his employer. This was the case of the independent business owner who had chronic diabetes and obtained his health care financing through the state sponsored TennCare program. This was interpreted as confirmation that most employed persons in Tennessee will have some form of health care financing or insurance provided by their employer. Table 6.1 - Telephone Interviews - Number of Health Care Financing Options indicated that the mode for the number of options is three. This suggested that choice among a set of options of health care financing is a decision that most employed persons in Tennessee will need to make.

Table 6.1 - Telephone Interviews - Number of Health Care Financing Options

Number Of Options	Number Of Responses
0 Options	1
1 Options	1
2 Options	3
3 Options	6
4 Options	3
5 Options	2

Figure 6.3 - Telephone Interviews - Number of Coverage Options



6.1.11 Understanding of Options.

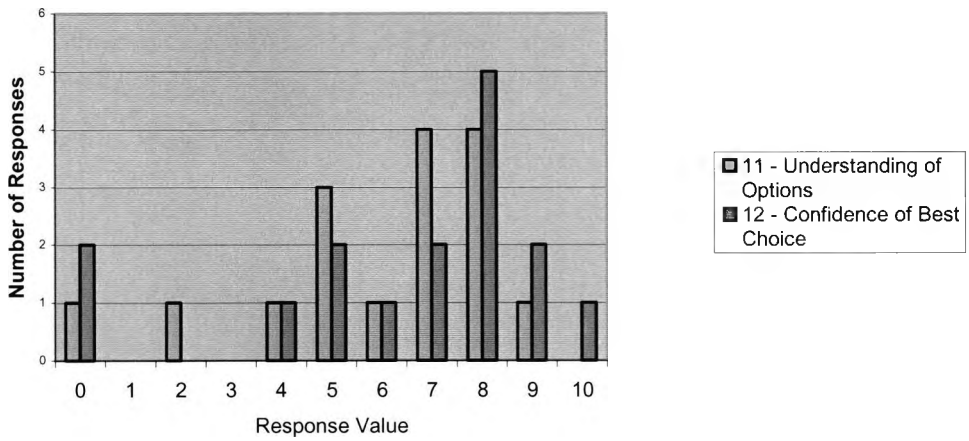
The respondents were asked to rate their understanding of their health care options on a scale of one to ten. A response of 1 represented the lowest possible level of understanding or confidence while a response of 10 represented complete understanding or confidence. In general, the respondents rated themselves as having a high level of understanding of their health care options. No respondents indicated that they did not know the number of options available to them, although several respondents indicated, "I think" or "I believe" when asked to identify the number of available options. Responses to Question 11 about the level of understanding of options

produced an average response value of 6.1, based on a scale of 1 to 10. Question 12, about confidence of having made the best choice, yielded an average response of 6.2. These responses suggest a rather high level of understanding and confidence based on the respondent's self-evaluation. However, one should note that these responses might have been influenced by the fact that the respondents did personally know the interviewer in many cases. These responses are summarised in Table 6.2 and Figure 6.4.

Table 6.2 - Telephone Interviews - Responses to Questions 11 and 12

Number of Responses	11 - Understanding of Options	12 - Confidence of Best Choice
0	1	2
1	0	0
2	1	0
3	0	0
4	1	1
5	3	2
6	1	1
7	4	2
8	4	5
9	1	2
10	0	1

Figure 6.4 - Telephone Interviews - Questions 11 - Understanding of Options and 12 - Confidence of Making Best Choice



6.1.12 Reporting of Expenses

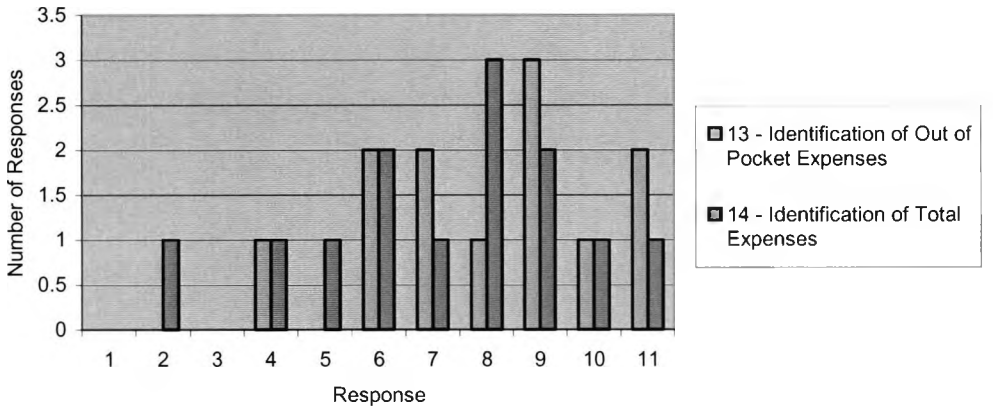
Two questions were asked regarding the respondent's ability to report actual health care expenses for the past year. The responses to these questions are summarised in Table 6.3 and Figure 6.5. Questions 13 asked the respondent to evaluate how accurately he could report his actual out-of-pocket health care expenses for the past year while Question 14 asked how accurately total health care expenses for the past year could be reported. In neither case was the person asked to identify the actual amount but to evaluate how accurately he or she could identify such expenses if requested to do so. For each question a response on a scale of 1 to 10 was requested. If the respondent inquired about the nature of the question or seemed to be having difficulty with the question, it was suggested that the respondent assume that he could examine any records he might have at home and could actually answer the next day. The average of the response value for Question 13, related to Out-of-Pocket expenses, had an average of 6.9. This was slightly higher than the average response value of 6.0 for Question 14, related to total expenses. The general pattern of

responses is illustrated in Table 6.3 and Figure 6.5. The response values were considered to be rather high considering that all except one of the respondents had health care coverage provided by an employer and a presumption that little attention to total cost would be given as this did not represent direct or out-of-pocket costs for the respondent. In most cases, based on common health care insurance practices in the U.S., the individual would have to analyse an "Explanation of Benefits" form provided after each health service encounter.

Table 6.3 - Telephone Interviews - Questions 13 and 14

Response	13 Out of Pocket Expenses	14 - Total Expenses
0	1	1
1	0	1
2	0	0
3	1	1
4	0	1
5	2	2
6	3	2
7	1	3
8	3	2
9	2	1
10	3	2
Response Average	6.9	6.0

Figure 6.5 - Telephone Interviews - Questions 13 - Out of Pocket Expense Identification and 14 - Total Expense Identification



6.1.13 Internet Uses

Two different types of questions regarding use of the Internet were asked. The first type consisted of general questions about Internet use at home or work. The second category of questions was about whether the respondent used the Internet for specific uses. The use of the Internet was also considered to be an indication of computer use.

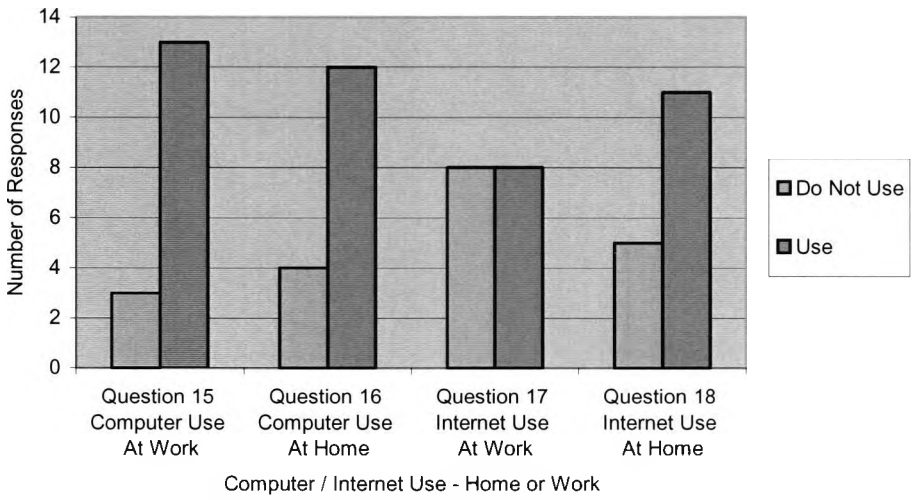
6.1.13.1 Computer / Internet Frequency of Use.

Seventeen questions were asked regarding general computer use and Internet use. However, if the respondent indicated that he did not use the computer or the Internet at work or at home; subsequent questions related to such use were omitted. Of the sixteen respondents indicating that they did use a computer or the Internet, a summary is presented in Table 6.4 and Figure 6.6.

Table 6.4 - Telephone Interviews - Questions 15 through 18 - Number of Respondents Reporting Computer / Internet Use

	Question 15 Computer Use At Work	Question 16 Computer Use At Home	Question 17 Internet Use At Work	Question 18 Internet Use At Home
Do Not Use	3	4	8	5
Use	13	12	8	11

Figure 6.6 - Telephone Interviews - Questions 15 - Computer Use at Work through 18 - Internet Use at Home



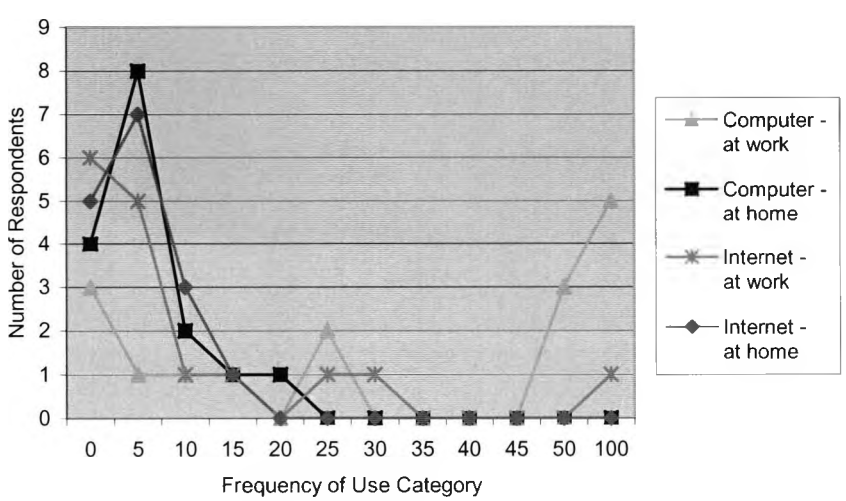
Questions 15 through Question 18 merely inquired as to whether the person did use a computer or the Internet either at work or at home. Based on the response to these questions, Questions 15-A through 18-A were asked if the respondent did indicate this type of computer use. The responses to these questions are summarised in Table 6.5 and Figure 6.7.

Table 6.5 - Questions 15A through 18A - Frequency of computer and Internet use

Times used per week *	Computer - at work	Computer - at home	Internet - at work	Internet - at home
0	3	4	6	5
5	1	8	5	7
10	1	2	1	3
15	1	1	1	1
20	0	1	0	0
25	2	0	1	0
30	0	0	1	0
35	0	0	0	0
40	0	0	0	0
45	0	0	0	0
50	3	0	0	0
100	5	0	1	0
	0	0	0	0
Average	45.5	4.8	11.8	3.9
Standard Deviation	41.6	5.6	25.3	4.5

* Maximum value for inclusion within this category

Figure 6.7 - Questions 15A through 18A - Frequency of Computer and Internet Use



6.1.13.2 Specific Internet Uses

Question 20 through 26 asked about specific uses of the Internet. Respondents were asked to indicate if they personally used the Internet for any of these purposes. These questions provide examples of types of personal Internet use. A composite index of these Internet use questions was constructed with all questions given equal weight. A summary of the responses to Questions 20 through 26 is presented in Table 6.7 and Figure 6.8. The composite index had an average value of 2.0 with a standard deviation of 2.1.

6.1.13.2.1 Federal Income Tax Preparation

Two questions related to preparation of Federal Income Tax were included as a measure of computer use apart from efforts to measure Internet use. Question 27 seeks to determine whether the respondent prepared his or her own Federal Income Tax during the past year, while Question 27A asks if a software package was used for this purpose. An individual may use Federal Income Tax preparation software without regard as to whether actual submission of the tax return was accomplished through the Internet. In fact, a number of services provide for submission of the tax return and request for a refund, when applicable, through the Internet even though the calculation of the return may have been accomplished without use of a computer-based service. The responses to these two questions are presented in Table 6.6.

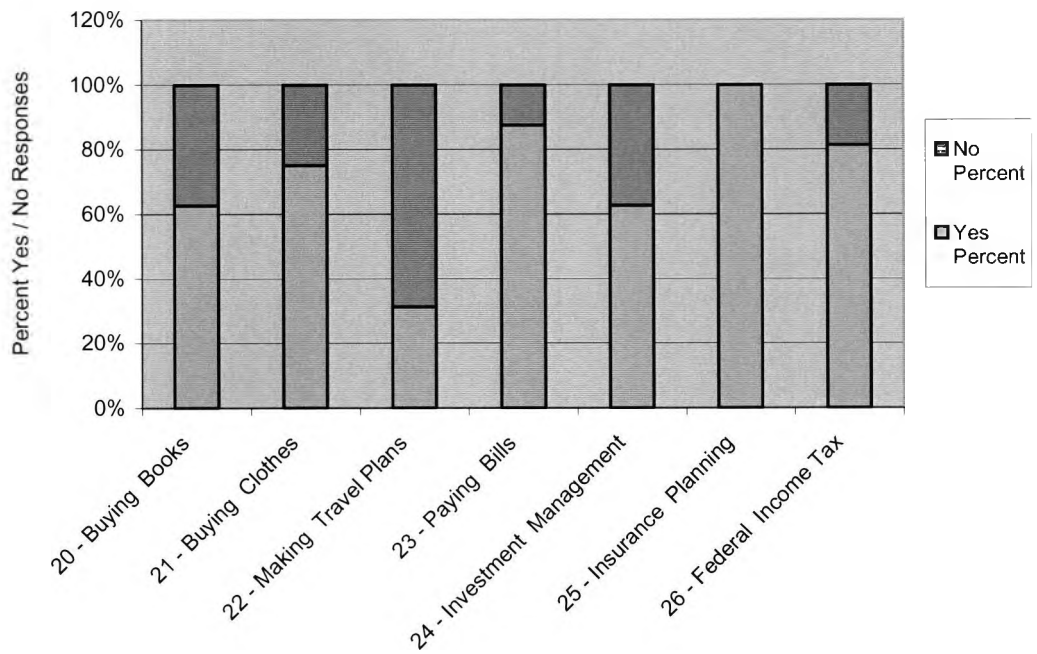
Table 6.6 - Questions 27 and 27A - Federal Income Tax Preparation

Federal Income Tax Prepared by:	Number	Used Tax Preparation Software	
Other Person	8	N/A	N/A
Self	8	Yes	3
		No	5

Table 6.7 - Questions 20 through 26 - Specific Uses of the Internet

Use	Yes Count	No Count	Yes Percent	No Percent
20 - Buying Books	10	6	63%	38%
21 - Buying Clothes	12	4	75%	25%
22 - Making Travel Plans	5	11	31%	69%
23 - Paying Bills	14	2	88%	13%
24 - Investment Management	10	6	63%	38%
25 - Insurance Planning	16	0	100%	0%
26 - Federal Income Tax	13	3	81%	19%

Figure 6.8 - Telephone Interviews - Questions 20 through 26 - Specific Uses of the Internet



6.1.14 Reaction to Computer System PDSS

Four questions were asked regarding the respondent's opinion about and reactions to possible use of a personal decision support system (PDSS) to assist in choosing a health care financing or insurance package. The answers to Question 28 about whether the respondent would consider use of a computer program for this purpose, and Question 29 about possible use of such a service on the Internet are summarised in Table 6.8.

Table 6.8 - Telephone Interviews - Question 28 and Question 29 - Use of PDSS Program or Internet Service

	Consider use of PDSS Program	Consider use of PDSS on Internet
No	4	5
Yes	12	11

Questions 30 and 31 related to issues of the validity of the PDSS service and any possible concerns about the publisher or provider of the PDSS service. Responses to both of these questions were treated as open-ended questions and no effort was made to quantify responses. Responses to these questions are listed in Appendix XI - Summary of Responses from Telephone Interview Questions 30 and 31.

In general, most respondents did show some concern about both issues. The degree of concern expressed was adequate to suggest development of questions related to these issues that provide a quantifiable response for the actual survey.

6.2 Pilot Survey

The objectives of this pilot survey activity were not to collect data for analysis directly related to the research question but to test the survey instrument and to seek reduction in the length of the survey instrument. As a result of this objective for the pilot survey, limited statistical analysis was conducted. The statistical analysis conducted was primarily to assist in identification of

duplicate questions, and selection of questions most likely to produce useful results for analysis from the final administration of the survey. This limited statistical analysis was conducted with the JMP IN statistical analysis software published by the SAS Institute, Inc. The Microsoft Excel spreadsheet product was used to confirm calculation of mean, standard deviation, and correlation coefficient. Values calculated by the two products, after consideration of missing responses, were confirmed to be equal to four decimal places as reported by JMP IN. The questions used in this pilot survey are shown by question category in Appendix XII - Pilot Survey Instrument - Original Questions by Category.

As an aid in the evaluation of the proposed questions, a summary identification of the various questions by category is shown as Appendix XIII - Classification of Selected Questions - Pilot Survey. A comparable summary classification of questions selected for the final survey is included as Appendix XIV - Classification of Selected Questions - Final Survey Instrument.

The pilot survey was administered to staff and faculty of two educational institutions in Columbia, Tennessee. The two organisations selected were a public (county government administered) middle school serving students in grades 6 through 8, generally ages 11 through 14 and a state community college offering degree programs oriented toward the first two years of bachelor's study. At the middle school the survey instrument was distributed to the faculty and professional staff, such as librarians and school counsellors. At the community college the pilot survey was administered to faculty, professional staff, and support staff, such as financial aid workers and secretaries. The number of survey instruments distributed, the number of responses and the response rates are indicated in Table 6.9.

Table 6.9 - Pilot Survey Response Rates

Type of Institution	Survey Instruments Distributed	Survey Instruments Returned	Number of Valid Responses	Response Rate *
Middle School	76	29	29	38 %
Community College	120	36	29	24 %
Total	196	65	58	30 %

* Calculated as percent of valid responses / number of instruments distributed

6.3 Evaluation of Pilot Survey

Of special concern during evaluation of the pilot survey results was an effort to reduce duplicate questions. The length of the survey of six pages and sixty-nine questions was a substantial cause of concern. The derivation of the initial list of questions from more than one set of constructs to be considered for measurement did contribute to the presence of duplicate questions as well as the initial effort to have more than one question related to each construct.

Development of the pilot survey instrument included the identification of the descriptive phrases "HI-Help" and "HCF-AS" which were used at a number of points throughout the survey instrument to identify the type of PDSS under consideration. These phrases were identified strictly for the purpose of the survey and were developed in an effort to use a short, descriptive term to identify the type of system under consideration. Use of either term in the pilot survey suggested that they were not effective and detracted from the effectiveness of the survey instrument. This was despite the fact that this type of system was identified as a "Health Insurance / Helper System" and described as, "Such a system would not provide health care information about an illness or injury that you may have. Instead it would provide you with suggestions about making a choice among health care financing or health insurance options that may be available to you." Based on narrative comments returned with the

pilot survey instrument and personal comments made to the survey administrator, it appeared that such terms suggested a particular software product or product category with which the respondent should have had experience. The comment was often made that the respondent had never used this system or type of system and lacked knowledge or experience with such a system.

In the final version of the survey instrument the type of system under consideration was described more generally as a "Health Insurance Selection System". A more detailed description of such a possible system was included on the cover page of the survey as shown in Appendix XV - Survey Instrument and Instructions - Final Version. This description included identification of optional forms of coverage such as, "a Health Maintenance Organisation (HMO), a Preferred Provider Organisation (PPO), or a traditional Fee for Service type of coverage." It was further suggested that such a system might ask the system user to rate the importance of such factors as:

- Low cost per visit to your doctor
- Low overall annual cost
- Level of health insurance deductible payment
- Ability to choose your personal physician or primary care doctor
- Coverage when you travel outside of your home area

These factors were listed to help the respondent identify some of the characteristics that might distinguish the coverage options presented. The goal was to help the survey respondent have a better concept of the purpose of the system.

The pilot instrument requested a narrative response to list job duties. The nature of responses to this question varied greatly, from no response at all to a rather lengthy and detailed narrative. Since it seemed impractical to use the answers to this question as a basis of categorizing the respondent demographically, the question was eliminated. The two remaining generalised demographically focused

questions asked about the job title and the level of education. These questions were retained.

6.3.1 Health Care Financing and Insurance Questions

In the second portion of questions related to the respondent's health care financing and insurance, few changes were made. Since almost all respondents, 92 percent, had made use of their coverage within the past year the question asking if the respondent had used his health care financing or insurance within the past year was removed from the survey. The small percentage of respondents not using the coverage suggested that this would not likely be a factor influencing attitudes regarding potential use of such a system. The sequence of questions was modified slightly to insure that questions were grouped more by the type of response applied. The question asking for identification of the number of health care financing options was modified to use the same response technique as the remaining questions asking for a response on a scale of 1 to 10.

Most of the questions from question number 9 through the remainder of the revised survey instrument asked for a response on a scale of 1 to 10. The pilot survey instrument allowed a blank area on the left of each line using this 1 to 10 scale response or permitted the respondent to mark on a scale line to the right of this area. No specific instructions as to how to use the response area were included. The nature of the responses suggested confusion on the part of respondents as to how they were expected to use the response area. Some respondents used the blank area to the left of the line and wrote in a numeric value. Others marked a position on the scale line to the right of the response area. However, it appeared that the format of the scale line suggested that the portion of the line to each presented value was a "fill in the blank" area. For example, it is interesting to note that no respondent made an effort to indicate a response value of 10 when using the scale line response area. The

final version of the survey form removed the blank area on the left of the response line and modified the line shown in the scale line area. Furthermore, instructions were included near the beginning of the survey instrument to circle all answers.

6.3.2 Computer and Internet Questions

The number of questions related to computer and Internet use was reduced from 14 to 10. Two questions asking about frequency of computer use at work and at home were eliminated since comparable questions regarding Internet use were considered to provide a measure of both computer and Internet use. Two questions regarding whether a person prepared his federal income tax personally and whether he used a computer to assist in federal income tax preparation were removed. The inter-twined nature of the questions suggested some difficulty in analysis of the responses and there was little evidence that these gave any further indication of a respondent's likelihood of regular use of the Internet or computer for processes or decisions related to personal finance than the other questions asked in this area.

6.3.3 Attitude Questions

The initial examination for duplicate questions was directed to questions 41 through 69 on the survey instrument identified as "Questions about some of your attitudes." Since questions 47 and 61 were omitted from the pilot instrument this resulted in 27 questions for this portion of the instrument.

6.3.4 Ease of Use Questions

Comparison of the constructs taken from previous study of DSS within organisations and the criteria taken from Carson, et al. suggest two topics that likely represent much the same actual construct: Ease of Use, from Moore and Benbasat, and usable from Carson, et al. The actual questions for these two constructs were:

Table 6.10 - Ease of Use and Usability Construct Questions

Construct	Question
Ease of Use	46 – Overall, I believe that a HI-HELP system would be easy for me to use.
	58 – I believe that it would be easy to get a HI-HELP system to do what I want it to do.
	66 – I believe that learning to use a HI-HELP system would be easy for me.
Usable	54 – I believe that I understand enough about my health care financing options to use a HI-HELP system and understand the results.
	57 – I believe that I have enough computer experience to use a HI-HELP system.
	64 – I believe that a HI-HELP system will be easy to use.

Pair-wise Pearson product-moment correlation coefficients were calculated, as shown in Table 6.11, using the JMP IN software product. The higher the correlation coefficient, the more the two questions are considered to be evaluating the same construct. In an effort to reduce the number of these questions, we note the high correlation coefficient for the relationship between questions 64 and 66. Examination of these two questions further suggests they are very close to duplicate questions with question 66 including a reference to "learning to use a HI-HELP system" being easy. Consideration of other correlation coefficients shows all coefficients within the range of .40 to .65. It is also noted that the following pair-wise comparisons yield relatively high correlation coefficients: questions 58 and 64, questions 58 and 66, questions 57 and 58, and questions 57 and 66.

Table 6.11 - Pair-Wise Correlation Coefficients - Ease of Use and Usable Questions

Question	46	54	57	58	64	66
46	1	.5954	.3127	.4155	.5313	.4763
54		1	.3795	.3941	.4084	.3450
57			1	.6668	.4534	.6239
58				1	.6067	.6306
64					1	.7211
66						1

Low correlation coefficient values are noted for question pairs 46 and 57, questions 54 and 57, questions 54 and 58, and questions 54 and 66. Examination of these correlation coefficient values and the wording of the questions led to the conclusion to retain questions 46, 54, and 57:

46 - Overall, I believe that a HI-HELP system would be easy for me to use.

54 - I believe that I understand enough about my health care financing options to use a HI-HELP and understand the results.

57 - I believe that I have enough computer experience to use a HI-HELP system.

This set of three questions provided one question worded to focus on "easy for me to use" without regard to the criteria for considering ease of use, one question that addresses the respondent's understanding of health care financing, and one question oriented toward computer experience. This combination of focus was considered appropriate given the goal of reduction of the length of the survey instrument.

6.3.5 Relative Advantage Questions

The Relative Advantage construct was represented by five questions in the pilot survey:

Table 6.12 - Relative Advantage Construct Questions

Construct	Question
Relative Advantage	41 – Using a HI-HELP system would enable me to accomplish tasks related to financial and insurance decisions more quickly.
	45 – Using a HI-HELP system would enhance my effectiveness in making financial decisions.
	50 – Using a HI-HELP system would improve the quality of my financial and insurance decisions.
	60 – Using a HI-HELP system would give me greater control over my financial and insurance affairs.
	65 – Using a HI-HELP system would make it easier to make my financial and insurance decisions.

As was done with the questions related to Ease of Use and Usability, pair-wise Pearson product-moment correlation coefficients were calculated and examined as a basis of evaluating which questions to retain for the final survey. These values are presented in Table 6.13.

Table 6.13 - Pair-wise Correlation Coefficients - Relative Advantage

Question	41	45	50	60	65
41	1	.7017	.7958	.6890	.6194
45		1	.7330	.5954	.7466
50			1	.7081	.7226
60				1	.8655
65					1

The first point noted is that the correlation coefficients for these five questions were notably higher than the values determined for the six questions considered for the Ease of Use and Usability constructs. The coefficient for questions 45 and 60 was the only value below .60. The higher overall level of correlation coefficients suggested that the questions were likely measuring much the same concept. After consideration of the values displayed in Table 6.13 and the wording of the questions, a choice was made to retain question 50, with a reference to "quality" of decision, and question 65, with a reference to ease of decision making:

50 - Using a HI-HELP system would improve the quality of my financial and insurance decisions.

65 - Using a HI-HELP system would make it easier to make my financial and insurance decisions.

6.3.6 Compatibility Questions

Three questions from the pilot survey instrument were related to the construct of compatibility:

Table 6.14 - Compatibility Construct Questions

Construct	Question
Compatibility	42 – Using a HI-HELP system would fit into my work and decision styles.
	53 – Using a HI-HELP system would be compatible with all aspects of my financial and insurance planning.
	63 - I think that using a HI-HELP system would fit well with the way I like to work and make decisions.

The pair-wise Pearson product-moment correlation coefficients calculated for the comparison of these three questions are presented in Table 6.15.

Table 6.15 - Pair-wise Correlation Coefficients - Compatibility

Question	42	53	63
42	1	.8013	.7666
53		1	.8277
63			1

Based on these values and the wording of the questions, questions 53 and 63 were selected to use for measurement of this construct. Question 53 was reworded slightly to change the phrase "all aspects of my financial and insurance planning" to "most aspects of my financial and insurance planning". One question focused on personal work and decision style and a second question focused on financial and insurance planning.

53 - Using a HI-HELP system would be compatible with all aspects of my financial and insurance planning.

63 - I think that using a HI-HELP system would fit well with the way I like to work and make decisions.

6.3.7 Image

Three questions from the pilot survey instrument were related to the construct of Image:

Table 6.16 - Image Construct Questions

Construct	Question
Image	43 - Using a computer system like a HI-HELP system is a status symbol among the people that I know.
	51 - People who I know who use computer systems like a HI-HELP system have more prestige than those who do not.
	69 - People who I know who use computer systems like a HI-HELP system generally have a high profile.

The pair-wise Pearson product-moment correlation coefficients calculated for the comparison of these three questions are presented in Table 6.17.

Table 6.17 - Pair-wise Correlation Coefficients for Image

Question	43	51	69
43	1	.3763	.1847
51		1	.3887
69			1

Based on these values and the wording of the questions, the following two questions were selected for measurement of this construct:

43 - Using a computer system like a HI-HELP system is a status symbol among the people that I know.

51 - People who I know who use computer systems like a HI-HELP system have more prestige than those who do not.

6.3.8 Visibility

Two questions from the pilot survey instrument were related to the construct of Visibility:

Table 6.18 - Visibility Construct Questions

Construct	Question
Visibility	48 – Among the people that I know, many use a computer system like a HI-HELP system
	68 – Computer systems such as a HI-HELP system are very visible, or well known among people that I know.

The pair-wise Pearson product-moment correlation coefficients calculated for the comparison of these two questions are presented in Table 6.19.

Table 6.19 - Pair-wise Correlation Coefficients for Visibility

Question	48	68
48	1	.4431
68		1

Since a design goal of the survey was to provide two questions related to attitude constructs, both of the questions for Visibility were retained:

Among the people that I know, many use a computer system like a HI-HELP system

Computer systems such as a HI-HELP system are very visible, or well known among people that I know.

6.3.9 Trialability

Two questions from the pilot survey instrument were related to the construct of Trialability:

Table 6.20 - Trialability Construct Questions

Construct	Question
Trialability	56 – Before deciding whether to use a HI-HELP system, I would like to be able to try it out properly.
	67 – I would expect to use a HI-HELP system long enough on a trial basis to see what it could do.

The pair-wise Pearson product-moment correlation coefficients calculated for the comparison of these two questions are presented in Table 6.21.

Table 6.21 - Pair-wise Correlation Coefficients for Trialability

Question	57	67
57	1	.4822
67		1

Since a design goal of the survey was to provide two questions related to attitude constructs, both of the questions for Trialability were retained:

56 - Before deciding whether to use a HI-HELP system, I would like to be able to try it out properly.

67 - I would expect to use a HI-HELP system long enough on a trial basis to see what it could do.

6.3.10 Voluntariness

Three questions from the pilot survey instrument were related to the construct of Voluntariness:

Table 6.22 - Voluntariness Questions

Construct	Question
Voluntariness	44 - Although it might be helpful, using a HI-HELP system is certainly not compulsory for me.
	52 – No one of great influence, such as my boss or my spouse, requires me to use a HI-HELP system.

The pair-wise Pearson product-moment correlation coefficients calculated for the comparison of these two questions is presented in Table 6.23.

Table 6.23 - Pair-wise Correlation Coefficients for Voluntariness

Question	44	52
44	1	.3207
52		1

A design goal of the survey was to provide two questions related to attitude constructs, both of the questions for Voluntariness were retained. However, the relatively low correlation coefficient of .3207 raises the question as to whether both questions are actually measuring the same construct regarding attitudes. Review of the

wording of these questions suggested that they both represented the construct of Voluntariness. However, other or more generalised use may indicate review to determine their appropriateness and those factors such as location or relationship to other questions did not influence the responses.

44 - Although it might be helpful, using a HI-HELP system is certainly not compulsory for me.

52 - No one of great influence, such as my boss or my spouse, requires me to use a HI-HELP system.

6.3.11 Safety

Two questions from the pilot survey instrument were related to the construct of Safety:

Table 6.24 - Safety Construct Questions

Construct	Question
Safety	49 – I am concerned that a HI-HELP system may provide advice that is financially unwise for me.
	55 – I am concerned that a HI-HELP system may provide advice that will cause me financial loss.

The pair-wise Pearson product-moment correlation coefficients calculated for the comparison of these two questions are presented in Table 6.25.

Table 6.25 - Pair-wise Correlation Coefficients for Safety

Question	45	55
48	1	.6774
55		1

Since a design goal of the survey was to provide two questions related to attitude constructs, both of the questions for Safety were retained:

49 - I am concerned that a HI-HELP system may provide advice that is financially unwise for me.

55 - I am concerned that a HI-HELP system may provide advice that will cause me financial loss.

6.3.12 Reliability

Two questions from the pilot survey instrument were related to the construct of Reliability:

Table 6.26 - Reliability Construct Questions

Construct	Question
Reliability	59 – I believe that a HI-HELP system will provide consistent recommendations if I elect to use it more than one time.
	62 – I would trust the suggestions provided by a HI-HELP system as being in my best interest.

The pair-wise Pearson product-moment correlation coefficients calculated for the comparison of these two questions are presented in Table 6.27.

Table 6.27 - Pair-wise Correlation Coefficients for Reliability

Question	49	62
49	1	.6774
62		1

A design goal of the survey was to provide two questions related to attitude constructs therefore both of the questions for Reliability were retained:

59 - I believe that a HI-HELP system will provide consistent recommendations if I elect to use it more than one time.

62 - I would trust the suggestions provided by a HI-HELP system as being in my best interest.

6.3.13 Acceptability

Acceptability was a construct taken from Carson, et al. that was not represented with specific questions devoted to this construct. The constructs of Relative Advantage, Compatibility, Image, Visibility, and Voluntariness were considered to represent

characteristics of "acceptability" for the purposes of this study. "Acceptability" as an attribute of an information system may have a rather different basis of definition depending on the type of system. The function of the application and the environment in which it is to be applied may cause significant variance in a perception of "acceptability." For example, information systems for health care administration may suggest rather different "acceptability" factors than systems used to support the direct delivery of patient care.

6.3.14 Conclusions Regarding the Pilot Survey Instrument

A result of the pilot survey and the analysis was to modify the survey instrument to produce a shorter and more focused survey instrument for the final survey. This resulted in an instrument of five rather than six pages. The actual number of questions for the instrument was reduced from 58 questions to 44 questions. Additionally, the introduction to the survey was modified substantially to improve the description of the type of system under consideration, and to improve the nature of the appeal to the recipient of the instrument to respond. The final version of the survey had the first page of the instrument devoted to a cover page providing an appeal to respond, an identification of the expectations of the respondent, and a description of the type of system under consideration.

6.3.15 Expert Panel Review of Survey Instrument

Following the revisions to the survey instrument, as indicated by the pilot survey and described above, an additional review of the proposed survey instrument was conducted by a panel of experts. The panel consisted of five members of the faculty or staff of the community college at which the pilot survey had been conducted. Each member of this expert panel had a graduate degree, most with a Ph.D. and each had some demonstrated research interest or experience. Membership of this panel is summarised in Table 6.28.

Table 6.28 - Membership of Expert Review Panel

Job Title	Degree Level	Comment
Associate Professor of Management and Marketing	Ph.D.	Formerly served as market researcher in private industry.
Professor of Economics	Ph.D.	Regular contributor to referred journals in discipline of Economics.
Assistant Professor of History and Political Science	M.S.	Strong interest in the conduct of public opinion polls.
Director of Institutional Research	Ph.D.	Conducts on-going research activities on behalf of the college.
Director of the Nursing Program	Ph.D.	Recently completed Ph.D. research and recently awarded degree.

The review by this panel led to some minor modifications of the instructions for the survey and rewording of several questions. All references to health care financing were removed and the reference to this topic was consistently described as "Health Care Insurance." This is in agreement with the common practice and perception in the United States. Efforts to distinguish whether all forms of commonly used health care financing support such as Fee for Service reimbursement, Health Maintenance Organisations (HMO), Preferred Provider Organisations (PPO), etc. are actually insurance would be rather technical in nature and likely have little if any meaning to the typical survey respondent. Use of the term "Health Insurance" and "Health Insurance Selection System" were considered to provide for more effective communications with the survey respondent. In one case the sequence of two questions was modified and the question wording modified to reduce the impression of duplicate questions. The final version of the survey instrument is provided in Appendix XV - Survey Instrument and Instructions - Final Version.

6.3.16 Estimating Sample Size

An analysis of sample size required, based on a desired margin of sampling error, was conducted using questions 8, 10, 14, 15, and 16 from the pilot survey. These questions were selected from questions to be answered on a scale of 1 to 10 from the section of the survey

related to "Health Care Financing and Insurance Questions." This portion of the survey was considered to be more valuable for this purpose than other portions of the survey. The standard deviation and required sample size suggested by each question is shown in Table 6.29. The calculation of the necessary sample size was based on the following formula provided by Neter, et al. (Neter, Wasserman et al. 1988, p.283) as applicable to estimation of population means:

Equation 6.1 - Estimation of Sample Size

$$n = \left(\frac{(Z_{a/2})^2 \sigma^2}{h^2} \right)$$

Application of this formula requires the determination or estimation of three values:

1. The desired margin of sampling error. Represented by *h*, this represents the half-width of the confidence interval.
2. The desired confidence interval. This was defined to be .95 in accord with common practice.
3. The planning value for the population standard deviation. This is frequently estimated with the value of the sample deviation since the population standard deviation is commonly not known (Neter, Wasserman et al. 1988, p. 292).

The value of *h* was assigned as 1, the *Z* value was assigned as 1.96, representing a 95% confidence interval, and the population standard deviation was estimated with the sample standard deviation for the specific question reported in Table 6.29.

Table 6.29 - Estimated Sample Sizes - Pilot Survey

Question	Standard Deviation	Sample Size
8 – How well do you feel that you understand the health care financing options available to you?	2.35	22
10 – How confident do you feel that you have made the best choice among these options for your benefit?	2.73	29
14 – How likely do you think you would be to use a guide to making health care financing choices in a printed form?	2.11	18
15 – How likely do you think you would be to use a guide to making health care financing choices if the guide were a computer-based system?	2.23	20
16 – How valuable would a HI-HELP type of system likely be to you?	2.38	22

Based on the values for sample size calculated in Table 6.29, the largest sample size indicated was 29. The plan for the actual survey was to mail to 1,000 subjects with an anticipated response rate for the survey of 5%. This number of subjects, if the assumptions about response rate were reasonable, was judged to provide an adequate number of survey responses.

6.4 Conduct of Final Survey

The survey was conducted using the survey instrument developed through the preliminary process described in the preceding section and using the sample size determined at that time. A mailing list of 1,000 randomly selected names and home addresses of employees of the State of Tennessee was obtained from the state Personnel Office. This did not include employees of the two state university systems but included all other types of employees. This choice of sample was considered to be representative of employed citizens of the State of Tennessee. It was chosen to provide a sample with demographic characteristics comparable to employed citizens of the state at large, and a sample where the members had the same type and number of health care options. The actual organisation providing the health care may

not be the same for all respondents since the health care provider may vary based on the geographic location across the state. However, even though the specific health care provider may vary under a particular option, the number and type of options should remain constant. For example, not all HMO plans operate in all regions of Tennessee. However, a HMO option is available to state employees in all areas of the state. A period of three and one half weeks was allowed for receipt of responses to the survey. No effort was made at follow-up mailings.

Of the 1,000 survey instruments distributed, one was returned for an invalid address and marked that the respondent had moved and left no forwarding address. One hundred seventy instruments were returned with three rejected as invalid responses based on incomplete or no responses, or apparent misunderstanding of the instructions. This resulted in 167 valid survey instruments used in the analysis. Of course not all respondents did respond to each question. The detailed analysis of questions included only valid responses and ignored invalid responses. For example, 10 respondents of the 167 valid instruments choose not to respond to question number 18 - "Approximately what percentage of your friends use computers or the Internet either at work or at home on a regular basis?" In this case responses of "0" were treated as an actual response in contrast to responses in which no response was provided. Therefore, 157 responses were considered when conducting analysis based on this question. For other questions for which "0" was not a valid response, the value "0" was coded to represent "no response."

The evaluation of appropriate sample sizes, originally conducted with data from the pilot survey, was re-evaluated as displayed in Table 6.30 - Sample Size Estimates - Final Survey. The same questions used in the pilot survey were used for this evaluation even though the actual question numbers had changed based on revision to the survey

Requirements for a Personal Decision Support System instrument. Calculated sample sizes, using the same formula as presented in the previous section, ranged from 15 through 28. Actual sample sizes, based on actual responses to individual questions rather than overall response to the survey instrument, were either 166 or 167. Therefore the sample sizes, based on responses to the final survey, were determined to be adequate for estimation of mean values at the 95% confidence level.

Table 6.30 - Sample Size Estimates - Final Survey

Question	Standard Deviation	Calculated Sample Size	Actual Sample Size
7 – How well do you feel that you understand the health care insurance options available to you?	2.22	19	167
8 – How confident do you feel that you have made the best choice among these options for your benefit?	1.93	15	166
12 – How likely do you think you would be to use a guide to making health care insurance choices in a printed form?	2.41	23	166
13 – How likely do you think you would be to use a guide to making health care insurance choices if the guide were a computer-based system?	2.67	28	166
14 – How valuable would a computer-based Health Insurance Selection type of system likely be to you?	2.68	28	166

This portion of the study has described the development of the survey instrument and provided a brief summary of the administration of the actual survey. The survey instrument was developed through a process including preliminary telephone interviews, a pilot survey, and review of a proposed survey instrument by a small panel of experts. The final survey was conducted as planned with an overall response rate of 17% and a rate of 16.7% of acceptable responses. The data from these 167 acceptable responses served as the basis of the data analysis addressed in the next section of the study.

7 Chapter 7 - Results

7.1 Data Analysis of the Survey - Introduction

Using the survey instrument developed through the processes described in the previous section, the final survey of individuals was conducted during the spring of 2002. The survey instrument and instructions are shown in Appendix XV - Survey Instrument and Instructions - Final Version. One thousand survey instruments were mailed to randomly selected State of Tennessee government employees during the second week of April 2002. The responses to this survey served as the basis of the data analysis to be presented in this section of the study.

7.2 General Response

By the end of the first week of May 2002, one hundred and sixty seven usable responses to the survey mailing had been received. This resulted in an effective response rate of 16.7%. Based on a previous mail survey conducted in middle Tennessee, for another project, and the pilot survey activities, this was considered to be a good response rate. The survey questionnaire was mailed by metered mail, included a cover letter from the Vice President of Academic Services of Columbia State Community College (the home institution of the author), a page of instructions and encouragement, and the survey instrument. A stamped, first-class postage envelope was included for return of the survey instrument. No other forms of survey distribution were used. No follow-up mailings were conducted as the response rate was considered to be satisfactory.

7.3 Demographic Summary

A significant factor in selection of the sample for the survey was to provide a sample that would be demographically characteristic of employed citizens of the State of Tennessee, U.S.A. Appendix XVI - Occupational Specialities Represented by Respondents indicates that

the respondents represented a wide range of occupations. Only one respondent did not report Occupation on the survey. Of the 166 responding to this question, 91 different occupations were indicated. The occupation specialties with multiple respondents are indicated in Table 7.1.

Table 7.1 - Occupations with Multiple Respondents

Occupation	Number of Respondents
Accounting	5
Administrative Assistant	7
Administrator	3
Biologist	2
Case Manager / Case Worker	3
Civil Engineering	3
Clerk	3
Correctional Counsellor	2
Educator / Administrator	2
Eligibility Counsellor	3
Environmental Engineering	3
Forensic Science	2
Health Care / Health Educator	3
Information Resources / Technology	4
Judicial	3
Legal Assistant	2
Librarian / Library Aide	3
Manager	2
Nurse	8
Nurse - Public Health	3
Pharmacist / Pharmacy Tech.	2
Probation / Parole Officer	6
Secretary	11

Occupation	Number of Respondents
Social work / Counsellor	8
System Analyst / Administrator	2
Teacher	3

The second question of the survey questionnaire asked about the highest education level achieved. Responses are summarised in Table 7.2.

Table 7.2 - Question 2 - Education Level

Education Level	Count	Percentage
A - Have not completed High School	1	0.6%
B - Completed High School	12	7.3%
C - Completed some college study	27	16.5%
D - Completed two year college degree	8	4.9%
E - Completed four year college degree	65	39.6%
F - Completed master's degree	33	20.1%
G - Completed other graduate degree	11	6.7%
H - Other	7	4.3%
Total	164	100.0%

The table does demonstrate a wide distribution of educational level with 66.4% of respondents reporting completion of a four-year college degree or higher and 87.8% reported having completed at least some college. This does cause question as to whether the respondents effectively represent a random sample of the employed citizens of Tennessee given the rather high levels of education reported. These rather high levels of education were considered acceptable for the purposes of this study given that the employed citizens of the state likely have a generally higher level of education, and given that state government agencies may be more likely to employ a higher percentage of workers in jobs requiring at least some college education. It is also possible that respondents with higher education levels elected to respond to the survey. Given the wide range of job

categories represented by the respondents and the response from various areas of the state, the sample was considered acceptable for this study.

Although the survey responses were treated as anonymous, and respondents were not asked to include their zip code or other identifying information, some information regarding the location from which the response was mailed could be derived. Since the questionnaires were returned by first class mail and the envelopes were cancelled individually, the first three digits of the zip code from which the response was mailed were available with the cancelled postmark. Of course this may not be the residential zip code to which the questionnaire was addressed. The respondent may have mailed the response at work or at some other location other than the zip code of residence. Nonetheless, the zip code used for mailing the response was analysed for distribution as indicated in Table 7.3. In reviewing this table note was made that a large percentage of respondents were from Nashville zip codes. This is not surprising given that Nashville is the state capital and a large number of state government workers reside in or near Nashville. The total number of zip codes reported in Table 7.3 is less than the total number of acceptable survey responses because the mailing zip code could not be identified on all responses.

Table 7.3 - Zip Code From Which Response was Mailed

Zip Code of Response	Total	Percentage
372 - Nashville	92	56.8%
374 - Chattanooga	5	3.1%
376 - Northeast TN	12	7.4%
379 - Knoxville	22	13.6%
381 - Memphis	17	10.5%
383 - Jackson	12	7.4%
384 - Columbia	1	0.6%
385 - Cookeville	1	0.6%
Total Number of Responses	162	100.0%

Consideration of the occupational types reported by the respondents, the educational level and the zip code of the respondent show a wide variety of responses. This tends to give credibility to the assumption that the randomly selected state government employees are acceptably characteristic of employed citizens of the State of Tennessee.

No questions regarding gender or age were included in the survey nor did review of the pilot survey suggest any specific uses for such questions. However, in retrospect, inclusion of questions requesting age and gender would have led to a richer set of data for analysis and may have provided for more detailed analysis for data that was generated by the survey. Should the sample have included retired persons, who may have been making choices of Medicare supplemental insurance rather than primary coverage based on employer provided insurance programs, collection of age may have been especially relevant. Collection of age and gender may also have been valuable in the conduct of more specific analysis of certain functional requirements of programs such as types of coverage or choice of physician based on age ranges. For example, young families may have different needs for coverage and preventative services than retired persons or those approaching retirement. The choice not to include

age and gender in the collected data may have given the impression of more homogeneity of the respondents than is appropriate. The choice not to collect age data is somewhat offset by the fact that only employed persons were included in the sample.

7.4 Health Care Insurance Questions

Questions three through eleven were all treated as related to Health Care Insurance. However, they may be considered as related to three categories within this area: 1 - Participation in Health Insurance (questions 3 through 6), 2 - Understanding and confidence of Health Insurance choice (questions 6 through 9), and 3 - Awareness of costs (questions 10 and 11). Questions 3 through 6, related to participation, are summarised in Table 7.4.

Table 7.4 - Questions 3, 4, and 5 - Health Insurance Participation

Question	Number of Responses	Number of Yes Responses	Percentage of Yes Responses
3 – Is Health Care Insurance provided as part of your employment or retirement benefits?	167	166	99.4%
4 – If Health Care Insurance is provided as part of your employment or retirement benefits, are you enrolled in the program?	167	156	93.4%
5 – Are you covered under any other Health Care Insurance programs such as one available to a spouse?	167	37	22.2%

For questions 7 through 9 the respondents were asked to rate their understanding or confidence on a scale of 1 to 10 with a value of 1 representing low understanding or confidence and a value of 10 representing high understanding or confidence. The results to these questions are presented in Table 7.5.

Table 7.5 - Questions 7, 8, 9 - Understanding and Confidence

Question	Valid Responses	Mean Response	Standard Deviation
7 – How well do you feel that you understand the health care insurance options available to you?	167	7.02	2.22
8 – How confident do you feel that you have made the best choice among these options for your benefit?	166	7.84	1.93
9 – Health care insurance programs use many special terms and abbreviations such as "fee for service", HMO, and PPO. How well do you feel that you understand such terms?	167	7.14	2.10

Two questions, number 10 and 11, were used to ask respondents to identify how accurately they would be able to identify "out of pocket" amounts and total amounts spent on health care on their behalf during the past year. This was of interest since the actual charge or expense on behalf of the individual receiving health care services is not obvious to the individual under certain forms of health insurance coverage. The answers to these two questions are presented in Table 7.6.

Table 7.6 - Awareness of Costs

Question	Valid Responses	Mean Response	Standard Deviation
10 – How accurately would you be able to identify the "out of pocket" amounts that you paid for health care last year?	166	7.64	2.32
11 – How accurately would you be able to identify the total amounts paid for your health care last year? This would include the "out of pocket" amounts you paid as well as the amounts paid by a health insurance or benefit program.	166	6.67	2.63

Questions numbers 12 through 15 were characterised as questions related to the use and value of guides to health insurance selection. Questions 12 and 13 asked for an indication of how likely the person

Requirements for a Personal Decision Support System would be to use a "guide for making health care choices" in a printed or computer-based form. Question number 14 asked for rating of the value of a computer-based system based on a scale while question 15 asked the respondent to identify how much he or she would be willing to spend per year for the use of such a system. The responses are summarised in Tables 7.7 and 7.8.

Table 7.7 - Use and Value Questions

Question	Valid Responses	Mean Response	Standard Deviation
12 – How likely do you think you would be to use a printed form as a guide for making health care insurance choices?	166	7.20	2.41
13 – How likely do you think you would be to use a computer-based system as a guide for making health care insurance choices?	166	6.36	2.67
14 – How valuable would a computer-based Health Insurance Selection type of system likely be to you?	166	6.07	2.68

The pattern of response to question number 15 was quite different than to most other questions. This question asked how much a person would be willing to spend, on an annual basis, for use of a Health Insurance Selection system. This question had the lowest response rate of any item on the survey questionnaire. During the processing of responses to this item, care was taken to insure that responses of "0" were truly entered into the analysis database as a value of 0 and that a null value, indicating no response to the question was made. In other words, a difference was identified between a response of 0 and no response to the item. Of the 167 valid survey responses considered in the overall study, only 121 valid responses to this item were present. This indicates a response rate of 74.3 of the valid survey responses. Of the actual responses, 103 responses indicated no willingness to pay for such a service or an amount of $0.00. Of the eighteen responses who indicated a willingness to pay an amount greater than $0.00, the average value

Requirements for a Personal Decision Support System indicated was $37.61 with a standard deviation of $46.69. When all respondents who actually indicated a value were considered, the average was $5.60 with a standard deviation of $22.12. These values are summarised in Table 7.8. Table 7.9 lists the values indicated for all non-zero responses.

Table 7.8 - Summary of Responses to Question 15 - Amount Willing to Spend

All Actual Responses	
Count	121
Average	$ 5.60
Standard Deviation	$22.12
All Responses Greater than $0.00	
Count	18
Average	$37.61
Standard Deviation	$46.69

Table 7.9 - Annual Amount Willing to Spend for Non-Zero Responses

Amount Willing to Spend	Number of Responses
$12	1
$20	4
$25	2
$30	1
$45	1
$50	1
$60	1
$100	1
$200	1

7.5 Computer and Internet Use Questions

The final version of the survey questionnaire used questions related to the Internet as a basis of evaluating both Internet and computer use. For this study there was no objective to differentiate between computer users and Internet users. Three questions, numbers 16 through 18, asked estimation of how many hours per week the Internet was used, either at work or at home, and an estimate of the

percentage of the respondent's friends who used the Internet on a regular basis. Analysis of these responses also indicated that 143 of the 167 respondents, or 86%, reported using the Internet either at work or at home.

Table 7.10 - General Internet Use Questions (16 through 18)

General Internet Use Questions	Count	Mean Response (in hours)	Standard Deviation (in hours)
16 – Approximately how many hours per week do you use the Internet at work?	164	5.12	6.99
17 – Approximately how many hours per week do you use the Internet at home?	161	4.23	5.99
18 – Approximately what percentage of your friends use computers or the Internet either at work or at home?	151	70.31	25.64

Questions 19 through 25 presented seven potential uses of the Internet and asked if the respondent had used the Internet for such a purpose. A composite scale had been developed as a sum of the number of such uses confirmed by the respondent. The Yes responses to Questions 19 through 25, indicating specific Internet uses and the calculated composite scale, are shown in Table 7.11. The composite scale values shown were calculated by determining the total number of Internet uses reported by the 167 respondents. The percentage factor reported was calculated as the number of actual Internet uses divided by the maximum possible number of Internet uses that could have been reported (the product of the 167 respondents and the 7 potential uses per respondent). The last row of Table 7.11 shows 143 respondents, or 80%, report use of the Internet for at least one of the specific purposes listed. This is consistent with the 86% of respondents who reported use of the Internet at work or at home in response to questions 16 and 17.

Table 7.11 - Specific Internet Use Questions (19 - 25)

Have You Used the Internet to:	Count	Number of Yes Responses	Percentage of Yes Responses
19 – Buy Books	167	60	36%
20 – Buy clothes	167	61	37%
21 – Make travel plans	167	111	66%
22 – Pay bills online	167	35	21%
23 – Manage your investments	167	41	25%
24 – Plan your insurance coverage	167	11	7%
25 – Submit your federal income tax	167	42	25%
Composite Index of Internet Use *	167	361	31%
At least one use reported	167	143	80%

* See text for discussion.

7.6 Comparative Analysis - Health Care Insurance Questions

In the previous section of data analysis, attention was directed to the comparison of the concept-pair questions addressed in the "Questions About Some of Your Attitudes", questions number 26 through 44. This section of the analysis addressed attention to the relationship demonstrated between the questions identified as construct oriented question pairs and identified a positive correlation between all questions identified as construct-pair question sets. The objective of this preliminary analysis was to confirm the credibility of the proposed construct-pair sets used in the development of these survey questions. The focus on the analysis now turns to investigation of relationships among the set of questions identified in an earlier section of the survey identified as "Health Care Insurance Questions."

7.6.1 Questions 3 Through 6

Questions 3 through 6 were included in the survey to give indication of the respondents' understanding of their health care coverage. Very homogenous answers were expected since all respondents were State of Tennessee employees. As such employees they all should

have the same type and number of health insurance options available even though the provider of the insurance and health coverage may vary based on their geographic location within Tennessee. All 167 respondents indicated "Yes" in response to Question 3 indicating that their employer did provide Health Care Insurance as part of their employment or retirement benefits. This was the expected response as State of Tennessee employees are provided with such insurance coverage. Question 4, asking if the respondent was enrolled in the program provided by the employer, indicated that 11 of the 167 or 7% of the respondents did not participate in the employer provided insurance program. Question 5, asking if the person was covered under any other Health Care Insurance program, indicated that 37 respondents or 22% were covered under other Health Insurance Programs. Ten of the respondents or 6%, reported only having coverage under some other insurance program. A likely reason for only having coverage under some other program is an election to only participate in a program available through a spouse or some other family member. Only one respondent indicated neither form of coverage. However, this respondent did indicate in the comments of the survey that he was retired from the federal government with health insurance benefits provided at that level. Therefore, all respondents may be considered to have some form of health insurance coverage although not all participate in a program offered by the employer.

The use of health insurance options other than coverage provided by the employer may contribute to the number of health insurance options other than 3 as provided to state government employees.

7.6.2 Health Insurance Questions - Questions 7 Through 14

Evaluation of questions 7 through 14, also identified on the survey as "Health Insurance Questions", was initiated by examination of the correlation coefficients for these responses as shown in Appendix XVIII - Correlation Coefficients for Selected Health

Insurance Questions (Questions 7 through 14). These correlation factors are also reported in Table 7.12 where each pair-wise factor has been sorted in descending value. Therefore, the higher value correlation factors are reported first in the table. Those question pairs having correlation coefficient greater than .50 were considered to be of special note.

Table 7.12 - Correlation Coefficients for Health Insurance Question Pairs - Sorted in Descending Order

Table Item Number	Question Pair	Correlation Coefficient *	Comments
1	13 - Use computer-based guide / 14 - Value of System	0.86	Those most likely to use the system had a higher perception of value of the system.
2	7 - Insurance Understanding / 9 - Understanding of Terms	0.66	Both questions are measures of understanding. High correlation was to be expected.
3	8 - Confidence in Choice / 9 - Understanding of Terms	0.65	Higher understanding and confidence in choice had a high correlation.
4	7 - Insurance Understanding / 8 - Confidence in choice	0.64	Higher understanding and confidence in choice had a high correlation. Closely associated with Questions 8 / 9.
5	8 - Confidence in Choice / 10 - Accuracy of Out of Pocket	0.62	Confidence in choice showed correlation with identification of Out of Pocket expenses.
6	10 - Accuracy of Out of Pocket / 11 - Accuracy of Total Amounts	0.60	High correlation for identification of two types of payments seemed likely.
7	9 - Understanding of Terms / 10 - Accuracy of Out of Pocket	0.58	Higher levels of understanding showed correlation with estimate of identification of Out of Pocket expenses.
8	8 - Confidence in Choice / 11 - Accuracy of Total Amounts	0.55	Confidence in choice showed correlation with identification of Total Amounts. Closely associated with Questions 8 / 10.
9	12 - Use printed guide / 13 - Use computer-based guide	0.52	Likelihood of using a guide, whether printed or computer-based showed some

Table Item Number	Question Pair	Correlation Coefficient *	Comments
			correlation.
10	7 - Insurance Understanding / 10 - Accuracy of Out of Pocket	0.50	
11	9 - Understanding of Terms / 11 - Accuracy of Total Amounts	0.47	
12	12 - Use printed guide / 14 - Value of system	0.46	
13	7 - Insurance Understanding / 12 - Use printer guide	0.41	
14	7 - Insurance Understanding / 11 - Accuracy of Total Amounts	0.40	
15	8 - Confidence in Choice / 12 - Use printer guide	0.33	
16	9 - Understanding of Terms / 12 - Use printer guide	0.33	
17	10 - Accuracy of Out of Pocket / 12 - Use printer guide	0.33	
18	11 - Accuracy of Total Amounts / 12 - Use printer guide	0.21	
18	10 - Accuracy of Out of Pocket / 13 - Use computer-based guide	0.20	
20	7 - Insurance Understanding / 13 - Use computer-based guide	0.17	
21	10 - Accuracy of Out of Pocket / 14 - Value of system	0.14	
22	8 - Confidence in Choice / 13 - Use computer-based guide	0.12	
23	9 - Understanding of Terms / 13 - Use computer-based guide	0.12	
24	7 - Insurance Understanding / 14 - Value of system	0.07	
25	8 - Confidence in Choice / 14 - Value of system	0.06	
26	9 - Understanding of Terms / 14 - Value of system	0.06	
27	11 - Accuracy of Total Amounts / 14 - Value of system	0.03	
28	11 - Accuracy of Total Amounts / 13 - Use computer-based guide	0.02	

* Sorted by descending value of the correlation coefficient.

Table 48 includes brief comments for those question pairs with correlation coefficients greater that .50. Evaluation of these question pairs, based on the comments in Table 7.12 leads to the following conclusions:

1. **Use of computer-based system and the perception of value.** The highest correlation reported in Table 7.12 is between Question 13, related to use of a computer-based system and Question 14, related to perception of value. This seems rather apparent. The likelihood of using such a system will be closely related to the perception of value that the system will offer.

2. **Understanding questions.** The two questions related to understanding of Health Care Insurance: question number 7, related to general understanding, and question number 8, about understanding of related terms show a correlation coefficient of .66.

3. **Confidence in Choice and Understanding Questions.** The correlation coefficients of .65 and .64 associated with Question 8, related to Confidence of Choice of the health insurance option, and the two questions related to health insurance understanding suggest that understanding of the options is closely associated with the willingness to use a computer-based system. This almost equal correlation coefficient for these two question pair comparisons may suggest the relevance of an explanatory role for such a PDSS.

4. **Confidence, Understanding, and Accuracy of Amounts Questions.** Table item numbers 5 through 8 show correlation coefficients with values between .62 and .55. The value of .60 for table item number 6 merely seems to comment on the association between responses regarding ability to identify

out of pocket costs and total costs. Of perhaps greater interest is the fact that table items 5, 7, and 8 have correlation coefficients within such a small range. This suggests associations between issues of confidence of choice, understanding, and accuracy of estimate responses.

5. **Use of Guides Questions.** Table item number 9 shows a correlation coefficient of .52 between the questions regarding use of a printed guide and a computer-based guide. Little inference seems appropriate here except to observe that it is a bit surprising that this value is not somewhat higher.

7.6.3 Attitude Questions

7.6.3.1 Preliminary Analysis of Attitude Questions

The attitude question responses, questions 27 through 44, are summarised in Table 7.13 with the number of responses to the question, the mean value for the response, and the standard deviation of the response value. As with certain previous questions, respondents were requested to respond on a scale of 1 to 10 indicating the strength of their agreement with the statement. These questions are presented in Table 7.13 and are organised by Construct-Pair based on the construct with which they are associated as identified in Appendix XIV - Classification of Selected Questions - Final Survey Instrument. Correlation coefficients for the relationship between the questions in a Construct-Pair are also shown in Table 7.13. Correlation coefficients for all attitude questions are presented in Appendix XVII - Correlation Coefficients for Attitude Questions (Questions 26 through 44).

All correlation coefficients are positive values showing a positive correlation between the two questions in each Construct-Pair. However, the value of the coefficient does vary from a low of .3936

for Voluntariness to .7745 for Reliability. It may be that in some cases the two questions were perceived as measuring somewhat different aspects of the construct under consideration. For example, even though question 27 and question 33 were associated with the construct of Voluntariness, they may have been interpreted to have a different emphasis. Question 33 makes mention of the expectations of others, such as a spouse or boss. However, question 27 may have been evaluated based on a perception of the system itself or personal requirements or expectations. Given the consistent, pervasive positive correlation for all construct pairs, they are all taken to be appropriate for measurement of the construct under consideration.

The constructs are sorted in descending order by the average value of the mean response values for each of the two questions in each construct-pair in Table 7.14. This reports Trialability at the top of the sorted list with Image placed in the last place. This placing of Image at the last place is compatible with the written comments submitted by several respondents questioning the relevance of Image to this decision process.

The evaluation of these "attitude questions" in relationship to reported likelihood to use either a printed guide or computer-based PDDS system are reported in Appendices XIX through XXIV. Appendix XIX - Correlation Coefficients - Question 12 and Attitude Constructs and Appendix XX - Correlation Coefficients - Question 13 and Attitude Constructs reports the correlation coefficients based on either Question 12, related to the use of a printed guide, or Question 13, related to the use of a computer-based guide. This data is sorted by correlation coefficients in Appendix XXI - Correlation Coefficients - Questions 12 and All Attitude Constructs - Sorted in Descending Sequence and Appendix XXII - Correlation Coefficients - Question 13 and All Attitude Constructs - Sorted in Descending Sequence to aid in the identification of the highest correlations.

More focused analysis of these attitude questions in relationship to Question 12, asking about likely use of a computer-based guide to making health care insurance choices. Appendix XXIII - Correlation Coefficients - Question 13 Only and Attitude Constructs - Sorted in Descending Sequence reports on correlations between Question 13 and specific attitude constructs. Appendix XXIV Correlation Coefficients - Question 13 and Constructs Including Extended Constructs presents a more comprehensive correlation coefficient matrix showing correlations among Question 13 and the attitude constructs. The correlation coefficients for the attitude questions only, without use of Question 12 or Question 13 are reported in Appendix XXV- Correlation Coefficients - Constructs without Question 13.

Table 7.13 - Questions about Attitudes - Questions 26 through 44

Questions about attitudes	Count	Mean Response	Standard Deviation
Construct: Voluntariness			
27 - Although it might be helpful, using a Health Insurance Selection system is certainly not required for me.	166	7.14	2.70
33 - No one of great influence, such as my boss or my spouse, expects me to use a Health Insurance Selection system.	166	6.96	2.88
Correlation Coefficient	.3936		
Construct: Relative Advantage			
31 - Using a Health Insurance Selection system would improve the quality of my financial and insurance decisions.	165	4.60	2.25
36 - Using a Health Insurance Selection system would make it easier to make my financial and insurance decisions.	166	5.08	2.52
Correlation Coefficient	.6269		
Construct: Compatibility			
34 - Using a Health Insurance Selection system would be compatible with other aspects of my financial and insurance planning.	164	4.92	2.54
41 - I think that using a Health Insurance Selection system would fit well with the way I like to work and make decisions.	164	5.32	2.56
Correlation Coefficient	.6830		
Construct: Image			
26 - Using a computer system to help make personal financial or insurance decisions is a status symbol among the people that I know.	165	3.85	2.10
32 - People I know who use computer systems or the Internet for personal financial decisions generally have more prestige than those who do not.	165	3.56	2.23
Correlation Coefficient	.4905		
Construct: Ease of Use			
28 - Overall, I believe that a Health Insurance Selection system would be easy for me to use.	165	6.64	2.57
38 - I believe that I have enough computer experience to use a Health Insurance Selection system.	166	7.84	2.52
Correlation Coefficient	.4594		
Construct: Visibility			
29 - Among the people that I know, many use a computer system or the Internet to assist with	166	4.60	2.31

Questions about attitudes	Count	Mean Response	Standard Deviation
financial or insurance decisions.			
44 - Computer systems or Internet systems for making personal financial decisions are very visible, or well known, among people that I know.	163	5.63	2.50
Correlation Coefficient	.4841		
Construct: Trialability			
37 - Before deciding whether to use a Health Insurance Selection system, I would like to be able to personally try it out properly.	165	7.68	2.67
43 - I would expect to be able to use a Health Insurance Selection system, on a trial basis, long enough to see what it could do.	164	4.38	2.16
Correlation Coefficient	.4046		
Construct: Safety			
30 - I am concerned that a Health Insurance Selection system may provide advice that is financially unwise for me.	166	4.80	2.24
42 - I think that a Health Insurance Selection system may make suggestions that will cause me financial loss.	160	4.20	2.16
Correlation Coefficient	.5066		
Construct: Reliability			
39 - I believe that a computer-based Health Insurance Selection system will provide consistent recommendations if I elect to use it more than one time.	162	6.28	2.44
40 - I would trust the suggestions provided by a Health Insurance Selection system as being in my best interest.	163	5.53	2.34
Correlation Coefficient	.7745		
Construct: Acceptability			
NOTE: No questions for this construct			
Construct: Usable			
35 - I believe that I understand enough about my health care financing or insurance options to use a Health Insurance Selection system and understand the results.	165	6.83	2.41
NOTE: Also consider the questions for the Ease of Use construct questions presented below.			
Correlation Coefficient with Ease of Use Question: 28 - Overall, I believe that a Health Insurance Selection system would be easy for me to use.	.4174		
Correlation Coefficient with Ease of Use	.5172		

Questions about attitudes	Count	Mean Response	Standard Deviation
Question: 38 - I believe that I have enough computer experience to use a Health Insurance Selection system.			

Table 7.14 -
Constructs Sorted by Average Mean Value (Descending sequence)

Construct	Question 1	Question 2	Average Mean Value *
Trialability	7.68	7.38	7.53
Ease of Use	6.64	7.84	7.24
Voluntariness	7.14	6.96	7.05
Usable	6.83		6.83
Reliability	6.28	5.53	5.91
Compatibility	4.92	5.32	5.12
Visibility	4.60	5.63	5.12
Relative Advantage	4.60	5.08	4.84
Safety	4.80	4.20	4.50
Image	3.85	3.56	3.71

* Average Mean Value is calculated as the average of the mean responses of the Construct-Pair questions.

7.6.3.2 Regression Analysis of Attitude Questions

In previous sections of this study, attention was devoted to the description of the development of the primary survey instrument used, administration of the survey, and general analysis of a number of the questions from the survey. In this section techniques of multiple regression analysis are used to evaluate the responses to certain of the survey questions. The objective of this regression analysis is to determine a limited number of variables as having the most relationship with use of the type of Personal Decision Support System under consideration

The analysis conducted here was not based on a single, quantitative, theoretical model but the variables considered in the

regression analysis were developed from previous published work. The independent variables used in this analysis were based on the models and theory suggested by Rogers' work on Diffusion of Innovation, (Rogers 1995, p. 212-244) discussed in section 3.4.3 of this study, and the four Carson-Cramp-Morgan-Roudsari Prerequisite Criteria, (Carson, Cramp et al. 1998, p. 80-88) discussed in section 6.1.6 of this study). Responses to Question 13 - "How likely do you think you would be to use a computer-based system as a guide to making health care insurance choices?" were used as values for the dependent variable for this analysis. The empirical data provided by the survey was used to evaluate nine independent variables in the initial regression model. Table 7.15 - Variables Used in Regression Equations identified these initial independent variables that represent the constructs of interest. Values for these variables were derived as an average or arithmetic mean of answers to questions associated with the constructs listed. For each construct treated as an independent variable, two questions were associated with the specific construct. Evaluation of the empirical data was conducted to develop a modified regression model representing a smaller, more parsimonious set of dependent variables.

Table 7.15 - Variables Used in Regression Equations

Dependent Variable	Variable or Construct Represented	Associated Questions
Q_{13}	Question 13 Response	13
Independent Variables	**Variable or Construct Represented**	
A	Relative Advantage Construct	31, 36
C	Compatibility Construct	34, 41
R	Reliability Construct	39, 40
U	Usability Construct	28, 32
T	Trialability Construct	37, 43
V	Visibility Construct	29, 44
M	Image Construct	26, 32
O	Voluntariness Construct	27, 33
S	Safety Construct	30, 42

The application of regression techniques to this initial set of variables was based on a sequence of activities identified by Ott (Ott 1988, pp. 541 - 580). These techniques were applied in three primary phases presented by Ott:

1. Selection of the Variables
2. Model Formulation
3. Checking Model Assumptions with Residual Analysis

Statistical tests for this analysis were applied with Microsoft Excel 2000 spreadsheet software and the SPSS for Windows Student Version, Release 11.0.0 statistical analysis software.

7.6.3.2.1 Selection of the Variables

A preliminary first-order, multiple regression model was prepared using the nine variables listed in Table 7.15. This preliminary model was developed as a linear model using conventional techniques to minimize the Sum of the Squares of Error (SSE) for the

regression line using the Microsoft Excel product. Equation 7.1 represents the regression equation developed for this initial process.

Equation 7.1 - Initial Nine-Construct Regression Model

$$Q_{13} = .17 + .41A + .20C + .03R + .27U + .10T + .01V + .08M + .04O - .05S$$

Note: Variables are defined in Table 7.15 - Variables used in Regression Equations

The results of this initial regression analysis are summarized in Appendix XXVI - Nine-Construct Regression Model Summary, ANOVA, and Coefficients. Evaluation of this output was made with consideration of the *F* test for the overall model and *t* tests for the individual variables using the guidelines presented by Anderson, et al. (Anderson, Sweeney et al. 2003, p. 661). The r^2 value, or Coefficient of Determination, representing the proportion of variation in the dependent variable explained by the model, was .494. Evaluation of the data presented in Appendix XXVI - Nine-Construct Regression Model Summary, ANOVA, and Coefficients focused on consideration of the *F* test and *t* tests as suggested by Anderson, et al.

> 1 - The *F* test is used to determine whether a significant relationship exists between the dependent variable and the set of all the independent variables; we will refer to the F test as the test for *overall significance*.
>
> 2 - If the *F* test shows an overall significance, the *t* test is used to determine whether each of the individual independent variables is significant. A separate *t* test is conducted for each of the independent variables in the model; we refer to each of the t tests as a test for *individual significance* (Anderson, Sweeney et al. 2003, p. 661).

The *F* value, taken from Appendix XXVI - Nine-Construct Regression Model Summary, ANOVA, and Coefficients, with a value of 17.00 and a significance of .0000 (as calculated to four decimal places) suggests rejection of the null hypothesis for the overall model and indicates that overall significance is present for the set of all variables. Examination of the levels of significance of the *t* tests suggests that only independent variables of Relative Advantage,

Usability, and Compatibility, with significance for these three *t* tests reported as .00, .01, and .08 respectively appear to be significant in relationship to the dependent variable. The null hypothesis for these tests represents the case where the regression coefficient for the specific variable is equal to zero.

Further analysis of appropriate variables to include in a regression model was conducted with use of the *stepwise* procedure with the results summarized in Appendix XXVIII - Addition of Variables by Stepwise Regression. The results were confirmed by application of the *backward elimination* procedure as summarized in Appendix XXIX - Removal of Variables by Backward Elimination

The stepwise procedure begins with a regression model of $y = \beta_0 + \varepsilon$ and iteratively adds candidate variables, based on the *F* test value for the remaining candidate variables, until the stopping criteria is satisfied. In each case values of .05 for entry into the model and .10 for removal from the model were used. The backward elimination process begins with a regression equation with all candidate variables, such as that given as Equation 1 above, and identifies one variable at a time for potential removal from the model. The procedure continues an iterative process of evaluation of possible variable removal until the criteria for removal, .10 in this example, is satisfied. For each iteration of the procedure, the variable with the smallest *F* value is identified for removal from the model.

Both the Stepwise procedure and the Backward Elimination procedure identified the same three variables for inclusion in the revised model. The three independent variables suggested for inclusion in the multiple linear regression model are the Relative Advantage Construct (A), the Usability Construct (U) and the Compatibility Construct (C) variables.

Inclusion of these three variables with the Stepwise procedure suggests a regression model as shown as Equation 2 - Three-Construct Regression Model. Comparison with the initial regression model, with the nine constructs treated as independent variables, indicates the same three variables for inclusion as suggested by the Stepwise and Backward Elimination procedures. Some difference in values, based on rounding, between Microsoft Excel and SPSS software was noted but the conclusions indicated by each software product were compatible. The r^2 value is reported as .483 indicating that approximately 48% of the variation in the responses to Question 13 is explained by regression equation 7.2 - Three-Construct Regression Model. Calculation of values for the intercept and the coefficients used in the model is reported in Appendix XXVII - Three-Construct Regression Model Summary, ANOVA, and Coefficients.

Equation 7.2 - Three-Construct Regression Model

$$Q_{13} = .71 + .44A + .32U + .26C$$

The *p-values* associated with the *t* test values for significance of .00 for Relative Advantage, .01 for Usability, and .00 for Compatibility suggest that for each variable the H_0 hypothesis, that the value of the coefficient is zero, may be rejected at either .05 or .10 levels of confidence.

7.6.3.2.2 Fitting the Regression Model

An examination of the scatter diagram of residual values and the standardized residual values, as shown in Appendix XXXI - Scatter Diagrams of Residuals, did not show any apparent pattern suggesting use of higher-order, non-linear regression models. Therefore, all subsequent analysis was conducted using the three-construct linear multiple regression model, based on the least squares line fitting technique, and given as Equation 7.2 - Three-Construct Regression Model above.

7.6.3.2.3 Model Assumptions for the Multiple Regression Model

The following assumptions about the error term $\mathcal{E}$ in the multiple regression model, paralleling the assumptions for a linear regression model, are commonly addressed in the statistical literature and in this case are taken from Anderson, et al. (Anderson, Sweeney et al. 2003, p. 660):

1. The error $\mathcal{E}$ is a random variable with mean or expected value of zero; i.e. $E(\mathcal{E}) = 0$.
2. The variance of $\mathcal{E}$ is the same for all values of the independent variables x_1, x_2, . . . x_p.
3. The values of $\mathcal{E}$ are independent.
4. The error $\mathcal{E}$ is a normally distributed random variable reflecting the deviation between the y value and the expected value of y (Anderson, Sweeney and Williams, 2003, p. 660).

7.6.3.2.3.1 Assumption 1 - Expected Value of 0.

The residual values, as shown graphically in Appendix XXXI - Scatter Diagrams of Residuals, were evaluated for an expected value of 0, H_0: mean = 0. In Appendix XXX - Test of Equal Variance Assumption, the *p-value* of 1, for a two-tailed test *z* test was determined as 1. Thus the null hypothesis, that the expected value of the variance is zero, cannot be rejected. Therefore, no evidence is presented to reject the assumption of a mean value of zero.

7.6.3.2.3.2 Assumption 2 - Equal Variance

The assumption of equal variance, that the variance of $\mathcal{E}$ is the same for all values of the independent variables, was evaluated by visual examination of a scatter plot of residuals as shown in Appendix XXXI - Scatter Diagrams of Residuals. Neither the scatter diagram of residual values, nor the scatter diagram of standardized residual value, suggest a violation of this assumption of equal variance of the independent variables.

7.6.3.2.3.3 Assumption 3 - Independent Values

The assumption of independent values for the independent variables was evaluated by examination of the Correlation Coefficient Matrix and VIF values as shown in Appendix XXXII - Independence of Variables - Analysis of Multicollinearity. Examination of the correlation coefficient values does indicate a rather high level of correlation between Relative Advantage and Compatibility with a value of .76. Further evaluation was conducted with determination of the Variance Inflation Factors (VIF) suggested by Kvanli (Kvanli, Pavur et al. 2000, p. 706) and Neter (Neter, Wasserman et al. 1988, pp. 391 - 393). The calculations were performed using the formula presented by Kvanli:

Equation 7.3 - Variable Inflation Factors Equation

$$VIF_j = \frac{1}{1 - R_j^2}$$

where: R_j^2 = coefficient of determination obtained by regressing X_j on the remaining independent variables

The criteria presented by both Kvanli and Neter, that if any of the VIF values are greater than 10 a severe problem with multicollinearity is suggested, was used. Given that the largest VIF_j value was 2.59, for the construct of Compatibility, the conclusion was made that problems of severe multicollinearity do not appear to be present in this model and do not require further investigation.

7.6.3.2.3.4 Assumption 4 - Normally Distributed Random Variable

The assumption of a normally distributed random variable was performed by visual examination of a scatter plot of standardized residuals as shown in Appendix XXXI - Scatter Diagrams of Residuals. Since all standardized residual values are within plus or minus three standard deviations, and most are within plus or minus two standard

deviations, no evidence is identified for rejection of this assumption.

7.6.3.2.4 Conclusions of Regression Analysis

The multiple regression analysis considered in this section suggests three primary conclusions:

1. **Three Construct Model.** Three independent variables should be included in the regression equation:
   A. Relative Advantage
   B. Usability
   C. Compatibility
2. **Portion of Variability Explained.** The three-construct model only has a Coefficient of Determination, r^2, of .483. Since only approximately 48% of the variation in the model is explained by the independent variables, the model should be applied with care.
3. **Test of Assumptions.** The fundamental assumptions of an expected value of 0 for ε, equal variance of ε, independence of values of ε, and random distribution of ε that are associated with the use of the multiple regression model were satisfied.

7.7 Functional Attributes

The relevant functional attributes were evaluated in a more qualitative manner. This evaluation was based on the nature of the particular problem domain for the type of system under consideration, the selection of a health finance or insurance program. This included examination of the few examples of PDSS's that could be identified on the World Wide Web of the Internet. This led to consideration of the attributes as shown in Appendix XXXIV - Sample PDSS Feature Comparison Matrix.

Identification of functional requirements and comparison of sample existing PDSS's for health insurance selection presented a difficulty in that so few examples could be identified on the World Wide Web. Examination of all Blue Cross / Blue Shield web sites and use of nine different web search tools identified fewer than five sites that were considered to represent a decision support system of the nature considered by this study. Development of the features matrix shown in Appendix XXXIV - Sample PDSS Feature Comparison Matrix was based on review of the following tools and sites:

1. **Weigh Your Options.** A paper-based, chart-oriented guide to selection of different types of coverage offered to employees of the State of Tennessee. Although not a computer-based system, this document may be considered as an example of a paper-based PDSS and does an effective job of summarizing a substantial amount of information on one printed page.
2. **My Health Plan Advisor.** A coverage or health plan selection tool offered on the World Wide Web by several of the New York Blue Cross / Blue Shield plans.
3. **CnnMoney / Money Magazine "Money 101" Web Site.** Topic 17 - Health Insurance offers a "Health Plan Navigator" which supports comparison of plans based on identified criteria. However, the user must obtain and evaluate information for each plan under consideration.
4. **Medicare Personal Plan Finder.** This Web based service offered by the U.S. federal government represents an example of the most comprehensive PDSS identified. However, it is only relevant for older

citizens eligible for Medicare, generally those citizens of retirement age.

The identification of these functional requirements was undertaken by the examination of this small number of sample systems that could be described as characteristic of the type of system under consideration. These systems were analysed in terms of their features in much the same manner that a practicing system analyst investigating such a system might undertake. Commonly a systems analyst will seek to identify an expert from the "user" area to assist in definition and verification of the functional requirements in a systems development effort. In this case, the sample systems served the role of the user department expert. It is also practical to consider this examination of the completed systems as a form of meta-analysis. The systems as implemented disclose the results of an analysis of requirements undertaken by some analyst or designer for the development of the example system. The four example systems reviewed included three World Wide Web based systems and one paper system. The paper system was included based on the small number of computer-based systems that were identified on the World Wide Web and the well organised and comprehensive nature of the information presented by the paper system. The four systems were:

7.7.1.1 State of Tennessee - Weigh Your Options

This system is presented in paper form and has been reconstructed in Appendix XXXIII - State of Tennessee "Weigh Your Options" Worksheet - 2002. This worksheet is part of the material provided to new employees and to employees annually during the "open enrolment period" when they may elect to change their health insurance coverage. The worksheet is organised to help the individual compare a PPO Option, a POS Option, and a HMO Option type of coverage. Often though, supplemental manual instructions may be required as not all three types of coverage may be available in a particular geographic

area at a certain time. The different types of coverage are listed on the left column of the worksheet and brief descriptive information is provided describing the benefits and restrictions, such as co-pay requirements, for each category of coverage. The tabular form of the worksheet does aid in the summarisation of a substantial amount of information to two printed pages.

7.7.1.2 Medicare - Personal Plan Finder

This World Wide Web based system is oriented toward helping Medicare eligible people (normally elderly persons) understand their Medicare coverage and evaluate possible supplementary coverages that they may wish to purchase. This system is the most comprehensive of those examined but is applicable only to Medicare eligible persons.

7.7.1.3 Selected Blue Cross / Blue Shield Plans

Available from the World Wide Web sites for several of the New York state Blue Cross / Blue Shield plans, this example is more generalized in nature than the Medicare example identified above. The primary restriction regarding the use of this system is geographic; it only provides data for services in the New York state area and only Blue Cross / Blue Shield programs are covered.

7.7.1.4 CNNMoney / Money Magazine - Health Plan Navigator

This system, also available through the World Wide Web, does classify as a PDSS but differs from the two previous examples. This is a very generalized system that does not include any specific data about particular programs. Instead, it provides a generalized, interactive system for assignment of priorities to different factors from different programs of coverage and assignment of an evaluation of these different factors. The system may then be used to compare the different programs based on the priorities and evaluations entered by the user. Perhaps the greatest value of this system is to serve an educational role to help identify the use of factors to consider and

prioritise and encourage comparison of alternatives. The system user must perform all data collection.

7.7.1.5 Functional Factor Categories

Of course each of the examples of PDSS identified above includes somewhat different features and takes different design approaches. However, as is to be expected, there is substantial common ground among the different systems. The details of the functional topics addressed by each of the four example systems are listed in Appendix XXXIV - Sample PDSS Feature Comparison Matrix. These features are summarised into major feature categories at the end of this appendix. It is these major feature categories to which attention is directed here.

7.7.1.5.1 Demographic Factors

Anticipated factors such as age and gender are included for some of the systems. The Medicare system includes some factors unique to this system such as whether the person is a military retiree or a veteran. This is not surprising since benefits available under these other federal government programs may require coordination with the Medicare system.

Perhaps the most relevant factor included in this factor category is identification of the geographic area. Systems used with a specific employer or a special governmental program, may be very sensitive to the geographic area of residence or employment of the individual using the system. For example, the My Health Plan Advisor system offered by the New York state plans only offers information on geographic areas in which these specific plans operate. This is despite the fact that various Blue Cross / Blue Shield plans operate in all of the states in the U.S.A. This example of geographic area introduces the more generalized issue of eligibility for a coverage plan. These example systems make an assumption of eligibility while

in some cases it may be appropriate to determine or confirm eligibility of coverage. Even in the case of the Medicare system, and the State of Tennessee systems, the geographic area may serve to determine eligibility for specific regional programs or coverage. The example systems may obscure the relevance of an eligibility determination requirement for certain systems.

7.7.1.5.2 Underwriting Factors

Included in this requirements category are individual factors that may impact underwriting. These factors may influence whether or not to offer insurance coverage and perhaps in what type of risk pool the individual will be placed, influencing the premium to be charged. Questions about general health or specific medical conditions may be included. For example, the Medicare system asks about permanent kidney failure. These types of questions are often asked when applications for individual policies are marketed and are frequently referred to as "medical questions." Questions regarding family coverage and current health insurance coverage may be included. The specific requirements in this category will likely depend on the underwriting practices of the organization providing the health insurance or financing program.

7.7.1.5.3 Financial Factors

These functional requirements represent costs or expenses to the individual. The combination of financial factors clarifies why lowest cost coverage may not be easily identified in many cases. Factors identified here include: monthly premium, annual deductible, annual out-of-pocket maximum, annual pharmacy co-pay maximum, and any maximum lifetime coverage. These financial factors tend to represent some form of cost sharing by the individual or some form of limit to liability either by the individual or by the underwriting organization.

7.7.1.5.4 Coverage Information

The coverage information factors tend to deal with either restrictions to coverage, such as limits on pre-existing conditions, or clarification that a particular type of coverage is offered. For some types of coverage, clarification that the coverage is offered is combined with the identification of restrictions related to this type of coverage. For example, in the State of Tennessee system Mental Health and Substance Abuse are covered but include clearly defined restrictions.

The medical conditions covered may well vary from plan to plan and may be related to the population to which the plan is offered. For example, the Medicare system provides information about coverage for conditions such as skilled nursing care, home health care, and hospice, which may be of great value to an elderly population. However, coverage such as family planning and infertility, identified in the CNNMoney - Money Magazine system, will likely have little value to this older population.

7.7.1.5.5 Preventive Services

A number of the services that may be covered here as Preventive Services may be listed in the Coverage Information category discussed immediately above. However, in some cases certain services were clearly identified as preventive in nature. Examples of such services included preventive health assessments, bone mass measurement, immunisations, and certain types of cancer diagnostic procedures. It is interesting to note that the Medicare system gives more emphasis to identification of these factors. Again, services that may be characterized in this category by one insurance or financing plan may be present but categorized in the more general Coverage Information category by other plans.

7.7.1.5.6 Preference Factors

The category of Preference Factors includes factors describing the willingness of the individual to submit to practices that may limit freedom of choice in access to medical care. A willingness to pay higher co-payment fees when seeing an "out of plan" or "out of network" physician is an example of such a limit. Most forms of managed care include some form of access restriction such as the "gatekeeper" function commonly to be exercised by the primary care physician. The Blue Cross / Blue Shield system gave the most attention to issues related to this functional category and included more generalised statements such as "emphasis on low cost", "emphasis on flexibility", and "willing to do additional paperwork."

7.7.1.5.7 Additional Information Request

This category indicates whether the information system itself supports requests for further or more detailed information than that provided by the PDSS. The only system to address this possible request for additional information was the Medicare system. The Medicare system supported four types of request for additional information:

1. Contact information for more information
2. Want information on health care cost control
3. Identification of different available plans
4. Request for more plan specific information

It should be noted that the additional printed materials distributed with the printed worksheet for the State of Tennessee employees may include provision for requesting additional information. However, this is beyond the scope of the worksheet identified as the PDSS for this functional requirements comparison.

7.7.1.6 Summary of Functional Attribute Analysis

Based on the analysis of the sample PDSS systems, a summary set of factor categories was developed. These seven general categories are:

1. Demographic Factors
2. Underwriting Factors
3. Financial Factors
4. Coverage Information
5. Preventive Services
6. Preference Factors
7. Additional Information Request

The more detailed factors may be identified in Appendix XXXIV - Sample PDSS Feature Comparison Matrix.

8 Chapter 8 - Stakeholder Analysis

8.1 Introduction

Following the analysis of the requirements for a PDSS to be used for selection of health care insurance or financing, a supplementary analysis was performed to address stakeholder groups that may be impacted by such a system. Two primary issues were addressed regarding these stakeholders. The first was the identification of likely stakeholder groups while the second issue was the conduct of a small number of interviews with representatives of certain of the stakeholder groups. Given the general exploratory nature of this study, the identification of appropriate stakeholder groups was considered more relevant to this study than the identification of additional stakeholder requirements or reactions to the use of such a PDSS.

8.2 Preliminary Identification of Stakeholder Groups

The Stakeholder Groups were first identified as primary or secondary. This was accomplished by the identification of a preliminary, proposed set of professions or occupational areas considered as candidates for identification as stakeholders. During this identification, a proposed, preliminary classification of each stakeholder occupational area to a primary or secondary status was made. Then a survey of a sample of college faculty in programs of Information Systems and Business Administration was conducted as a basis of actual identification of the occupational area as a primary or secondary stakeholder. The specific criteria given to the survey respondents for classifying a group as primary or secondary were:

1. **Primary Stakeholders.** Those occupational areas that may have a financial impact in 12 months or less from the implementation of the type of PDSS under consideration.

2. **Secondary Stakeholders.** Those occupational areas that may have a financial impact from the implementation of the type of PDSS under consideration but such impact is likely to be more than 12 after systems implementation.

Following this preliminary classification, the survey described below was completed to produce a more validated classification of the proposed groups. The stakeholder groups are discussed based on the preliminary classification into categories.

8.2.1 Primary Stakeholder Groups

The preliminary classification of occupational areas resulted in eight occupational areas being identified as Primary Stakeholders:

1. Hospital Administrator - Local / Regional Hospital
2. Hospital Administrator - Hospital System
3. Insurance Agent
4. Insurance Carrier
5. Medical Practice Administration
6. Primary Care Physician
7. Referral or Specialist Physician
8. Software Developer

8.2.1.1 Hospital Administrator

Hospital Administrators, and other hospital employees, may be impacted by use of a PDSS for health insurance or finance selection from several perspectives. This is especially true since, in many cases, the hospital assumes responsibility for submission of any insurance claims. As a result of this hospital claims submission, the patient tends to view issues of payment problems as an issue to be resolved between hospital and the underwriting organization.

The inclusion of the hospital in the network or plan may have direct impact on whether a patient elects to use a certain hospital. In such a case participation in the network or plan may become a critical part of the marketing activities of the hospital. Larger plans or underwriting companies commonly are able to negotiate discounted rates with hospitals often based on the promise of prompt and reliable payment, which may or may not be realised. Again, the TennCare program of Tennessee provides an example. Both hospital administrators and doctors have continually expressed great displeasure with TennCare, largely over payment practices. Accusations have been common that TennCare contractors have made late payments, incomplete payments, and have failed to show financial responsibility as suggested by bankruptcy by several of the contractors.

It is also noted that the Hospital Administrator category should likely be viewed as consisting of at least two sub-categories. One category would be the independent local or regional hospital. Commonly this will be a non-profit, community owned hospital and likely managed locally to include governance by a local board of directors or trustees. The second proposed sub-category is that of administrators of a hospital system. In the U.S.A., over the past few decades, a trend for large systems of hospitals to develop has been obvious. Frequently these systems include hospitals owned and managed, or at least managed, by private for-profit hospital management companies. These systems are likely to have a very different structure of management and government than locally owned and managed hospitals.

8.2.1.2 Medical Practice Administrators

Medical practice administrators do have much in common with hospital administrators but should be seen as a different stakeholder group. This is largely based on the tradition of different

underwriting and reimbursement schemes as evidenced by the development of the Blue Cross / Blue Shield system (Blue Cross for hospital coverage, Blue Shield for medical practice) and the Part A and Part B approach of Medicare. In some cases uncertainty about whom to include in this category may be present. In the historical, traditional single doctor private practice model the duties of administration of the practice are likely shared among the physician, the physician's nurse, and the practice secretary or receptionist. Today, with the evolution of the multi-physician practice, it is more likely that a full-time practice administrator will be retained who will be especially alert to the impact of insurance programs and reimbursement policies and practices.

Many of the issues of concern to the hospital administrator are likely to be of concern to the practice administrator. Inclusion in the network or plan, provisions for discounting of fees, reliability and promptness of reimbursement, and financial stability of the financing organization are examples of these common concerns.

8.2.1.3 Primary Care Physician

Participation in a network or plan may well be even more of a significant factor for primary care physicians, such as general practitioners or family practice physicians, than even the hospital groups described above. For many types of managed care programs, membership in the network or plan may determine whether the insurance or finance program will pay for services provided by the physician or the level of co-pay required from the individual. The State of Tennessee health insurance plan outlined in Appendix XXXIII - State of Tennessee "Weigh Your Options" Worksheet - 2002 illustrates this. This demonstrates the higher co-pay rates for out-of-network services for the PPO coverage option and out-of-plan services for the POS option.

In contrast to the advantages to the physician of participation in the network or plan, a willingness to accept negotiated or discounted rates of payment for services is a disincentive for the physician's participation. Each primary care physician or practice will have to determine the advantages of the marketing services provided by participation in the "approved list" with a willingness to adjust to the reimbursement practices of the particular program.

8.2.1.4 Referral or Specialist Physician

In most cases the impact on the referral or specialist physician of the PDSS usage is likely to be less obvious than on the primary care physician. This is based on the fact that contact with the specialist is commonly based on referral from a primary care physician. However, additional administrative burdens for certain referrals and procedures, such as the requirement in certain managed care programs to obtain pre-admission or a preliminary certification of approval of the referral or procedure for payment, may increase the expense for the physician. In many cases a physician's office assumes a role in contacting the insurance company to obtain such certification or approval. This requirement for preliminary approval also places an additional administrative burden on the hospital in many cases.

8.2.1.5 Insurance Agent

The impact on and response of the insurance agent is closely associated with the lines of insurance given emphasis by the agent or agency. Some agents do give special attention to the marketing of health care insurance and group health care insurance while others give little if any attention to this line of business. The review of web sites conducted in search for example PDSS systems suggests that, even for those sites that included references to health care insurance, generally the design of the site was to directly support

marketing efforts, especially the development of referrals or sales leads. As mentioned in the discussion of example systems, very few World Wide Web sites that served as a PDSS to support selection of the most appropriate coverage for an individual could be identified.

For those agents who do specialize in group health care insurance, use of a PDSS for individual choice may be useful. The PDSS may be a time saving tool in advising or counselling individuals in the selection from a set of available options. However, it appears that in many cases, especially for customers with limited computer experience, the PDSS may actually be used by the agent or a representative as an aid in interaction with the individual customer.

8.2.1.6 Insurance Carrier

The direct impact on the insurance carrier or underwriter is hard to identify. In fact, it appears that any particular value is likely to be in support of the sales and marketing activities of the organization. Such software may be offered to company agents, or used by an internal sales force to assist in the advising of individuals as they make a choice of programs and enrol in a particular program. It may be likely that though the insurance carrier may offer such a PDSS, it would be viewed as a cost with little associated revenue generation both for development and continuing support of the system.

8.2.1.7 Software Developer

The impact on the software developer stakeholder group again would largely depend on the market(s) in which the software developer participates. In fact one software developer, specialising in insurance agency software, indicated that they had developed a system related to this functional area in response to a customer request. However, this company did not identify this as a primary market commitment and did not indicate any further interest in development of additional systems of this nature. For software developers,

development of such a system would require a commitment to development of appropriate application area expertise and continuing support of changing requirements for such an application.

Review of the data collected for the previous portion of this study does not suggest that a market for PDSS's for selection of health care insurance or finance will develop to a degree to attract significant attention of many software developers. Any such commitment to new development will likely be by organizations that see this as a complement to business areas to which they are already committed.

8.2.2 Secondary Stakeholder Groups

In addition to the primary stakeholder groups identified above, the following groups were given preliminary identification of secondary stakeholders. Secondary stakeholders were considered to be groups who are likely to have a financial impact based on adoption of a PDSS but the impact would be more than 12 months following the implementation of such a system.

The preliminary classification of occupational areas by stakeholder categories identified five occupational areas as Secondary Stakeholders:

1. Health System Planner
2. Human Resource / Personnel Representative
3. Consumer Advocates
4. Special Interest Groups
5. Employee Representative / Unions

8.2.2.1 Health Systems Planner

The role of health systems planner may be hard to identify in some cases and some organizations may assume this role as well as

roles related to other stakeholder groups. For example, some governmental programs, such as Medicare, Medicaid, TennCare and military health care systems may find the same agency serving in roles such as health systems planner, carrier or underwriter, and service provider. Some public health agencies may well serve in some of these roles. The various roles assumed by such an organization would likely influence the attitude toward use of the type of system considered here.

8.2.2.2 Human Resource or Personnel Department

In larger organisations the Human Resources Department or Personnel Department may take an interest in such PDSS's. Use of such services may be seen as an additional service to be offered to the employee or may be seen as an aid to reduce the amount of personal counsel required by individuals making a coverage choice. As mentioned in the discussion of the Insurance Agent stakeholder group above, it is likely that in many cases the PDSS's would be used as an aid to members of the department to support personal counselling with employees, especially those employees with limited computer experience.

8.2.2.3 Consumer Advocacy and Special Interest Groups

Various types of consumer advocate groups may take an interest in the use of such PDSS systems. This seems more likely to occur if the use of such systems becomes more widespread. Many states in the U.S.A. do maintain some form of state agency to serve consumer advocacy roles and in some cases the state Insurance Commissioner's office may take an interest in such systems while serving in a consumer advocate role.

Closely associated with such consumer advocate group's interest is the possible involvement by a number of special interest groups. It is to be expected that special interest groups associated with

health care may express an interest in such PDSS usage or even assume roles of advocacy for such systems. This may include groups with an interest in general health, such as the American Red Cross, or groups focused on special medical conditions such as the American Heart Association or the American Diabetes Association. The Medicare "Personal Plan Finder" example system discussed previously suggests that demographically oriented special interest groups, such as the American Association of Retired Persons (AARP) or the Military Officers Association of America (MOAA) designed for military retirees, may assume special roles of interest in such PDSS systems.

8.2.2.4 Employee Representative Groups

Employee Representative groups may also represent a stakeholder group that could develop a role related to the use of such PDSS's. Examples of such employee representative groups could include trade unions, likely based on their negotiations with employers, and certain professional associations that may offer insurance programs to group members.

8.3 Interview Comments

Personal interviews were conducted with one or two representatives of each of the stakeholder groups given preliminary identification as a primary stakeholder. The purpose of these interviews was to seek tentative and preliminary insights into the use of and reaction to such systems. Given the small number of interviews, no effort at quantitative analysis was conducted as part of this study. These interviews are summarized in Appendix XXXVII - Stakeholder Response Recap Report. As an aid in the conduct of these interviews, Appendix XXXV - PDSS Stakeholder Questionnaire Worksheet was used to guide the interview and Appendix XXXVI - Attribute Definitions was used to provide a definition of the attributes that were identified to the interviewee. Use of the printed guides by

helped insure that the various interviews were conducted in a compatible manner.

It is difficult to construct effective generalizations or reach definite conclusions from the small sample of stakeholders and based the qualitative nature of the interviews conducted. However, a review of the interview notes in Appendix XXXVII - Stakeholder Response Recap Report suggests several interesting points. The further away from the actual insurance / finance decision process individuals were the more likely were they to have a positive reaction to the concept of such a system. For example, the physicians interviewed tended to have a more positive response than did the insurance underwriters or insurance agents. One of the most positive responses, "Yes, I believe that people would be likely to use such a system," came from a specialist or referral physician. This stakeholder group was seen as likely less impacted by the use of such a system than some of the other groups. One of the most negative responses, "Most people likely will not use the system, most people do not like to read," came from an insurance carrier representative. An insurance agent voiced another clearly expressed negative response, "We would not want to do that." One respondent suggested that the human resources department might find such a system useful. Her organization recently experienced an annual re-enrolment in insurance plans and she indicated that the human resources department spent substantial time advising and counselling individuals.

Responses to a question about who should provide such services were varied but generally indicated provision by the employer or an insurance company. No one attempted to differentiate between who actually developed the system and who actually made it directly available to an individual. For example, it may be that such a PDSS would be developed by an insurance carrier or underwriter but made available to individual employees by the human resource or personnel

department of the employer. Several interviewees raised the question of trust or credibility of the system with identification of a third party and a consumer advocate as choices for providers of the system.

8.4 Conduct of the Survey

A survey was conducted in May of 2003 to validate how the potential stakeholder groups identified should be categorized. The sample for the survey was based on college and university faculty members employed in institutions governed by the Tennessee Board of Regents, a state higher educational system in Tennessee. Faculty members in programs of Information Systems and Business Administration from the six universities and four two-year community colleges were chosen for the survey sample. This sample was considered to represent a group who would be familiar with the concept of stakeholders, aware of uses of information systems in general, and accustomed to making choices of health care financing or insurance programs. It was considered unlikely that these respondents would actually be members of the candidate stakeholder groups. The e-mail addresses of faculty members were obtained from World Wide Web sites for their institutions and their participation in the survey was requested by e-mail. When faculty members at an institution could be identified as members of an Information Systems department they were selected for inclusion in the sample. When this determination could not be made from the Web site, members of the Business Administration program from the institution were selected for inclusion in the sample. The four community colleges from which faculty members were included in the study were selected at random from the thirteen community colleges of the Board of Regents system.

The survey was distributed by Internet based e-mail with two "mailings" or requests for response. The first request for response was conducted in early May, 2003 with a second request to non-respondents sent two weeks later. The number included in each request

for participation, response rate, and the number of unacceptable responses are summarized in Table 8.1 - Summary of Stakeholder Survey Responses. The original request for response resulted in invalid e-mail addresses for 28 members included in the sample. These e-mail addresses were confirmed against the addresses listed on the institution's web sites. The most probable explanation is that some addresses may not have been listed correctly on the institution's web site and other addresses are not actually supported perhaps because the faculty member is no longer employed at the institution. The overall response rate from the two requests for participation, based on valid e-mail addresses and acceptable responses was 32%. Of the respondents 38% identified as female with 62% reporting as male. The average age reported was 48.20 with a standard deviation of 8.57.

Table 8.1 - Summary of Stakeholder Survey Responses

Category	Mailing Number 1	Mailing Number 2	Consolidation of Both Mailings
Original Addresses	190	129	190
Invalid Addresses	28	0	28
Number Actually Mailed	162	129	162
Number of Responses	35	21	56
Invalid Responses	2	2	4
Valid Responses	33	19	52
Response Rate	20%	15%	32%

The survey form, to which respondents were requested to reply on the World Wide Web, is included as Appendix XXXVIII - Stakeholder Survey Form. On the survey form respondents were asked to identify each occupational area as a Primary Stakeholder group, a Secondary

Stakeholder group, or not a stakeholder group. The criteria of financial impact within 12 months following implementation of the PDSS was presented as the basis identification as a Primary or Secondary stakeholder. Although the discussion of responses to the survey is organised by the preliminary, proposed categories to which the occupational areas were assigned, on the survey form these occupational areas were arranged in random order to reduce the influence on respondents to group the occupational areas into a category. The survey form also included a hyperlink to a second web page that provided further explanation for those respondents who wished to view such information. This explanatory page is included as Appendix XXXIX - Stakeholder Group Identification Survey - Further Information Page.

8.5 Analysis of the Data

The analysis of the data from the Stakeholder Survey is organised by the preliminary categories. The analysis of those groups given a preliminary identification of Primary is shown in Appendix XL - Stakeholder Analysis - Preliminary Identification of Categories as Primary. For those groups with a preliminary identification of Secondary, the data analysis is presented in Appendix XLI - Stakeholder Survey Analysis - Preliminary Identification of Categories as Secondary. However, the responses from the survey did not confirm this preliminary classification in all cases. Respondents were requested to classify each occupational area as a Primary, Secondary, or not a stakeholder.

The analysis of the results was conducted by identification of the most frequently selected stakeholder category and then calculation of counts of the number selecting that category and the number not selecting that category. This resulted in the identification of the most frequently selected category. The responses were then compressed into two categories, "selected" and "not selected" and treated as a

binomial response. For each of the occupational areas the counts were then used to determine the proportion that chose the "most selected" category. This resulted in categorization as shown in Appendices XLII - Stakeholder Survey Analysis - Preliminary Identification of Categories as Primary and XLIII - Stakeholder Survey Analysis - Preliminary Identification of Categories as Secondary. Using procedures for testing the binomial parameter π as presented by (Ott 1988, pp. 230-231) the normal approximation to the binomial distribution was applied using the *Z* distribution. The *Z* distribution was used rather than a *t* distribution since the number of responses exceeded 30. For each category a null hypothesis of $\pi_0 = .50$ was used. The value of .50 for the probability was chosen to represent indifference as to the stakeholder category. Since the responses had been compressed into two categories and treated as a binomial response, the values for a one-tailed test were used to support consideration of the value for the most likely response as greater than .50 rather than use of a two-tailed test to evaluate not equal to .50. A level of significance of .10 was used to evaluate the statistical test. However, the conclusions regarding the rejection of H_0 at both the .05 and .10 levels of significance are reported in Appendices XLII - Stakeholder Survey Analysis - Preliminary Identification of Categories as Primary and XLIII - Stakeholder Survey Analysis - Preliminary Identification of Categories as Secondary. The identification of categories indicated by the survey responses is summarized in Table 8.2 - Summary of Stakeholder Survey Conclusions. The empirical value of the probability was determined as indicated by Ott (Ott 1988, p. 227):

Equation 8.1 - Equation for Sample Proportion of Success

$$\hat{\pi} = \frac{y}{n}$$

where: y = the number of success

n = the number of trials

The variance of the proportion was also determined as indicated by Ott:

Equation 8.2 - Variance of Proportion

$$\sigma_{\pi} = \sqrt{\frac{\pi(1-\pi)}{n}}$$

where: π = the probability of success

n = the number of trials

Table 8.2 - Summary of Stakeholder Survey Conclusions

Occupational Area	Proposed Category	Category Indicated by Survey	Conclusion (H_0 = .10)	Comments
Hospital Administrator - Local / Regional Hospital	Primary	Primary	Reject H_0	
Hospital Administrator - Hospital System	Primary	Primary	Reject H_0	
Insurance Agent	Primary	Primary	Fail to reject H_0	
Insurance Carrier	Primary	Primary	Reject H_0	
Medical Practice Administrator	Primary	Primary	Fail to reject H_0	
Primary Care Physician	Primary	Primary	Reject H_0	
Referral or Specialist Physician	Primary	Primary	Reject H_0	H_0 not rejected at .05 level
Software Developer	Primary	Secondary	Fail to reject H_0	Survey category differs from proposed
Health Systems Planner	Secondary	Primary	Fail to reject H_0	Survey category differs from proposed
Human Resource / Personnel Representative	Secondary	Primary	Fail to reject H_0	Survey category differs from proposed
Consumer Advocate	Secondary	Secondary	Fail to reject H_0	
Special Interest Groups	Secondary	Secondary	Fail to reject H_0	
Employee Representative / Unions	Secondary	Primary	Fail to reject H_0	Survey category differs from proposed

8.6 Properties of a Binomial Experiment

As indicated above, the three options of 'P' for Primary Stakeholder, 'S' for Secondary Stakeholder, and 'X' for Not a Stakeholder were compressed to two categories for the data analysis. This resulted in two possible outcomes for the identification of occupational area categories: 1) the 'indicated category' of Primary or Secondary that obtained the majority of responses and 2) the implied category of 'not the indicated category' that included all other responses whether for the other category specifically or an indication of 'not a stakeholder category'. With all responses placed into one of these two categories, the responses were treated as a binomial experiment. Five properties of a binomial experiment are presented by Ott:

1. **Identical Trials.** The experiment consists of n identical trials.
2. **Two Outcomes.** Each trial results in one of two outcomes. We will label one outcome a success and the other a failure.
3. **Probability of Success.** The probability of success on a single trial is equal to π and π remains the same from trial to trial.
4. **Independent Trials.** The trials are independent; that is, the outcome of one trial does not influence the outcome of any other trial.
5. **Variables.** The random variable y is the number of successes observed during the n trials (Ott 1988, p. 89).

The responses of the survey do meet these five properties of a binomial experiment:

1. **Identical Trials.** The same survey form, on the World Wide Web, was administered to each of the survey participants.

2. **Two Outcomes.** Though the respondents could choose from three options when making their response, the combination of the least frequently selected stakeholder category with the 'not a stakeholder' response resulted in the compression of the response options to only two.
3. **Probability of Success.** Given the characteristics of the sample the probability of success was considered to be the same for each respondent. Choice of a sample that had an awareness of stakeholder groups but where the individuals were not likely to be a member of a possible stakeholder group was considered important in satisfaction of this property.
4. **Independent Trials.** The trials were independent since the contact with respondents was made individually and it was unlikely that the nature of the study would have introduced any collaboration or collusion among groups of respondents even when they may have been located at the same institution.
5. **Variables.** The number of respondents choosing the most frequently selected stakeholder category was treated as variable y, representing success. The number of valid e-mail addresses representing delivered e-mail requests to respond to the survey was treated as n, the number of trials.

The survey was considered to adequately satisfy the properties of a binomial experiment.

8.7 Conclusions from Stakeholder Survey Analysis

The survey only partially supports the proposed assignment of professions or occupational areas to Primary or Secondary stakeholder groups. There is stronger support for the Primary categories than the proposed assignments to Secondary categories.

Of the eight occupational areas proposed as primary stakeholders, only one area, Software Developer, was identified by a greater number of survey respondents as a secondary stakeholder. However, even though a greater number of respondents identified this as a secondary stakeholder, the hypothesis for this occupational area did not provide conclusive support for this identification. Two other occupational areas, Insurance Carrier and Medical Practice Administrator, did not provide strong support for classification as a primary stakeholder based on the failure to reject H_0. The analysis of the survey data supports the conclusion that the following occupational areas warrant identification as primary stakeholders:

- Hospital Administrator - Local Regional Hospital
- Hospital Administrator - Hospital System
- Insurance Carrier
- Primary Care Physician
- Referral or Specialist Physician

The designation of the Referral or Specialist Physician as a primary stakeholder was supported by rejection of H_0 at the .10 level of significance but not at the .05 level.

The occupational areas given preliminary classification as secondary stakeholders were not supported in this preliminary classification by the results of the survey. Only two of the five proposed occupational areas were identified as secondary stakeholders by the majority of the respondents and for all five of the occupational areas there was not support for the rejection of H_0, representing indifference to the classification. This weakness for classification of all occupational areas within the group with preliminary identification as secondary stakeholders, suggests that the respondents did have difficulty recognizing a clear-cut classification for these examples. This conclusion is supported by

the fact that none of these occupational areas were classified in either category by the survey data.

Overall only five of the thirteen occupational areas given attention in the survey could be classified in either category based on the survey responses. Furthermore all of these classifications were for the occupational areas given preliminary designation as primary stakeholders. Perhaps the most interesting suggestion supported by this data is, for the two classification categories and the criteria presented, that only classification as a Primary stakeholder was statistically significant. No statistical significance was found for efforts to identify Secondary stakeholders,

9 Chapter 9 - Discussion

The evaluation of the requirements for the type of PDSS under consideration resulted in the identification of two types of attributes: the meta-attributes and the functional attributes. The meta-attributes, which may be relevant to many different types of information systems, were addressed by the survey discussed above. The functional attributes for the particular type of system under consideration were identified by examination of a small number of existing systems that were identified as the type of PDSS of concern.

9.1 General Conclusions Supported by the Survey

Examination of the data produced by the survey of State of Tennessee government employees produced several general conclusions:

1. **Occupational Variety.** A wide variety of occupations were represented with 91 different occupational specialties identified from the respondents. This encourages the view that the sample was representative of employed citizens of the State of Tennessee.

2. **Educational Level.** The educational level of the respondents was rather high with approximately 65% reporting completion of a four-year college degree or higher. This is a substantially higher level than is representative of Tennessee citizens generally and probably higher than representative of employed citizens of the state. Some likely reasons for this rather high educational level identified among the respondents include: individuals with higher educational levels may have been more likely to respond to surveys in general and especially a survey on this subject, state government may tend to hire a higher percentage of employees with a college degree based on job requirements, there appears to

be a trend for a large percentage of state government employees to be located in metropolitan areas such as Nashville, the state capital. However, given the wide variety of occupations represented and the general, introductory nature of this study, use of this sample was considered reasonable.

3. **Health Insurance Coverage.** Employer provided insurance programs covered approximately 93% of the respondents. About 22.2% reported having other insurance coverage.

4. **Insurance Understanding.** Responses indicated a rather high understanding of their insurance coverage. Mean response values of 7.02 and 7.14, based on a scale of 1 to 10, were determined for the two questions related to health insurance understanding. These were considered to be rather high values. Reasons for such high values may include a tendency of respondents to favourably rate their own understanding, and the fact that a high education level was reported by the sample.

5. **Confidence in Choice.** The confidence in having made the best choice was considered to be high with a mean value of 7.84, on a scale of 1 to 10. This confidence is likely to be closely associated with the high level of understanding identified in the previous item, and may represent a high level of self-confidence in an effort to want to believe that the best choice had been made.

6. **Cost Reporting Ability**. The reported ability to report costs, both total costs and out-of-pocket costs was rather high. Mean values of 7.64 for out-of-pocket costs and 6.67 for total costs were reported. This was seen as rather interesting since some forms of health care

financing and insurance in common use, such as some forms of managed care, tend to hide the actual costs from the individual. Even in other cases, such as fee-for-service coverage, rather careful examination of the Explanation of Benefits form commonly mailed to the individual after processing an insurance claim is necessary to identify both total costs and out-of-pocket costs.

7. **Use of Guides.** A stronger inclination to use a printed guide rather than a computer-based system for health insurance selection was reported. However, the mean response value for use of a computer-based system was 6.07.

8. **Unwillingness to pay for advisory service.** Perhaps closely associated with the observations made regarding the previous item, a very few respondents were willing to pay directly for use of a PDSS for health insurance selection. Willingness to pay was considered to be a measure of perception of value. This low level of willingness to pay may also reflect the large amount of information available to many consumers without an apparent, direct cost.

9.2 Conclusions Derived From Attitude Questions

During the evaluation of the meta-attributes, special attention was directed to analysis of the "attitude questions" included in the survey, questions number 26 through 44. The data from questions was analysed through a three-step process:

1. Evaluation of the Correlation Coefficients of the individual questions
2. Determination of Constructs for consideration

3. Application of regression analysis to the constructs derived in step 2 above

This three-step process identified nine constructs of possible value for identification of attributes important to the adoption and use of a PDSS for selection of health financing or insurance.

Of these nine constructs, three were identified as most relevant and were used in development of a "three-construct" regression equation: relative advantage, usability, and compatibility. These three constructs were also used as a basis of questions developed for the stakeholder interview process described below.

9.3 Functional Attribute Contributions

The identification of functional attributes or requirements for a PDSS for selection of health care insurance or finance was undertaken after completion of the data collection and analysis of the survey of individuals discussed above. Not only was this portion of the analysis conducted as a separate activity, but it was conducted in a different manner than the survey used to obtain the information from individual responses that has been described.

Consideration of the example PDSS systems resulted in the identification of seven categories of functional requirements rather than development of a long, detailed list of potential requirements. The more detailed factors may be identified in Appendix XXXIV - Sample PDSS Feature Comparison Matrix. The seven general categories include:

1. Demographic Factors
2. Underwriting Factors
3. Financial Factors
4. Coverage Information
5. Preventive Services
6. Preference Factors

7. Additional Information Request

In some cases the Preference Factors may well be addressed as Coverage Information and may not be identified as separate requirements or a separate category. The identification of these more general categories, rather than a more detailed checklist, supports the recognition that specific requirements to be addressed by a PDSS for health insurance or finance choice may require analysis and interpretation, especially in relationship to the population to be served and the underwriting practices of the underwriting organizations.

It should also be noted that determination of eligibility for coverage might be a requirement warranting more attention than the Sample PDSS Feature Comparison Matrix in Appendix XXXIV suggests. In almost all cases of group coverage, such as is so prevalent in the U.S.A., some form of eligibility qualification is suggested. This may be employment by a particular organization, a demographic requirement, such as age for Medicare, or an income and means test for programs such as Medicaid or the TennCare program. In reality, three of the four systems are relevant to only certain qualified populations. The State of Tennessee system is relevant only to employees of this state government. The Medicare system is relevant only to Medicare eligibles, usually based on age. The Blue Cross / Blue Shield system only has relevance to residents of certain geographic areas of New York State. Again, review of the four example systems may tend to conceal the role of eligibility determination as a requirement for the PDSS.

9.4 Stakeholder Group Analysis Contributions

The Stakeholder Group analysis was performed as a supplement to the survey of individuals and the analysis associated with this survey. The identification of appropriate stakeholder groups was seen

to be the most important part of this supplemental portion of the study. Seven stakeholder groups were identified as "Primary":

1. Hospital Administrator - Local Regional Hospitals
2. Hospital Administrator - Hospital System
3. Insurance Carrier
4. Primary Care Physician
5. Referral or Specialist Physician

None of the potential "Secondary" stakeholder groups were confirmed as such by survey respondents.

Interviews were conducted with the initial set of potential "Primary" stakeholder group representatives. Given the small set of interviews, and the qualitative nature of the interviews, few conclusions could be drawn from this interview process. However, there did appear to be a difference in opinion about the likely use of the type of PDSS under consideration based on how "close" the stakeholder group was to the decision process.

10 Chapter 10 - Conclusions

10.1 Achievement of the Objectives

The objectives and aims of the study have been satisfied as follows:

10.1.1 Health Care Financing

The first portion of Chapter 3 does provide an overview of the health care financing system of the U.S.A. This overview briefly reviews the widespread development of health insurance, largely based on the development of the Blue Cross / Blue Shield system, and the increased involvement of the federal government, beginning in the late 1960s, primarily through the U.S. Medicare and Medicaid programs. A brief discussion of some fundamentals of health insurance, from an economics and a rational, economic-oriented decision process is also included. The U.S.A. health care financing system is recognized as a rather diverse, fragmented system.

In addition to a description of the fundamental nature of this system, analysis of participation by employers, government agencies, private insurance carriers, health care providers as well as by individuals has identified some of the issues and trends influencing this system. Examples of such issues and trends include the increasing cost of health care in general, an increasing role of governmental programs (such as the current political demand for increased funding of prescription payments under the Medicare program), development of various forms of managed care, and experiments with alternatives to the Medicaid program (such as the TennCare program). Such issues and trends, combined with related issues of difficulty in co-ordination of programs, and issues of dual coverage that characterize the U.S.A. system contribute to development of a complex decision making environment. A complex environment in

which the individual is often called on to make decisions that may have significant impact on the individual's finances and health.

10.1.2 Decision Support Systems (DSS)

The second section of Chapter 3 presents an introduction to Decision Support Systems. The definition of such a system is explored and a generalized, fundamental architecture is presented. Fundamental decision making issues are addressed and differences in decision making style are considered, largely in terms of the framework of the Myers-Briggs personality model. This section also argues that Personal Decision Support Systems (PDSS) represent a specialized case of Decision Support Systems (DSS). These areas of specialization derive not so much from the subject area of decisions supported by the system but from the fact that the decision is a personal decision rather than one to be made within an organizational structure. Issues such as the voluntary use of the system, personal trust in the system and the system provider, and concerns with safety and the validity and objective nature of the recommendations to be made by the system, were presented as suggesting identification of a Personal Decision Support System (PDSS) as a special case of Decision Support System (DSS).

10.1.3 Technology Adoption

The third major portion of Chapter 3 addresses issues of technology adoption and acceptance. The research tradition of Diffusion of Innovation, based largely on work by Rogers (Rogers, 1995), is used as a foundation for this topic's discussion. Stages of Rogers' model are presented and the attributes proposed by him are applied in later development of the survey instrument used in this study.

10.1.4 Data Analysis

Following Chapter 6, which discusses the development of a survey instrument used in the study, and the methodology of this primary data

collection process, Chapter 7 presents an analysis of the data collected by this survey. The analysis of the survey-generated data in Chapter 7 is organised around the general administration and response characteristics, demographic questions, health insurance questions, computer and Internet use questions, and a series of attitude questions related to a number of different attributes of such a system. Analysis of more detailed, functional attributes or requirements of such a system is presented, based on review of several existing systems. Among the conclusions from the analysis of this data, is that the requirements or attributes of such a system are well viewed as attributes from two general categories. The first more generalized category represents the meta-attributes. The second category includes more specific, detailed requirements based on the subject domain of the system under consideration. This category of requirements was identified as functional attributes.

The data collected from the State of Tennessee employees would have offered more flexibility for analysis had the attributes of gender and age been included on the survey instrument. Though no specific analysis based on age or gender were identified prior to administration of the survey, in retrospect it became apparent that the choice not to include these attributes limited some types of analysis that may have been of interest. One influence of not collecting such data is to create the impression of more homogeneity of data than may have actually been present.

10.1.5 Stakeholder Identification

As a complement to the analysis addressed in Chapters 6 and 7, a supplemental analysis was conducted in Chapter 8. This supplemental analysis moves from data related to the individual decision process and focuses on the identification of stakeholder groups with a likely or identifiable interest in the type of PDSS under consideration. A limited set of interviews with representatives of these stakeholder

groups given preliminary identification as Primary Stakeholders was conducted. A survey of college and university faculty regarding categorization of groups did not support the proposed categorization as Primary or Secondary Stakeholders. In fact only five groups could be identified as Primary Stakeholder groups based on the results of the survey.

10.1.6 Determine Conclusions

The conclusions that emerged from this study were presented in Chapter 9. These conclusions include identification of meta-attribute type of requirements as well as more detailed functional-attribute requirements for a Personal Decision Support System (PDSS) for selection among health care financing or insurance options. Furthermore, conclusions regarding the relationship between PDSS and DSS systems in general were suggested. Chapter 9 also makes some observations regarding system requirements definition in general.

10.2 Contributions to Knowledge

The contributions to knowledge developed by this study fall into two separate but related categories. The first category is the methodology or practice of information systems as a discipline. Two specific contributions in this category are described in this section. Although these contributions have been identified through research undertaken in the health care financing domain, they have relevance to many decision processes and personal choices to be made by individuals and to the general subject area of information systems. The second category is the subject matter domain of health care finance decision making.

The two primary contributions to the methodology or practice of information systems are:

1. Identification of PDSS as a special case of PDS
2. Importance of Requirements Definition

10.2.1 Identification of PDSS as a special case of PDS

The possible recognition that Personal Decision Support Systems should be seen as a special case of Decision Support Systems in general is the most important contribution to the information systems field. The argument that PDSS does warrant consideration as a special, separate type of system is not resolved by this study. Rather the issue has been identified as a question that may warrant further investigation. Arguments in support of this conclusion have previously been presented in Chapter 9. A rather summary comment regarding the characterisation of PDSS as a special case of DSS is related to the lack of organisational sanction or "certification" of the information system under consideration. In most cases of systems development or acquisition within an organisation, with a defined Information Systems (IS) or Information Technology (IT) department, a degree of rigor in subscription to some form of Systems Development Life Cycle (SDLC) is likely. Some of the results from use of a defined SDLC should contribute to improved requirements definition, system testing and validation, and user training. When an individual elects to use a PDSS, he or she most often will have to do so as a personal, individual decision. The structure and practices of the organization that serve to provide sanction for use of the system are likely not present. The individual must decide if the credibility of the system and the system provider justify the use of the system and give value and credibility to the results or output of the decision system. This requirement for individual acceptance and adoption of the information system, in contrast to the organizational sanction, may be required even when the individual is weak in the expertise or resources to effectively evaluate the credibility of the product under consideration.

Further support for the view of PDSS as a special case of Decision Support Systems (DSS) is derived from evaluation of the

perceived attributes or requirements of such a system. The application of Rogers' five perceived attributes by Moore and Benbassat (Moore and Benbasat 1991, p. 193) to information technology and the four pre-requisite criteria proposed by Carson, et al. (Carson, Cramp et al. 1998, p. 87) were not fully supported as relevant to the PDSS under consideration here. The survey of State of Tennessee employees identified only three requirements or attributes as significant. The suggested difference in requirements or selection attributes further argues for consideration of PDSS as a special case.

10.2.2 Importance of Techniques for Requirements Definition

The identification of a need for more useful and detailed guidance for requirements definition represents a secondary area of contribution to the knowledge of the field of Information Systems. Recognition of the need for effective requirements definition is not new. A presentation of techniques for tracking requirements through a systems development process is not new. However, the observation that many standard, introductory materials on systems analysis and design or systems development give such limited attention as to how to actually accomplish effective definition of the requirements is of interest. Merely giving emphasis to the importance of effective requirements definition, without provision of guidance of how to achieve this, presents a weakness in addressing the subject. Techniques such as Soft Systems Methodology (SSM) which purport to address this issue are quite limited in awareness and use within the U.S.A. The issue here is not a recognition of the importance of effective requirements definition; the issue is related to a more effective understanding of how to accomplish improved requirements definition.

10.3 Contributions Specific to the Subject Matter Domain

In contrast to the contributions to Information Systems in general, this section addresses contributions to the specific subject matter of Personal Decision Support systems used for selection of health care financing or insurance. It is here that the results of this study are more specific and focused.

10.3.1.1 Identification of Meta-Attribute/Requirements and Functional-Attributes/Requirements

The separation of requirements into the generalized meta-requirements and the more specific specialised functional requirements may be considered a contribution to the specific subject matter of this decision system domain. The identification of the three meta-requirements and seven functional requirements is directly associated with the type of PDSS under consideration. This has led to the identification of the three meta-requirements of:

1. Relative Advantage
2. Usability
3. Compatibility

The seven functional requirement categories identified for this type of system include:

1. Demographic Factors
2. Underwriting Factors
3. Financial Factors
4. Coverage Information
5. Preventive Services
6. Preference Factors
7. Additional Information Request

The identification of both the general categories and the more specific requirements provides a basis for determination of requirements for a specific PDSS of this type and may also provide a foundation for requirements analysis for closely related types of application systems.

10.3.1.2 Identification of Associated Stakeholder Groups

The identification of stakeholder groups associated with, or with a stake in, the development and use of a PDSS for selection among health care finance or insurance alternatives is the second primary contribution to knowledge specifically associated with the subject matter domain. Not only are the meta-requirements and functional requirements of the subject system of concern but the needs and demands of stakeholder groups may have significant impact on the successful development and implementation of any systems development effort. Speculation might suggest that failure to identify and consider appropriate stakeholder groups may be a significant factor in unsuccessful systems projects. Though the validity of this speculation has not been resolved by this study, attention has been directed to the importance of stakeholder group identification and consideration. The primary contribution of this study in this area has been the identification of relevant stakeholder groups for the type of system under consideration.

10.4 Future Research Indicated

Based on the perceptions developed during this research project the following areas of additional research in related areas are recommended in this section:

10.4.1 Meta-Requirements / Functional Requirements Role

The identification of the two general categories of meta-requirements and functional attributes developed in this study should be validated by further study and study associated with different

types of information systems should be applied for this purpose. It is unlikely that this further study will be based on fundamental theory but rather on the use of the meta-requirement, functional requirement as a useful and helpful categorisation of requirements for various types of systems. This simple categorisation may be developed into a more complete taxonomy of requirements that may be of value in guiding either systems development projects or systems evaluation projects.

10.4.2 Prerequisite / Evaluative Requirements Classification

This study has presented a set of system attributes or system requirements proposed by Carson, Cramp, Morgan, and Roudsari (Carson, Cramp et al. 1998, p. 97) as a set of prerequisite requirements with other requirements being more evaluative in nature. This view suggests that a system under evaluation must first satisfy this fundamental set of prerequisite criteria before warranting further, and perhaps more detailed evaluation, using other criteria. The argument suggests that if the system does not meet fundamental prerequisite criteria, why devote significant effort to further evaluation. The criteria proposed by Carson, Cramp, Morgan, and Roudsari include "safety", "reliability", "acceptability", and "Usable" (or Usability). These four criteria do provide a useful set of criteria for this purpose. However, given that they were developed within a particular field of study associated with medical information systems, their general application should be confirmed. This will likely include determination of how such general concepts should be interpreted in other information systems applications areas. For example the concept of safety may have a very different interpretation when applied to patient monitoring or diagnosis systems than in a system used in an industrial environment.

10.4.3 PDSS versus DSS

This study has argued that Personal Decision Support Systems (PDSS) represent a specialised case of Decision Support Systems (DSS). This argument has been based on the specific findings of this study and with emphasis on the analysis of the meta-requirements or attributes determined during the study. This representation of PDSS as a special case should be confirmed by further study. This should include investigation of whether the emphasis on only certain of the attributes selected from the Diffusion of Innovation literature warrants such characterisation as a special case.

10.4.4 Use of Health Care Insurance / Finance PDSS

The emphasis in this study on systems for the choice of health care finance or insurance was an emphasis on requirements definition. This has given limited attention to acceptance and use of such systems. It may well be that in this subject area that no matter how effectively requirements are defined and implemented, that actual demand for and use of a system may remain low. This is suggested in this study by the fact that even though the sample surveyed showed rather high use of the Internet, and consequently use of computers, the perceptions of likely use of a computer-based PDSS was not much higher than use of a paper-based system. Does implementation of a computer-based system offer enough value over a more traditional system? For this particular type of system, should the individual making the insurance coverage choice be seen as the likely user or some other person such as a representative of the employer's human resource department or an insurance agency representative? It may be that, in terms of systems acceptance in contrast to systems requirements definition, the individual being most impacted by the decision may not be the most probable user of the system. In this case building a better mousetrap may provide no assurance that the trap will actually be used to trap mice.

10.5 Final Summary

Early in this study the general objective was identified as the determination of requirements for a Personal Decision Support System for selection among health care financing or insurance programs by an individual. In chapter 5 this general statement was restated and clarified to give attention to the definition of meta-requirements, more specific functional requirements, and the role of associated stakeholder groups. Through this restatement and identification of more specific areas of focus the general purpose of this study was given more clear-cut direction. Recognition of the three areas of interest has given definition and organisation to this study. It also has resulted in the generation of suggestions for more general impact on the definition of requirements of information systems at large. As a rather exploratory study in this area, the project has developed a fundamental awareness of the research question at hand, developed recommendations for information systems methodology, and has led to suggestions of some potential future directions for further investigation.

11 Appendices

11.1 Appendix I - Selected Economic Definitions

ADVERSE SELECTION

When you do business with people you would be better off avoiding. This is one of two main sorts of MARKET FAILURE often associated with insurance. The other is MORAL HAZARD. Adverse selection can be a problem when there is ASYMMETRIC INFORMATION between the seller of INSURANCE and the buyer; in particular, insurance will often not be profitable when buyers have better information about their risk of claiming than does the seller. Ideally, insurance premiums should be set according to the risk of a randomly selected person in the insured slice of the population (55-year-old male smokers, say). In practice, this means the AVERAGE RISK of that group. When there is adverse selection, people who know they have a higher risk of claiming than the average of the group will buy the insurance, whereas those who have a below-average risk may decide it is too expensive to be worth buying. In this case, premiums set according to the average risk will not be sufficient to cover the claims that eventually arise, because among the people who have bought the policy more will have above-average risk than below-average risk. Putting up the premium will not solve this problem, for as the premium rises the insurance policy will become unattractive to more of the people who know they have a lower risk of claiming. One way to reduce adverse selection is to make the purchase of insurance compulsory, so that those for whom insurance priced for average risk is unattractive are not able to opt out.

ASYMMETRIC INFORMATION

When somebody knows more than somebody else. Such asymmetric information can make it difficult for the two people to do business together, which is why economists, especially those practising GAME THEORY, are interested in it. Transactions involving asymmetric (or private) information are everywhere. A government selling broadcasting licenses does not know what buyers are prepared to pay for them; a lender does not know how likely a borrower is to repay; a used-car seller knows more about the quality of the car being sold than do potential buyers. This kind of asymmetry can distort people's incentives and result in significant inefficiencies.

Source: www.economist.com/research/Economics/alphabetic.cfm

11.2 Appendix II - Selected American Hospitalisation Association Utilisation Statistics

AHA Utilisation Statistics						
Selections from AHA Table 1 - Historical Trends in Utilisation, Personnel, and Finances for Selected Years from 1946 through 2000						
Classification						
Total non-federal short-term general and other special hospitals						
	Hospitals	Amount (In Millions of dollars)	Adjusted per Inpatient Stay (dollars)	Annual Percent of Change - Inpatient Stay	Adjusted per Inpatient Day (dollars)	Annual Percent of Change - Inpatient Day
1970	5,859	19,560	604.59		73.73	
1971	5,865	22,400	667.44	10%	83.43	13%
1972	5,843	25,549	747.42	12%	94.61	13%
1973	5,891	28,496	793.88	6%	101.78	8%
1974	5,977	32,751	883.04	11%	113.21	11%
1975	5,979	39,110	1,024.72	16%	133.08	18%
1976	5,956	45,402	1,172.25	14%	152.24	14%
1977	5,973	51,832	1,316.70	12%	173.25	14%
1978	5,935	58,348	1,470.13	12%	193.81	12%
1979	5,923	66,184	1,631.16	11%	215.75	11%
1980	5,904	76,970	1,844.19	13%	244.44	13%
1981	5,879	90,739	2,167.70	18%	283.94	16%
1982	5,863	105,094	2,493.09	15%	326.68	15%
1983	5,843	116,632	2,775.55	11%	368.01	13%
1984	5,814	123,550	2,984.00	8%	409.85	11%
1985	5,784	130,700	3,238.94	9%	459.57	12%
1986	5,728	140,907	3,529.60	9%	499.19	9%
1987	5,659	152,909	3,848.79	9%	536.96	8%
1988	5,579	168,941	4,194.39	9%	581.08	8%
1989	5,497	185,204	4,572.23	9%	630.59	9%
1990	5,420	203,927	4,929.93	8%	681.52	8%
1991	5,370	225,230	5,345.63	8%	745.37	9%
1992	5,321	248,318	5,788.52	8%	815.99	9%
1993	5,289	266,382	6,120.94	6%	874.98	7%
1994	5,256	276,148	6,230.33	2%	929.65	6%

AHA Utilisation Statistics						
Selections from AHA Table 1 - Historical Trends in Utilisation, Personnel, and Finances for Selected Years from 1946 through 2000						
Classification						
Total non-federal short-term general and other special hospitals						
	Hospitals	Amount (In Millions of dollars)	Adjusted per Inpatient Stay (dollars)	Annual Percent of Change - Inpatient Stay	Adjusted per Inpatient Day (dollars)	Annual Percent of Change - Inpatient Day
1995	5,220	286,073	6,220.54	0%	966.79	4%
1996	5,160	293,920	6,225.95	0%	1,005.45	4%
1997	5,082	306,088	6,266.24	1%	1,031.68	3%
1998	5,039	319,035	6,387.53	2%	1,064.93	3%
1999	4,977	335,405	6,512.44	2%	1,101.47	3%
2000	4,934	356,757	6,650.68	2%	1,147.99	4%

Source: Selected data from (AHA 2002, p. 2)

11.3 Appendix III

- Information Services for Retirement Planning - Examples From the World Wide Web

Page Description	URL	Comment
Deloitte & Touche: Principles of Retirement Planning	http://www.dtonline.com/prptoc/prptoc.htm	A series of general articles on the subject of retirement planning. Less of a DSS that a web based version of a rather comprehensive booklet on retirement planning.
Retirement Planning (U.S.) – Home Page	http://retireplan.about.com/finance/retireplan/mbody.htm	Serves somewhat as a portal to a number of other Web sites with information on retirement planning. Sites such as special purpose calculators, investment company sites, product information, and investment strategy articles are included.
Retirement Planning from Morningstar	http://retireplan.about.com/finance/retireplan/mbody.htm	General retirement planning services provided by Morningstar, a well-known financial services publisher.
Retirement Planning Home	http://www.wellsfargo.com/retirement/	Serves as a Web portal to a variety of services on retirement planning offered by Wells Fargo.
Retirement and Financial Planning – Online Resources	http://www.aoa.dhhs.gov/aoa/pages/finplan.html	A series of Web pages provided by the Administration on Aging, a component of the U.S. Department of Health and Human Services. Includes general discussions of retirement issues and special purpose calculators.
Insurance and Retirement Planning Directory of Information	http://www.e-analytics.com/insdir.htm	An Insurance And Retirement Planning Directory of Information provided by the Equity Analytics Company. Serves as a directory or portal to a number of additional topics related to insurance and retirement.
MSN Money Central: Retirement Planning	http://moneycentral.msn.com/retire/home.asp	Serves as a portal to additional information regarding retirement and wills.
Charles Schwab | Home	http://www.schwab.com/	The home page for the Charles Swab investment company. Provides more direct access to general investment information than retirement specific information.
Retirement Plan Rollover.- Qualified Plans, Mutual Funds, Annuities, Insurance	http://www.retirement.plan-online.com/	A web site offered by Northeast Securities, Inc., a broker-dealer. Offers links to other web sites, support of some definition of terms, and the ability to request more information. Organised primarily as a marketing support site and offers little further information as an

Page Description	URL	Comment
		example of a DSS.
Vanguard Education, Planning, and Advice	http://www.vanguard.com/educ/inveduc.html	Serves as a front-end page to investor information services offered by the Vanguard Mutual Fund investment company. May be considered as a portal to additional information but not organised in the visual style of many contemporary portal sites.
Retirement Planning -- a guide to retirement planning from 4anything.com	http://www.4retirementplanning.com	A search service that serves as a front end for additional articles on retirement topics. A specific search page offered as part of the "4 Anything" search site.
D.A. Davidson & Co.	http://www.wealthmanagementsvcs.com/	A marketing or promotional web site for Wealth Management Services and a Brian D. Orton, a financial consultant with this organisation. Not to be considered a good example of a DSS.
RetireWeb Home Page	http://www.retireweb.com/	Serves as a front end to additional retirement information for Canadians. Of particular interest is the graphical site map diagram presented on the home page of the site as an aid to site users.
Quicken.com Retirement	http://www.quicken.com/retirement/	A portal type of page offering access to additional retirement information. One of a set of investment portal pages offered on the site.
Insurance and Retirement Planning Directory of Information	http://stocknbond.31.net/	Provides a link to a specialised search on the topic of "insurance" generated by the savvy.com search engine. A good example of a specialised search engine as part of another service, but does not directly provide a good example of a DSS.
International Society for Retirement and Life Planning	http://www.isrplan.org/	Site provided by International Society For Retirement and Life Planning. The site provides information about this organisation but should not be considered a good example of DSS.
Guide to Retirement Living Online!	http://www.retirement.living.com/	Promotes the Retirement Living Magazine, which includes articles about retirement living in the Washing, D.C. area and other cities in the Northeast U.S. Not a good example of DSS.
Retirement Plus	http://www.retirement.plus.com	Investment site with guide to personal financial planning for Canadians. Emphasis is on retirement strategies and tax planning.
Retirement Planning Worksheet	http://www.troweprice.com/retirement/retire.html	This worksheet gives a quick estimate of the total amount of money likely needed for retirement. Provided by the T. Rowe Price investment company, this does provide a good example of a DSS.

11.4 Appendix IV

- Information Services for Life Insurance - Examples from the World Wide Web

Page Description	URL	Comment
Insurance Cost Estimator	http://www.budgetlife.com/cgi-bin/get-url.cgi?affilid=tb9918	Includes an estimator feature for term life insurance that claims to "to figure out how much you "should" be paying for term life insurance" and give access to 160 companies' rates.
Metropolitan Life Insurance Company (MetLife Online)	http://www.metlife.com/	An online service to assist in selecting various types of insurance products.
URL Insurance Agency Inc.'s QuoteTermLife Service	http://www.quotetermlife.com/	Provides for preparation of term life insurance quotes from a number of life insurance companies.
411 Life Insurance	http://www.411insure.com/	Serves as a portal or directory to various Life Insurance services to include identification of companies and agencies, definition of terms, and links to state insurance commissioners' offices.
AARP Life Insurance	http://www.nylaarp.com/	Provides portal to Life Insurance services offered by American Association of Retired Persons (AARP) in conjunction with New York Life company. Includes provision for online quotes and "How to Buy Life Insurance guide."
ABC Life Insurance	http://www.abc-life-insurance.com/	Includes provision for online quote.
Life Insurance.net	www.lifeinsurance.net	Includes provision for online quote, access to "Life Insurance 101" and use of specialised calculators.
Term Life Pros	http://www.lifeinsurancetermquote.com/	Provides for online quotes with special emphasis on quotes for term life insurance.
AlifeQuote com	http://www.lifeinsurancetermquote.com/	Includes online quote feature and access to general information on Life Insurance.
New York Life Insurance Company	http://www.newyorklife.com/	Serves as a portal to additional information about New York Life Insurance, Life Insurance in general, identification of agents, and a Virtual Service Center providing "online policy management and customer service.
Pyramid Life Insurance	http://www.pyramidlife.com/	Gives emphasis on marketing to senior citizens with special emphasis on long term care coverage.
Netaquote.com	http://www.netaquote.com/	Provides online quote screen claiming to provide

Page Description	URL	Comment
		quotes on a variety of term life products from 175
FBIC	http://www.badfaithinsurance.org/	Site claims to provide a "Ranking of Insurance Companies by Payment of Claims." Identifies "Good Faith" and "Bad Faith" companies.
NOLO.COM – Law for Com	http://www.nolo.com/encyclopedia/articles/ep/li_buy.html	Provides a general discussion of making Life Insurance purchases and gives links to several online rate quotation services or insurance rate shopping services.

11.5 Appendix V

- Information Services for Health Insurance - Examples from the World Wide Web

Page Description	Comment
Find Health Insurance URL: http://www.find-health-insurance.com/	Provides assistance in obtaining rate quotations from a number of agents and health insurance companies. Includes a glossary. Requires identification of family members, tobacco use, and selection of type if health insurance sought. No assistance other than glossary for assistance in the selection of type of coverage. PDSS Support: Limited. Provides links to insurance company rating services and glossary.
Health Care Financing Administration (Changed to CMS – Centers for Medicare and Medicaid) URL: http://www.find-health-insurance.com/	Health Care Financing Administration (HCFA) web site. Includes information on government programs such as Medicare and Medicaid. PDSS Support: No
Castle Group Health Net URL: http://www.midwesthealth.com/	Described on the Web site as: "Castle Group is an independent health insurance agency located in Northbrook, Illinois. We can provide access to individual and group health insurance quotes and related products for individuals and businesses ..." Directly serves only the states of Illinois, Indiana, Wisconsin, and Texas but provides links to agents in all states. Major subjects' links from the home page include: Individual and Family Health Plans, Plans for the Self Employed, Employer Based Group Health Plans, Insurance 101, and Get a quote. Of special interest are the Insurance 101 page and the list of additional web resources available from the Insurance 101 page. PDSS Support: NO
4Health Insurance.com URL: http://4healthinsurance.4anything.com/	A page providing links to other related Web sites. Major topic areas on the home page include: Consumer Information, Health Plan Providers, Professional Resources, Specialty Plan Providers, Get A Quote rate finder, and search for a local agent. PDSS Support: No

Page Description	Comment
Global Health Insurance.net URL: http://www.globalhealthinsurance.net/	Provides quote capability for health insurance. Includes quotes for international health and term life. PDSS Support: No
Alternative Health Insurance URL: http://www.althlthins.com/	**"Alternative** Health Insurance Services offers coverage to patients who seek such treatments as acupuncture, chiropractic, homeopathy and naturopathy as well as conventional treatments." PDSS Support: No
Health Plans Online . com URL: http://www.healthplansonline.com/	Provides access to a number of insurance agents and some general information regarding health insurance coverage. PDSS Support: No
Texas Health Insurance URL: http://www.texashealthinsurance.com/index.html	Offers quotes on health insurance for residents of Texas. PDSS Support: No
Equity Analytics Limited, Ltd. URL: http://www.e-analytics.com/insdir.htm	Provides links to a number of papers and information resources related to finance, investment, insurance, and retirement planning. However, the link for Health Insurance shows a brief paper on Single Premium Life Insurance. PDSS Support: No. However, links mentioned above may be useful.
InsWeb	Provides links to a number of insurance company sites. The "toolbox" page offers access to a "Health Plan Analyzer" which serves as an example of a fairly simple (6 questions) decision support system to assist in the selection of a type of health care financing system. PDSS Support: Limited
Web site for the Prudential company URL: http://www.prudential.com/	Provides Web based access to a number of financial products and services from the Prudential company categorised by: Insurance, Investments and Brokerage, Real Estate and Relocation, Banking, Business to Business, and Financial Planning. No services specific to health care financing or health insurance noted. PDSS Support: No. Provides support services for Life, Homeowners, Long Term Care, Personal Liability, and Annuities but not Health coverage.
Michael W. Smith Agency URL: http://www.insuremn.com/	Web site for an independent insurance serving Minnesota. Includes rate quote facility. PDSS Support No

Page Description	Comment
ACE Health Insurance URL: http://www.acehealth.com/	Insurance agent site supporting quotes for states of California, Texas, Georgia, and Illinois PDSS Support: Limited. A page of information, "Secrets of Buying Individual Health Insurance" available.
Savon California Health Insurance URL: http://www.savonhealthinsurance.com/	Provides online access to rate quotations for a number of health plans and group health insurance. PDSS Support: No. Not on web in summer 2002.
Conesco Company URL: http://www.conseco.com/	Web site offering information on insurance and other financial products. Includes a "Comprehensive Financial Planning Tool" that addresses retirement planning. No special relationship to health care financing noted. PDSS Support: No.
HCFA's State Children's Health Insurance Program (SCHIP) URL: http://www.hcfa.gov/init/children.htm	A web page provided by HCFA that gives information on the State Children's Health Insurance Program (SCHIP) PDSS Support: No. However, link to bphc.hrsa.gov site provides access to information on certain public health services.
About Health Insurance, Inc. URL: http://www.abouthealthinsurance.com/	A full service independent agency serving the small business owner in New York, Connecticut, New Jersey, Pennsylvania, Maryland and Delaware PDSS Support: No.
Business Benefits, Inc. URL: http://www.majormedicalinsurance.com/	A web site offering insurance information categorised by: Individual, Family, Small Group, Short Term Health Insurance, Term Life and an Insurance Glossary. Serves the states of Illinois, Indiana, Iowa, Michigan, Missouri, Idaho, Wisconsin, Texas, Georgia, and Florida. PDSS Support: No.
SafTNet URL: http://www.safetnet.com/	Opinions expressed as an "editorial" about the sale of insurance services in the Web. Does include links to other insurance sites and links to a geographical and alphabetic list of agents.
Nationwide insurance company URL: http://www.nationwide.com/	Web site for the Nationwide insurance company. No special emphasis on health insurance noted. PDSS Support: No. Provides support for Auto, Life, Homeowners, Business but not Health. The "Calculators" provided to not address Health.

Page Description	Comment
411 Insure URL: http://www.411insure.com/	Includes links to Insurance companies, agents, a glossary, and state departments of Insurance. No special emphasis on health insurance noted. PDSS Support: No
Health of America Insurance Agency URL: http://www.healthinsuranceagency.com/wisconsin_health_insurance.html	Provides quotes for health insurance in categories of Self Employed, Medical Savings Accounts, families, students, etc. Provides services in Minnesota, Texas and Wisconsin. PDSS Support: No
U.S. News Online URL: http://www.usnews.com/usnews/nycu/health/hekdlst.htm	Provides a list of health insurance programs for children who are not eligible for Medicaid. PDSS Support: No. The specific document was no longer online in summer of 2002 although the web site is still online.
Farmer's Insurance Group URL: http://www.farmersinsurance.com/	Web page for the Farmer's Insurance Group providing links to general insurance topics. No emphasis on health insurance noted. PDSS Support: No. The "Determine My Needs" section of the site addresses other lines but not health coverage.

11.6 Appendix VI -

BCBS Association PDSS for Health Care Financing Example

The following example of a Personal Decision Support system is taken from the World Wide Web site of the Blue Cross Blue Shield Association as presented in 1999. As of the summer of 2002 this service was no longer posted on the BCBSA web site. However, this system may be taken as an example of a "qualitative" type of decision support system. Personal judgments are made in answering questions 1 through 8, which result in a point score being determined. A scale is then provided to use in evaluating the significance of the calculated points. This system may be compared in nature to point oriented Loan Application evaluation systems used by banks for loan or mortgage qualification.

Choosing the plan that's right for you.

Do you travel a lot? Does your health plan need to cover you or members of your family away from home, such as at college or an extended vacation?

1. **Do you currently have any pre-existing medical conditions?**

2. **Is it important for you to be able to use a specific brand of prescription medication?**

3. **Is it important for you to be able to see a specialist without a referral from a primary care physician?**

4. Is it important for you to be able to choose any physician or hospital for your care, even if it will cost more?

5. Is it important for your health plan to include routine and preventive care?

6. Is it important for your health plan to cover most of the cost of a physician visit?

7. Would you be willing to switch to a new primary care physician to save money?

How to score your results:

8-11	Your health care needs can probably be met by a traditional HMO
12-16	Your health care needs can probably be met by an HMO with POS options
17-20	Your health care needs can probably be met by a PPO
21-24	Your health care needs can probably best be met with a fee-for-service plan

11.7 Appendix VII - BCBS of Tennessee - Health Plan Options

Individual Products

Product Name	Product Description
BlueCross 65 Select	A special PPO-style Medicare supplement plan for Senior Tennessee's available in some Middle and East Tennessee counties.
BlueCross 65	A traditional Medicare supplement for Senior Tennessee's which is available statewide.
Non-Group BluePeferred	Broad health care protection for individuals through Tennessee's largest state-of-the-art PPO network.
Short-Term BluePreferred	A special program offering guaranteed acceptance for broad Blue Cross and Blue Shield protection from unexpected health care expenses for 90 or 120 days.

Group Products

Product Name	Product Description
PPO – Preferred Provider Organisation Plans	PPO Plans provide coverage through a broad state-wide network of health care providers. They give members the widest possible selection of doctors and hospitals. Health care providers are paid through state-of-the-art reimbursement methods that reduce members' costs. Reduced benefits are provided for the services of out-of-network providers.
CoPay PPO Plans	CoPay PPO Plans feature predictable HMO-style copay benefits in a PPO environment. This means the Plans provide broad benefits and access to doctors and hospitals in a broad state-wide network without complicated referral procedures.
POS – Point of Service Plans.	Point-of-service Plans provide regular HMO benefits through a primary care physician-based delivery system, but also provide insurance benefits for out-of-network services. POS Plans are available in most Tennessee counties.
HMO – Health Maintenance Organisations Plans.	An HMO Plan is a systematic approach combining the delivery and financing of all non-emergency health care services through a provider network with a primary care physician access point. The HMO is the most effective method for helping individuals manage their own health care. HMO coverage is available in most Tennessee counties.

Source: Blue Cross Blue Shield of Tennessee web site: http:/www.bcbst.com/plans

11.8 Appendix VIII -

Rogers' Generalisations

The generalisations presented here are those presented by Rogers in his 1995 4th edition of *Diffusion of Innovations*. The generalisation numbers and page numbers are those assigned by Rogers based on the chapters of his work. The identification of objects and attributes of the generalisation shown here are not included in Rogers' original work.

Gen. Number	Page Number	Generalisation	Object	Attribute
		Chapter 5 – The Innovation-Decision Process		
5-1	166	Earlier knowers of an innovation have more formal education than later knowers.	Knowers of Innovation	Formal education
5-2	166	Earlier knowers of an innovation have higher socio-economic status than late knowers.	Knowers of Innovation	Socio-economic status
5-3	167	Earlier knowers of an innovation have more exposure to mass media channels of communication than later knowers.	Knowers of Innovation	Exposure to mass media
5-4	167	Earlier knowers of an innovation have more exposure to interpersonal channels than later knowers.	Knowers of Innovation	Exposure to interpersonal channels
5-5	167	Earlier knowers of an innovation have more change contact than later knowers.	Knowers of Innovation	Change agent contact
5-6	167	Earlier knowers of an innovation have more social participation than later knowers.	Knowers of Innovation	Social participation
5-7	167	Earlier knowers of an innovation are more cosmopolite than later knowers.	Knowers of Innovation	Cosmopolite
5-8	176	At least some degree of re-invention occurs at the implementation stage for many innovations and for many adopters.	Implementation stage	Re-invention
5-9	183	Later adopters are more likely to discontinue innovations than are earlier adopters.	Early adopters vs. later adopters.	Inclination to discontinue
5-10	188	Stages exist in the innovation process	The innovation process	Existence of stages
5-11	195	Mass media channels are relatively	Communication	Importance of

Gen. Number	Page Number	Generalisation	Object	Attribute
		more important at the knowledge stage and interpersonal channels are relatively more important at the persuasion stage in the innovation-decision process.	channels	channel at stages
5-12	196	Cosmopolite channels are relatively more important at the knowledge stage, and localite channels are relatively more important at the persuasion stage in the innovation-decision process.	Communication channels	Importance of channel at stages
5-13	197	Mass media channels are relatively more important than interpersonal channels for earlier adopters than for later adopters.	Channels of communication	Importance for earlier vs. later adopters
5-14	197	Cosmopolite channels are relatively more important than localite channels for earlier adopters than for later adopters.	Channels of communication	Importance for earlier vs. later adopters
5-15	199	The rate of awareness-knowledge for an innovation is more rapid than its rate of adoption.	Innovation	Rate of awareness-knowledge vs. rate of adoption
5-16	199	Earlier adopters have a shorter innovation-decision period than later adopters.	Earlier vs. later adopters	Length of innovation-decision period
		Chapter 6 – Attributes of Innovations and Their Rate of Adoption		
6-1	216	The relative advantage of an innovation, as perceived by members of a social system, is positively related to its rate of adoption.	Rate of adoption	Relative Advantage
6-2	234	The compatibility of an innovation, as perceived by members of a social system, is positively related to its rate of adoption.	Rate of adoption	Compatibility
6-3	242	The complexity of an innovation, as perceived by members of a social system, is negatively related to its rate of adoption.	Rate of adoption	Complexity
6-4	243	The trialability of an innovation, as perceived by members of a social system, is positively related to its rate of adoption.	Rate of adoption	Trialability
6-5	244	The observability of an innovation, as perceived by members of a social system, is positively related to its rate of adoption.	Rate of adoption	Observability

Gen. Number	Page Number	Generalisation	Object	Attribute
		Chapter 7 – Innovativeness and Adopter Categories		
7-1	260	Adopter distributions follow a bell-shaped curve over time and approach normality.	Adopter categories	Shape of distribution over time
7-2	269	Earlier adopters are not different from later adopters in age.	Earlier vs. later adopters	Age
7-3	269	Earlier adopters have more years of formal education than later adopters.	Earlier vs. later adopters	Formal education
7-4	269	Earlier adopters are more likely to be literate than are later adopters.	Earlier vs. later adopters	Literacy
7-5	269	Earlier adopters have higher social status than later adopters.	Earlier vs. later adopters	Social status
7-6	269	Earlier adopters have a greater degree of upward social mobility than later adopters	Earlier vs. later adopters	Upward social mobility
7-7	269	Earlier adopters have larger units (farms, schools, companies, and so on) than later adopters	Earlier vs. later adopters	Size of units
7-8	272	Earlier adopters have greater empathy than later adopters.	Earlier vs. later adopters	Empathy
7-9	272	Earlier adopters may be less dogmatic than later adopters.	Earlier vs. later adopters	Dogmatism
7-10	273	Earlier adopters have a greater ability to deal with abstractions than do later adopters.	Earlier vs. later adopters	Abstraction ability
7-11	273	Earlier adopters have greater rationality than later adopters.	Earlier vs. later adopters	Rationality
7-12	273	Earlier adopters have greater intelligence than later adopters.	Earlier vs. later adopters	Intelligence
7-13	273	Earlier adopters have a move favourable attitude toward change than later adopters.	Earlier vs. later adopters	Attitude toward change
7-14	273	Earlier adopters are better able to cope with uncertainty and risk than later adopters.	Earlier vs. later adopters	Uncertainty and risk
7-15	273	Earlier adopters have a more favourable attitude toward science than later adopters.	Earlier vs. later adopters	Attitude toward science
7-16	273	Earlier adopters are less fatalistic than later adopters.	Earlier vs. later adopters	Fatalism
7-17	273	Earlier adopters have higher aspirations (for formal education, occupations, and son on) than later adopters.	Earlier vs. later adopters	Aspirations
7-18	273	Earlier adopters have more social	Earlier vs. later	Social

Gen. Number	Page Number	Generalisation	Object	Attribute
		participation than later adopters.	adopters	participation
7-19	273	Earlier adopters are more highly interconnected through interpersonal networks in their social system than later adopters.	Earlier vs. later adopters	Interpersonal networks
7-20	273	Earlier adopters are more cosmopolite than later adopters.	Earlier vs. later adopters	Cosmopolitenes s
7-21	274	Earlier adopters have more change agent contact than later adopters.	Earlier vs. later adopters	Change agent contact
7-22	274	Earlier adopters have greater exposure to mass media communications channels than later adopters.	Earlier vs. later adopters	Exposure to mass media
7-23	274	Earlier adopters have greater exposure to interpersonal communication channels than later adopters.	Earlier vs. later adopters	Exposure to interpersonal communication channels
7-24	274	Earlier adopters seek information about innovations more actively than later adopters.	Earlier vs. later adopters	Innovation information seeking
7-25	274	Earlier adopters have greater knowledge of innovations than later adopters.	Earlier vs. later adopters	Knowledge of innovations
7-26	274	Earlier adopters have a higher degree of opinion leadership than later adopters.	Earlier vs. later adopters	Degree of opinion leadership
		Chapter 8 – Diffusion Networks		
8-1	288	Interpersonal diffusion networks are mostly homophilous.	Diffusion networks	Homophily
8-2	289	When interpersonal diffusion networks are heterophilous, followers seek opinion leaders of higher socio-economic status.	Diffusion networks	Socio-economic status
8-3	289	When interpersonal diffusion networks are heterophilous, followers seek opinion leaders with more formal education.	Diffusion networks	Formal education
8-4	289	When interpersonal diffusion networks are hetrophilous, followers seek opinion leaders with a greater degree of mass media exposure.	Diffusion networks	Mass media exposure
8-5	289	When interpersonal diffusion networks are hetriphilous, followers seek opinion leaders who are more cosmopolite.	Diffusion networks	Cosmopolitenes s

Gen. Number	Page Number	Generalisation	Object	Attribute
8-6	289	When interpersonal diffusion networks are hetrophilous, followers seek opinion leaders with greater change agent contact.	Diffusion networks	Change agent contact
8-7	289	When interpersonal diffusion networks are hetrophilous, followers seek opinion leaders who are more innovative.	Diffusion networks	Innovativeness
8-8	293	Opinion leaders have greater exposure to mass media than their followers.	Opinion leaders / followers	Mass media exposure
8-9	294	Opinion leaders are more cosmopolite than their followers.	Opinion leaders / followers	Cosmopolitenes s
8-10	294	Opinion leaders have greater change agent contact than their followers.	Opinion leaders / followers	Change agent contact
8-11	294	Opinion leaders have greater social participation than their followers.	Opinion leaders / followers	Social participation
8-12	294	Opinion leaders have higher socio-economic status than their followers	Opinion leaders / followers	Socio-economic status
8-13	294	Opinion leaders are more innovative than their followers.	Opinion leaders / followers	Innovativeness
8-14	295	When a social system's norms favour change, opinion leaders are more innovative, but when the norms do not favour change, opinion leaders are not especially innovative.	Opinion leaders	Innovation
8-15	303	The network interconnectedness of an individual in a social system is positively related to the individual's innovativeness.	Individual	Innovativeness
8-16	310	The information-exchange potential of communication network links is negatively related to their degree of (1) communication proximity and (2) homophily.	Network links	Information exchange potential
8-17	311	Individuals tend to be linked to others who are close to them in physical distance and who are relatively homophilous in social characteristics.	Individuals	Links
8-18	322	An individual is more likely to adopt an innovation if more of the other individuals in his or her personal network have adopted previously.	Individual	Tendency to adopt
		Chapter 9 - The Change Agent		
9-1	339	Change agent success in securing the adoption of innovations by	Change agent	Client contact

Gen. Number	Page Number	Generalisation	Object	Attribute
		clients is positively related to the extent of change agent effort in contacting clients.		
9-2	340	Change agent success in securing the adoption of innovations by clients is positively related to a client orientation, rather than to a change agency orientation.	Change agent	Client orientation
9-3	340	Change agent success in securing the adoption of innovations by clients is positively related to the degree to which a diffusion program is compatible with clients' needs.	Change agent	Compatibility with clients' needs
9-4	342	Change agent success in securing the adoption of innovations by clients is positively related to empathy with clients.	Change agent	Empathy with clients
9-5	346	Change agent contact is positively related to higher social status among clients.	Change agent	Social status
9-6	346	Change agent contact is positively related to greater social participation among clients.	Change agent	Social participation
9-7	346	Change agent contact is positively related to higher formal education among clients.	Change agent	Formal education
9-8	346	Change agent contact is positively related to cosmopoliteness among clients.	Change agent	Cosmopolitenes s
9-9	350	Change agent success in securing the adoption of innovations by clients is positively related to homophily with clients.	Change agent	Homophily
9-10	352	Change agent success in securing the adoption of innovations by clients is positively related to credibility in the clients' eyes.	Change agent	Credibility
9-11	354	Change agent success in securing the adoption of innovations by clients is positively related to the extent that he or she works through opinion leaders.	Change agent	Work through opinion leaders
9-12	357	Change agent success in securing the adoption of innovations by clients is positively related to increasing client ability to evaluate innovations.	Change agent	Client ability to evaluate innovations
		Chapter 10 – Innovation in Organisations		

Gen. Number	Page Number	Generalisation	Object	Attribute
10-1	375	Both the innovation and the organisation usually change in the innovation process in organisations.	Innovation / Organisation	Change
10-2	379	Larger organisations are more innovative.	Organisation	Innovativeness
10-3	393	A performance gap can trigger the innovation process.	Innovation process	Performance
10-4	398	The involvement of an innovation champion contributes to the success of an innovation in an organisation.	Innovation champion	Success of innovation
		Chapter 11 – Consequences of Innovations		
11-1	414	The effects of an innovation usually cannot be managed to separate the desirable from the undesirable consequences.	Consequences	Innovation effects
11-2	421	The undesirable, indirect, and unanticipated consequences of an innovation usually go together, as do the desirable, direct, and anticipated consequences.	Consequences	Nature of consequences
11-3	423	Change agents more easily anticipate the form and function of an innovation for their clients than its meaning	Change agent	Anticipations
11-4	433	The consequences of the diffusion of innovations usually widen the socio-economic gap between the earlier and later adopting categories in a system.	Socio-economic status	Gap of status
11-5	433	The consequences of the diffusion of innovation usually widen the socio-economic gap between the audience segments previous high and low in socio-economic status.	Socio-economic status	Gap of status
11-6	436	A system's social structure partly determines the equality versus the inequality of an innovation's consequences.	Consequences	Social structure
11-7	439	When special efforts are made by a diffusion agency, it is possible to narrow, or at least to maintain the size of, socio-economic gaps in a social system.	Socio-economic gaps	Diffusion agency efforts

Source: (Rogers 1995, see table for page numbers)

11.9 Appendix IX -

List of Moore and Benbasat's Scale Items by Construct

From Moore and Benbasat

These scale items are taken from the scale proposed by Moore and Benbasat. Their study was based on the adoption of Personal Work Stations (PWS) but developed so that the scale is readily adaptable to other specific technologies.

Item Number	Short Scale *	Item Description
		Attribute: Voluntariness
1		My superiors expect me to use a PWS.
2		My use of a PWS is voluntary (as opposed to required by my superiors or job description).
3	*	My boss does not require me to use a PWS.
4	*	Although it might be helpful, using a PWS is certainly not compulsory in my job.
		Attribute: Relative Advantage
1	*	Using a PWS enables me to accomplish tasks more quickly.
2	*	Using a PWS improves the quality of work I do.
3	*	Using a PWS makes it easier to do my job.
4		The disadvantages of my using a PWS far outweigh the advantages. (See Note a.)
5		Using a PWS improves my job performance.
6		Overall, I find using a PWS to be advantageous in my job.
7	*	Using a PWS enhances my effectiveness on the job.
8	*	Using a PWS gives me greater control over my work.
9		Using a PWS increases my productivity.
		Attribute: Compatibility
1	*	Using a PWS is compatible with all aspects of my work.
2		Using a PWS is completely compatible with my current situation.
3	*	I think that using a PWS fits well with the way I like to work.
4	*	Using a PWS fits into my work style.
		Attribute: Image
1		Using a PWS improves my image within the organisation.
2		Because of my use of a PWS, others in my organisation see

		me as a more valuable employee. (See Note a.)
3	*	People in my organisation who use a PWS have more prestige than those who do not.
4	*	People in my organisation who use a PWS have a high profile.
5	*	Having a PWS is a status symbol in my organisation.
		Attribute: Ease of Use
1		I believe that a PWS is cumbersome to use.
2		It is easy for me to remember how to perform tasks using a PWS. (See Note a.)
3		My using a PWS requires a lot of mental effort.
4		Using a PWS is often frustrating.
5	*	My interaction with a PWS is clear and understandable. (See Note a.)
6	*	I believe that it is easy to get a PWS to do what I want it to do.
7	*	Overall, I believe that a PWS is easy for me to use.
8	*	Learning to operate a PWS is easy for me.
		Attribute: Result Demonstrability
1	*	I would have no difficulty explaining my feelings to others about the results of using a PWS.
2	*	I believe I could communicate to others the consequences of using a PWS.
3	*	The results of using a PWS are apparent to me.
4	*	I would have difficulty explaining why using a PWS may or may not be beneficial.
		Attribute: Visibility
1		I have seen what others do using their PWS.
2		In my organisation, one sees PWS on many desks.
3		I have seen a PWS in use outside my firm. (See Note a.)
4		PWS are *not* very visible in my organisation.
5		It is easy for me to observe others using PWS in my firm.
		I have had plenty of opportunity to see the PWS being used. (See Note b.)
		I have not seen many others using a PWS in my department. (See Note b.)
		Attribute: Trialability
1		I've had a great deal of opportunity to try various PWS applications.
2		I know where I can go to satisfactorily try out various uses of

		a PWS.
3		A PWS was available to me to adequately test run various applications.
4	*	Before deciding whether to use any PWS applications, I was able to properly try them out.
5	*	I was permitted to use a PWS on a trial basis long enough to see what it could do.
		I am able to experiment with the PWS as necessary. (See Note b.)
		I can have PWS applications for long enough periods to try them out. (See Note b.)
		I did not have to expend very much effort to try out the PWS. (See Note c.)
		I don't really have adequate opportunities to try out different things on the PWS. (See Note c.)
		A proper on-the-job tryout of the various uses of the PWS is not possible. (See Note c.)
		There are enough people in my organisation to help me try the various uses of the PWS. (See Note c.)

Notes (from the original Moore and Benbasat article)

a. The indicated items were all deleted as the result of the first factor analysis and hence were not in the final scales.

b. The indicated items, which were deleted after the initial test, are suggested as candidates for inclusion in any expanded scale.

c. The indicated items, which were not in the final instrument, had item-scale correlations less than 0.40 in the initial test and are suggested as secondary candidates for lengthening the scale.

d. * - Indicates items suggested for inclusion in any "short" scales.

11.10 Appendix X -

Health Care Financing Decision Factors Interview Worksheet

Telephone Interview Worksheet

Intro:

This is an interview about some facts related to your health care financing or insurance and how you might use computers. I will not release your name with any summary of information that I may prepare as a result of this interview. If I ask any question that you do not care to answer, just let me know. This should not take more than ten minutes.

Do you mind if I tape record this conversation?

Demographic Information

2 - Interviewer: Jim Murchison

3 - Name of Person Interviewed:
3A – Respondent Code

4 - Date:

5 - Time of Day:

6 - Employment Status:

Health Care Financing Overview

7 - Is Health Care Financing provided as part of your employment or retirement benefits?

Have you needed to use your Health Care Financing
8 - Within the past year?
8A - Within the past two years?

9 - Do you have any choices of type of financing program such as a "fee for service" option or an "HMO option"?

10 - Do you know how many financing options are available to you?

11 - How well do you feel that you understand these options? (Scale of 1 to 10)

12 - If you have a choice, how confident do you feel you have made the best choice? (Scale of 1 to 10)

13 - If asked to report your actual out of pocket health care expenses for last year, how accurately could you do this? (Scale of 1 to 10)

14 - If asked to report your total health care expenses for last year, how accurately could you do this? (Scale of 1 to 10)

Computer / Internet Use

Do you use a computer system	Average times per week
15 - At work _____	15 A - _____
16 - At home_____	16 A - _____

Do you use the Internet	average times per week
17 - At work	17 A - _____
18 - At home	18 A - _____

19 - If Internet user, do you use Internet for the following:

20 - Buying books

21 - Buying clothes

22 - Making travel plans

23 - Paying bills on-line

24 - Investment management (either portfolio management or analysis)

25 - Any time of insurance planning

26 - Submitting your federal income tax return (last year)

27 - Did you prepare your own federal income tax return last year?

27 A - Did you use a software package for this?

Reaction to Computer System PDSS

28 - Would you consider using a computer program to help you make choices about types of health care insurance or financing?

29 - Would you use such a program or service on the Internet?

30 - What concerns about the validity (honesty) of such a service would you have?

31 - How concerned would you be about who provided such a program or service (BCBS, Doctor's Office, Hospital, other health insurance company, Money Magazine, ???)?

Conclusion

32 - How do you feel about these questions?

33 - What questions should I have asked you?

34 – Interviewer Comments

11.11 Appendix XI -

Summary of Responses from Telephone Interview

Questions 30 and 31

Question 30

30 - What concerns about the validity (honesty), of such a service would you have?
Concerns about personal questions
Creditable source. There are so many sources out there on the Internet.
If from independent source then no concern.
No, as long as responsible company.
None
Yes. Who sponsored the service? What about release of information.
No questions.
Might be concerned. Is the service provided by a reputable company?
Who do "they" represent? Is it slanted?
Some concerns. Uncertain about such a service.

Question 31.

31 - How concerned would you be about who provided such a program or service (BCBS, Doctor's Office, Hospital, Other Health Insurance Company, Money Magazine, ???).
No
Big concern
Concerned
Highly concerned
Yes
Yes.
Yes
Yes
Yes
Yes
Yes
Yes

11.12 Appendix XII -

Pilot Survey Instrument - Original Questions by Category

Survey Regarding
Health Insurance / Financing Advisor System (HIFAS) Use

This survey asks you to answer questions about your possible use of a Health Care Financing Advisor System (HCF-AS). This is a form of computer-supported system that you might use to help make choices of different types of Heath Care Financing programs or Health Care Insurance programs that may be available to you. This type of information system may also considered to be a Decision Support System related to personal choices about health care financing.

Such a system would not provide health care information about an illness or injury that you may have. Instead it would provide you with suggestions or recommendations regarding your choice of health care financing or health insurance options that may be available to you.

It is quite likely that you have never used such a system. That is not important in terms of answering this survey. Please answer based on your best impression for each question. We are seeking to understand your opinions on this subject regardless of whether you have used such a system or not.

Your help in responding to this survey will be quite helpful with this project. Your response will help in understanding how people understand their health care, the payment for their health care, and how they feel about using computer services to assist in making choices in these areas.

Thank you for helping by completing and returning this survey.

Section 1 – Background and Demographic Questions

1-1 What is your occupation or type of work? _____

1-2 What is the highest level of education that you have completed?

__ Have not completed High School.
__ Completed High School.
__ Completed some college study
__ Completed two year college degree (Associate degree)
__ Completed four year college degree (Bachelor's degree)
__ Completed master's degree
__ Completed other graduate degree
__ Other
Please describe: _____

Computer Use Attributes

1-3 Do you use a computer on a regular or frequent basis at work? __ (yes / no)

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

1-4 If so, approximately how many hours per week: ___

1-5 Do you use a computer on a regular or frequent basis at home? ___ (yes / no)

1-6 If so, approximately how many hours per week: ___

1-7 Do you use the Internet on a regular or frequent basis at work? ___ (yes / no)

1-8 If so, approximately how many hours per week: ___

1-9 Do you use the Internet on a regular or frequent basis at home? ___ (yes / no)

1-10 If so, approximately how many hours per week: ___

1-11 Approximately what percentage of your friends use computers either at work or at home on a regular basis? ___

Do you use a computer-based system to

1-12 Pay your bills? __ (yes / no)

1-13 Balance your checkbook? __ (yes / no)

1-14 Make travel arrangements? __ (yes / no)

1-15 Help prepare your income tax return? __ (yes / no)

1-16 Send e-mail to friends or family members? __ (yes / no)

1-17 Do you have children in your home that use a computer at home? __ (yes / no)

1-18 If so approximately how many hours per week do your children use a computer at home? (give the average if you have more than one child who is a computer user) ___

Health Care Financing Perceptions

How well do you feel that you understand the health care financing options available to you?

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

Health care financing programs use many special terms and abbreviations to describe options of coverage such as "feel for service", HMO, and PPO. How well do you feel that you understand such terms?

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

1-20 Either by recall from memory, or personal records that you keep, how accurately are you able to identify the "out of pocket" expenses that you had for health care last year?

1_____2_____3_____4_____5_____6_____7_____8_____9_____10

Low Agreement **High Agreement**

1-21 Either by recall from memory, or personal records that you keep, how accurately are you able to identify the total expenses that you had for health care last year? This would include your "out of pocket" expenses as well as the expenses paid by a health care financing or health insurance program?

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

1-22 How likely do you think you would be to use a guide to making health care financing choices in a printed form?

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

1-23 How likely do you think you would be to use a guide to making health care financing choices with a computer-based system?

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

1-24 How pleased are you with your current health care financing program?

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

1-25 How confident are you that you have made the best choice about health care financing choice for you and/or your family?

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

Section 2 – Proposed questions based on Moore and Benbasat.
Attribute: Voluntariness

2-1 No one of great influence, such as my boss or my spouse, requires me to use a HCF-AS.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

2-2 Although it might be helpful, using a HCF-AS is certainly not compulsory for me.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

Attribute: Relative Advantage

2-3 Using a HCF-AS would enable me to accomplish tasks related to financial decisions more quickly.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

2-4 Using a HCF-AS would improve the quality of my financial decisions.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10

Low Agreement **High Agreement**

2-5 Using a HCF-AS would make it easier to make my financial decisions.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

2-6 Using a HCF-AS would enhance my effectiveness in making financial decisions.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

2-7 Using a HCF-AS would give me greater control over my financial affairs.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

Attribute: Compatibility

2-8 Using a HCF-AS would be compatible with all aspects of my financial planning.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

2-9 I think that using a HCF-AS would fit well with the way I like to work.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

2-10 Using a HCF-AS would fit into my work style.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

Attribute: Image

2-11 People who I know who use a HCF-AS have more prestige than those who do not.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

2-12 People who I know who use a HCF-AS generally have a high profile.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

2-13 Using a HCF-AS is a status symbol among the people that I know.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

Attribute: Ease of Use

2-14 I believe that it would be easy to get a HCF-AS to do what I want it to do.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

2-15 Overall, I believe that a HCF-AS would be easy for me to use.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

2-16 I believe that learning to use a HCF-AS would be easy for me.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10

Low Agreement **High Agreement**

Attribute: Visibility

2-17 Among the people that I know, many use a HCF-AS .

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

2-18 HCF-AS systems are very visible, or well known, among people that I know.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

Attribute: Trialability

2-19 Before deciding whether to use a HCF-AS, I would like to be able to try it out properly.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

2-20 I would expect to be able to use a HCF-AS long enough on a trial basis to see what it could do.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

Section 3 – Proposed Precursor Requirements Questions
Section 3 – Proposed questions based on Precursor requirements presented by Carson, Cramp, Morgan, and Roudsari.

Precursor Requirements:
- **Safety**
- **Reliability**
- **Acceptability**
- **Usable (restatement of the ergonomic design requirement)**

Safety

3-1 I am concerned that a HCF-AS may provide advice that is financially unwise for me.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

3-2 I am concerned that a HCF-AS may provide advice that will cause me financial loss.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

Reliability

3-3 I believe that I trust the suggestions provided by a HCF-AS as being in my best interest.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

3-4 I believe that a HCF-AS will provide consistent recommendations if I elect to use it more than one time.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

Acceptability

3-5 No specific questions here. This subject area has been dealt with in other subject areas above.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

Usable

3-6 I believe that a HCF-AS will be easy to use.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

3-7 I believe that I understand enough about my health care financing options to use a HCF-AS and understand the results.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

3-8 I believe that I have enough computer experience to use a HCF-AS.

1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Low Agreement **High Agreement**

Comments:

11.13 Appendix XIII -

Classification of Selected Questions - Pilot Survey

Questions 41 through 69 of the pilot survey were designed to obtain responses about attitudes and opinions in several categories. After the questions were developed, based on the concept they were intended to measure, they were arranged in random order on the survey instrument. The question numbers from the survey instrument were associated with the concepts or categories as indicated in Table 11.1.

Table 11.1 - Classification of Pilot Survey Questions

Construct or Category	Survey Instrument Question Numbers
Moore and Benbasat Attributes	
Voluntariness	44, 52
Relative Advantage	41, 45, 50, 60, 65
Compatibility	42, 53, 63
Image	43, 51, 69
Ease of Use	46, 58, 66
Visibility	48, 68
Trialability	56, 67
Precursor Requirements (Carson, Cramp, Morgan and Roudsari)	
Safety	49, 55
Reliability	59, 62
Acceptability	
Usable	54, 38, 64

Note: Based on a final review of the pilot survey instrument, questions 47 and 61 were omitted from the final version of the survey instrument. This produced an actual total of 69 questions on the version of the pilot survey instrument actually distributed.

11.14 Appendix XIV -

Classification of Selected Questions - Final Survey Instrument

The survey numbers from the pilot survey instrument were revised for the preparation of the actual survey instrument. For this actual survey instrument questions 41 through 69 of the pilot survey were designed to obtain responses about attitudes and opinions in several categories. As with the pilot survey, the questions were arranged in random order rather than by topic. The question numbers from the survey instrument were associated with the concepts or categories as indicated in Table 11.2.

Table 11.2 - Classification of Final Survey Questions

Construct or Category	Survey Instrument Question Numbers
Moore and Benbasat Attributes	
Voluntariness	27, 33
Relative Advantage	31, 36
Compatibility	34, 41
Image	26, 32
Ease of Use	28, 38
Visibility	29, 44
Trialability	37, 43
Precursor Requirements (Carson, Cramp, Morgan and Roudsari)	
Safety	30, 42
Reliability	39, 40
Acceptability	
Usable	35,

Note: This produced a total of 66 questions on the version of the pilot survey instrument actually distributed.

11.15 Appendix XV -

Survey Instrument and Instructions - Final Version

Survey about
Health Insurance Selection System Use

This survey asks you to answer questions about your possible use of a Health Insurance Selection System. Such a system would be a computer-based system to help you with making a choice among health insurance options.

This is a new concept for computer and information systems and it is quite likely that you have never used such a system. Your answers are valuable whether or not you have used such a computer system!

WHAT IS A HEALTH INSURANCE SELECTION SYSTEM?
A Health Insurance Selection System is a concept for a new type of information system that would assist you in making choices about the type of health care insurance that you may choose. For example, you may have options among various types of coverage such as a Health Maintenance Organisation (HMO), a Preferred Provider Organisation (PPO), or a traditional Fee for Service type of coverage. A system of this type might help you choose among such types of coverage by asking you to identify the relative importance, from your point of view, of such things as:
Low cost per visit to your doctor
Low overall annual cost
Level of health insurance deductible payment
Ability to choose your personal physician or primary care doctor
Coverage when you travel outside of your home area
A Health Insurance Selection system would not be a system to help you process insurance claims or obtain service when you are sick. Instead it would help you choose among health insurance options before you are sick. You might think of such a system as a financial or insurance advisor.

Your response to this survey is important. It will help in understanding how people view their health care, the payment for their health care, and how they feel about using computer and Internet services to assist in making choices in these areas.

Thank you for completing and returning this survey.

BACKGROUND AND DEMOGRAPHIC QUESTIONS

1 - What is your occupation or type of work? _____

2 - What is the highest level of education that you have completed?

Have not completed High School
Completed High School
Completed some college study
Completed two year college degree (Associate degree)
Completed four year college degree (Bachelor's degree)
Completed master's degree
Completed other graduate degree
Other
Please describe: _____

HEALTH CARE INSURANCE QUESTIONS

Please circle the best choice for the following questions.

3 - Is Health Care Insurance provided as part of your employment or retirement benefits?
yes / no

4 - If Health Care Insurance is provided as part of your employment or retirement benefits, are you enrolled in the program? yes / no

5 - Are you covered under any other Health Care Insurance programs such as one available to a spouse? yes / no

6 - How many health care insurance options (HMO, PPO, etc.) are available to you?
1 2 3 4 5 6 7 8 9 10

7 - How well do you feel that you understand the health care insurance options available to you?
1 2 3 4 5 6 7 8 9 10
Low Understanding **High Understanding**

8 - How confident do you feel that you have made the best choice among these options for your benefit?
1 2 3 4 5 6 7 8 9 10
Low Confidence **High Confidence**

9 - Health care insurance programs use many special terms and abbreviations such as "fee for service", HMO, and PPO. How well do you feel that you understand such terms?
1 2 3 4 5 6 7 8 9 10
Low Understanding **High Understanding**

10 - How accurately would you be able to identify the "out of pocket" amounts that you paid for health care last year?
1 2 3 4 5 6 7 8 9 10
Low Accuracy **High Accuracy**

11 - How accurately would you be able to identify the total amounts paid for your health care last year? This would include the "out of pocket" amounts you paid as well as the amounts paid by a health insurance or benefit program.
1 2 3 4 5 6 7 8 9 10
Low Accuracy **High Accuracy**

12 - How likely do you think you would be to use a printed form as a guide for making health care insurance choices?

1 2 3 4 5 6 7 8 9 10
Not likely **Very likely**

13 - How likely do you think you would be to use a computer-based system as a guide to making health care insurance choices?

1 2 3 4 5 6 7 8 9 10
Not likely **Very likely**

14 - How valuable would a computer-based Health Insurance Selection type of system likely be to you?

1 2 3 4 5 6 7 8 9 10
Not valuable **Very valuable**

15 - How much would you be willing to spend per year to use a computer-based Health Insurance Selection type of system?

_____

COMPUTER AND INTERNET USE QUESTIONS

16 - Approximately how many hours per week do you use the Internet at work?

_____

17 - Approximately how many hours per week do you use the Internet at home?

_____

18 - Approximately what percentage of your friends use computers or the Internet either at work or at home on a regular basis?

_____

Have you used the Internet to:

19 - Buy books yes / no

20 - Buy clothes yes / no

21 - Make travel plans yes / no

22 - Pay bills on-line yes / no

23 - Manage your investments yes / no

24 - Plan your insurance coverage yes / no

25 - Submit your federal income tax yes / no

QUESTIONS ABOUT SOME OF YOUR ATTITUDES.

26 - Using a computer system to help make personal financial or insurance decisions is a status symbol among the people that I know.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

27 - Although it might be helpful, using a Health Insurance Selection system is certainly not required for me.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

28 - Overall, I believe that a Health Insurance Selection system would be easy for me to use.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

29 - Among the people that I know, many use a computer system or the Internet to assist with financial or insurance decisions.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

30 - I am concerned that a Health Insurance Selection system may provide advice that is financially unwise for me.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

31 - Using a Health Insurance Selection system would improve the quality of my financial and insurance decisions.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

32 - People I know who use computer systems or the Internet for personal financial decisions generally have more prestige than those who do not.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

33 - No one of great influence, such as my boss or my spouse, expects me to use a Health Insurance Selection system.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

34 - Using a Health Insurance Selection system would be compatible with other aspects of my financial and insurance planning.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

35 - I believe that I understand enough about my health care financing or insurance options to use a Health Insurance Selection system and understand the results.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

36 - Using a Health Insurance Selection system would make it easier to make my financial and insurance decisions.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

37 - Before deciding whether to use a Health Insurance Selection system, I would like to be able to personally try it out properly.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

38 - I believe that I have enough computer experience to use a Health Insurance Selection system.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

39 - I believe that a computer-based Health Insurance Selection system will provide consistent recommendations if I elect to use it more than one time.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

40 - I would trust the suggestions provided by a Health Insurance Selection system as being in my best interest.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

41 - I think that using a Health Insurance Selection system would fit well with the way I like to work and make decisions.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

42 - I think that a Health Insurance Selection system may make suggestions that will cause me financial loss.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

43 - I would expect to be able to use a Health Insurance Selection system, on a trial basis, long enough to see what it could do.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

44 - Computer systems or Internet systems for making personal financial decisions are very visible, or well known, among people that I know.

1 2 3 4 5 6 7 8 9 10
Low Agreement **High Agreement**

Comments. Please list any comments or suggestions that you may have about the subject matter of the survey or about the survey itself.

Thank you for your help.

11.16 Appendix XVI - Occupational Specialties Represented by Respondents

Occupation *	Count	Occupation *	Count
(None Specified)	1	Engineering / Transportation	1
Accounting	5	Environmental Engineering	3
Administrative Assistant	7	Facilities planning	1
Administrator	3	Forensic Science	2
Analyst	1	Geologic / Engineering	1
Archivist / Historian	1	Government	1
Asst. Reg. Mgr. - TWRA	1	Health care / Health Educator	3
Attorney	3	Highway Plans Archivist	1
Auditor	3	Highways Maintenance Manager	1
Behaviour Analyst	1	Housing	1
Biologist	2	Information Resources / Technology	4
Bridge Inspector	1	Insurance Benefits Specialist	1
Business Consultant	1	Interviewer II	1
Calculations of felony sentences	1	ISC Liaison	1
Case Manager / Case Worker	3	Judicial	3
Child Care Program Evaluator	1	Law enforcement	1
Child Support	1	Legal Assistant	2
Civil Engineering	3	Legislative employee	1
Claims examiner	1	Librarian / Library Aide	3
Clerk	3	Maintenance	1
Computer Programmer	1	Manager	2
Consultant	1	Mental Health Specialist	1
Correctional Counsellor	2	Music Therapist	1
Criminal Investigator	1	Nurse	8
Data Entry	1	Nurse - Public Health	3
Data Processing	1	Nurse's Assistant	1
Department of Transportation	1	Office Supervisor	1
Dept Human Services - Supv. - Rehab Svcs	1	Pharmacist / Pharmacy Tech.	2
Desktop support	1	Plant Inspector	1
Developmental Tech.	1	Principal	1
DHS - Department of Health Services	1	Probation / Parole Officer	6
Director of Quality Improvement	1	Radio Operator	1
Distributor Computer III	1	Real Estate Appraiser	1
Editor (Student Tests)	1	Road word	1
Educator / Administrator	2	Sate worker	1
Eligibility Counsellor	3	Secretary	11
Emergency management	1	Server	1
Emergency Operations Officer	1	Social work / Counsellor	8
Employment Interviewer	1		

11.17 Appendix XVII - Correlation Coefficients for Attitude Questions (Questions 26 through 44)

	26 - Status Symbol	27 - Required	28 - Easy to use	29 - Know many users	30 - Financially unwise	31 - Quality of Decisions	32 - More Prestige	33 - Expected use	34 - Compatible w / planning	35 - Understand aciequately	36 - Easier decisions	37 - Personally try out	38 - Enough computer experience	39 - Consistent recommendations	40 - Best interest	41 - Way like to work	42 - Financial loss	43 - Trial basis	44 - Visibility
26 - Status Symbol	1.00	0.02	0.17	0.32	0.17	0.24	0.48	-0.12	0.27	0.00	0.21	0.00	-0.08	0.24	0.19	0.22	0.13	-0.05	0.23
27 - Required		1.00	0.38	0.22	0.09	0.08	-0.10	0.40	0.10	0.14	-0.02	0.30	0.14	0.13	0.13	0.09	0.05	0.26	0.09
28 - Easy to use			1.00	0.35	-0.11	0.38	-0.03	0.27	0.46	0.42	0.37	0.32	0.45	0.33	0.41	0.47	-0.09	0.32	0.23
29 - Know many users				1.00	0.03	0.45	0.21	0.01	0.39	0.16	0.33	0.21	0.14	0.34	0.39	0.42	0.03	0.17	0.48
30 - Financially unwise					1.00	-0.06	0.22	0.04	-0.16	-0.15	-0.15	-0.02	-0.13	-0.08	-0.21	-0.15	0.52	-0.04	0.01
31 - Quality of Decisions						1.00	0.37	-0.10	0.55	0.21	0.63	0.38	0.18	0.44	0.59	0.65	-0.01	0.31	0.34
32 - More Prestige							1.00	-0.15	0.32	-0.09	0.32	0.08	-0.08	0.32	0.33	0.30	0.19	-0.08	0.15
33 - Expected use								1.00	0.01	0.21	-0.17	0.18	0.21	0.04	0.05	0.00	-0.11	0.12	0.07
34 - Compatible w / planning									1.00	0.29	0.59	0.37	0.30	0.52	0.58	0.69	-0.03	0.30	0.37
35 - Understand adequately										1.00	0.32	0.38	0.52	0.24	0.29	0.28	-0.09	0.34	0.29
36 - Easier decisions											1.00	0.36	0.32	0.55	0.54	0.70	0.00	0.31	0.32
37 - Personally try out												1.00	0.38	0.50	0.47	0.43	0.02	0.60	0.25
38 - Enough computer experience													1.00	0.47	0.38	0.40	-0.17	0.38	0.34
39 - Consistent recommendations														1.00	0.78	0.59	-0.06	0.34	0.36
40 - Best interest															1.00	0.69	-0.15	0.34	0.33
41 - Way like to work																1.00	-0.05	0.40	0.48
42 - Financial loss																	1.00	-0.03	0.06
43 - Trial basis																		1.00	0.24
44 - Visibility																			1.00

11.16 Appendix XVI - Occupational Specialties Represented by Respondents

Occupation *	Count	Occupation *	Count
(None Specified)	1	Engineering / Transportation	1
Accounting	5	Environmental Engineering	3
Administrative Assistant	7	Facilities planning	1
Administrator	3	Forensic Science	2
Analyst	1	Geologic / Engineering	1
Archivist / Historian	1	Government	1
Asst. Reg. Mgr. - TWRA	1	Health care / Health Educator	3
Attorney	3	Highway Plans Archivist	1
Auditor	3	Highways Maintenance Manager	1
Behaviour Analyst	1	Housing	1
Biologist	2	Information Resources / Technology	4
Bridge Inspector	1	Insurance Benefits Specialist	1
Business Consultant	1	Interviewer II	1
Calculations of felony sentences	1	ISC Liaison	1
Case Manager / Case Worker	3	Judicial	3
Child Care Program Evaluator	1	Law enforcement	1
Child Support	1	Legal Assistant	2
Civil Engineering	3	Legislative employee	1
Claims examiner	1	Librarian / Library Aide	3
Clerk	3	Maintenance	1
Computer Programmer	1	Manager	2
Consultant	1	Mental Health Specialist	1
Correctional Counsellor	2	Music Therapist	1
Criminal Investigator	1	Nurse	8
Data Entry	1	Nurse - Public Health	3
Data Processing	1	Nurse's Assistant	1
Department of Transportation	1	Office Supervisor	1
Dept Human Services - Supv. - Rehab Svcs	1	Pharmacist / Pharmacy Tech.	2
Desktop support	1	Plant Inspector	1
Developmental Tech.	1	Principal	1
DHS - Department of Health Services	1	Probation / Parole Officer	6
Director of Quality Improvement	1	Radio Operator	1
Distributor Computer III	1	Real Estate Appraiser	1
Editor (Student Tests)	1	Road word	1
Educator / Administrator	2	Sate worker	1
Eligibility Counsellor	3	Secretary	11
Emergency management	1	Server	1
Emergency Operations Officer	1	Social work / Counsellor	8
Employment Interviewer	1		

Occupation *	Count		Occupation *	Count
Social work / working w/ Info. Systems	1			
Statistical Analyst	1			
Supervisor	1			
Systems Analyst / Administrator	2			
Teacher	3			
Technician 3	1			
TN Bureau of Investigation agent	1			
Transportation Survey Supervisor	1			
Truck Driver	1			
Urban Planning	1			
Vocational Rehab. Counsellor	1			
Woodworker	1			
WPO	1			
Writer & artist, computer software	1			

* Selected occupation descriptions were combined for reporting. For example "auditor" and "audit Manager" were combined.

11.17 Appendix XVII - Correlation Coefficients for Attitude Questions (Questions 26 through 44)

	26 - Status Symbol	27 - Required	28 - Easy to use	29 - Know many users	30 - Financially unwise	31 - Quality of Decisions	32 - More Prestige	33 - Expected use	34 - Compatible w / planning	35 - Understand adequately	36 - Easier decisions	37 - Personally try out	38 - Enough computer experience	39 - Consistent recommendations	40 - Best interest	41 - Way like to work	42 - Financial loss	43 - Trial basis	44 - Visibility
26 - Status Symbol	1.00	0.02	0.17	0.32	0.17	0.24	0.48	-0.12	0.27	0.00	0.21	0.00	-0.08	0.24	0.19	0.22	0.13	-0.05	0.23
27 - Required		1.00	0.38	0.22	0.09	0.08	-0.10	0.40	0.10	0.14	-0.02	0.30	0.14	0.13	0.13	0.09	0.05	0.26	0.09
28 - Easy to use			1.00	0.35	-0.11	0.38	-0.03	0.27	0.46	0.42	0.37	0.32	0.45	0.33	0.41	0.47	-0.09	0.32	0.23
29 - Know many users				1.00	0.03	0.45	0.21	0.01	0.39	0.16	0.33	0.21	0.14	0.34	0.39	0.42	0.03	0.17	0.48
30 - Financially unwise					1.00	-0.06	0.22	0.04	-0.16	-0.15	-0.15	-0.02	-0.13	-0.08	-0.21	-0.15	0.52	-0.04	0.01
31 - Quality of Decisions						1.00	0.37	-0.10	0.55	0.21	0.63	0.38	0.18	0.44	0.59	0.65	-0.01	0.31	0.34
32 - More Prestige							1.00	-0.15	0.32	-0.09	0.32	0.08	-0.08	0.32	0.33	0.30	0.19	-0.08	0.15
33 - Expected use								1.00	0.01	0.21	-0.17	0.18	0.21	0.04	0.05	0.00	-0.11	0.12	0.07
34 - Compatible w / planning									1.00	0.29	0.59	0.37	0.30	0.52	0.58	0.69	-0.03	0.30	0.37
35 - Understand adequately										1.00	0.32	0.38	0.52	0.24	0.29	0.28	-0.09	0.34	0.29
36 - Easier decisions											1.00	0.36	0.32	0.55	0.54	0.70	0.00	0.31	0.32
37 - Personally try out												1.00	0.38	0.50	0.47	0.43	0.02	0.60	0.25
38 - Enough computer experience													1.00	0.47	0.38	0.40	-0.17	0.38	0.34
39 - Consistent recommendations														1.00	0.78	0.59	-0.06	0.34	0.36
40 - Best interest															1.00	0.69	-0.15	0.34	0.33
41 - Way like to work																1.00	-0.05	0.40	0.48
42 - Financial loss																	1.00	-0.03	0.06
43 - Trial basis																		1.00	0.24
44 - Visibility																			1.00

11.18 Appendix XVIII - Correlation Coefficients for Selected Health Insurance Questions (Questions 7 through 14)

Variable	7 - Insurance understanding	8 - Confidence in choice	9 - Understanding of terms	10 - Accuracy of Out of Pocket	11 - Accuracy of total amounts	12 - Use printed guide	13 - Use computer-based guide	14 - Value of system
7 - Insurance understanding	1.00	0.64	0.66	0.50	0.40	0.41	0.17	0.07
8 - Confidence in choice		1.00	0.65	0.62	0.55	0.33	0.12	0.06
9 - Understanding of terms			1.00	0.58	0.47	0.33	0.12	0.06
10 - Accuracy of Out of Pocket				1.00	0.60	0.33	0.20	0.14
11 - Accuracy of total amounts					1.00	0.21	0.02	-0.03
12 - Use printed guide						1.00	0.52	0.46
13 - Use computer-based guide							1.00	0.86
14 - Value of system								1.00

11.19 Appendix XIX - Correlation Coefficients - Question 12 and Attitude Constructs

Variable	12 - Use printed guide	Voluntariness Construct	Relative Advantage Construct	Compatibility Construct	Image Construct	Ease of Use Construct	Visibility Construct	Trialability Construct	Safety Construct	Reliability Construct	Usability Construct
12 - Use printed guide	1.00	0.19	0.28	0.29	0.16	0.28	0.24	0.30	0.02	0.31	0.23
Voluntariness Construct		1.00	-0.08	0.06	-0.13	0.35	0.14	0.28	0.01	0.11	0.21
Relative Advantage Construct			1.00	0.75	0.37	0.41	0.45	0.42	-0.07	0.62	0.30
Compatibility Construct				1.00	0.35	0.52	0.52	0.46	-0.12	0.69	0.31
Image Construct					1.00	0.00	0.29	-0.02	0.24	0.34	-0.06
Ease of Use Construct						1.00	0.35	0.45	-0.17	0.49	0.55
Visibility Construct							1.00	0.29	0.02	0.43	0.28
Trialability Construct								1.00	-0.03	0.49	0.40
Safety Construct									1.00	-0.14	-0.15
Reliability Construct										1.00	0.28
Usability Construct											1.00

11.20 Appendix XX - Correlation Coefficients - Question 13 and Attitude Constructs

Variable	13 - Use computer-based guide	Voluntariness Construct	Relative Advantage Construct	Compatibility Construct	Image Construct	Ease of Use Construct	Visibility Construct	Trialability Construct	Safety Construct	Reliability Construct	Construct
13 - Use computer-based guide	1.00	0.12	0.62	0.61	0.23	0.55	0.38	0.44	-0.11	0.52	0.27
Voluntariness Construct		1.00	-0.08	0.06	-0.13	0.35	0.14	0.28	0.01	0.11	0.21
Relative Advantage Construct			1.00	0.75	0.37	0.41	0.45	0.42	-0.07	0.62	0.30
Compatibility Construct				1.00	0.35	0.52	0.52	0.46	-0.12	0.69	0.31
Image Construct					1.00	0.00	0.29	-0.02	0.24	0.34	-0.06
Ease of Use Construct						1.00	0.35	0.45	-0.17	0.49	0.55
Visibility Construct							1.00	0.29	0.02	0.43	0.28
Trialability Construct								1.00	-0.03	0.49	0.40
Safety Construct									1.00	-0.14	-0.15
Reliability Construct										1.00	0.28
Usability Construct											1.00

11.21 Appendix XXI - Correlation Coefficients - Question 12 and All Attitude Constructs - Sorted in Descending Sequence

Table Item Number	Question Pair	Correlation Coefficient	Comment
1	Relative Advantage / Compatibility	0.75	
2	Compatibility / Reliability	0.69	
3	Relative Advantage / Reliability	0.62	
4	Ease of Use / Usability	0.55	
5	Compatibility / Ease of Use	0.52	
6	Compatibility / Visibility	0.52	
7	Ease of Use / Reliability	0.49	
8	Trialability / Reliability	0.49	
9	Compatibility / Trialability	0.46	
10	Relative Advantage / Visibility	0.45	
11	Ease of Use / Trialability	0.45	
12	Visibility / Reliability	0.43	
13	Relative Advantage / Trialability	0.42	
14	Relative Advantage / Ease of Use	0.41	
15	Trialability / Usability	0.40	
16	Relative Advantage / Image	0.37	
17	Voluntariness / Ease of Use	0.35	
18	Compatibility / Image	0.35	
19	Ease of Use / Visibility	0.35	
20	Image / Reliability	0.34	
21	Question 12 / Reliability	0.31	

Table Item Number	Question Pair	Correlation Coefficient	Comment
22	Compatibility / Usability	0.31	
23	Question 12 / Trialability	0.30	
24	Relative Advantage / Usability	0.30	
25	Question 12 / Compatibility	0.29	
26	Image / Visibility	0.29	
27	Visibility / Trialability	0.29	
28	Question 12 / Relative Advantage	0.28	
29	Question 12 / Ease of Use	0.28	
30	Voluntariness / Trialability	0.28	
31	Visibility / Usability	0.28	
32	Reliability / Usability	0.28	
33	Question 12 / Visibility	0.24	
34	Image / Safety	0.24	
35	Question 12 / Usability	0.23	
36	Voluntariness / Usability	0.21	
37	Question 12 / Voluntariness	0.19	
38	Question 12 / Image	0.16	
39	Voluntariness / Visibility	0.14	
40	Voluntariness / Reliability	0.11	
41	Voluntariness / Compatibility	0.06	
42	Question 12 / Safety	0.02	
43	Visibility / Safety	0.02	
44	Voluntariness / Safety	0.01	
45	Image / Ease of Use	0.00	

Table Item Number	Question Pair	Correlation Coefficient	Comment
46	Image / Trialability	-0.02	
47	Trialability / Safety	-0.03	
48	Image / Usability	-0.06	
49	Relative Advantage / Safety	-0.07	
50	Voluntariness / Relative Advantage	-0.08	
51	Compatibility / Safety	-0.12	
52	Voluntariness / Image	-0.13	
53	Safety / Reliability	-0.14	
54	Safety / Usability	-0.15	
55	Ease of Use / Safety	-0.17	

11.22 Appendix XXII - Correlation Coefficients - Question 13 and All Attitude Constructs - Sorted in Descending Sequence

Table Item Number	Question Pair	Correlation Coefficient	Question 12 Correlation Coefficient	Comment
1	Relative Advantage / Compatibility	0.75	0.75	
2	Compatibility / Reliability	0.69	0.69	
3	Question 13 / Relative Advantage	0.62	0.28	
4	Relative Advantage / Reliability	0.62	0.62	
5	Question 13 / Compatibility	0.61	0.29	
6	Question 13 / Ease of Use	0.55	0.28	
7	Ease of Use / Usability	0.55	0.55	
8	Question 13 / Reliability	0.52	0.31	
9	Compatibility / Ease of Use	0.52	0.52	
10	Compatibility / Visibility	0.52	0.52	
11	Ease of Use / Reliability	0.49	0.49	
12	Trialability / Reliability	0.49	0.49	
13	Compatibility / Trialability	0.46	0.46	
14	Relative Advantage / Visibility	0.45	0.45	
15	Ease of Use / Trialability	0.45	0.45	
16	Question 13 / Trialability	0.44	0.30	
17	Visibility / Reliability	0.43	0.43	
18	Relative Advantage / Trialability	0.42	0.42	
19	Relative Advantage / Ease of Use	0.41	0.41	
20	Trialability / Usability	0.40	0.40	
21	Question 13 / Visibility	0.38	0.24	
22	Relative Advantage / Image	0.37	0.37	
23	Voluntariness / Ease of Use	0.35	0.35	

Table Item Number	Question Pair	Correlation Coefficient	Question 12 Correlation Coefficient	Comment
24	Compatibility / Image	0.35	0.35	
25	Ease of Use / Visibility	0.35	0.35	
26	Image / Reliability	0.34	0.34	
27	Compatibility / Usability	0.31	0.31	
28	Relative Advantage / Usability	0.30	0.30	
29	Image / Visibility	0.29	0.29	
30	Visibility / Trialability	0.29	0.29	
31	Voluntariness / Trialability	0.28	0.28	
32	Visibility / Usability	0.28	0.28	
33	Reliability / Usability	0.28	0.28	
34	Question 13 / Usability	0.27	0.23	
35	Image / Safety	0.24	0.24	
36	Question 13 / Image	0.23	0.16	
37	Voluntariness / Usability	0.21	0.21	
38	Voluntariness / Visibility	0.14	0.14	
39	Question 13 / Voluntariness	0.12	0.19	
40	Voluntariness / Reliability	0.11	0.11	
41	Voluntariness / Compatibility	0.06	0.06	
42	Visibility / Safety	0.02	0.02	
43	Voluntariness / Safety	0.01	0.01	
44	Image / Ease of Use	0.00	0.00	
45	Image / Trialability	-0.02	-0.02	
46	Trialability / Safety	-0.03	-0.03	
47	Image / Usability	-0.06	-0.06	

Table Item Number	Question Pair	Correlation Coefficient	Question 12 Correlation Coefficient	Comment
48	Relative Advantage / Safety	-0.07	-0.07	
49	Voluntariness / Relative Advantage	-0.08	-0.08	
50	Question 13 / Safety	-0.11	0.02	
51	Compatibility / Safety	-0.12	-0.12	
52	Voluntariness / Image	-0.13	-0.13	
53	Safety / Reliability	-0.14	-0.14	
54	Safety / Usability	-0.15	-0.15	
55	Ease of Use / Safety	-0.17	-0.17	

11.23 Appendix XXIII - Correlation Coefficients - Question 13 Only and Attitude Constructs - Sorted in Descending Sequence

Table Item Number	Construct	Correlation Coefficient	Comment
1	Relative Advantage	0.62	
2	Compatibility	0.61	
3	Ease of Use	0.55	
4	Reliability	0.52	
5	Trialability	0.44	
6	Visibility	0.38	
7	Usability	0.27	
8	Image	0.23	
9	Voluntariness	0.12	
10	Safety	-0.11	

11.24 Appendix XXIV - Correlation Coefficients - Question 13 and Constructs Including Extended Constructs

	13 - Use computer-based guide	Voluntariness Construct	Relative Advantage Construct	Compatibility Construct	Image Construct	Visibility Construct	Trialability Construct	Safety Construct	Reliability Construct	Usability Construct	Internet Use Construct
13 - Use computer-based guide	1.00	0.12	0.62	0.61	0.23	0.38	0.44	-0.11	0.52	0.51	0.40
Voluntariness Construct		1.00	-0.08	0.06	-0.13	0.14	0.28	0.01	0.11	0.34	0.12
Relative Advantage Construct			1.00	0.75	0.37	0.45	0.42	-0.07	0.62	0.42	0.28
Compatibility Construct				1.00	0.35	0.52	0.46	-0.12	0.68	0.50	0.38
Image Construct					1.00	0.29	-0.02	0.24	0.34	-0.03	0.03
Visibility Construct						1.00	0.29	0.02	0.43	0.37	0.31
Trialability Construct							1.00	-0.03	0.49	0.49	0.22
Safety Construct								1.00	-0.14	-0.18	0.00
Reliability Construct									1.00	0.47	0.25
Usability Construct										1.00	0.32
Internet Use Construct											1.00

11.25 Appendix XXV- Correlation Coefficients - Constructs without Question 13

Construct:	Relative Advantage	Compatibility	Reliability	Usability	Trialability	Visibility	Image	Vountariness	Safety
Relative Advantage	1.000	0.749	0.624	0.299	0.418	0.450	0.368	-0.075	-0.071
Compatibility		1.000	0.685	0.306	0.459	0.521	0.352	0.064	-0.118
Reliability			1.000	0.276	0.487	0.426	0.337	0.105	-0.142
Usability				1.000	0.404	0.275	-0.063	0.213	-0.146
Trialability					1.000	0.289	-0.023	0.285	-0.028
Visibility						1.000	0.291	0.142	0.025
Image							1.000	-0.126	0.244
Voluntariness									0.013
Safety									1.000

11.26 Appendix XXVI - Nine-Construct Regression Model Summary, ANOVA, and Coefficients

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.70
R Square	0.49
Adjusted R Square	0.46
Standard Error	1.98
Observations	167

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	9	599.51	66.61	17.00	0.0000000
Residual	157	615.03	3.92		
Total	166	1214.54			

Regression Coefficients

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.17	0.82	0.20	0.84	-1.45	1.79
Relative Advantage	0.41	0.12	3.55	0.00	0.18	0.64
Compatibility	0.20	0.11	1.74	0.08	-0.03	0.42
Reliability	0.03	0.10	0.30	0.77	-0.16	0.22
Usability	0.27	0.10	2.65	0.01	0.07	0.46
Trialability	0.10	0.08	1.29	0.20	-0.05	0.26
Visibility	0.01	0.09	0.10	0.92	-0.16	0.18
Image	0.08	0.10	0.78	0.44	-0.12	0.28
Voluntariness	0.04	0.07	0.59	0.56	-0.10	0.19
Safety	-0.05	0.09	-0.62	0.54	-0.22	0.12

Source: Calculated with Microsoft Excel 2002

11.27 Appendix XXVII - Three-Construct Regression Model Summary, ANOVA, and Coefficients

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.70
R Square	0.49
Adjusted R Square	0.48
Standard Error	1.92
Observations	164

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	562.02	187.34	50.57	0.00
Residual	160	592.77	3.70		
Total	163	1154.80			

Regression Coefficients

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.71	0.56	1.26	0.21	-0.40	1.82
Relative Advantage	0.44	0.11	4.05	0.00	0.22	0.65
Compatibility	0.26	0.10	2.53	0.01	0.06	0.46
Usability	0.32	0.08	3.72	0.00	0.15	0.48

Source: Calculated with Microsoft Excel 2002

11.28 Appendix XXVIII - Addition of Variables by Stepwise Regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.634[a]	.402	.398	2.05726
2	.683[b]	.466	.460	1.94985
3	.698[c]	.487	.478	1.91718

a. Predictors: (Constant), Relative Advantage Construct

b. Predictors: (Constant), Relative Advantage Construct, Usability Construct

c. Predictors: (Constant), Relative Advantage Construct, Usability Construct, Compatability Construct

ANOVA[d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	449.891	1	449.891	106.299	.000[a]
	Residual	668.703	158	4.232		
	Total	1118.594	159			
2	Regression	521.691	2	260.846	68.609	.000[b]
	Residual	596.902	157	3.802		
	Total	1118.594	159			
3	Regression	545.205	3	181.735	49.444	.000[c]
	Residual	573.389	156	3.676		
	Total	1118.594	159			

a. Predictors: (Constant), Relative Advantage Construct

b. Predictors: (Constant), Relative Advantage Construct, Usability Construct

c. Predictors: (Constant), Relative Advantage Construct, Usability Construct, Compatability Construct

d. Dependent Variable: 13 - Use computer-based guide

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.651	.399		6.645	.000
	Relative Advantage Construct	.779	.076	.634	10.310	.000
2	(Constant)	.738	.580		1.272	.205
	Relative Advantage Construct	.643	.078	.523	8.218	.000
	Usability Construct	.363	.084	.277	4.346	.000
3	(Constant)	.752	.571		1.317	.190
	Relative Advantage Construct	.450	.108	.366	4.161	.000
	Usability Construct	.305	.085	.232	3.574	.000
	Compatability Construct	.260	.103	.230	2.529	.012

a. Dependent Variable: 13 - Use computer-based guide

Source: SPSS for Windows Student Version

11.29 Appendix XXIX - Removal of Variables by Backward Elimination

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.705[a]	.497	.466	1.93734
2	.705[b]	.497	.470	1.93101
3	.705[c]	.497	.473	1.92477
4	.704[d]	.496	.476	1.91926
5	.704[e]	.496	.479	1.91363
6	.704[f]	.495	.482	1.90845
7	.698[g]	.487	.478	1.91718

a. Predictors: (Constant), Safety Construct, Visibility Construct, Vountariness Construct, Trialability Construct, Image Construct, Usability Construct, Relative Advantage Construct, Reliability Construct, Compatability Construct

b. Predictors: (Constant), Safety Construct, Vountariness Construct, Trialability Construct, Image Construct, Usability Construct, Relative Advantage Construct, Reliability Construct, Compatability Construct

c. Predictors: (Constant), Safety Construct, Vountariness Construct, Trialability Construct, Image Construct, Usability Construct, Relative Advantage Construct, Compatability Construct

d. Predictors: (Constant), Safety Construct, Vountariness Construct, Trialability Construct, Usability Construct, Relative Advantage Construct, Compatability Construct

e. Predictors: (Constant), Vountariness Construct, Trialability Construct, Usability Construct, Relative Advantage Construct, Compatability Construct

f. Predictors: (Constant), Trialability Construct, Usability Construct, Relative Advantage Construct, Compatability Construct

g. Predictors: (Constant), Usability Construct, Relative Advantage Construct, Compatability Construct

ANOVA[h]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	555.601	9	61.733	16.448	.000[a]
	Residual	562.992	150	3.753		
	Total	1118.594	159			
2	Regression	555.543	8	69.443	18.623	.000[b]
	Residual	563.051	151	3.729		
	Total	1118.594	159			
3	Regression	555.471	7	79.353	21.419	.000[c]
	Residual	563.123	152	3.705		
	Total	1118.594	159			
4	Regression	555.010	6	92.502	25.112	.000[d]
	Residual	563.583	153	3.684		
	Total	1118.594	159			
5	Regression	554.650	5	110.930	30.292	.000[e]
	Residual	563.944	154	3.662		
	Total	1118.594	159			
6	Regression	554.058	4	138.515	38.031	.000[f]
	Residual	564.536	155	3.642		
	Total	1118.594	159			
7	Regression	545.205	3	181.735	49.444	.000[g]
	Residual	573.389	156	3.676		
	Total	1118.594	159			

a. Predictors: (Constant), Safety Construct, Visibility Construct, Vountariness Construct, Trialability Construct, Image Construct, Usability Construct, Relative Advantage Construct, Reliability Construct, Compatability Construct

b. Predictors: (Constant), Safety Construct, Vountariness Construct, Trialability Construct, Image Construct, Usability Construct, Relative Advantage Construct, Reliability Construct, Compatability Construct

c. Predictors: (Constant), Safety Construct, Vountariness Construct, Trialability Construct, Image Construct, Usability Construct, Relative Advantage Construct, Compatability Construct

d. Predictors: (Constant), Safety Construct, Vountariness Construct, Trialability Construct, Usability Construct, Relative Advantage Construct, Compatability Construct

e. Predictors: (Constant), Vountariness Construct, Trialability Construct, Usability Construct, Relative Advantage Construct, Compatability Construct

f. Predictors: (Constant), Trialability Construct, Usability Construct, Relative Advantage Construct, Compatability Construct

g. Predictors: (Constant), Usability Construct, Relative Advantage Construct, Compatability Construct

h. Dependent Variable: 13 - Use computer-based guide

Source: SPSS for Windows Student Version

11.30 Appendix XXX - Test of Equal Variance Assumption

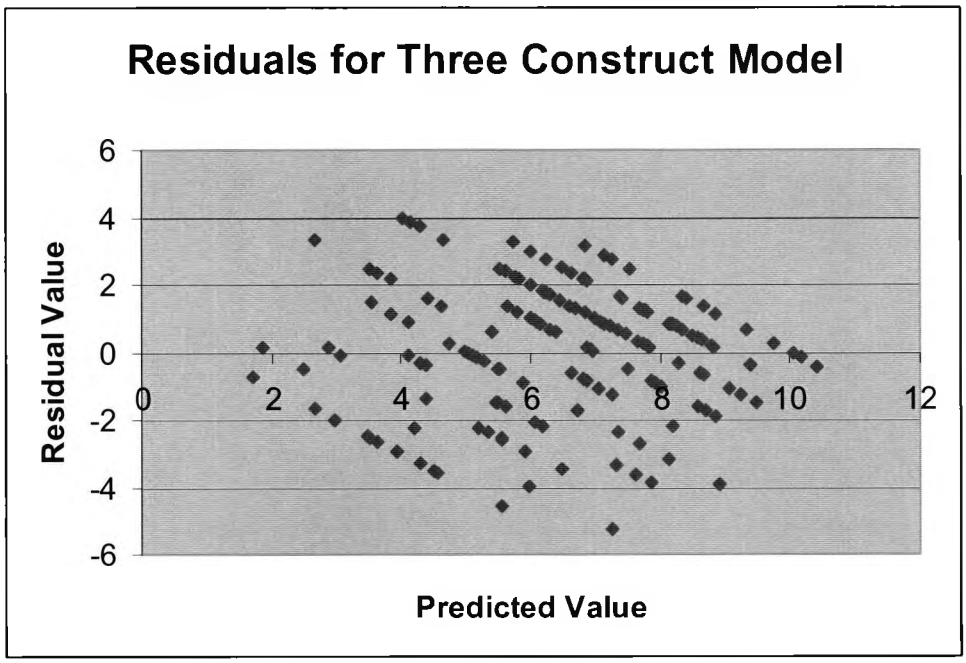
Hypothesis Test about a Population Mean Using the Standard Normal Distribution (z)

Sample Size	164
Mean	-4.92831E-16
Standard Deviation	1.9070
Hypothesized value	0
Standard Error	0.1489
Test Statistic	0.0000
***p*-value (Lower Tail)**	0.5000
***p*-value (Upper Tail)**	0.5000
***p*-value (Two Tail)**	1.0000

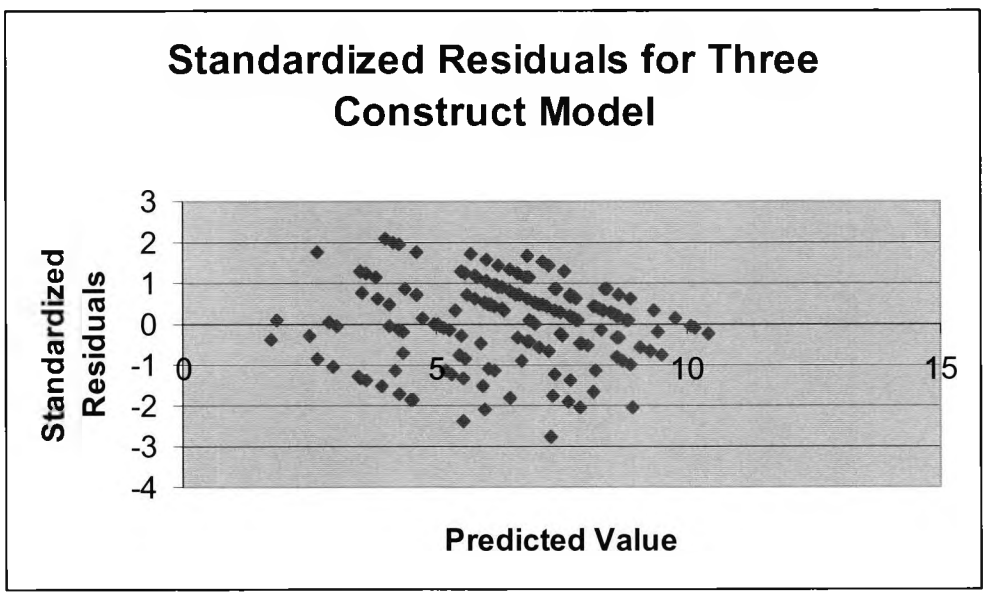
Source: Microsoft Excel 2002

11.31 Appendix XXXI - Scatter Diagrams of Residuals

11.31.1 Scatter Diagram Residuals for the Three Construct Model



11.31.2 Scatter Diagram of Standardized Residuals



Source: Microsoft Excel 2000

11.32 Appendix XXXII - Independence of Variables - Analysis of Multicollinearity

Correlation Coefficients with Question 13 Included

	Question 13	*Relative Advantage*	*Compatibility*	*Usability*
Question 13	1			
Relative Advantage	0.63	1		
Compatibility	0.62	0.76	1	
Usability	0.50	0`.41	0.47	1

MULTIPLE REGRESSION COEFFICIENTS

	Coefficients	Standard Error	t Stat	P-value	VIF*
Intercept	0.71	0.56	1.26	0.21	
Relative Advantage	0.44	0.11	4.05	0.00	2.42
Compatibility	0.26	0.10	2.53	0.01	2.59
Usability	0.32	0.08	3.72	0.00	1.30

* Variance Inflation Factor

Source: Microsoft Excel 2000

11.33 Appendix XXXIII - State of Tennessee "Weigh Your Options" Worksheet - 2002

Weigh Your Options					
Benefit	**PPO OPTION**		**POS OPTION**		**HMO Option**
	In-Network	**Out-of-Network**	**In-Plan**	**Out-of-Plan ****	
Annual Deductible *	$250 per individual; $625 family *		None	$300 per individual; $750 family	None
Pre-Existing Condition Requirement	6 months if no immediate prior coverage		6 months if no immediate prior coverage		None
Physician Office Visit	90% of MAC	70% of MAC	$15 copay per PCP or specialist visit	70% of MAC after deductible	$10 per visit PCP; $15 per visit specialist
Hospital Care	90% of MAC	70% of MAC	$100 copay per admission	$300 copay then 70% per diem after deductible	$100 per admission
Prescription Drugs ***	$5 for generic; $15 preferred brand; $25 non-preferred brand ***	$5 for generic; $15 preferred brand; $25 non-preferred brand + MAC ***	$5 copay generic: $15 copay brand ***	70% of MAC after deductible	$5 copay generic; $15 copay brand ***
Maternity	90% of MAC	70% of MAC	$15 copay per visit, $195 maximum $100 copay per hospital admission	$300 copay then 70% per diem after deductible	$10 visit OB, first visit only; $15 visit specialist; $100 admission hospital
Preventive Health Assessment	Immunisations covered up to age 6 90% of MAC	Immunisations covered up to age 6 70% of MAC	100% benefit (maximum of 12 child immunisations through age 6)	Not covered	$10 per visit PCP; $15 visit specialist; immunisations covered up to age 17
Emergency Care	$25 copay (waived if admitted) 90% of MAC	$25 copay (waived if admitted) 70% of MAC	$50 copay per visit per visit (waived if admitted)	$50 copay per visit then 70% of MAC after deductible (copay waived if admitted)	$50 copay per visit (waived if admitted)
Vision Care	90% of MAC (limitations apply)	70% of MAC (limitations apply)	$15 copay if referred; Limited to one physician visit per year	Not covered	$10 per visit PCP (limitations apply); $15 per visit specialist (limitations apply)
Chiropractic Care	90% of MAC Maintenance visits not covered	70% of MAC Maintenance visits not covered	$15 copay if referred and pre-approved by POS Medical Director (Middle and West only, POS East does not have this benefit)	70% of MAC after deductible if referred and pre-approved by POS Medical Director (Middle and West only, POS East does not have this benefit)	Not covered
Ambulance Service - Air & Ground	80% of charges for air; 80% of charges for ground		100% of reasonable charges when deemed medically necessary by POS		100% of reasonable charges when deemed medically necessary by HMO
Lab and X-Ray	90% of MAC	70% of MAC	100% benefit	70% of MAC after deductible	100% benefit

Weigh Your Options					
Benefit	**PPO OPTION**		**POS OPTION**		**HMO Option**
	In-Network	**Out-of-Network**	**In-Plan**	**Out-of-Plan ****	
Physical, Speech & Occupational Therapy	80% of reasonable charge (limitations apply)		$15 copay per visit; Limited to 45 visits per year for any one condition	70% of MAC; Limited to 45 visits per year for any one condition after deductible	$10 per visit; Limited to the 60-day period from the date therapy begins for any one condition
Mental Health Inpatient *	90% if referred; Limited to 45 days per year	70% if self-referred; Limited to 45 days per year	$100 copay per admission; Limited to 30 days per year	Not covered	$100 copay per admission; Limited to 30 days per year
Substance Abuse Inpatient *	90% if referred; Limited to two 5-day detox stays per lifetime: plus two 28-day lifetime stays	70% if self-referred; Limited to two 5-day detox stays per lifetime; plus two 28-day lifetime stays	$100 copay per admission; Limited to two 5-day detox stays per lifetime; plus two 28-day lifetime stays	Not covered	$100 copay per admission; Limited to two 5-day detox stays per lifetime; plus one 28-day lifetime stay
Mental Heath / Substance Abuse Outpatient *	Referred: 1–15: $5 copay/session 16-45: $25 copay/session	Self-Referred: 1–15: $20 copay/session 16-45: $50 copay/session	$15 copay per session; Limited to 45 sessions Mental Health and Substance Abuse combined, must be preauthorised	Not covered	$15 copay per session; Limited to 45 sessions Mental Health and Substance Abuse combined, must be preauthorised
Annual Out-of-Pocket Maximums(excludes mental health & substance abuse)	$1,250 per individual; $2,500 family	$3,750 per individual; $7,500 family	None		None
Annual Pharmacy Copay Maximum	$720 per individual ***		None		None

MAC - Maximum Allowable Charge

*Separate $ 150 deductible for mental health/substance abuse care required under the PPO, POS and PPO mental health and substance abuse benefits must be pre-authorized and referred by United Behavioral Health to be reimbursable at the highest level

** Out-of-plan refers to services received in the POS network without a PCP referral and for services received outside the POS network which are reimbursed at lower benefits levels. Copayments to not apply toward the required deductible.

*** Does not apply to annual deductible or the annual out-of-pocket, if applicable. If cost of prescription is less than the copay, the lesser amount will apply.

Source: State of Tennessee; "Weigh Your Options": 2002 Medical Options Comparison; Document No. 317277

11.34 Appendix XXXIV - Sample PDSS Feature Comparison Matrix

Functional Attribute *	Plan 1	Plan 2	Plan 3	Plan 4
PDSS Name	State of TN	Medicare	Selected Blue Cross / Blue Shield Plans	CNNMoney - Money Magazine
	Weigh Your Options	Personal Plan Finder	My Health Plan Advisor	Health Plan Navigator
Demographic Factors				
Geographic Area		Y		
Age or Age Range		Y	Y	
Gender		Y	Y	
Military Retiree		Y		
Veteran		Y		
Summary - Demographic Factors	0	5	2	0
Underwriting Factors				
Covered by Medicare Parts A & B		Y		
Permanent Kidney Failure		Y		
General Health		Y		
Spousal or family coverage		Y	Y	
Marital Status		Y		
Income Level		Y	Y	
Financial Resources		Y		
Current health insurance coverage		Y	Y	
Summary - Underwriting Factors	0	8	3	0
Financial Factors				

Functional Attribute *	Plan 1	Plan 2	Plan 3	Plan 4
PDSS Name	State of TN	Medicare	Selected Blue Cross / Blue Shield Plans	CNNMoney - Money Magazine
	Weigh Your Options	Personal Plan Finder	My Health Plan Advisor	Health Plan Navigator
Monthly Premium		Y		
Annual Deductible	Y			
Annual Out-of-Pocket Maximums	Y			
Annual Pharmacy Copay Maximum	Y			
Maximum lifetime coverage				Y
Summary - Financial Factors	3	1	0	1
Coverage Information				
Pre-Existing Condition Requirement	Y	Y		Y
Physician Office Visit	Y	Y		
Hospital Care	Y	Y		
Prescription Drugs	Y	Y		Y
Maternity	Y			
Emergency Care	Y	Y		
Vision Care	Y	Y		Y
Hearing Services		Y		
Chiropractic Care	Y	Y		
Ambulance Service – Air & Ground	Y	Y		
Lab and X-Ray	Y	Y		Y
Physical, Speech & Occupational Therapy	Y	Y		Y

Functional Attribute *	Plan 1	Plan 2	Plan 3	Plan 4
PDSS Name	State of TN	Medicare	Selected Blue Cross / Blue Shield Plans	CNNMoney - Money Magazine
	Weigh Your Options	Personal Plan Finder	My Health Plan Advisor	Health Plan Navigator
Mental Health Inpatient	Y			Y
Substance Abuse Inpatient	Y			Y
Mental Health / Substance Abuse Outpatient	Y			Y
Routine Physical Exams		Y		Y
Dental Services		Y		
Skilled Nursing Coverage		Y		
Home Health Care		Y		
Hospice		Y		
Podiatry Services		Y		
Outpatient Surgery		Y		
Urgently Needed Care		Y		
Durable Medical Equipment		Y		
Prosthetic Devices		Y		
Diabetes		Y		
Radiation Therapy		Y		
Alternative Care				Y
Extended Care				Y
Family Planning				Y
Home Health Care				Y
Hospice care				Y
Infertility				Y

Functional Attribute *	Plan 1	Plan 2	Plan 3	Plan 4
PDSS Name	State of TN	Medicare	Selected Blue Cross / Blue Shield Plans	CNNMoney - Money Magazine
	Weigh Your Options	Personal Plan Finder	My Health Plan Advisor	Health Plan Navigator
Pre-existing conditions				Y
Surgery / hospitalisation				Y
Wellness programs			Y	Y
Hearing Services		Y		
Summary - Coverage Information	14	23	1	18
Preventive Services				
Preventive Health Assessment	Y			
Bone Mass Measurement		Y		
Colorectal Screening Exams		Y		
Immunisations		Y		
Mammography		Y		Y
Pap Smears and Pelvic Exams		Y		
Prostate Cancer Screening Exams		Y		
Summary - Preventive Services	0	6	0	1
Preference Factors				
Doctor / Hospital Choice		Y	Y	

Functional Attribute *	Plan 1	Plan 2	Plan 3	Plan 4
PDSS Name	State of TN	Medicare	Selected Blue Cross / Blue Shield Plans	CNNMoney - Money Magazine
	Weigh Your Options	Personal Plan Finder	My Health Plan Advisor	Health Plan Navigator
Out-of-Network care			Y	
Physician participation			Y	
Most care from local doctor			Y	
Willing to accept coordination of access to medical specialists			Y	
Cost identification / control			Y	
Emphasis on low costs			Y	
Emphasis on flexibility			Y	
Frequent travel			Y	
Willing to do additional paperwork			Y	
Summary - Preference Factors	0	1	10	0
Additional Information				
Contact Information for more information		Y		
Want info on health care cost control?		Y		
Identification of different available plans		Y		
Request for more plan specific information		Y		

Functional Attribute *	Plan 1	Plan 2	Plan 3	Plan 4
PDSS Name	State of TN	Medicare	Selected Blue Cross / Blue Shield Plans	CNNMoney - Money Magazine
	Weigh Your Options	Personal Plan Finder	My Health Plan Advisor	Health Plan Navigator
Summary - Additional Information	0	4	0	0

Functional Attribute *	Plan 1	Plan 2	Plan 3	Plan 4
PDSS Name	State of TN	Medicare	Selected Blue Cross / Blue Shield Plans	CNNMoney - Money Magazine
	Weigh Your Options	Personal Plan Finder	My Health Plan Advisor	Health Plan Navigator
Summary Information				
Demographic Factors	0 of 5 items	5 of 5 items	2 of 5 items	0 of 5 items
Underwriting Factors	0 of 8 items	8 of 8 items	3 of 8 items	0 of 8 items
Financial Factors	3 of 5 items	1 of 5 items	0 of 5 items	1 of 5 items
Coverage Information	14 of 36 items	23 of 36 items	1 of 36 items	18 of 36 items
Preventive Services	0 of 7 items	6 of 7 items	0 of 7 items	1 of 7 items
Preference Factors	0 of 10 items	1 of 10 items	10 of 10 items	0 of 10 items
Additional Information	0 of 4 items	4 of 4 items	0 of 4 items	0 of 4 items

* "Y" indicates only that the PDSS addresses this topic. It is not an indication of any specific coverage by a plan.

11.35 Appendix XXXV - PDSS Stakeholder Questionnaire Worksheet

Date:

Telephone / In Person:

Stake-Holder Category:

Name:

Organisation:

Telephone Number:

E-Mail Address:

Primary Services of Organisation

General Impression of such a Decision System

Advantages to Your Organisation

Disadvantages to Your Organisation

If used, who should provide such a Decision System service?

Comments

Interviewer Comments

Rate Importance of Attribute (Influences that would encourage use of the system)

Use scale of 1 to 10

1 = not very important 10 = Very Important

Construct	Rating
Relative Advantage	
Compatibility	
Reliability	
Usability	
Trialability	
Internet Use	
Visibility	
Image	
Voluntariness	
Safety	

Conducted by: _____

11.36 Appendix XXXVI - Attribute Definitions

Construct	Description
Relative Advantage	Provides an identifiable advantage over other methods of selection of health care insurance.
Compatibility	Use would be compatible with my style of decision process and work.
Reliability	The system will provide consistent results and be available when I choose to use the system.
Usability	I would find the system reasonably easy to use.
Trialability	I would expect an opportunity to test or try the system before making an actual decision.
Internet Use	Previous Internet Use would be a good measure of my ability to use the system.
Visibility	Knowing other people who use such a system would influence me to use the system.
Image	The prestige and image of people using such a system would influence me to use the system.
Voluntariness	The use of such a system should be completely voluntary with no requirement to use the system.
Safety	Use of the system should not cause me financial or health damage.

11.37 Appendix XXXVII - Stakeholder Response Recap Report

Stakeholder Response Recap Report

Type Description	Relative Advantage	Compatibility	Reliability	Usability	Trialability	Internet Use	Visibility	Image	Voluntariness	Safety
Hospital	5	7	10	10	9	9	5	1	8	10

Primary Services Regional, locally owned hospital. Provides secondary level of hospital care for several local clinics and smaller community hospitals.
General Impression May be used by Human Resources. Might be used by H.R. to survey employees to assist in needs
Advantages Software of a similar nature is currently used to check on plan benefits for patients in some cases.
Disadvantages No universal number (identifier) available to access individual's information.
Provider? Insurance company.

Insurance Agent	8	8	10	10	8	5	5	5	7	10

Primary Services Insurance sales agency.
General Impression Would not want to do that. Most employees would expect the employer to offer a specific option or package.
Advantages Yes, ability to offer choice more rapidly.
Disadvantages User may not trust the program.
Provider? Agents / underwriting company

Insurance Agent	2	2	5	5	10	10	9	5	10	10

Primary Services Insurance Product Sales - Multiple lines (types) of insurance coverage
General Impression My impression would be "dynamic." More favorable today that it would have been a year ago.
Advantages Processing - speed and ease of processing.
Disadvantages Handling isses on "Problem Day." When there is a problem, especially regarding issue of coverage or who made the offer of coverage, this may be hard to resolve. The system may not adequately deal with the compexites of this business.
Provider? "place of trust" - the employer.

Type Description	Relative Advantage	Compatibility	Reliability	Usability	Trialability	Internet Use	Visibility	Image	Voluntariness	Safety
Insurance Carrier	7	6	9	9	10	7	5	2	9	10

Primary Services Insurance underwriting company. More emphasis to lines to life, homeowners and other lines of business other that health insurance. However some health coverage is provided, especially for military and military retiree

General Impression Some people would use such a system, especially those people with larger organizations that offer several options of coverage. People generally do not understand insurance and how the sharing of risk and risk pools impacts coverage and costs. People often find it hard to make an informed decision in this area and the educational process of the proposed type of system may have value.

Advantages Possible advantages to the company but seem to be limited because of the emphasis of the company on other lines of business.

Disadvantages Resources necessary to keep the system up to data. Problems of systems maintenance.

Provider? Benefits department.

Insurance Carrier	4	5	5	5	5	3	3	3	2	5

Primary Services Health insurance carrier or underwriting company.

General Impression Most people likely will not use the system. Most people do not like to read. They will prefer an example.

Advantages May in some cases assist the agent in the sales process. Such a system may have potential as a training tool for agents.

Disadvantages No

Provider? Not clearly identified. Suggested the insurance agent.

Medical Practice	5	5	9	8	10	7	5	5	10	10

Primary Services Orthopedic practice. Currently has eight physicians, expect to expand to ten physicians soon.

General Impression Compared to retirement plan selection tools. Suggested that may be relevant as new types of coverage evolve in the market. Suggested the more insurance expertise would increase probability the individual would use the

Advantages Patient may develop a better understanding of actual costs. May make "cheap" plans look less attractive. May encourage more emphasis on true value of plan to a particular individual. May, in some cases, encourage switching of plans or physicians.

Disadvantages May result in lower reimbursement to the medical practice. May result in higher out-of-pocket expenses for some individuals. May, in some cases, encourage switching of plans or physicians.

Provider? Some type of "Patient Advocate." Insurance Commissioner / Consumer Advocate?

Type Description	Relative Advantage	Compatibility	Reliability	Usability	Trialability	Internet Use	Visibility	Image	Voluntariness	Safety
Medical Practice	7	8	8	10	5	9	8	3	10	1

Primary Services Skilled Nursing Care
General Impression Great idea. Might help user understand coverage better.
Advantages Huge payoff. Save time, answer unasked questions about coverage. Should provided printed material to take home and discuss and explain to family.
Disadvantages No major disadvantages identified. Might in some unusual cases encourage misuse of insurance.
Provider? Employer

Physician Primary Care	5	8	10	8	4	6	5	3	8	9

Primary Services Provide general family and personal medical practice as part of a multi-physician practice.
General Impression The users would have to be sophisticated enough to understand their health insurance. They would also require an adequate level of computer expertise.
Advantages People would have more information available. They should be able to determine which physicians are participating in a particular health plan.
Disadvantages May encourage people to consider only cost when making a choice.
Provider? Insurance company or third party.

Physician Primary Care	8	7	9	9	9	5	7	7	8	10

Primary Services Medical practice in family medicine. Practice includes six physicians and serves as primary care physician.
General Impression Should list physicians in area participating in a particular plan. Should provide information on subjects such as co-pay, whether referrals must be by the primary care physician or may be self-referral.
Advantages Provide information about services available from the practice.
Disadvantages May lead to direct price competition or "price wars" between local practices.
Provider? Employer

Physician Referral	10	10	10	10	10	10	10	9	9	10

Primary Services Provides radiologic services to local hospital and medical community.
General Impression Yes, believe that people would be likely to use such a systems.
Advantages No particular advantages.
Disadvantages No
Provider? Independent service

Type Description	Relative Advantage	Compatibility	Reliability	Usability	Trialability	Internet Use	Visibility	Image	Voluntariness	Safety
Physician Referral	8	10	8	9	9	5	10	3	7	10

Primary Services Provides anesthesiology services at local hospital.
General Impression What about computer literacy?
Advantages No
Disadvantages No - if information is presented in a non-biased manner.
Provider? Employeer - HR department.

Software Developer	10	10	10	7	3	8	10	10	8	10

Primary Services Software developer of applications for various types of local government agencies. Develops a wide variety of government systems for many types of agencies but does not specalize in insurance applications.
General Impression Don't know. My company only offers one type of coverage and I am not certain about this.
Advantages No
Disadvantages No
Provider? Employer

Software Developer	7	8	10	8	9	6	5	5	8	10

Primary Services Developer of applications software for insurance agencies.
General Impression Yes, we have just renewed our insurance and had to devote significant effort to assisting our employees. Rates go up every year and often people with good health and little demand for health care services feel as if they are paying to support other people with more need for health care services.
Advantages Possible. Could possibly be a new product or service to offer to our customers. However most the work that our company does work is based on lines of coverage other than health.
Disadvantages None
Provider? Third party

11.38 Appendix XXXVIII - Stakeholder Survey Form

Stakeholder Survey Response Form

Please be certain to click on the "Submit Form" button at either the top or the bottom of the form when you have completed the survey.

Tell me more about the Study and Stakeholders

Submit Form | Reset Form

The following questions are for basic demographic and survey control information.

1. ***Survey* Control Number.** For survey control only. No data will be published so as to be individually identifiable.

2. **Gender.** 'F' - female, 'M' male, or blank

3. **Age.**

The following questions ask for your opinion about stakeholder categories.

For the following questions please indicate whether you feel the profession or occupational area indicated should be considered as a Primary Stakeholder (Respond with P) or a Secondary Stakeholder (Respond with S).

Primary Stakeholders (P) - a financial or direct impact within 12 months or less from use of such an information system.

Secondary Stakeholders (S) - a **financial** or direct impact more than 12 months from use of such an information system

4. **Hospital Administrator - Hospital System.**

P - Primary Stakeholder S - Secondary Stakeholder X - Not a stakeholder

5. **Consumer Advocate.** Such as a state consumer advocate agency.

   P - Primary Stakeholder S - Secondary Stakeholder X - Not a stakeholder

6. **Insurance Carrier or Underwriter.**

   P - Primary Stakeholder S - Secondary Stakeholder X - Not a stakeholder

7. **Human Resource or Personnel Office Representative.**

   P - Primary Stakeholder S - Secondary Stakeholder X - Not a stakeholder

8. **Health System Planner.** Such as a public health agency or government insurance program (such as TennCare) planner.

   P - Primary Stakeholder S - Secondary Stakeholder X - Not a stakeholder

9. **Primary Care Physician.**

   P - Primary Stakeholder S - Secondary Stakeholder X - Not a stakeholder

10. **Special Interest Group.** Such as the American Red Cross or the American Diabetes Association.

    P - Primary Stakeholder S - Secondary Stakeholder X - Not a stakeholder

11. **Software Developer.** A software developer specializing in health care software.

    P - Primary Stakeholder S - Secondary Stakeholder X - Not a stakeholder

12. **Employee Representative.** Examples would include trade union representatives or members of a special employee contract negotiation committee representing an employee group.

    P - Primary Stakeholder S - Secondary Stakeholder X - Not a stakeholder

13. **Hospital Administrator - Local hospital.**

    P - Primary Stakeholder S - Secondary Stakeholder X - Not a stakeholder

14. **Medical Practice Administrator.** An administrator of a medical practice such as an administrator of a multi-physician practice.

    P - Primary Stakeholder S - Secondary Stakeholder X - Not a stakeholder

15. **Insurance Agent.**

P - Primary Stakeholder S - Secondary Stakeholder X - Not a stakeholder

16. **Referral or Specialty Physician.** Examples might be an Orthopedic Surgeon or a Cardiologist. Consider specialties to whom you may be referred by a Primary Care Physician.

P - Primary Stakeholder S - Secondary Stakeholder X - Not a stakeholder

17. **Comments.**

Submit Form | Reset Form

Thank you for your response and assistance.

For further information please contact: murchison@columbiastate.edu
Revised: 04/30/03

11.39 Appendix XXXIX - Stakeholder Group Identification Survey - Further Information Page

Stakeholder Group Identification Survey Further Information

Return to Stakeholder Survey Form

This page includes brief discussions of the following topics:

- The Study in General
- Concept of a Stakeholder
- Primary or Secondary Stakeholders
- Sample Response
- Privacy of Respondents

The Study in General.

The purpose of this study is to investigate requirements for a Personal Decision Support System that might be used by individuals to choose among various health care financing alternatives. For many employed persons in the United States, this type of choice is represented by an annual choice among health insurance programs offered by the employer. Automated or computer supported systems for such purposes do not appear to be in common use at this time. However, with the increased use of personal computers and the Internet, use of this type of system may become more common in the future.

As part of this study an effort is being made to identify professions or occupational specialties that may have a "stake" in the choices made or the use of such a system. You are being asked to help identify such "stake-holder" groups.

Concept of a Stakeholder.

The term "stakeholder" is used at times to describe a person who will be impacted by or have an interest in a decision or action. The term "stakeholder" often is not a "stockholder" in a corporation. For example, assume that an airline company is considering cancellation of several routes that they currently serve. The pilots that work for the company may have a "stake" in this decision even though they may not own stock in the company or be the one who is making the decision to cancel service on these routes.

Primary or Secondary Stakeholders.

This survey will be used to help identify professional or occupational specialties that may be considered to be a "stake-holder" group. Two different categories have been identified, Primary and Secondary. You are being asked to categorize certain occupational specialties into one of these categories. For the purposes of this study, the categories are being defined as:

Category	Description
Primary	Occupational specialties that will likely be financially impacted by the adoption and use of such an information system within 12 months or less after adoption of the system.
Secondary	Occupational specialties that will NOT likely be financially impacted by the adoption and use of such an information system or the impact will be more than 12 months after adoption of such a system.

Sample Response.

When you are asked to identify the type of stakeholder, please respond with a "P" for Primary or "S" for Secondary Stakeholder. If you feel this occupational specialty is not a stakeholder, enter an "X". A sample response indicating a Primary Stakeholder is shown below:

Hospital Administrator - Hospital System.

P - Primary Stakeholder S - Secondary Stakeholder X - Not a stakeholder

Privacy of Respondents.

All data collected in response to this survey will be treated as anonymous and will not be released in such a manner as to be associated with an individual respondent.

Return to Stakeholder Survey Form

11.40 Appendix XL - Stakeholder Survey Analysis - Preliminary Identification of Categories as Primary

Summary Counts - Proportions	Hospital Admin. Local	Hospital Admin. - System	Insurance Agent	Insurance Carrier	Medical Practice Admin.	Primary Care Physician	Referral Physician	Software Developer
Most selected category *	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Secondary
Counts								
Most Selected	35	42	20	37	27	40	31	24
Other Category	10	5	14	9	19	7	16	19
X - Not a stakeholder	7	5	7	6	6	5	5	9
N - Total Number of Responses	52	52	41	52	52	52	52	52
Not - Most Selected	17	10	21	15	25	12	21	28
* Highest number of responses								
Proportions								
Most Selected	0.6731	0.8077	0.4878	0.7115	0.5192	0.7692	0.5962	0.4615
Not - Most Selected	0.3269	0.1923	0.5122	0.2885	0.4808	0.2308	0.4038	0.5385
Sum of Proportions	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Summary of Statistical Test								
Proportion (p) of Ho	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Standard Deviation of p	0.0693	0.0693	0.0781	0.0693	0.0693	0.0693	0.0693	0.0693
Test Statistic (z value)	2.4962	4.4376	-0.1562	3.0509	0.2774	3.8829	1.3868	-0.5547

Summary Counts - Proportions	Hospital Admin. Local	Hospital Admin. - System	Insurance Agent	Insurance Carrier	Medical Practice Admin.	Primary Care Physician	Referral Physician	Software Developer
Alpha = .05 z value	1.6449	1.6449	1.6449	1.6449	1.6449	1.6449	1.6449	1.6449
Alpha = .10 z value	1.2816	1.2816	1.2816	1.2816	1.2816	1.2816	1.2816	1.2816
Conclusions								
Reject Ho for Alpha = .05	Yes	Yes	No	Yes	No	Yes	No	No
Reject Ho for Alpha = .10	Yes	Yes	No	Yes	No	Yes	Yes	No
P-Value for Normal Distribution	0.006277	0.000005	0.562052	0.001141	0.390756	0.000052	0.082759	0.710450

11.41 Appendix XLI - Stakeholder Survey Analysis - Preliminary Identification of Categories as Secondary

Summary Counts - Proportions	Health System Planner	Human Resource	Consumer Advocate	Special Interest Group	Employee Representative
Most selected category *	Primary	Primary	Secondary	Secondary	Primary
Counts					
Most Selected	27	27	28	29	23
Other Category	20	23	14	6	19
X - Not a stakeholder	5	2	10	17	10
N - Total Number of Responses	52	52	52	52	52
Not - Most Selected	25	25	24	23	29
* Highest number of responses					
Proportions					
Most Selected	0.5192	0.5192	0.5385	0.5577	0.4423
Not - Most Selected	0.4808	0.4808	0.4615	0.4423	0.5577
Sum of Proportions	1.0000	1.0000	1.0000	1.0000	1.0000

Summary of

Summary Counts - Proportions	Health System Planner	Human Resource	Consumer Advocate	Special Interest Group	Employee Representative
Statistical Test					
Proportion (p) of Ho	0.5	0.5	0.5	0.5	0.5
Standard Deviation of p	0.0693	0.0693	0.0693	0.0693	0.0693
Test Statistic (z value)	0.2774	0.2774	0.5547	0.8321	-0.8321
Alpha = .05 z value	1.6449	1.6449	1.6449	1.6449	1.6449
Alpha = .10 z value	1.2816	1.2816	1.2816	1.2816	1.2816
Conclusions					
Reject Ho for Alpha = .05	No	No	No	No	No
Reject Ho for Alpha = .10	No	No	No	No	No
P-Value for Normal Distribution	0.390756	0.390756	0.289550	0.202690	0.797310

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