FACTORS LEADING TO THE SUCCESS OF END USER COMPUTING

A Research Topic

Presented to Business Division

Beirut University College

In Partial Fulfillment

of the Requirements for the Degree

Master of Science in Business

Management

BY

MANAL M. YUNIS

JULY, 1990

BEIRUT UNIVERSITY COLLEGE

P.O. BOX 13 - 5053 / 154

BEIRUT, LEBANON

APPROVAL OF RESEARCH TOPIC

CANDIDATE : MANAL MUSTAFA YUNIS DATE : JULY, 1990

DEGREE : MASTER OF SCIENCE IN BUSINESS MANAGEMENT

ADVISOR : DR. TAREK MIKDASHI

TITLE OF RESEARCH TOPIC : FACTORS LEADING TO THE SUCCESS OF END USER COMPUTING

The following professors nominated to serve as the advisors of the above candidate have approved her research work.

ADVISORS

DR. TAREK MIKDASHI
NAME

[redacted]

SIGNATURE

DR. ABDEL-RAZZAK CHARBAGI
NAME

[redacted]

SIGNATURE

D E D I C A T I O N

To those who Inspired me
and I deeply love,

My father
My mother
and
Maggy

ACKNOWLEDGEMENT

I would like to express my deep appreciation to all those who cooperated in this undertaking.

I am particularly grateful to Dr. Tarek Mikdashi for his generous cooperation and continued guidance. I also extend my sincere appreciation to Dr. Abdul Razzak Charbaji for his big assistance in providing the sound remarks and advices. I extend special thanks to Dr. Nihad Pasha for his encouragement and assistance. Particular thanks are due to Dr. Hayfa Nabali for her guidance and support in seeing the research through to completion.

The timely preparation of the research would have been impossible without the valuable assistance and cooperation of all the assistants at the Business Computer Center. Many thanks are due to my friends Ali Jaafar, Khaled Sayyid, and Mahmoud Baitam, and particular thanks are dedicated to my friend Hani Chebaro who provided every possible assistance that could facilitate my work and expedite the production of this research.

My hope is that this effort will assist in furthering the studies aimed at improving the level of computer usage in the organizations operating in Lebanon and at investigating the factors that are most likely to play a critical role in achieving the success of end user computing.

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

Information is a vital ingredient to the success of management. The sharply reduced cost of computer technology and rapid improvements in the availability of software applications for business and of useful new technology in the telecommunications and office automation fields have created a very real opportunity to improve the effectiveness of corporate and non-profit management through improved use of information by management.

The corporate information processing environment is very dynamic in nature. Frequently, the introduction of new technologies or ideas can produce a profound impact on the work environment and behavior of the personnel involved. In the last few years, the technologies of end user computing have produced such an impact. The term **"End User Computing" (EUC)** is commonly used to refer to the direct use of computing technology by non-data processing experts. This is a

recent major development affecting the structure and design of the Management Information System function. Users are provided with the appropriate hardware and software for accessing data, developing models, and performing information processing directly. This development is a significant force for change in the way information resources are organized, provided, and used. In fact, the declining cost of computer technology, especially that of personal computers (PC's), and easy to use software have hastened the spread of end user computing to a broad range of knowledge workers from clerks to chief executive officers (CEOs). This means that the computer resource is no longer limited to a small group of computer specialists; rather current office automation and end-user computing trends are placing information technology in the hands of workers at all levels and in all functional areas.

End users include executives, managers professional staff, secretaries, office workers, salespeople and others. A subset of end user computing is end user programming. Here, end users create programs -sets of procedures or instructions- that are stored and used over and over. An example of end user programming could be building a spreadsheet

with Lotus 1-2-3 or VisiCalc. As end users become more adept at using computers directly, such types of computer "programming" will increase[1].

The Huge Growth Of End User Computing.

One of the most important aspects of end user computing is its rapid growth rate. It is the most rapidly growing segment of the information systems activity in many organizations[2]. This growth is usually attributed to the following five factors:

1. The Growing Familiarity With Computers.

Our daily lives abound with computer terms: Videotape machines are programmed days in advance to record television shows or plays; clocks and stereorecorders are digital; memory is available on electronic typewriters; and computerized games are widely available for youngsters.

Many people can now confidently control their video game systems without first attending a computer course. Secretaries move forward to sophisticated electronic typewriters with storage, switches, and more functions than they ever had available before.

---

[1]. Ralph H. Sprague & Barbara C. McNurlin, Information System Management In Practice, (New Jersey, Prentice-Hall, Inc., 1986) P. 285.

[2]. Ibid, p. 286

Retail store clerks use point-of-sale registers to complete simple transactions that affect various other sections of the informationsystem. In fact, the skill level necessary to operate a terminal or a microcomputer is no longer high and, consequently, more non-data processing personnel and non-computer experts are willing to consider using a computer to solve many of their business problems.

2. Exposure To Computers In Schools And Colleges.

College students began to get some exposure to computers many years ago, and as middle managers, they were more likely to become end users of computers. Today, most college students receive intensive hands-on training with computers by way of on-line terminals or microcomputers.In the coming decade more and more people will enter the middle management ranks will have had intensive hands-on computer training and most of them will probably make extensive use of end user computing in their jobs.

3. Theories Of Growth.

In a study titled "Managing The Four Stages Of EDP Growth",[3] Richard Nolan and Cyrus Gibson

---

[3]. Richard Nolanand Cyrus Gibson, "managing the Four stage of EDP Growth," Harvard Business Review, (Boston:Reprint Service, January/February, 1974)p.76.

observed that many organizations go through four stages in the introduction and implementation of new technologies. The stages are the following:

Stage-1: Early success. This is the early use of the new technology. While some unsteadiness and confusion exist in this stage, early successes lead to increased interest and experimentation.

Stage-2: Proliferation. This is the learning period for the field. Based on the early successes, interest grows rapidly and new products and/or services based on the technology enter the marketplace. These begin to be visible in a variety of application systems.

Stage-3: Control Of Proliferation. Here, management begins to find that the costs of using the new technology are too high. Systems integration is attempted but proves difficult, and suppliers commence toward standardization.

Stage-4: Mature Use. At this stage, the use of the particular new technology reaches maturity and other new technologies are introduced, wherein the pattern is repeated.

A modified version of these growth stages was introduced by McFarlan and McKenny[4].

---

[4]-Rephrased from Sprague & McNurlin, Information System Management In Practice, p.77.

These are:

1. Identification and initial investment.
2. Experimentation and learning.
3. Management control.
4. Widespread technology control.

They believe that the value of this "stage theory" approach is that it gives a better understanding of the factors that affect the formulation of information systems strategy.

In fact,the growth theories just mentioned could help us explain the recent growth in end user computing. After an initial introductory phase, technology usage goes through the second phase which is characterized by experimentation, learning, and proliferation. It is during this stage that the use of technology becomes widespread. This upturn is caused by the acceptance of the idea by the people who have the most influence upon the opinions and actions of others in the organizations.

4. The Eighteen-Month Effect

This effect was presented by Turoff and Hiltz[5]. During the first months of using a new

---

[5]. Murray Turoff & Starr Hiltz, " Management Issues In Human Communication Via Computer", In Emerging Office Systems, ed., Robert Landau (N.J: Ablex Publishing Corporation, 1982).

technology, people tend to use it to perform familiar tasks more efficiently. In the case of a personal computer, for example, this might mean using the computer for word processing or for spreadsheet calculations. After a period of time, averaging about eighteen months, users become more confident and are willing to try new applications. This same phenomenon isevident in the growth of end user computing.

5. **The Growing Backlog Problem**[6]. The most important factor beyond the growth of end user computing is the needs itmeets for users. End user computing is growing rapidly because it helps knowledge workers perform their jobs better, especially when they cannot get adequate assistance from data processing departments. Users are discovering that they can satisfy some of their unmet needs through purchasing software packages or by writing their own applications on a personal computer.

These five explanations show why end user computing has grown rapidly in the past few years. They also indicate that this growth is likely to continue into the future.

---

[6]- Sprauge & McNurlin, Information System Management In Practice, P.288.

The Need For The Study.

The rapid spread of end user computing has had a dramatic impact on the information processing in organizations. The rising rate of PC (Personal Computer) use and the availability of a wide variety of software applications for business reinforce the importance of gaining a more thorough understanding of the factors related to computer usage and user satisfaction.

The critical interrelationships among the three management groups (corporate management , user management and information management) will probably be the single most critical success factor in the effectiveness of information management functions in the future firm[7]. This is true because top managers are becoming research_based managers, looking more to scientific tools (statistical, quantitative, and analytical) to manage the business, as opposed to the experience _ based managers of the past, who relied heavily on verbal inputs. Users are also becoming more sophisticated in computers, are becoming more involved in the management and control of the computer resources used to support their business activities.

---

[7]- William R. Synnott & William H. Gruber, Information Resource Management, (N.Y. A Wiley Interscience Publication, 1981), P.10

The uses of computers by end users can be listed under twelve categories (Table 1) . These evolved from a study examining uses of computers in companies interviewed for the EDP Analyzer[e]. Examples of the specific activities or uses in each category follow:

-As an aid for accounting, reporting, and calculating: Use a spreadsheet package for budgeting, financial planning: filling out sales report forms; calculating loan amortizations, cost allocations, among others.

-As an aid for writing: Preparing memos, notes, meeting minutes, documents using a package such as a word processor, editing and revising documents.

-As an aid for search and retrieval: Geting responses to ad hoc queries, searching large data files and retrieving selected data or information.

-As an aid for Communications:
Sending/receiving/responding to computer messages, using computer conferencing; exchanging drafts of documents with others via data communications.

---

[e]. Sprague & McNurlin, Information Systems Management In Practice, p.288.

Table I. Twelve Categories of end user computing.

1. As an accounting, reporting, calculating aid.
2. As a writing aid.
3. As a search and retrieval aid.
4. As a communications aid.
5. As a presentation aid.
6. As a planning, scheduling, monitoring aid.
7. As an analysis aid.
8. As a memory aid.
9. As a record processing aid.
10. As a learning aid.
11. As an aid in developing new programs.
12. As an aid in making decisions.

-As an aid for presentation: Using packages to prepare proposals such as insurance proposals, using computer graphics to prepare presentation slides.

-As an aid for planning, scheduling, and controlling: Developing and revising meeting plans (agendas, attendance); Developing and revising work plans, using project management (such as the Harvard Total Project management Software) and control packages.

-As an aid for analysis: Analyzing sales data for customers buying patterns, for salespersons effectiveness, for product profitability, and for credit policies; analyzing variances from plan or budget.

-As and aid for memory: Using appointment calendar package, keeping an on-line business card file (names, addresses, notes, comments).

-As an aid for record processing: Performing routine transaction entry, using application programs, performing complete transaction processing.

-As an aid for learning: using computer-based training packages.

-As an aid for developing new programs: Developing own application systems, developing own decision support systems, maintaining and enhancing own programs.

-As an aid in making decisions: Using forecasting, analysis, and simulation packages to test what if hypothesis, using decision support systems such as the Materials Requirements Planning (MRP) system and Interactive Financial Planning System (IFPS).

In fact, The list includes a few uses that are not yet common but will become increasingly prevalent as users gain familiarity with common activities and expand into more creative applications.

With such an expected growth, companies should realize the importance of today's end-user systems and decide how best to manage and protect them. To meet the challenge of managing them effectively, an organization's management must know how to control and support end users. The potential for wasted efforts and unfavourable results, along with the magnitude of end user computing activities and expenditures, has led to increased interest in methods of giving sufficient attention to end users in order to aid and

guide their activities. The importance of this study lies in the fact that it will cast a light upon the areas that information system executives should take into consideration in order to render this trend successful and productive .

The Statement Of The Problem.

Despite the extraordinary progress made in information management practices during the 1970's after the time when computers were viewed largely as a technological curiosity[9], a big gap still exits between producers of information and users of information. Despite the widespread use of information technology systems, and despite the high qualitative benefits obtained from such systems, some organizations are still viewing them as costs rather than assets that should be efficiently managed.

Moreover, the proliferation of microcomputers in business and other organizations (medical, educational,...) reveal that the actual use of these machines is not as widespread as the number would suggest.

Microcomputers are introduced and applied within the organization and the individual context in

---

9. Synnott & Gruber, Information Resource Management, p VII.

a way that is inhibiting their wider use. Many people have found computers very difficult to apply and thus resist using them, or are not using them as much as they should, given the many application areas possible.

As end user computing emerged as a serious and rapidly growing effort in organizations, some problems were encountered when large numbers of non-technical users began taking on more responsibility for information systems. On the one hand, personal computing encouraged innovation by putting computer support in the hands of a wide variety of knowledge workers. On the other hand, the lack of experimentation, learning and proliferation of the different EUC products[10] created incompatibility problems in both technology and training , i.e, technical incompatibility and lack of adequate training.

---

[10]. Stephen K. Kuwan & Kathleen Foley Curley, "Corporate MIS/DP End User Computing", Database, (Summer 1989) P.31.

Research Questions:

In our study we assume that management of end user computing is one of the critical keys to the success of any information management function to meet organizational objectives.The interest beyond this survey lies in investigating factors that are associated with the extent to which end user computing will be successful. In doing so, the following questions are addressed:

1-what are the major features of end user computing and its users (including end user computing applications) ?

2-what are the factors thatare most likely to be associated with the successful adoption of end user computing ?

Hypothesis:

Based on the problem stated and the research questions mentioned above, the hypotheses to be tested throughout the research will be the following:

1-The extent of end user computer usage is directly related to the users' previous computer experience and their beliefs concerning the impact of computers on their work.

2-There is a strong positive relationship between factors such as management support, participation in computer training programs, and the use of highly flexible systems on one hand and end user computing success on the other.

Statement of the Purpose

The rapid spread of end user computing has had a dramatic impact on the information processing environment in organizations. In the past, managers simply delegated technology decisions to the data processing departments and attended to other matters. But managers can no longer avoid the process of making decisions about information technology. Information technology (IT) affects the entire business. Delegating such important decisions does not ensure that IT investments will further the company's competitive business strategy. In fact, this might mean that they will not. Why? Simply because the technical experts just don't have a deep enough understanding of where the overall business is going.

Managers, however, usually don't know much about computers. They may like the idea of using information technology, but they seldom know how to translate these wishes into effective IT investments. The challenge to organizations thus is to foresee and manage the flood of technologically induced changes that will face them in such a way that the business gains a competitive advantage.

The purpose of this study is to provide a general insight into the major reasons for MIS success. Information about managers' attitudes towards various aspects of computer usage as it relates to their jobs, satisfaction, and training will help us develop a better understanding of the various factors that affect managers' decisions as to whether to adopt the new technology. Such information will help us identify the various factors that could make out of the end user computing a successful trend that can add to the productivity of the users of the new technology in organizations of various business types (financial, merchandising, insurance, health care,...). The study also intends to focus on the relationships between systems usage and user training, computer experience, demographic variables and organizational level, as well as beliefs about computer usage.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 INTRODUCTION

End user computing has become an important and pervasive phenomenon. This has been extensively documented through a growing and substantial body of research, and in the popular press. Primary among the potential benefits of increased end-user access to computing is improved personal productivity at all levels in the organization.However, despite its great potential, end-user computing needs to be managed and guided in order to avoid many of the problems which plagued information systems development during its early years[1].

In the previous chapter, we suggested that one of the critical keys to the success of any information management function lies in the effectiveness of end-user operations.

---

[1]. James C.Brancheau, Douglas R.Vogel & James C. Wetherbe, "An Investigation of the Information Center from the User's Perspective", Database, Fall 1985,P.4

In fact, of all the resources that an organization has, the human resources are the most important. Historically, Computer-Based Information System (CBIS) implementation has tended to focus on the computer. This view continues in most organizations using the computer technology today, as is reflected in Kroeber and Watson's definition of implementation of information systems[2]. As these authors note, implementation consists of site preparation, hardware installation, software testing and debugging, and personnel training. Even personnel training, as it is typically conducted, focuses on adapting people to fit the design of the computer.

This focus on the computer portion of the system is myopic. It has led to the condition of placing the hardware and software at the center of the organization's universe and adapting the people to fit the CBIS. This symptom is highly widespread. However, we should recognize that such a view, the machine oriented view, is too limited. Instead, the user's functions and needs, in conformity with the organizational objectives, should be the focus. After

---

[2]. D.W.Kroeber & H.J.Watson, Computer-Based Information systems: A Management Approach,(New York, Macmillan, 1984).

all, "CBISs should exist to support the work of the organization; the organization does not exist to support the computer".[3]

Thanks to Ergonomics, or human factors engineering, this situation is placed in a better perspective. Ergonomics deals with the design of things for human use. It recognizes that the machine is only one of three subsystems in a well defined social systems context (Fig.2.1). The other two subsystems are the users, the humans who use or are affected by the system, and the environment in which the system is used. The environment subsystem includes the internal environment (organizational culture, employees' resistability to change,...) and the external environment (Industry, government regulations,...).

Ergonomics thus indicates that an organization, while adopting and implementing a CBIS, must be developed so that its people, work environment, and machine components are harmoniously integrated to execute the organization's functions. Since this integration is directed towards the goal of achieving

---

[3]- Alan F. Dowling, "Implementation of Computer Based Information Systems in the Ambulatory Health Care setting", Memeographed sheets.

or implementing the organization's functions, the technology component- the hardware, software, and so forth- should be supportive of and optimized for human use in a given work environment.

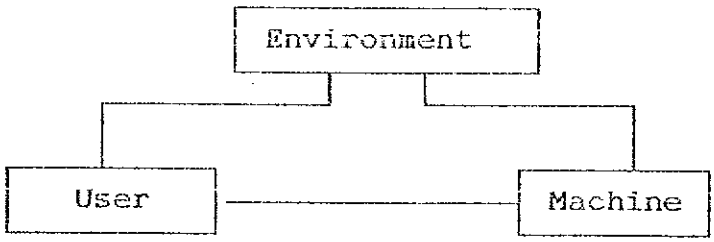


Fig.2.1. The Systems Context of an Organization Adopting a CBIS.

Thus, the care for users is an important issue that should be taken into consideration in the development of an information system. This is because as Doll states[4]:

> If the masses who are potential users of technology are not educated sufficiently to appreciate what it can do for them, you will find it going to waste.

---

[4]- Dixon Doll as quoted by Brad Schultz in "Interview with Dixon Doll", Computer World,(March 18, 1981) P.14

In this chapter,various methods of supporting EUC will be considered along with factors that lead to user satisfaction- the criterion we are going to use to represent the success of end user computing applications. A comprehensive review of the literature will be conducted to present the factors affecting user satisfaction with EUC and to provide insights for MIS success.

Studies pertaining to success have found that user perceptionregarding the advantages of microcomputers (PCs), user participation, user friendliness, human factors design, human-machine interfaces, the relationship between the corporate management information system and end user computing, perceived usefulness and perceived ease of use of the system, response time, and the degree to which a system meets user expectations are important factors in establishing user satisfaction with the computer system.

The intent of this study is to interpret and critique the literature, present factors that confirm that confirm with it and propose new factors that play a role in affecting the success of end user computing, such as management and EDP support, attitudes and beliefs about computer usage, and job satisfaction.

2.2. The Growth Witnessed in EUC

As mentioned previously, this field has undergone a tremendous growth which has been attributed to several factors.

2.2.1. Personal Computer as a Driving Force.

The personal computer has made tremendous inroads not only in the home market, but also as an integral part of an effective management information system. Starting in 1977, sales of personal computers increased dramatically with models such as Apple II, Commodore Pet, and Radio Shack TRS-80. In 1982, IBM introduced the IBM PC. This personal computer not only achieved a significant market share; it also firmly established the personal computer as business equipment[5].

Today microcomputers represent an increasingly important component of management information systems in organizations, and have a central role in the end user computing and office automation trends. A Study done by Engstrom estimated that "The number of microcomputers in U.S businesses rose from 2.6 million in 1982 to 4.6 million in 1984,

---

[5]-Gorden B.Davis & Margrethe H. Olson, Management Information Systems, (N.Y McGraw Hill Book Company, 1985) P.413.

and is expected to reach 13 million by 1990"[6]. The phenomenon of installing microcomputers as stand-alone processors or connected to other computer systems in the departments through a network communication system is a common thing taking place in many organizations (medical, educational, financial & Insurance) operating in Lebanon.

A- Reasons Beyond the Rapid Growth in Microcomputer Usage.

Several reasons exist for the growing presence of microcomputers in organizations. These are:

1. The Psychology of Personal Computers:

For the new user, there is something less forbidding about a small, personal computer as compared with a terminal tied to a larger host computer. A very dominant advantage of using a PC is the factor of ownership and control that the user feels, since a terminal user is always aware of being connected to, and under the control of a large computer located elsewhere.

---

[6]- Magid Igbaria et al., "Microcomputer Applications: An Empirical Look at Usage", Information & Management, (North-Holland, Elseur Science Publishers, 1989),quoted from T. Engstrom "new Kind of Managers coordinators Helter-Skelter Computer Growth", Wall Street Journal, (August 24, 1984) P.23

A related advantage of PCs is the well known-discussed concepts of "ease of use " and "friendliness". The user usually finds a PC to be friendlier than a terminal. To be successful and to be accepted in the market place, PCs must have friendly user interfaces, easy to turn-on, easy to load programs, numerous user-interactive menus, and similar facilities. In addition, if the user makes a mistake, it can usually be corrected without news of the mistake being spread[7]. In fact, the value of the concept of "ease of use" should not be underestimated. Today's PC workstations and the software created for them are generally friendlier than most mainframes with their complex operating systems, and thus, the relatively low level of technical support necessary with micros might in turn help to explain their positive impact on user satisfaction.

In summary, there is a large psychological value to PCs that comes from the very fact that they are personal. That has significant value for end users.

---

[7]- Ralph H. Sprauge & Barbara C. McNurlin, Information Systems Management in Practice, (N.J Prentice-Hall, Inc., 1986), P.337

2. The reduction in the Cost/Performance ratio of microcomputers:

The performance aspects of a microcomputer could be discussed in terms of response time, flexibility, and security[8].

a. Response Time:

The computing and processing workload, for the batch and on-line applications, continues to grow at most computer-using organizations. As a result, the number of terminals and/or workstations as well as the number of service requests entered on these terminals, will also continue to increase. In addition to this, there might be a shift somewhat towards requests that consume larger amounts of processor cycles. Decision support models, computer graphics, and the use of database management systems all will impose an increased demand on the processors. In such an environment, any type of shared computer resources will have an increasingly difficult time giving satisfactory response time to users.

In a research conducted by Avi and Sara Rushnik to study the effect of many variables on user satisfaction[9], results showed that good response time

---

8. Ibid, P. 337-389.

9. Avi Rushnik & Sara F. Rushnik, "What makes users happy?", Communication of the ACM, (July 1986, volume 29, Number 7), P.594-598.

is the most prominent inducer of user satisfaction. Users do not like to wait for the system to respond. Thus, the researchers state, " given two users with the same task, the user with the faster computer response time or rate will be more satisfied than the user whose computer has a slower response time".

b-Flexibility:

This is another aspect of performance. It is the ability to adapt to changing conditions. Here, too, the advantage seems to lie with the work station. For example, if a person's job changes and new tasks to be performed must be supported, the same workstation probably can be used by adding or replacing software packages.

c-Security:

Personal computers, with their own floppies and hard disks, are often viewed as security risks by information systems management. Users, on the other hand, users frequently feel their data is secure since they can remove the data and program diskettes, and store them in a secure place.

TV programs and read newspaper stories frequently relate the ease with which young hackers penetrate large computer systems.

Until these systems can provide a much higher degree of access control than is currently available, the security feature of PCs will be viewed as useful by executives, managers, and staff who want to store sensitive information in a computer. The main drawback, however, is that removable disks make it easy for someone to carry away copies of valuable programs and data.

With regards to cost, it would seem that minicomputers serving dumb terminals have a decided cost advantage over groups of interconnected PC work stations. However , as mentioned above, the large host computer-terminal configuration might cost less, but at the expense of lowered response time which means this configuration is not obviously lower in price than networks of work stations[10]. In addition, future trends seem to favor PCs. According to the law of supply and demand, the popularity of PC-based work stations promises to increase manufacturer production volumes in the coming years, which should bid the prices down.

Taking the above mentioned performance and cost aspects into consideration , Benjamin, Rockart,

---

[10]-Sprague & McNurlin, Information systems Management In Practice, P.340.

Scott-Morton and Wyman, in trying to assess the cost/performance ratio of using microcomputers[11], found that the rapid advances in microcomputer technology have consistently pushed the cost/performance ratio of microcomputers along a 30-40% annual reduction.

3. The Increased Power and Simplicity of the New Software:

The workstation supporting knowledge work will normally have functional capabilities of using various software packages. A list of widely used software packages is presented in table II. This capability along with the availability of easy to use software packages make the creation of new programs relatively easy. Some of these supporting software capabilities are:

a-Word and Text processing:

Software packages such as the WordPerfect, WordStar, or Easy Writer program packages transform the personal computer into an easy-to-use word processor. they handle a wide range of word processing jobs: text creation and filing, editing and revisions, plus formatting and final printing of documents or correspondence.

---

[11]-Magid Igbaria et al., "Microcomputer Applications", P.188, quoted from "Information Technology", Sloan Management Review, P.3-10.

b- Storage and Retrieval of Data:

Workstation storage files handle two types of files: data and text. For the management of data files, there are microcomputer database management systems such as the DBASE III+ and the FoxBase which provide the business user with the means of managing and manipulating large amounts of data. Some of these are provided in conjunction with fourth generation languages (to be discussed below) for data retrieval. For text storage and retrieval, a flexible keyword filing facility with cross-reference indexes is required. The system here is able to store and retrieve documents, memos, mailing lists, etc.

c- Communication Facilities:

Here, computer-based message systems and voice store-and-forward message systems are used to provide capabilities for different users in physically separate locations to work on joint projects and exchange messages.

An example on this is a type of "electronic meeting" called computer conferencing. A conference may be restricted to an invited group of participants; other conferences are open to any users and tend to be "bulletin boards" of general information or tips. For instance, an open conference might be run for any users of a particular application package; users share

experiences and suggestions on how to use the package.

d-Decision Support Systems:(DSS):

A DSS is an interactive system that provides the user with easy access to decision models and data in order to support primarily semistructured decision-making tasks. Examples of major packages are IFPS(Interactive Financial Planning System) and PMS(Portfolio Management System). Through using PMS, for instance, bank investment managers are aided in the management of clients' trust accounts. Such modeling packages provide the users with facilities such as "what-if" analysis, goal seeking to find values necessary to achieve a goal, and simulation using probabilities.

1-Spreadsheets(e.g lotus 1-2-3 or VisiCalc) 2-Word Processing(e.g wordperfect,wordstar) 3-Data Management Packages(e.g DBASE III +) 4-Modeling Systems(e.g HTPM, IFPS) 5-Statistical Packages(e.g SPSS) 6-Graphical Programs(e.g chartmaster) 7-Communication Packages Electronic Mail 8-Fourth Generation Languages(e.g FOCUS) 9-Third Generation Languages(e.g Fortran,Basic) 10-Other (Accounting,Payroll,...)

Table II. A list of the common software packages.

e- Graphics:

The computer graphics are used in organizational applications to provide users with

facilities such as analysis, presentation of stored data, and preparation of visual aids. They can generate forms, present the results of scheduling applications using critical path models, and permit users to use symbols to replace words in screen interface or to access a database.

f-Fourth Generation Languages:

These are integrated user-oriented development facilities that are usually called very high level languages. These require simple languages for writing queries and programming solutions. Some features of a very high level development language are:

-Interactive dialog to guide application development

-Powerful nonprocedural verbs with natural language syntax(English or other language).

-Simple to learn, helpful error messages.

-High level query language for direct access to the database.

These languages are thus designed to improve the productivity of programming professionals, while others are designed to be used directly by the end user. In very general terms, these languages are designed for specification of what needs to be

accomplished, as opposed to the procedure-oriented languages(e.g Third generation languages such as Fortran) which specify how. An example of a very high level language is the FOCUS.

g- Spreadsheets & Accounting Systems:

These are typical programs for the personal computer. Spreadsheet systems include programs such as VisiCalc and Lotus 1-2-3. These packages combine the ease and familiarity of a simple calculator with the powerful memory and screen display of the personal computer. They are designed to speed problem analysis and to simplify forecasting and planning tasks. As stated by Davis & Olson, the spreadsheet processor is the most available and commonly used model and programming facility.[12] Accounting Systems provide general ledger, accounts receivable, accounts payable, and general accounting packages. Of course, such programs are designed to work together across many general business areas to help reduce costs and increase productivity in the organization.

In fact, surveys have been conducted to study the software applications most likely to be used by end users. One of these has been a survey of corporate uses of personal computer software conducted by F.W.

---

12. Davis & Olson, Management Information Systems, P. 387.

Miller in 1983[13]. The result of this survey is shown in Figure 2-2. The software contained in the study included VisiCalc, Word Processors, System Support, Business Planning, Graphics, Office Support, Data Base Management Systems (DBMS), Communications, and others. The results of the survey showed that the spreadsheet system had the highest usage rate (76%). This was followed by the word processor system which had a usage rate 30%. The other software packages had lower usage rates: Systems Support (26%); Business Planning (20%); Graphics (16%); Office Support (11%); DBMS(8%); Communications (2%); and other software (6%). The result of this survey confirmed the above literature presented by Davis & Olson in that the most popular software packages, and the one most utilized by business and professional users, are spreadsheet processors.

---

13. Davis & Olson, Management Information Systems, P. 413

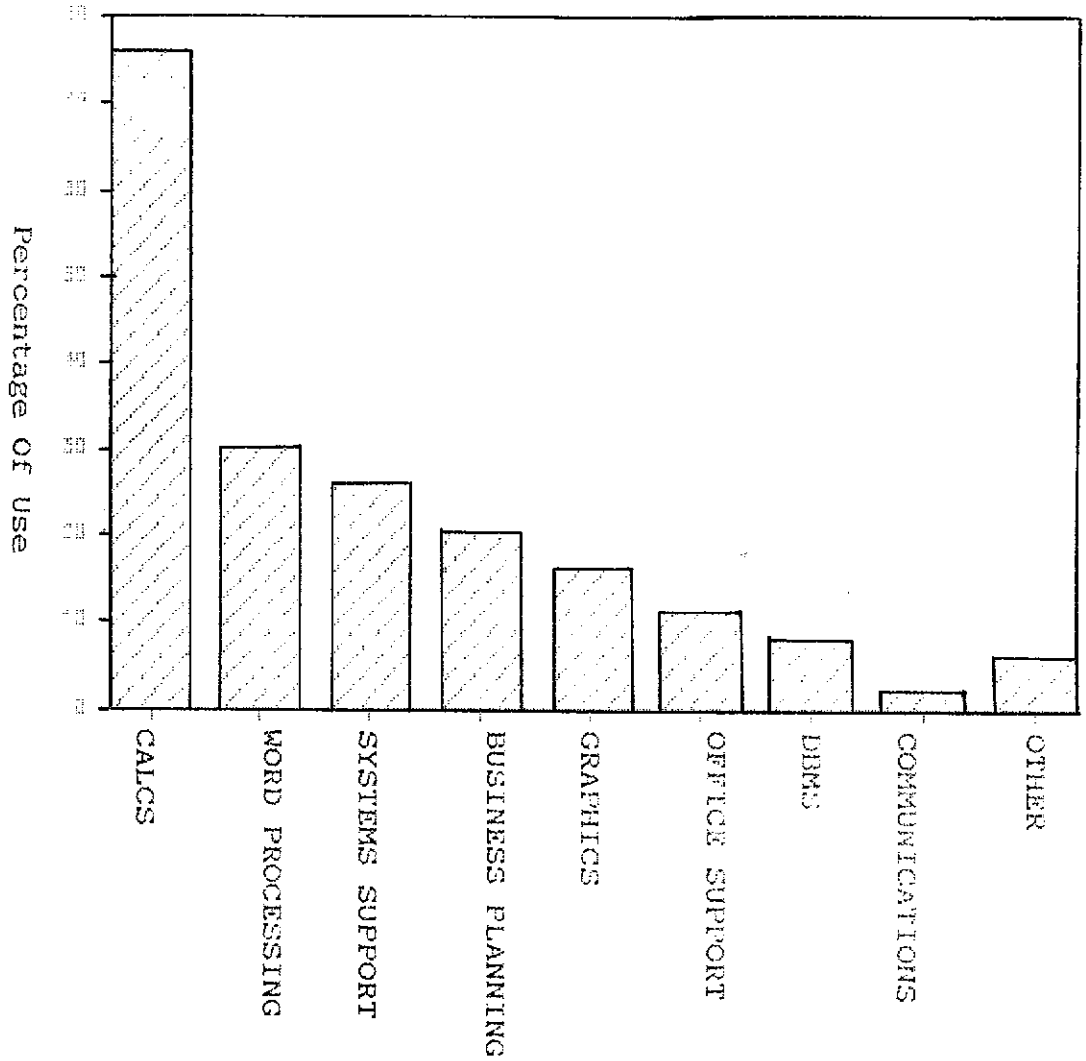


Fig 2.2. Corporate Use of Computer Software Packages. (Source: F.W. Miller, "Here, There." Reprinted from INFOSYSTEMS, April 1983).

These results are very similar to a study by Lee[14] on usage patterns of microcomputers in 1986; he reported that the greatest number of people used spreadsheet and wordprocessing (74% and 44% respectively). The percentage of graphics users was reported to be 29.7%, a rate higher than that reported by the previous study.

A similar survey recently conducted by Magid Igbaria[15] in 1989 also showed that spreadsheet applications were the most popular, with about 94% of the respondents reporting usage; the next most popular was word processing, with 63% reporting usage. These were followed by communication packages (52%) which because of the developments that took place in this area, has shown a much higher percentage than that reported by Miller. Also, in contrast with both Miller & Lee, Igbaria reported a much higher percentage of graphics users (51%). Here, graphics packages have increased in importance. This is not surprising, given the degree of attention that graphics is receiving from software and hardware developers and from DSS users. The usage percentage of other software packages was as follows: data management packages (41%),

---

[14]. D.S. Lee, "usage Pattern and Sources of Assistance to Personal Computer Users", MIS Quarterly (vol.10, NO. 4, December 1986), pp. 313-325.

[15]. Magid Igbaria et al., "Microcomputer Applications", P.187-194.

distantly followed by own programming (20%), other packages (15%), modeling systems and statistical packages (14% each), and fourth generation language usage was ranked last, with 11%. The study also showed the effect of certain demographic variables upon the system usage. Spreadsheet programs were used in the finance and accounting division more than others. Across the organizational hierarchy, higher level managers reported greater use of spreadsheet applications, while word processing and data management packages were used by relatively lower staff. Data management packages were highly used by people who had the data (accounts, computer and data processing people) and less for queries by higher level managers. Moreover, statistical packages were used by managers with graduate degrees.

4. The Increased Availability & Capability of Communications Networks:

Communications Networks connect workstations to one another and to the Mainframe systems. Since a large part of a knowledge worker's time is spent in communication, technological developments affecting the communication process can result in significant productivity gains. "The cost of transmitting data,

voice, and images has decreased and communications systems have become an important factor in knowledge work support"[16].

For users, in order for communications technology to significantly affect knowledge work, comprehensive communications networks are required. For example, electronic message systems are only effective when a fairly high proportion of others with whom one communicates have access to the network and use the system regularly. The communications network can also connect a user to the main computer and its database.

In conclusion, the literature presented hereto showed that personal computers have a competitive edge over terminals connected to host computers. They "feel" friendlier, they offer better and more consistent response time, they can be changed more quickly, users often believe they offer more program and data security, they may not cost a lot more than the terminal/host combination, and they allow users to stay at the forefront of technology more easily. Such benefits have induced authors to identify personal computers as one of the driving forces behind end user computing, and to argue that they launched the end user computing era.

---

[16]. Davis & Olson, Management Information Systems, P. 414.

B. The Actual Use Of Computers:

After presenting the various reasons that led to a growing presence of the micro computer in organizations, it comes as a surprise to recognize that the researcheconducted on microcomputers in organizations reveal that the actual use of these machines is not as widespread as the numbers would suggest.

On one side, Rockart[17] Provides managers and chief executives with certain methods that would help them define their own data needs, such as using the Critical Success Factors (CSFs) method which indicate the key areas of activity that should receive constant and careful attention from management. The current states of performance in each area should be continually measured, and that information should be made available. They would also help them abandon those masses of information that are reported to them from the various functional levels, much of which is partly digested and much of which is irrelevant.

---

[17]John F. Rockart, "Chief executives define their own data needs", Harvard Business Review, (No.79209, March-April, 1979), P. 81-82.

Moreover, Rockart and Treacy expecting an increasing number of executives doing their own computing[18].

On the other side, we read the findings of researches conducted to study the various aspects of microcomputer applications, and get informed that the optimistic scenario proposed by the above mentioned researchers has not yet materialized.

What is the reason beyond this ?

In fact,while the limited use of microcomputers may be ascribed partly to knowledge of how they operate or to concerns about their capability, a major factor inhibiting wider actual use appears to be the way they are introduced and applied within the organization and individual context[19]. Computers are still viewed by many people as being machines that are difficult to use and therefore hesitate in using them. In his study, "What's detaining the office of the future?", Uttal found that most executive are still "technophobic", i.e show fear of technology.[20]

As viewed by Carrol and McKendree, there are two

---

[18]-J.F. Rockart & M.E. Treacy, "The CEO Goes On Line", Harvard Business Review, (Vol.60, No.1 January-February 1982) pp.82-88

[19]-Magid Igbaria et al., "Microcomputer Application", pp 188-189.

[20]-B.Uttal, "What's Detaining the Office of the Future?", Fortune, (Vol. 105, No.9, May 3, 1982), pp.176-196.

empirical phenomena that have structured much recent research on human-computer interaction[21]. These are:

1- People have considerable trouble learning to use computer systems, and

2- People's skill tends to approach an ordinary or and average level.

The situation can be represented as follows: People want to use computer equipment because they want to get something accomplished. This is good in that it gives users a focus for their activity with a system and increases their likelihood of receiving concrete reinforcement from their work. But this same approach can also make an individual unwilling to spend time learning about a system on its own terms. This is because trying to consult on-line tutorials or self-instruction manuals will lead, for a time, to cease working.

After having portrayed the findings reached about the actual use of computers, it is now necessary to present the literatureconducted on the factors affecting computer usage. These factors, along with the areas that support end user computing, will help

---

[21]. John M. Carroll & Jean McKendree, "Interface Design Issues for Advice-Giving Expert Systems", Communication of the ACM, (Vol.30., No.1 January 1987) p. 14-30.

us define thepath along which user satisfaction can be enhanced and end user computing be successfully applied.

2.2.2. The Expanding Role of Information Centers

The facilitation and management of end user computing is a very important issue that should be taken into consideration by information system executives if a successful and effective MIS is to be attained.

Due to their close associations with end user computing, information centers have also received considerable attention in recent years. An information center is an organization specifically designed to produce "guided service to help users help themselves"[22]. As such it offers a proactive approach to the facilitation and management of end user computing. In fact, there is a need for a separate organizational mechanism or department to provide a bridge between technology and end users. Such a bridgehas already been developed under the name "information center".

---

[22]. Robert L. Leither & James C. Wetherbe, "Avoiding the pitfalls of end user computing" quoted from James C. Brancheau et al., "An Investigation of the Information Center from the User's Perspective", DataBase, (Fall, 1985), P.4

Information centers were originally conceived to be user-oriented computing services offered via mainframes or minicomputers, an idea developed at IBM Canada in 1974[23]. In essence, the information center was to support end user programming. This concept has developed, and in many companies the information center is now the focal point for supporting much more than end user programming; it is also supporting the various activities of end user computing.

A. The Information Center Services

IBM Canada's original information center was established because the managers of the information systems division of the company realized that they were not able to respond rapidly to user requests. The center began by offering seven services which still constitute the basic services provided in most information centers today[24]. These services are listed in table III.

1. Training
2. User assistance
3. Usage planning
4. Product evaluation
5. Consulting
6. Security
7. Marketing

Table III. The initial information center services

[23] Sprauge & Mc Nurlin, Information Systems Management in Practice, P. 311.

[24] Ibid, P. 312-314.

The initial seven services are described briefly as follows:

1. Training:

Here, each new user was trained on the software products he or she expected to use. As the center added new products, at least one staff member became knowledgeable on that product, in order to lead training programs and provide user assistance. Each member of the staff specialized in a couple of products, and users directed their questions to those experts.

2. User assistance:

Since the major purpose of the center was to get other employees to use the computer on their own, the staff did no programming themselves. Instead, they supported users as they performed new types of queries or programming, and helped them when they met difficulties. The center's staff thus had to be people-oriented as well as competent with technology.

3. Usage planning:

Since the center was assumed to bridge the gap between the end users and the computer center, it was one of its important functions to estimate how much computing resources would be needed by users for a future period of time.

4. Product evaluation:

The center made a formal evaluation of new products, and adopted those that met user needs. Today with the high variety of software packages in the market, this task of evaluating new software has become of a growing importance. Most information managers select one or two packages of a certain type (word processing, spreadsheet, others) and then support only those few packages.

5. Consulting:

The center provided users with advice in the design of new applications to minimize both development and processing time.

6. Security:

The center established certain security procedures that proved to be sound and critical. For example, the system automatically disconnected a terminal after it had remained unused for ten minutes, and it would not allow a user to access a system if the proper (always modified) password was not entered.

7. Marketing:

The manager of the center also directed the center's marketing program. The manager advertised the center's services throughout all of IBM Canada, encouraging all employees to pass by for a demonstration of the available products and services.

In 1983, a report on user-driven technologies gave some statistics on the use of personal computers, information centers, and fourth generation methodologies.[25] The report states that the role of information centers had changed from the original role in 1974. Personal Computers had become very important in many centers, application softwares were being affected in some organizations, and Fourth Generation Languages (4GL) were affecting development time for applications.

B- The importance and current role of information centers

The information center plays a crucial role in such key areas as the facilitation and coordination of end user computing, and the assessment and assimilation of computing technology. Its success is crucial to the overall effectiveness of information systems within the firm.

---

[25] "User Driven Technologies: Personal Computers, Information Centers, and Fourth Generation Languages", by FTP Technical library (New York, N.Y. 11776, 1983), quoted from Sprauge & McNurlin, Information Systems Management in Practice, P. 317-318.

As a relatively new organizational phenomenon, information centers have been the focus of many surveys and discussions aiming at assessing MIS success from the end user's perspective. A study conducted by Wetherbe and Leitheiser showed that almost all information centers offer consulting, training, and technical/hotline support.[26]

Another survey done by Brancheau, Vogal and Wetherbe[27] assessed the information centers' importance, effectiveness, and critical success factors in their role of advancing end-user computing. Trying to find out which services are most important to end-users, the results of the survey showed that troubleshooting (hotline/technical support), consulting, and training were deemed to be the most important services by information center users. The use of a "hot-line/technical" support service for troubleshooting problems was mentioned most frequently (by 77% of the users), and received the highest average ranking, making it the end user's most important service. Consulting services rated a close

---

[26] Leitheiser and Wetherbe, "Avoiding the pitfalls of end user computing", (October, 1984).

[27] Brancheau, Vogel, and Wetherbe, "An investigation of the information center from the user's perspective", P. 4-15.

second in importance as it was mentioned by 74% of the users. Training was not far behind, rating third in importance for being mentioned by 64% of the users. The other services offered by the information centers surveyed and their rank of importance as represented by the number of users mentioning them were as follows: database extract (33%), research on new products (33%), development services (28%), and work processing support (16%).

In conclusion, one can say that information centers are becoming increasingly important in enhancing end user computing by providing the needed guidance and support to end users. In combination with the end user's other sources of support, such as their growing network of informal contacts, the information center has become an essential part of the business. Technically competent and responsive staff and the ready availability of support are thus strongly needed for information centers to provide services effectively.

2.2.3. Designing for System Usability:

A significant problem with organizational change is resistance to the change by those affected. User resistance to new information systems can be a serious problem if use is voluntary (for instance, use of a decision support system by primary users involved in the process of decision making), resistance may be manifested by avoidance of the system. If use is not voluntary (for instance, data entry by secondary users), user resistance can cause significant problems in the way of disrupting the orderly course of the system, deliberate sabotage, increased error rates, or increased turnover.

One of the major reasons for resistance could be explained by the system-oriented theory.[28] According to this theory, resistance occurs because of factors inherent in the design of the system to be implemented.

Based on this statement, we can deduce that users' resistance could be minimized if information systems are designed in a way that would allow users

---

[28] Davis & Olson, Management Information Systems, P. 596.

to conceive them as being useful. So, the two basic questions that impose themselves now are:

-How could a system be perceived as useful ?

-What are the key principles that should be taken into consideration in the process of designing a new information system ?

Of course, systems perceived as being useful among users, and systems designed in a way as to ensure usefulness and easy to use aspects might enhance user satisfaction, and would thus add to the success of end user computing.

A. Perceived Usefulness and Ease of Use:

Information technology opens the opportunity for greatly improving users' performance. But performance gains are often obstructed by users' resistance to accept and use available systems.

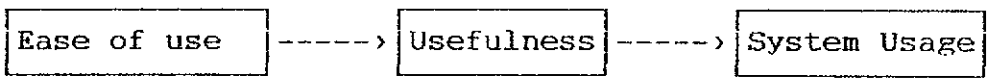
In his article, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology", Fred D.Davis described two measures for assessing systems quality: perceived usefulness and perceived ease of use, which are theorized to be fundamental determinants of system use.[29] The findings

---

[29]- Fred B. Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology", MIS Quarterly, (Vol. 13, No. 3, September, 1989), P. 319-335.

of this study reveal that usefulness is more strongly linked to usage than is ease of use. Such a finding led Davis to state that users are driven to adopt an application primarily because of the functions it performs for them, and secondarily for how easy or hard it is to deal with the system and get it to perform these functions.[30] This is true if in fact users are willing to cope with a certain amount of difficulty in use if the system provides them with the information they really need. This point has important implications for those attempting to design or implement a new system.

The same study has shown that ease of use could be a leading aspect of usefulness, rather than a parallel, direct determinant of usage. This could be shown in the following chain of causality suggested by researchers (such as J.A. Davis, 1985) and quoted by F.B. Davis[31]:



This causal influence of ease of use upon usefulness is acceptable since, other things being equal, the

---

[30]- Ibid, P.333
[31]- Ibid, P.334

easier a system is to interact with, the less effort needed to operate it, and the more effort one can devote to other activities (such as managerial analysis and control), contributing thus to overall job performance.

Having presented the importance of ease of use and usefulness factors in affecting system use, the key principles and aspects affecting usefulness and ease of use in designing a new information system will be presented and discussed.

B. Key Factors Contributing to Usefulness and Ease of Use

An information system designed for people to use should be easy to learn, useful, that is, contain functions and yield outputs users really need in performing their work, and be easy and pleasant to use. The literature in this area has paved the way for identifying the key factors that should be considered if the system is to be both useful and easy to use.

1. Principles of Design:

In their article, "Designing for Usability", Gould and Lewis described three principles of system

design which they believe must be followed to produce a useful and easy to use computer system. The three principles are[32]:

a. Early focus on users and tasks.

This principle states that designers must understand the characteristics (cognitive, behavioral & attitudinal) of the potential system users and the nature of their work that needs to be accomplished. In other words, the designer's work should be user oriented. For this to be achieved, the design team should be brought into direct contact with users, as opposed to hearing about them, and should conduct actual observations of them, and make interviews and discussions with them prior to system design. This is a better approach than first designing the system and then presenting, reviewing and verifying the design with users, or getting users to agree to the design.

This type of design, known as "interactive design" is valuable, especially for the design of an in-house system since it allows potential users to participate in the design of a system that they will ultimately use.

---

[32]. John D. Gould & Clayton Lewis, "Designing for Usability: Key Principles & What Designers Think", Communications of the ACM, (Vol. 28, No. 3, March 1985), P. 300-311.

If designers build upon previous releases of computer systems or update an existing system, then there might be little difficulty in identifying users and talking with them. The same difficulty might be met at the very early stages of design in a new area. In such cases, we need to refer to the other two principles stated by Gould and Lewis.

b. Empirical Measurement.

Here, in the early stages of the development process, potential users should actually use simulations and prototypes to carry out real work. Based on this, users' performance and reactions to the system should be observed, recorded and analyzed. The purpose of using a prototype here is to find out how easily people can learn and use that prototype.

Demonstrating a prototype system for typical users and analyzing its reactions to it can lead to inaccurate conclusions. "What is required is a usability test, not a selling job. People who have developed a system think differently about its use, do not make the same mistakes, and use it differently from novices." Users should be given simple prototypes to apply, and their thoughts and attitudes should be studied and analyzed.

c. Iterative Design.

This is the last principle recommended by Gould and Lewis. What they suggest is that there must be a

cycle of design, test and measures and redesign, repeated as often as necessary.

The system to be developed should achieve for the potential users certain goals such as "ease of use", "user friendliness", "ease to operate". "simplicity", "responsiveness", and "flexibility". What is therefore needed is a process that ensures meeting these goals."With testable behavioral goals, and ready access to user feedback, continuous evaluation and modification of the interface can be undertaken"[33]. However, this will only be feasible if the implementation strategy followed permits early testing of modular implementation thus providing cheap modification of the evolving system.

In fact, iterative design is necessary for understanding user needs and behaviors that might lead to fundamental changes in a design. User testing will often show that even carefully thought out system design ideas are inadequate. It can identify system problems with reliability and responsiveness -two factors that are necessary for building a good user system which would contribute to enhancing its usability.

In conclusion, the above three recommended principles could reduce the difficulty most people find

---

[33]. Ibid, p.307

while learning and using computer systems, and might add to their usability .

2- User Interface Design:

Using computers in the realm of Management Information Systems increasingly involves on-line interaction between the human user and the machine; a critical element of the design of these systems is the user interface. The term interface consists of screens, keyboards, devices, languages, and other means by which the human user and the computer system exchange inputs and outputs.

User interface design has received significant attention in recent years[34], and has been the subject of many pieces of research. This is because the design of user interfaces could be considered as the major factor in ease of learning and ease of use. Based on this, the following features have been emphasized in the design of a user interface.

a- Screen Design.

A good design is clear and free of irrelevant information. Two useful guidelines for deciding what information should be put on a single screen are the following:[35]

---

[34]- Davis & Olson, P.530.

[35]- Davis & Olson MIS, P. 534, quoted from W.O.Galitz, Human Factors In Office Automation (Atlatnta, Ga, Life Office Management Association, 1980), P.108.

-Providing only information that is essential to making a decision or performing an action, and
-Providing all data related to one task on a single screen. The user should not have to remember data from one screen to another.

Examples of good screen design facilities are forms-based screens for use with documents, and split screens and windows, for in working with a screen, a user may often look aside at other data or instructions while retaining, and returning to, the original screen.

b- Feedback & Assistance.

During the user computer system interaction, the human need for feedback cannot be underemphasized. Davis & Olson suggested two types of feedback to be part of a user machine dialog:
-Every user request should be acknowledged by the system in some way.
-Additional assistance (such as system status) should be available upon request.
In the first case, the most common form of feedback is the result that the user gets from his request. However, if the request requires a long time to be

processed, the user should be informed that the computer has accepted the request by getting messages such as : "Your query is being processed", or " Wait one moment please". Such acknowledgements will satisfy the users' psychological need for feedback. In the second case, a very familiar example could be when the user gets assistance from the HELP function, or when he sends a request for a certain report to be printed, and the request has been sent to a "print queue". Here, by typing a simple command such as "list output", the user would be able to view all the reports in the print queue and the status of the report he requested in the queue.

c-Response Time.

The importance of response time as a determinant of system use and user satisfaction was previously discussed in this chapter. In an interactive system, it is the time that elapse between the user keying in a command and the system beginning to display a result or response. Some useful guidelines to achieve this in a system design are:[36]

---

[36]-Davis & Olson, MIS, p. 541, quoted from B. Shneiderman, " Direct Manipulation", Computer, (Aug. 1983), PP.57-69

-Frequent, simple commands should take a fraction of a second.

-For commands that take a longer time, response time should be as consistent as possible.

-Short response time to complex requests may inhibit learning and increase the rate of error.

-For requests that will take a long time(›10 seconds), the system should provide the user with messages indicating that the request is being processed.

d- Interactive User Dialog.

The dialog between user and machine can follow many different structures: command languages, menus, forms, and natural languages. In general, the issues that should be considered in choosing the appropriate language structure are "the expertise of the user, the user's knowledge about the particular problem domains for which the system is used, the physical constraints of the computer and the terminal, and consistency with other dialogs in use"[37]. The most common command languages are the operating system commands that are used to access other applications and perform basic system functions (such as copying, renaming or listing files). Also, they are commonly used in database query languages to access information from a database.

---

[37]. Ibid, P.543

With the menu structure, the user is provided with a list of options, and is expected to choose the desired option by positioning the cursor or by keying the associated number. A well-designed menu provides a familiar format and a clear set of choices which are well understood by the user. They thus require less training to use than command languages.

In a forms-based interface design, the user is provided with the facility to "fill in the blanks" on a screen. This is convenient for data entry of transactions. As mentioned earlier, the design of the screen depends on whether a document is used. If so, the screen format should reflect the document format; if not, the dialog format simulates a form.

By using a natural language interface which is considered within the realm of artificial intelligence, the goal is to let the novice user communicate with the computer through a natural language such as English. But for computers to be able to understand natural language in the spoken voice is extremely difficult to implement, although considerable research and development is in progress.

3- Expert Systems:

The interest in "expert" systems, possibly as a part of decision support systems (DSS), has been

growing rapidly. One definition states that these are systems that contain the knowledge and expertise of an expert, in the form of facts and guidelines, so as to help others in making decisions ina specific subject domain[38]. The leading type of expert system is the knowledge-based system[39]. Knowledge here is represented in the form of facts and the relationships between them. This knowledge base -the data and decision rules- is in fact the unique distinguishing feature of an expert system which represents the expertise in it and which differentiates it from the DSS.

As an example, a user of medical diagnoses expert system provides the system with a particular set of symptoms. The program searches its knowledge base of symptoms and possible causes. It then might begin an interactive dialog with the user to elicit more information or to suggest a strategy for further tests[40].

Some pieces of research also surveyed a type of expert systems called "advice-giving expert system" and presented the interface design issues that should

---

[38]- Sprauge & McNurlin, Information Systems Management in Practice, P.378, & Davis & Olson, MIS, P.375.

[39]- Sprauge & McNurlin, Information Management in Practice, P.379-381.

[40]- R.Davis, "A DSS for diagnosis and Therapy", Database, (vol.8, No. 3, 1977), P.58-72.

be considered in order to render it an efficient system, and add to its usability and ease of use. The theme behind an advice-giving expert system is that users may show unwillingness to spend time learning about a system. Also, to consult on-line tutorials or user manuals means stopping work for a time. To avoid these problems -i.e. to enhance the learning motivation and to remove the learning versus working conflict -researchers provided the suggestion to integrate the time and effort spent on learning with actual use of a system through the use of intelligent system monitors[41].

This "advice giving approach" contrasts with the well-known on-line tutorials in that the latter "do, in some cases, monitor and adjust to the needs of specific users, but characteristically maintain a sharp separation between learning and working that can undermine the user's motivation to make use of training and help materials"[42]. Advice-giving systems, however, are distinguished in that they store information about a system and its commands and procedures, and can retrieve this information and provide it to users as on-line training and help while the user is working with an application system software, for example.

---

[41]·Carroll & McKendree, "Interface Design Issues for Advice-Giving Expert Systems",P.14-30.

[42]·Ibid, P.14.

In fact, current work on advice-giving systems has focused on system-initiated advice given within the context of user error. This is a convenient choice since it is in this type of situation that people might be receptive to advice and that the system would demonstrate its usefulness and feasibility.

2.2.4. Effect of User Participation on End User Computing Success:

Most surveys conducted on user satisfaction emphasized the importance of the system quality concept. "The most important thing to users is good service, which is measured in terms of responsiveness, the availability of resources, and the quality of work performed"[43].This means that an effective user satisfaction strategy is one that places greater emphasis on service and effectiveness (results achieved, value of system) than on efficiency (cost control).

Moreover, management's main concern is to raise the productivity of employees. But management should not be led to expect this of technology. Instead, it is the employees, perhaps with the help of technology, that can provide the big productivity gains.

---

[43]. William R. Synnott & William H. Gruber, Information Resource Management, (N.Y.: Wiley Interscience Publication, 1981), P.31

Therefore, the key to increased productivity is people. Technology can help people do their jobs better if they are willing to use it. However, many end users are not impressed or satisfied with the performance of their computerized systems. As was mentioned previously, employees have often had to adapt their ways of work to the computer, more than the reverse. Too often they have been told how their computerized systems would work, not asked how they would like the systems to work.

One way to ensure the effectiveness of a system is to have the user participate, through all the phases of system activity, in the creation of his own computerized system. This should be stated as one of the organization's policies. Also, it's worth noting here that the participation of a high-level user representative who has in depth knowledge of the business of the user is required.

User participation is a major contributor to the success of an MIS project. That is why a substantial amount of research and articles has been devoted to study the effect of user participation on the success of end user computing and thus on MIS success.

A- Cognitive & Motivational Factors:

In their study on user involvement and its impact on MIS success, Ives and Olson found out that involvement contributes towards achieving a high

system quality through cognitive factors and motivational factors [44] :

> "Cognitive factors, which intervene between involvement and system quality, include improved understanding of the system, improved assessment of system needs, and improved evaluation of system features. Motivational factors, which lead to improved system acceptance, include increased user perceived ownership of the system, decreasing resistance to change, and increasing commitment to the new system."

Ives and Olson also criticized the studies of user involvement which generally operationalize "successful implementation " through the dependent variables system quality or system acceptance- a narrow focus on outcomes that ignores the importance underlying cognitive and motivational characteristics of individuals affected by the changes. Ives and Olson's study concluded that the benefits of user involvement cannot be put in definitive conclusions because of the severe theoretical, methodological, and measurement problems associated with involvement research.

B- Attributional Approach:

A recent study conducted by Barki and Hartwick added that empirical results remain weak in spite of a number of recently conducted, methodologically sounded

---

[44]- Blake Ives & Margreth H.Olson, "User involvement & MIS Success" Management Science, (Vol.30, No.5, May 1984), P.590

studies.[45] They thus argued for the use of the attitudinal approach which was suggested by Swanson. This model proposed by Swanson suggests that user involvement leads to positive attitudes concerning the system.[46] These attitudes in turn lead to greater use of the system. Barki and Hartwick's approach focussed on attitudes _ the relationship of involvement to attitudes, the relationship of involvement on attempts to change attitudes, and the impact of involvement on translating attitudes into subsequent behavior.

The two researchers believe that in an MIS environment, the above stated approach would suggest that highly involved users are likely to develop very positive or very negative attitudes toward a system. One variable that should be taken into consideration here is system quality. Given a high quality system, highly involved individuals are likely to develop positive attitudes and use the system. "They just need to be given the facts concerning the system".[47]

---

[45] Henri Barki and Jon Hartwick, "Rethinking the Concept of User Involvement", MIS Quarterly, (March 1989), P. 53-61

[46] Ibid, P.60, quoted from Swanson, E.B., " Management Information System: Appreciation & Involvement", Management Science,(October 1974), PP.178-188.

47 Ibid, P.61

On the other hand, persons who are low in involvement were found to be more apt to form negative attitudes of the system and thus avoid using it. These less involved individuals are more likely to change attitudes and engage in various behaviors because "others urge them to do so, or are doing so themselves".

C- Power Relations among Users & Professionals:

Another aspect affecting user participation proposed by Markus & Andersen is the power relations between system professionals and end users. In their article, they stated that power relations between users and IS (Information System) professionals are an important topic for both theoretical and practical reasons. Theoretically, the power of IS professionals is related to their ability to implement technological change. In practice, the power of users may be essential to meaningful participation in systems development.48

Recognizing or being aware of the exercise of power by both parties might lead to various states as shown in Figure 2.3.

Mutual negotiation is the state achieved when both users and system professionals are aware of power exercise. This is because they may be able to

---

48. M.Lynne Markus & Neils Andersen, "Power Over Users: Its Exercise by system professionals", Communication of the ACM,(Vol.30, No.6, June 1987), p.498-504.

		User awareness.	
		Aware	Unaware
Designer Awareness	Aware	Mutual Negotiation	Professional Manipulation
	Unaware	User Resistance	Unintended Influence

Fig. 2.3. Awareness about power exercise.

negotiate an outcome they would perceive as convenient. However in the situation of intended influence (or mutual ignorance), the probability of successful or corrective negotiation may be very low. Yet, situations in which awareness is one-sided could be considered the most difficult from a change agent's point of view. When users are aware of a power exercise that IS professional deny, then user resistance emerges. Similarly, if IS professionals intend to influence users without their knowledge, then professional manipulation of users results.[49]

Moreover, the trends mentioned earlier in software developments and use (4th generation languages, easy-to-use office systems,..) might result in less users' dependence on IS professionals for expert services in programming and data retrieval. They decrease the number of technological choices and increase the role of users in making the necessary choices. This, of course, lead to greater user participation in system development processes which

---

[49]. Ibid, P.502

This enhances the importance of top management and EDP support in the development of positive user attitudes and behavior in information systems implementation. This important factor is discussed below.

2.2.5. Management and EDP support:

The importance of management and EDP support has been demonstrated by several researchers.

A. Importance of Management & EDP Support:

Just as user involvement is indispensable to successful project management, so management involvement with IM (information management) is a critical success factor in achieving IM effectiveness in organizations. This fact was presented at the 1978 SMIS conference by A.Jackson Forster[50]

> The importance of top management involvement and input must be considered by the Management Information Systems (MIS) professionals as critical to the success of the MIS activities. The rationale is simple and basic: without management support and input, a company wide commitment to MIS will not exist... this lack of commitment will be significantly detrimental in terms of the development and approval of an MIS

---

[50]. A. Jackson Forster, "Power Strategies and Techniques for Obtaining Top Management Input into MIS Master Plans," SMIS Conference Proceedings, (Sep., 1978), P. 57, quoted from Synnott & Gruber, Information Resource Management, P. 127

> master plan as well as the availability of adequate budget and resources.
> It is essential, therefore, that the MIS executive clearly understands the proper role and relationships between top management and MIS and, most importantly, identifies those strategies and techniques that will result in effective top management input into the master MIS plan.

Thus, it is important, as an information-planning activity to close the communications gap between line management and technical information people. To achieve this, it is important to upgrade the business quality of the information organization by placing people there who were equally proficient as businessmen and as systems people.

In fact, end users should not be left alone with their tasks. They should be provided with both management and EDP support to be more productive. As was mentioned earlier in this chapter, the development of low-cost minis and the advent of microcomputers led to the diversion of more work from time-sharing and a surge in new end user applications. As the cost of computing equipment decreased, the amount of vendor assistance decreased as well. Applications were installed with the use of relatively untested packages and minimal systems and analysis work. Hence the importance of the EDP guidance and support to end users when approached their MIS departments with a

variety of problems such as: [51]

- The systems that users or vendors developed did not solve business needs and were very difficult to modify in order to be useful.

- Redundant data and data integrity problems resulted from unsystematized (i.e ad hoc) development of files or databases from rekeyed data.

- Limitations in hardware and software prevented or complicated communication with other systems owned by a company.

- Computing costs were growing rapidly, but productivity gains were minimal or impossible to prove.

In such cases, the need for an environment in which a central MIS group provides control and direction is vital/critical. An end user who is thinking about expanding his own use of computing may also be involved in a number of other system-related activities[52] as illustrated in figure 2.4.

---

[51] John A. McGann, "Meeting The Challenge Of End User Computing", Journal Of Systems Management, (March 1990), P. 13-16.

[52] Ibid, P. 14.

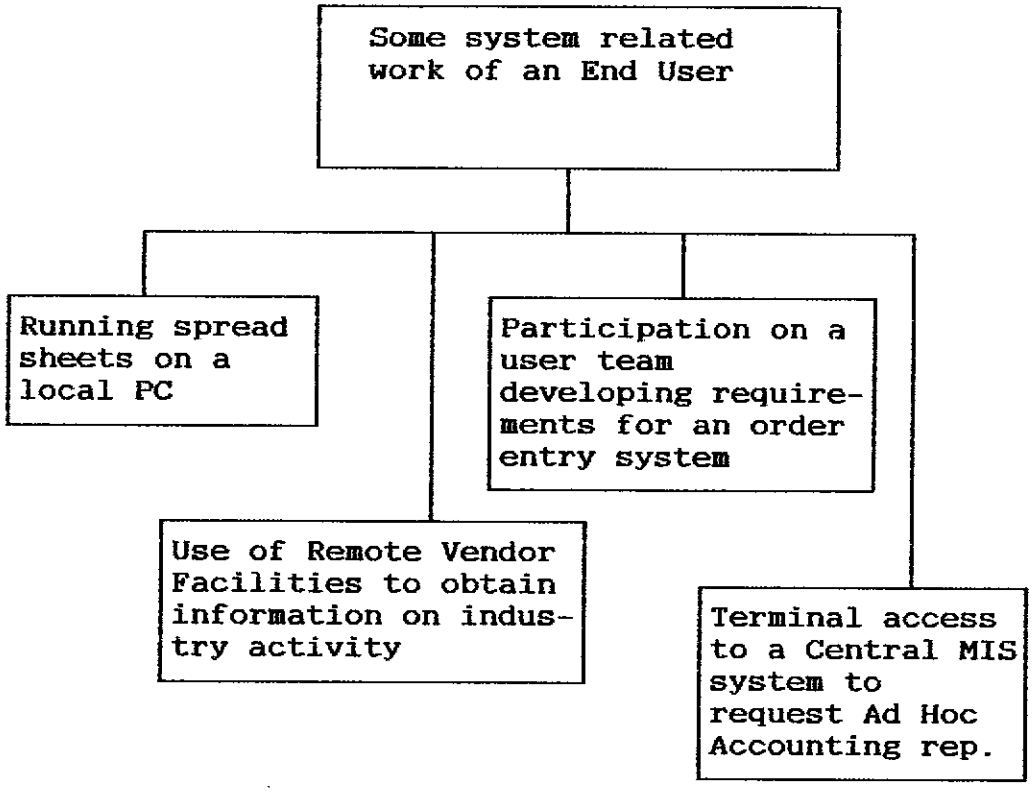


Fig. 2.4 _ Expansion of end user's own use of computing.

It is thus a straightforward task "to gather information about system activities and provide education and guidance to end users involved with a number of corporate and/or departmental projects or their plans or thoughts if they feel that both their business ideas and the system concept they have in mind could be viewed as simplistic or questionable".In fact, these ideas of end users can have a disruptive impact on systems planning or evolution, but they may arise from situations that could influence the way that the company's business should evolve. Therefore, it may not be wise to delay

listening to these users simply because the central MIS group is overburdened with project requests or other tasks.

B- Emergence of New Partnership between MIS/DP & End Users:

Moreover, as was mentioned previously, the end user computing trend helped in focusing information technology outside the traditional MIS/DP environment. In some of these cases, corporate MIS departments provided only reluctant and inadequate support to the computation activities of end users. In other cases, corporate MIS managers thought of end user computing as an opportunity to establish new and more visible roles in their corporations' overall strategy.[54] Defining an optimal role for MIS departments in this new environment has been a difficult task for most companies, and thus MIS managers and end users are being forced to reassess their traditional roles and relationships.

In a survey conducted by Kwan and Curley, the findings showed the emergence of a "new partnership" in the corporate processing environment based on a set of clear roles, responsibilities and relationships between the MIS department and end users.[55]

---

[54]- J.C. Henderson and M.E. Treacy, "Managing end user computing for competitive advantage", Sloan Management Review, (Winter, 1986), 3-14.

[55]- Stephen K. Kwan and Kathleen Curley, "Corporate MIS/DP & End User Computing: The Emergence of a New Partnership", Database, (Summer 1989), pp.31-37.

They found that end users were more likely to initiate stand alone applications and likely to monitor and implement various EUC technologies. The MIS/DP department is responsible for purchasing hardware/software and setting the standards for such purchases. This view of shared responsibilities is affirmed by both MIS professionals and end user respondents. It also reflects the organization's efforts to balance the need for technical guidance while increasing user innovation and experimentation.

In conclusion, one can say that end user computing has changed the relationship between MIS/DP & end users in the corporate information processing environment.

2.2.6. Job and Career Attitudes:

A general aspect noticed in some commonly used methods of systems analysis is that they do not pose questions about the relationship between the system and users' job satisfaction or other social values.[56] In fact, increased productivity depends on employee attitudes towards their jobs and the feelings they have about how management is treating them. In the early 1980s, there was much interest in why the Japanese seemed so successful at managing their employees and letting them be satisfied with their jobs. "Quality of work life", along with compensation

---

[56]. Markus & Andersen, "Power over users", p.501

and fringe benefits, is a growing concern among employees. In the office, for instance, health issues are being raised more often, job discrimination is a constant concern, and even job retraining is becoming an issue in forward-looking companies. These and other issues are becoming part of the challenge of how to best manage and motivate employees. It is believed that if employees are satisfied with their jobs and with the way management is treating them· this will lead them to accept and be satisfied with new information systems.

The above literature shows the various factors emphasized by researchers and authors in achieving user satisfaction and thus End user computing and MIS success. This study will attempt to investigate microcomputer usage among professionals and managers and the various factors related to it. It will also try to identify the variables that have a strong, significant and positive relationship with MIS success such as users' participation, training, knowledge and experience, management and EDP support, job satisfaction and others. As a result, this study will be able to show how much these findings conform with the literature in this area.

CHAPTER III

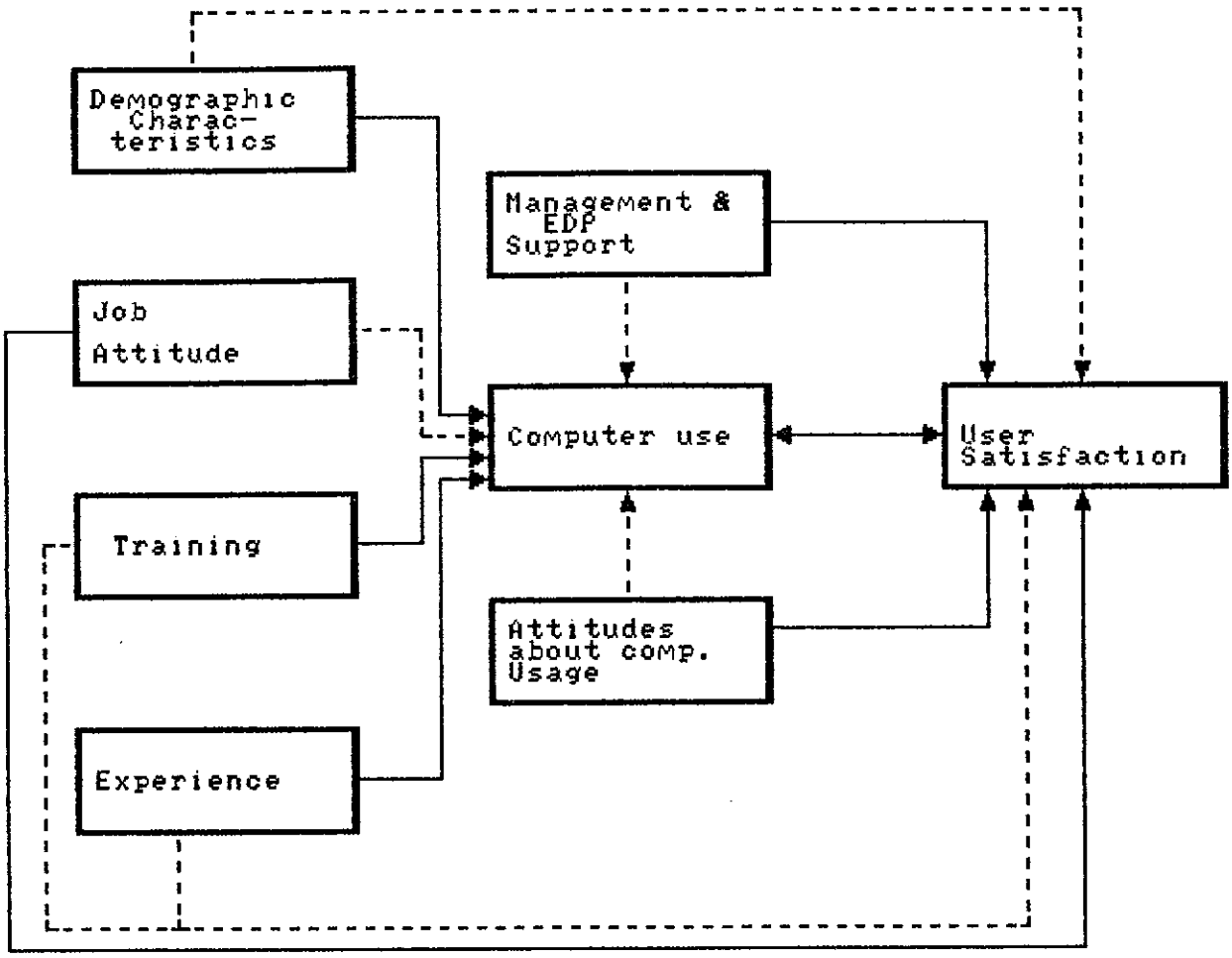
RESEARCH DESIGN & METHODOLOGY

3.1 The Basic Approach

This study has been conducted as a result of an interest in determining the critical factors that affect the success of end user computing (EUC) applications among managers and professionals in computer using organizations operating in Lebanon. Based on previous research, and as was mentioned in the previous chapter, user satisfaction is the measure selected as appropriate for EUC success in this study. Moreover, the study also intends to identify the various aspects related to computer usage-namely, organizational,demographic, and other characteristics.

As an initial step, the basic model proposed for this research is portrayed in Fig. 3.1.

Fig-3-1 The Computer Usage and User Satisfaction Model.



Following the common aspects in the methods used by Igbaria[1] and other researchers such as Delone[2], Yaverbaum[3], Mansour & Watson[4], and Srinivasan[5], computer usage will be investigated through the use of five dimensions: Computer reported duration of usage (time spent), computer reported frequency of usage (frequency), information inclusion, number of software packages used, and level of sofistication of usage. Also, the relationships between computer usage and demographic & organizational characteristics, and user training & experience, as well as attitudes & beliefs about computer usage, will be examined. Moreover, User Satisfaction, the measure for EUC success, will be studied from the perspective of to what extent indicators such as Management & EDP support, Job & Career Attitudes, computer type and beliefs about computer usage could be considered as success factors or determinants in this study.

---

[1]. Magid Igbaria et al., "Microcomputer Applications", Information & Management, (Vol. 16, 1989), pp. 187-196

[2]. William H. Delone, "Determinants of Success for Computer Usage in Small Business", MIS Quarterly, (vol.12, No.1 March 1988), pp. 51-61.

[3]. Gayle J. Yaverbaum, "Critical Factors in the User Environment", MIS Quarterly, (vol.12, No.1 March 1988), pp. 75-88.

[4]. Ali H. Mansour & Hugh J. Watson, "The determinants of Computer Based Information System Performance", Academy of Management Journal, (Vol. 23, No. 3, 1980), pp. 521-533.

[5]. Ananth Srinivasan, "Alternative Measures of System Effectiveness", MIS Quarterly, (Vol.9, No.3, September 1985), pp. 243-258.

3.2. Sources of Information & survey Design:

The major sources of information for this research were the computer using organizations in Lebanon. Questions were directed to managers and professional staff, normally in a good position to provide information on the previous aspects of computer usage and on the various factors leading to their satisfaction as end users.

The user survey selected to be used in our study was structured, according to the basic methodology, to cover a variety of factors related to computer usage and user satisfaction. The questionnaire used is divided into parts including computer use, software use, information inclusion, computer training, computer knowledge & experience, management & EDP support, beliefs & attitudes about computer use, user satisfaction, job and career attitudes, and demographic characteristics. Within each part, item questions were designed to build each specific measure. The validity of the survey scales adopted in this study was proved by many researchers who used them as the main tool for data collection (e.g. Igbaria, Mansour & Watson, & Srinivasan). A sample questionnaire could be referred to in Appendix A.

As to the measure of EUC sccess, the approach reported by Jenkins & Ricketts[6] "is one of the few (if not only) approaches that develops an instrument to measure user satisfaction that is well grounded in a widely accepted theoretical model ... the procedure adopted by Jenkins and Ricketts in developing and testing a satisfaction instrument provides a firm basis for researchers interested in this issue"[7].

In order to present the underlying factors that constitutes overall satisfaction with the system, Jenkins and Ricketts hypothesized that users evaluate their experiences with the system from the perspective of Simon's paradigm for the problem-solving process (intelligence, design, & choice phases). Using the factor analysis approach to empirically test their claim, they postulated that there are five underlying dimensions that make up overall user satisfaction: report content, report format, problem solving, input procedures, & system stability. Table III shows the correspondence between each of the five dimensions and the problem-solving paradigm[8].

---

[6] A.M. Jenkins and J.A. Ricketts, "Development of an Instrument to Measure User Satisfaction with Management Information Systems", Unpublished paper, Indiana University, bloomington, Indiana, 1979.

[7] Srinivasan, "Measures of System Effectiveness", p. 245.

[8] Ibid, p.245.

Table III. Dimensions of User Satisfaction & the Problem Solving Paradigm.

Problem Solving Paradigm	User Satisfaction
Intelligence	Input Procedures Systems stability
Design	Problem Solving Report Contents
Choice	Report Form

Source: Jenkins & Ricketts, "Development of an Instrument to Measure User Satisfaction with MIS".

Jenkins and Ricketts outlined the issues or the items to be included under each of the five dimensions as follows:

Report Content:

Accuracy of report contents

Relevance of report contents

Adequacy of report contents

Understandability of report contents

Report Form:

- Quality of format
- Timeliness of report
- Mode of presentation
- Sequencing of information

Problem Solving:

- Usefulness for identifying and defining problems
- Usefulness for selecting among alternatives
- Power of the modeling language employed
- Flexibility of the modeling language involved

Input Procedures:

- Ease of understanding input procedures
- Comprehensiveness of documentation
- Interfacing languages
- Editor characteristics

System Stability:

- Response time
- Error proneness
- Reliability of the system
- Accessibility/Availability of the system

Another similar approach was proposed by Bikson & Grutek[9] who measured user satisfaction along four dimensions: functionality, equipment performance, interaction, and environment. These measures were adopted by Igbaria et al. who incorporated them in their study along with other dimensions such as response time, presentation format, quality of maintenance, and overall user satisfaction. Such a scale was validated by the researchers for having an internal consistency reliability of 0.88[10]. This framework is used here in this study for the measurement of user satisfaction with the system.

3.3. Sample and Data Collection:

A questionnaire was distributed to managers and professionals who interact with a computer as part of their job. They were drawn from a sample of 30 organizations operating in Beirut.

Two hundred and fifty questionnaires were distributed to employees working in these organizations. Completed questionnaire were again taken back from only 114 managers and professional staff despite the fact that the personal approach in

---

[9] T.K. Bikson & B.A. Grutek, Advanced Office Systems: An Empirical Look at Use & Satisfaction, Proceedings National Computer Conference, 1983, pp. 319-328, quoted from Igbaria et al., p.190.

[10] Igbaria et al., "Microcomputer Applications", p. 190.

data collection was used. The process involved meeting with the repondent, explaining the nature of the study and then arranging for a follow-up visit after a few days to clarify any questions and pick up the complete questionnaires. The response rate thus was 45.6%. A lot of managers showed high resistance to fill the questionnaire items. The final sample consisted of 100 managers and professionals, since it excluded incomplete questionnaires and responses from non-direct computer users.

Although no random sampling technique was applied, the end users sampled came from a wide variety of organizations belonging to various economic sectors and from a broad spectrum of management levels and functional divisions. This, according to previous researchers such as Yaverbaum[11], seems to represent a fair sample of end users for this area and can be regarded as truly representative of a complete spectrum of attitudes & beliefs.

3.4. Research Variables.

The proposed factors to influence computer usage & EUC success are chosen on the basis of their perceived importance in the organizational context as was presented by previous research.

---

[11]- Yaverbaum, "Critical Factors In the User Environment", p. 79.

3.4.1 Computer Usage.

Based on previous research on MIS usage [Delone (1988), Srinivasan (1985), Igbaria et al. (1989)], five dimensions of computer usage are included in this study:

1. Inclusion of computer ananlysis in user tasks: this dimension was suggested by Lucas (1973) and by Chenney & Dickson (1982)[12] and has been used by Igbaria et al. (1989). The scale was developed for measuring thirteen tasks: looking for trends, finding problems, planning, budgeting, taking actions, communicating with others, controlling and guiding activities, making decisions, historical reference, keeping activities and performance up-to-date, aiding in reporting to superiors, aiding in increasing productivity, and aiding in cutting costs. Ordinal scaling was used to measure each task category. Five ordinal answers were listed. No usage at all made up the low end of the scale and was assigned the value of 1. A great extent of usage was assigned a value of 5. For each of the thirteen tasks, respondents were asked to indicate the extent to which they used computers in

---

[12] Igbaria, p. 189.

a scale ranging from "not at all" to "to a great extent". The number of these tasks was used as an index for this measure.

2. Actual daily use of computers: this dimension is widely used in MIS studies. For the purpose of this study, the scale used by Igbaria (1989) will be applied. Self reported time was used, as measured on a six point scale ranging from "almost never" to "more than 3 hours per day".

3. Frequency of use: This dimension was suggested by Raymond[13](1985) and Delone (1988), and was used by Igbaria (1989). It provides a slightly different perspective than duration of use. Srinivasan (1985) and Igbaria (1989) included actual daily use of microcomputers and frequency of use of microcomputers in their measures of usage. Frequency of use was measured on a six point scale ranging from "less than once a month" to "several times a day".

4. Number of packages used: A good indication of overall usage and the variety of tasks performed on the computer can be provided by measuring the number of different packages used by each manager. This was proposed by Lee[14], and used by Igbaria et al. (1989).

---

[13] L. Raymond, "Organizational Characteristics and MIS Success in the Context of the Small Business", MIS Quarterly, (vol.9, No.1, March 1985), pp. 37-52

[14] D.S. Lee, "Usage Patterns and Sources of Assistance to Personal Computer Users", MIS Quarterly, (vol.10, No.4, December 1986), pp. 313-325

A list of 10 different categories of packages was specified. The list consists of: spreadsheets (e.g Lotus 1-2-3), word processors (e.g Wordperfect), data management packages (e.g Dbase III+), modeling systems (e.g IFPS, HTPM), statistical packages (e.g SPSS), graphical programs (e.g Chartmaster), communication packages (e.g via electronic mail), fourth generation languages (e.g FOCUS), third generation language (e.g Fortran), & others (e.g Accounting packages, Payroll packages,....). For each of the ten applications, ordinal scaling was used where respondents were asked to indicate to what extent they used computer software applications. The number of these that respondents reported was used as a measure of this variable.

5. Level of sophistication of usage: This was used by Maish[15] and Igbaria (1989). This serves to measure proficiency of use of the computer. For each of the 10 different categories of applications, respondents were asked to indicate their level of expertise. Each item was measured on a five point scale ranging from (1) Not at all to (5) To a great extent. The measure was the sum of the levels of expertise indicated for each category of package used.

---

15. A.M Maish, "A User's Behavior Toward His MIS, MIS Quarterly, (Vol.3, No.1, March 1979), pp. 39-52

3.4.2. Computer Experience & Training: computer experience was assessed by asking respondents to indicate whether they had experience in using different types of computer software, languages, and development of computerized information systems. Responses were coded 0 for no experience, and 1 for some or more experience. The total number that the respondents reported was used as a measure. Computer training was measured by individual's responses to a question which asked them to report the extent of training they had received from four sources: college or university courses; vendor & outside consultants training; in house training; and self training. This scale was proposed by Nelson & Chenney[16] and used by Igbaria et al. (1989). The mean of the responses to these four questions was used as an indicator of computer training. The validity of the scale was proved by Igbaria since it had an internal consistency reliability of 0.86.

3.4.3 Demographic Variables: Single item questions were used to ascertain respondents' gender, age, education, and organizational position and division.

---

[16] R. Nelson and P. Cheney, "training End Users: An Exploratory Study", MIS Quarterly, (vol.11, No.4, Dec. 1987), pp. 547-559.

The level in the organizational hierarchy consisted of four categories: professional staff, first level supervisor, middle management, and strategic management. As to the functional division, 11 categories were used: Accounting, finance, marketing, general management, personnel, information systems, sales, manufacturing/production, engineering, R&D, & other.

3.4.4 User Satisfaction: A major indicator that reflects the success of end user computing can be provided by the user satisfaction measure. Respondents were asked to report their description of the computer-based information system products. A list of 18 items was used, and the response options range in a Likert type scale from 'Almost never' to 'Almost always'. The mean of the responses to these question items was used as a measure for this variable. This measure is used

as the dependent variable in this study. The validity of the scale used was proved by Srinivasan and Igbaria as was mentioned above.

3.4.5. Mnanagement and EDP Support: This measure is used to assess the support of management to end users

through providing them with the proper facilities that would lead to their satisfaction with the information system. This measure is assessed by asking respondents to indicate their agreement or disagreement with 8 statements reflecting management attitude towards & support to computer use. The response options are anchored on a five point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree. The mean of the responses to the item statements was used as the measure score for this variable.

3.4.6 Beliefs & Attitudes About Computer Usage: This measure reflects the general attitude of users about using computers in their jobs. This was used by Igbaria (1989) in term of computer anxiety and had an internal consistency reliability (coefficient alpha) of 0.94. The instrument asked individuals to indicate their agreement or disagreement with 11 statements reflecting the beliefs of users about the advantages and disadvantages of using computers. The response options in this scale range from (1) strongly disagree to (5) strongly agree. The mean of the responses was used as a measure for this variable.

3.4.7 Career and Job Attitudes: This factor is measured by asking respondents to indicate their

agreement and disagreement with statements related to career and job aspects. The scale included dimentions such as general satisfaction, promotion and pay level, status, job security, specific satisfactions, internal motivation, and task significance. Each dimension involves many items that are responded according to a five-point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree. The scale was validated by Yaverbaum (1988) in a job diagnostic survey (JDS) he conducted. The score measure of this variable is the mean of the responses for the item statements.

A list of all the variables used in this research, their description, and coding could be referred to by the reader in Appendix B.

3.5 Data Analysis.

Responses were analyzed using the facilities of the statistical package SPSS (Statistical Package for Social Sciences). Using this facility, a descriptive analysis was used to:

1- investigate the computer usage along the five dimensions and the relationship between each dimension and demographic variables, computer experience, user

training, beliefs about computer usage, and other variables. To achieve this, the frequencies, One-way ANOVA, Crosstabulation, and Correlation facilities were used.

2- build a regression equation that explains the variations in the user satisfaction variable (i.e the success of end user computing). The variable User Satisfaction was considered as the dependent variable with the rest of variables being independent.

Having identified the design and the methodology of this research, the variables to be included, and the analysis tools to be used, it is an important step now to list the findings and the implications of the study and to evaluate them in the light of the hypotheses to be tested. This is in fact the objective of the following chapter.

CHAPTER IV

STUDY FINDINGS

In chapter one, the research questions were listed as follows:

1- What are the major features related to end user computing and its users, including end user computing applications.

2- What are the factors that are likely to be associated with the successful adoption of end user computing ?

The aim of this chapter is to answer these questions in the light of the findings obtained and the interpretation of results.

4.1 General End User Characteristics.

As was mentioned in the previous chapter, the response rate was 45.6% and the size of the sample upon which the study was conducted is 100 end users. Employees surveyed by this study were those who interact with a computer as part of their job, either regularly or occasionally.

Of the 100 respondents 31% were females and 69% were males. The managers were employed in a variety of merchandising, insurance, finance, educational, and health care organizations. Moreover, these managers held managerial and professional positions in a wide range of functional areas, including accounting, finance, MIS, marketing, sales, and engineering. The average age of the respondents was 27.8 years. Table IV shows a profile of the end users included in the sample.

Table IV. Profile of End Users.

Characteristic	Range	Percentage
User Characteristics:		
Age	21-29	74 %
	30-39	23 %
	40 & above	3 %
	Mean = 27.3 Median = 27 Range = 21-44	
Sex	Male	69 %
	Female	31 %
Education	High school	5 %
	Some college	5 %
	B.S degree	57 %
	Some graduate	6 %
	Grad. degree	27 %
Computer courses	None	12 %
	Some or more	88 %
Job Characteristics:		
Job level	Proff. staff	33 %
	1st level sup.	21 %
	Middle Mgmt	23 %
	Strat. Mgmt	14 %
	Other	9 %
Organizational Characteristics:		
Organization business	Merchandising	18 %
	Health care	18 %
	Insurance	8 %
	Educational	12 %
	Financial	29 %
	Other	15 %

Before going on in this chapter, it's worth mentionning that a residual analysis was applied on the data. This analysis showed that 20 cases (records) should be discarded. This might be attributed to the fact that some users had given random responses on the questionnaires they were asked to fill out. As a result the sample size to be considered is n = 80.

4.2 Computer usage

A description analysis was used to investigate the computer usage along the five dimensions, and the relationship between each dimension and other variables. The distribution of each of the five dimensions is given as follows:

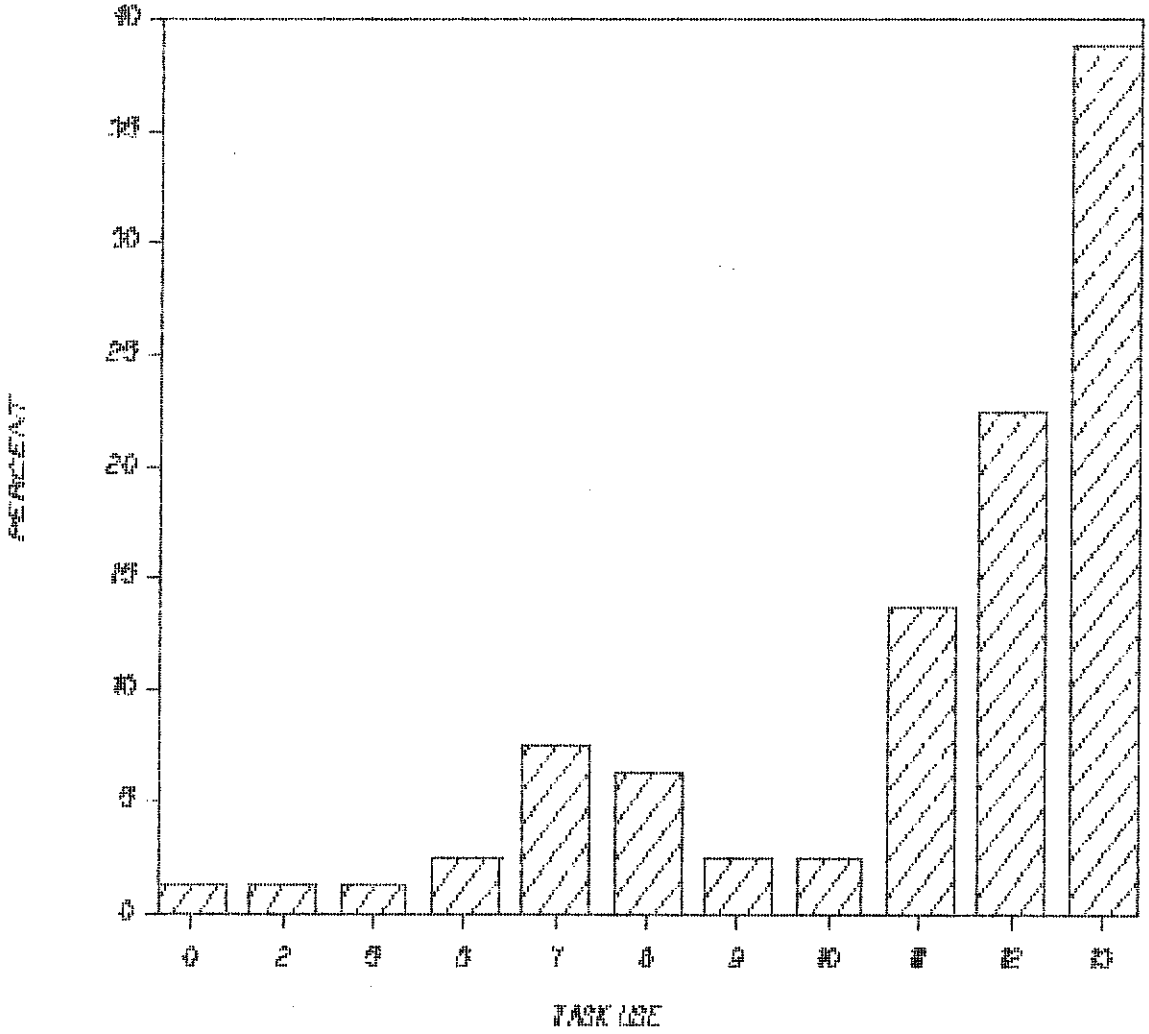
4.2.1 Inclusion of computer analysis in user tasks.

The frequency of this dimension of computer usage is shown in table V and in Fig. 4.1.

Table V. Number of tasks (TSK-Use).

TSK-USE	Frequency	Percent	Cum %
0	1	1.3	1.3
2	1	1.3	2.5
5	1	1.3	3.8
6	2	2.5	6.3
7	6	7.5	13.8
8	5	6.3	20.0
9	2	2.5	22.5
10	2	2.5	25.0
11	11	13.8	38.8
12	18	22.5	61.3
13	31	38.8	100.0
	80	100.0	

Fig. 4.1. Number of tasks reported



It was found that 95 % of the respondents had used computers as an aid for increasing productivity. Respondents also used them to be kept up-to-date on activities and performance (95%). This was followed by adequately reporting to superiors (94%), historical reference (87%), cutting costs (86%), planning (86%), finding problems (85%), taking actions (85%), Making decisions (84%), controlling and guiding activities (79%), budgeting (74%), looking for trend (72.5%), and communicating with others (65%). Moreover, it is interesting to find that 38.8 % of the respondents had used computers for all thirteen tasks, and less than 7% reported using computers for seven tasks or less.

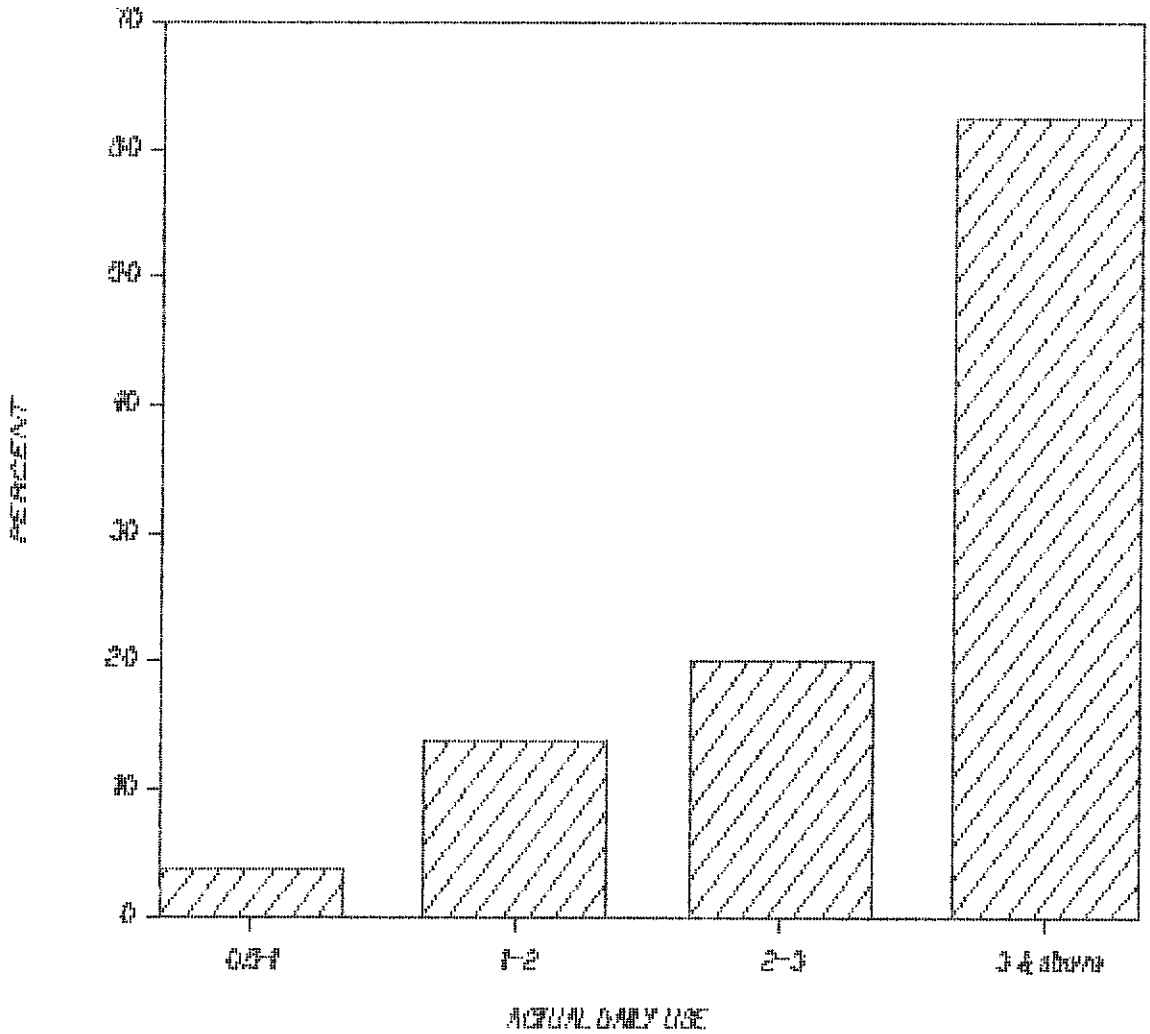
4.2.2. Actual use of computers.

Respondents spent a significant time using computers. Table VI and fig. 4.2. show the reported actual time spent on using computers. Most of the respondents used computers for more than 3 hours per day (median is category 6 (more than 3 hours)).

Table VI. Actual Daily Time Spent Using Computers.

Actual Time Spent	Frequency	Percent	Cum Percent
1/2hr to 1hr	3	3.8	3.8
1-2 hrs	11	13.8	17.5
2-3 hrs	16	20.0	37.5
3 and above	50	62.5	100.0
	80	100.0	

Fig. 4.2. Actual daily use



At least 62.5 % of the respondents had used the computers more than 3 hours per day. This group is the group of "heavy computer users". Because of the same method of measurement, this result can be directly compared with Igbaria's, where the managers averaged 1-2 hours per day. In his study, the median was category 4 (1-2 hours) which was also within a comportable range of Lee's figure (9.48 hours per week).

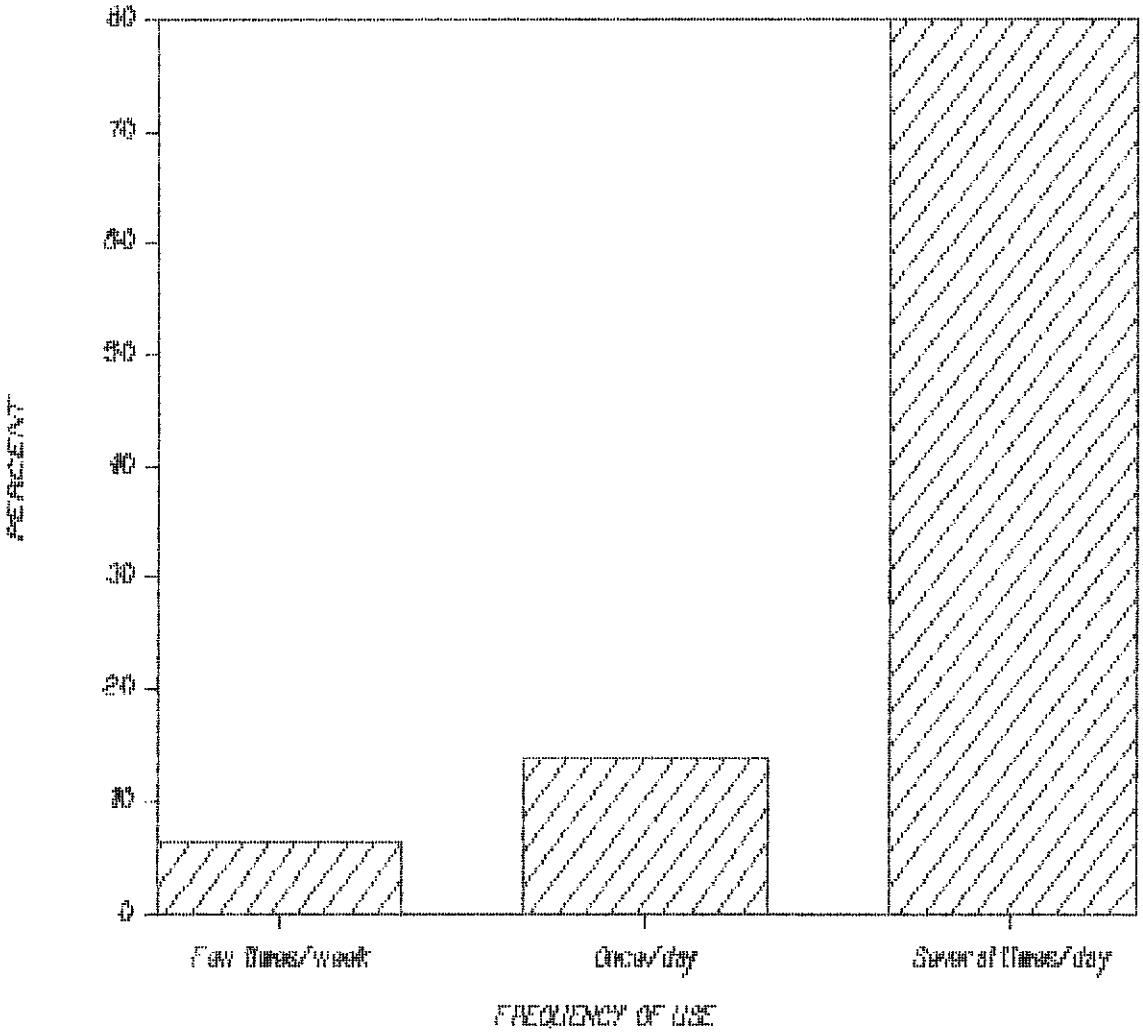
4.2.3. Frequency of Use.

"Heavy users" can also be defined as respondents who used computers several time a day. The respondents' reported frequency of use is presented in table VII. and in Fig. 4.3. The results show that 80% of the respondents classified themselves in this category. Such result made it necessary to raise the question: Who used computers frequently?

Table VII. Reported Frequency of Use.

Frequency of use	Frequency	Percent	Cum. Percent
Few times/week	5	6.3	6.3
About once/day	11	13.8	20.0
Sev.times/day	64	80.0	100.0

Fig. 4.3. Frequency of use reported



Significant differences were found across functional divisions. A one-way analysis of variance was used to test for significant differences in the frequency of usage accross the different divisions. This result was obtained at a significance level of 0.05 (P <= 0.05), and is shown is table VIII. When using one-way ANOVA, the observed significance level is obtained by comparing the obtained F to the values of F distribution with K-1 and N-K degrees of freedom,

Table VIII. One-Way ANOVA: C-FRQUSE by FUNC-AREA.

Source	Degree of Freedom	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	2	20.884	10.1442	1.2492	.2925
Within Grps	77	625.2616	8.1203		
Total	79	645.5500			

where K is the number of groups and N is the number of cases in the entire sample. The observed significance level is the probability of obtaining an F-statistic at least as large as the one calculated when all the population means are equal. If this probability is small enough, the hypothesis that all population means are equal is rejected. In other words, if $F_{statistic} < F_{calculated}$, then there is a significant difference between the means. Since in this case $F_{prob.}$ is equal to 0.2925 and F_{ratio} is equal to 1.2492, then $F_{prob.} < F_{ratio}$ which means that there is a significant difference in the frequency of usage across the different divisions. Consistent with expectations, computers were used more often in the Accounting departments(93.8%), followed by the Information system departments(81.3%). Computers were used least in the rest of the functional divisions. This result was obtained from the procedure of using the crosstabulation function of Functional Area by the frequency of use variable. The result is shown in table IX . A calculation of the Chi-square here also led to a similar result.

Table IX. Crosstabulation Of C-FRQUSE By FUNC-AREA.

Page 2 SPSS/PC+ 7/15/90

Crosstabulation: X8 C-FRQUSE
By X106 FUNC-AREA

- -Page 1 of 2

X8 / X106 ›	Count / Col Pct	ACC 1	FNC 2	MKG 3	GMG 4	PRS 5	Row Total
4 FEW TIMES/WEEK			1 25.0		1 20.0		5 6.3
5 ABOUT ONCE/DAY		1 6.3	1 25.0			1 25.0	11 13.8
6 SEV TIMES/DAY		15 93.8	2 50.0	4 100.0	4 80.0	3 75.0	64 80.0
Column		16	4	4	5	4	80

Page 3 SPSS/PC+ 7/17/90

Crosstabulation: X8 C-FRQUSE
By X106 FUNC-AREA

- - - -Page 2 of 2

X8 / X106 ›	Count / Col Pct	INFS 6	SLS 7	ENG 9	R&D 10	OTHER 11	Row Total
4 FEW TIMES/WEEK		1 3.1				2 40.0	5 6.3
5 ABOUT ONCE/DAY		5 15.6	2 50.0	1 20.0			11 13.8
6 SEV TIMES/DAY		26 81.3	2 50.0	4 80.0	1 100.0	3 60.0	64 80.0
Column Total		32 40.0	4 5.0	5 6.3	1 1.3	5 6.3	80 100.0

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F.< 5
24.79688	18	.1306	.063	28 OF 30 (93.3%)

Table IX. (continued).

Statistic	Symmetric	With X8 Dependent	With X106 Dependent
Lambda	.01563	.00000	.02083
Uncertainty Coefficient	.10589	.21079	.07070
Somers' D	-.13393	-.09598	-.22150
Eta		.38517	.17728

Statistic	Value	Significance
Cramer's V	.39368	
Contingency Coefficient	.48643	
Kendall's Tau B	-.14581	.0688
Kendall's Tau C	-.11203	.0688
Pearson's R	-.17483	.0604
Gamma	-.27252	

Number of Missing Observations = 0

This procedure was completed at 3:10:04

In the Chi-square test of independence, the hypothesis that two variables are independent of each other is tested. If the probability which is also known as the observed significance level is small enough (usually less than 0.05 or 0.01), the hypothesis that the two variables are independent is rejected. In this case the value of the Chi-square calculated was 24.79, and the observed significance level is 0.1306 at a degree of freedom equal to 18. Since 0.1306 is greater than 0.05, Then the conclusion is that the two variables Frequency of use and Functional area are independent of each other.

Another One-way ANOVA test was done to check for any significant difference in the frequency of usage among the various management levels. This is shown in Table X.

Table X. One-Way ANOVA:FRQUSE by ORGL.

Source	D.F	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	1	4.3376	4.3376	6.146	0.0153
Within Grps	78	55.0499	0.7058		
Total	79	59.3875			

Since $F_{Prob.}$ (0.0153) < F_{Ratio} (6.1460), then there is a significant difference in the frequency of usage among the levels of management in the organizational hierarchy. Crosstabulation of these two variables showed that computers were mostly used by middle management (88.9%), followed by professional staff (82.5%), first level supervisors and strategic management (75%), and others (60%). This result is shown in Table XI.

4.2.4. Number of Packages Used.

The diversity of applications used was used as an indicator of user sophistication. An "advanced user", as was called by Igbaria (1989), can be defined as one who reported using several different applications. Overall, the respondents had an average of 4.6 types of applications (median of 5.0). The number of packages used is shown in Table XII and Fig. 4.4. The results obtained show that less than 7% of the

Table XII. Number of Packages Reported.

# Of Packages	Frequency	Percent	Cum. Percent
1	5	6.3	6.3
2	5	6.3	12.5
3	14	17.5	30.0
4	11	13.8	43.8
5	16	20.0	63.8
6	18	22.5	86.3
7	6	7.5	93.8
8	3	3.8	97.5
9	2	2.5	100.0

Table XI. Crosstabulation of C-FRQUSE by ORGL

Crosstabulation: X8 C-FRQUSE
By X107 ORGL

X8 \ X107	PFS 1	FLS 2	MDM 3	STM 4	OTHER 5	Row Total
4 FEW TIMES/WEEK		1 6.3	1 5.6	2 16.7	1 20.0	5 6.3
5 ABOUT ONCE/DAY	5 17.2	3 18.8	1 5.6	1 8.3	1 20.0	11 13.8
6 SEV TIMES/DAY	24 82.8	12 75.0	16 88.9	9 75.0	3 60.0	64 80.0
Column Total	29 36.3	16 20.0	18 22.5	12 15.0	5 6.3	80 100.0

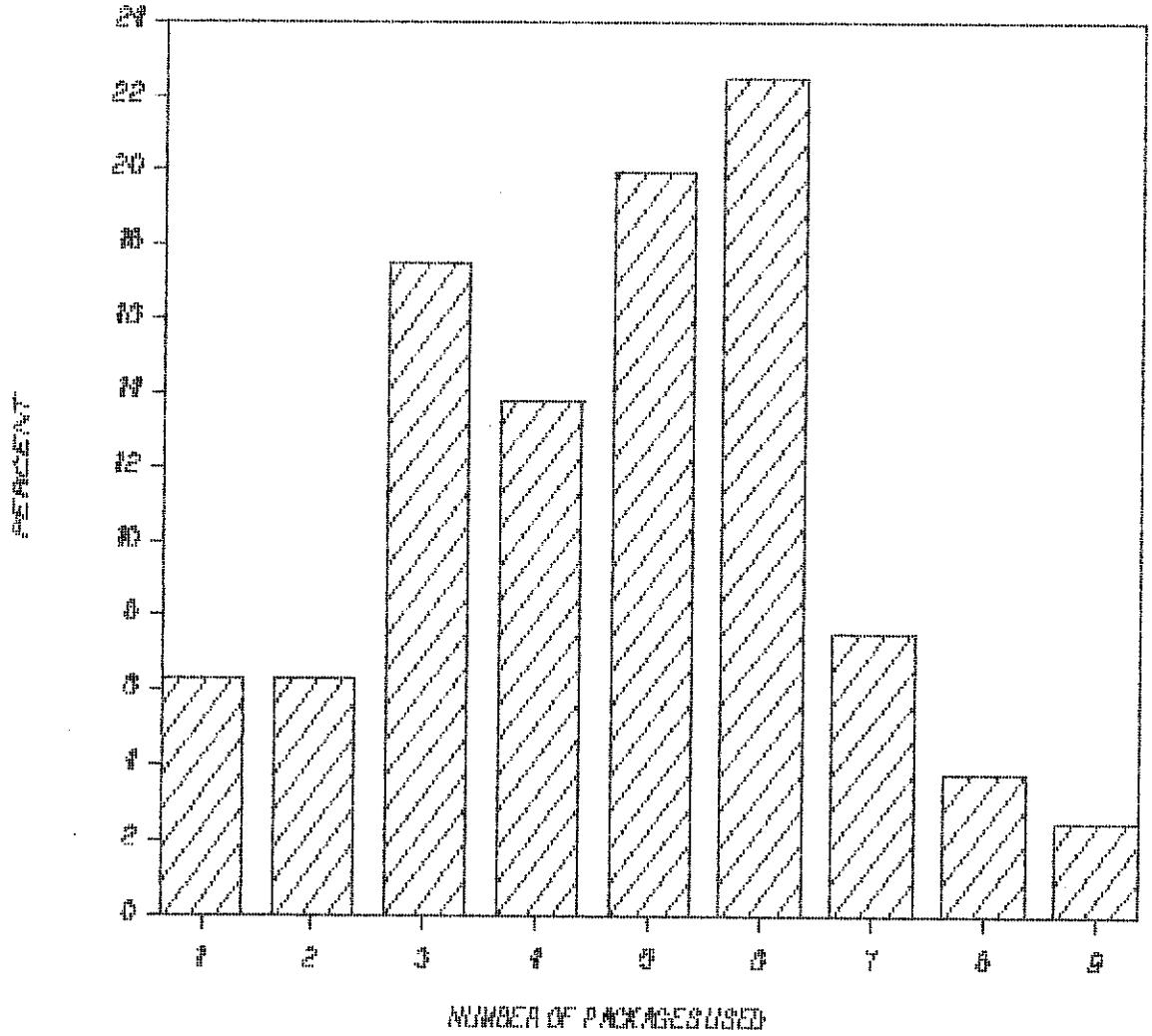
Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F.< 5
7.79023	8	.4542	.313	11 OF 15 (73.3%)

Statistic	Symmetric	With X8 Dependent	With X107 Dependent
Lambda	.02985	.00000	.03922
Uncertainty Coefficient	.05121	.08640	.03639
Somers' D	-.07750	-.05613	-.12512
Eta		.22544	.25896

Statistic	Value	Significance
Cramer's V	.22066	
Contingency Coefficient	.29789	
Kendall's Tau B	-.08380	.2011
Kendall's Tau C	-.06328	.2011
Pearson's R	-.16752	.0687
Gamma	-.16091	

Number of Missing Observations = 0
This procedure was completed at 1:28:38

Fig. 4.4. Number of packages reported



respondents had used 8 different applications or more. Moreover, 12.5% of the respondents had used one or two different applications. Other than the "other" category which was rated 98.7%, the Word Processor applications were the most popular with 87.5% reporting usage; the next most popular used was the spreadsheets, with 77.5% reporting usage. These were followed by data management packages (72.5%), Third Generation Languages (58.7%), Statistical Packages (45.0%), Graphical Packages (32.5%), distantly followed by Communication Packages (26.2%), Fourth Generation Languages (20%), and Modeling Systems were ranked last, with 17.5%. These results could be referred to in the frequency distribution of variables listed in Appendix C.

Applying the crosstabulation function here for the various kinds of software packages by the Functional Area variable, it could be derived that spreadsheet programs were used in the information systems and in the accounting departments more than others. This might drive us to conclude that the rest of the divisions such as the finance, personnel, marketing and sales are using Specialized Application programs (such as payroll and inventory stock

programs) to process their data across the organizational hierarchy, higher level managers reported greater use of spreadsheet applications, while word processing and data management packages were used by lower level staff. This finding may however be the result of non-user friendly or inflexible applications. Computer developers should consider this if they want managers to become direct users. In fact, data management packages were highly used by people who had the data (information systems people and accountants). This finding is completely consistent with Igbaria's findings that reported a high usage rate of data management packages by accountants, computer and data processing people. As expected, statistical packages were used by managers with B.S. degrees (45%) and graduate degrees (20%).

These results are very similar to the two studies provided by Igbaria and Lee. Both reported that the greatest number of people used spreadsheet and word processing (94% and 63% respectively by Igbaria and 74% and 44% respectively by Lee). However, this study conforms more with Lee's from the aspect of graphics users percentage. While about 51% of the respondents

reported graphical applications in Igbaria's study, only 29.7% was the reported usage percentage in Lee's study. A comparison of this survey findings with those of Igbaria's and Lee's is presented in Table XIII.

Table XII. Comparison of Reported Rates of Packages Usage.

Type of Package	Lee's	Igbaria's	This Study
Word processor	44.0%	63.0%	87.5%
Spreadsheets	74.0	94.0	77.5
Data Mgmt Packages	28.8	41.0	72.5
Third Gen. Languages	37.4	20.0	58.7
Statistical Packages	-	14.0	45.0
Graphical Packages	29.7	51.0	32.5
Communication Packages	13.8	52.0	26.2
Fourth Gen. Languages	-	11.0	20.0
Modeling Systems	-	14.0	17.5

4.2.5. Level of Sophistication.

When this final dimension of computer usage was analyzed, the uses of computers for task performance was relatively high. More than 60% reported that they performed the thirteen tasks with the aid of computers. 38.8% of the respondents used computers for all thirteen functions, while the average is 10.98 application types (a median of 12 applications). The largest number of respondents used their computers for keeping performance up-to-date and for aiding them in increasing productivity (both 95%). 92.5% used computers for adequate reporting to supervisors. This was followed by historical reference (87.5%), aiding in cost reduction and planning (86.2%), finding

problems and taking Actions (85%), making decisions (83.7%), controlling and guiding activities (78.7%), looking for trend (77.5%), budgeting (78.7%), and communicating with others ranked last, with 65%.
These results could provide us with an idea about the position of computer usage in this country. Managers are still somehow far from efficiently making use of the computer technologies. Most of them are still using these advanced tools for routine tasks such as historical reference and reporting to superiors rather than implementing them in more critical situations such as looking for trend, budgeting, controlling, guiding activities, and communicating with others. The usage rate of computers for planning (86.2%) is compatible with the high use of spreadsheet which are ideally suited for such tasks as planning and creating different scenarios for decision making.

4.3 Computer Usage VS. Individual Variables.

Table XIII. shows the intercorrelation matrix among the variables. Examination of zero order correlations shows that the level of education is unrelated to the use of computers along the five dimensions.

Table XIII. Pearson Correlations Between Computer Usage and Other Variables (n = 80).

Var.	TSK-USE	C-ACTUSE	C-FRQUSE	SWRE-USE	Sophlv
Sex	0.0463	0.2703*	0.1028	0.1732	0.2177*
Age	0.1418	-0.0297	-0.0277	-0.1782	-0.0386
LOE	0.0447	-0.0082	0.0751	0.0193	0.0190
YOE	0.0941	0.1419	0.1732	0.0230	0.1708
ORGL	-0.1691	-0.0972	-0.1675	0.2468*	0.1360
U-EXPC	0.2068	0.2128*	0.0096	0.2824**	0.3674***
U-TRNG	0.0867	0.1931	0.1289	0.2972**	0.4485***
USRSAT	-0.0386	0.0958	0.0771	0.1553	0.1132
CU-ATT	-0.0115	0.0880	0.2837**	0.2132*	0.2502*
MGEDPST	0.0853	-0.0702	0.1737	0.2498*	0.2340*

* p <= 0.05
** p <= 0.01
*** p <= 0.001

This might be the result of the finding that users with B.S degrees are using computers more extensively and more often (45%) than those with some graduate studies (6%) or with graduate degrees (20%). Moreover, the high level of education attained by the majority of the respondents in this study may provide a partial explanation for the generally low relationps observed (56.3% of the respondents completed undergraduate degrees).

Although users who are in lower levels of the organization use computers more extensively and for less tasks than those in upper levels, there is no relation between the organizational level and the level of sophistication, diversity of applications, or frequency of use. These results raise some interesting

questions about computer usage by respondents at different organizational level. Middle level managers and professional staff used computers for the same number of applications but for a larger number of tasks and for more hours than other management levels. Higher level management were more concerned with tasks and functions than with information search. This is consistent with the findings of Ein-Dor and Segev.[1]

As expected, age had negative correlation coefficients with the various computer usage aspects except with the number of tasks for which the computer was used. However, it was found that age is unrelated to these aspects. This result is inconsistent with Lee's and Igbaria's findings.

Finally, according to the popular literature, because the "male domain" is that of mathematics and electronics, then computers are widely perceived to belong to that domain. "This, coupled with reports of greater prevalence of math anxiety among women than men [Betz (1978), Tabias and Weissbrod (1980)], suggested that women are likely to be more anxious about computers and to use computers less".[2] While Igbaria's study showed no relationship between gender and computer usage, this study reports a relationship

---

[1] P. Ein-Dor and E. Segev, "Organizational Context and MIS Structure", MIS Quarterly, (Vol. 6, No.3, Sep. 1988), pp. 55-68.

[2] Igbaria, p. 194.

between gender and time spent and sofistication level aspects. A one-way analysis of variance was also used to test whether there were significant differences in the computer usage. Significant gender differences were found along the actual computer usage time and the level of sophistication.

4.4 Computer Usage VS Attitudes Towards Computers and Management and EDP Support.

Contrary to many reports in the popular press and other media, and in conformity with the findings of Igbaria (1989), there were very few signs of negative computer attitudes towards computers (average = 3.625, Median = 4.00). Consistent with expectations, attitudes towards computer usage was positively related to frequency of usage, diversity of applications, and level of sophistication.

As to Management and EDP support, it was positively related to the number of packages used and to the level of sophistication in usage. This is consistent with the general belief that top management support and EDP sence of cooperativeness would lead users to work more with the system and to try various available sophisticated technologies.

4.5. Computer Usage Vs. User Experience and Training.

Computer experience and user training are considered important factors in computer usage. As could be noticed in Table XIII, computer experience is positively related to the duration of use (time spent, diversity of applications, and sophistication level). People with a stronger computer experience clearly seem to use microcomputers more often than others. Thus, the implication, in conformity with Igbaria's findings, is that the greater their experience with computers, the more managers will use computers in their tasks and for a larger number of applications.

Moreover, quite interesting relationships were also noted between training sources and computer usage. Training was found to be positively correlated with the number of packages used and the level of sophistication. The relationships between the four individual sources of computer related training and the system usage was examined.

Some significant relations were found:

1 - Computer training received in the form of courses in the college seemed to support data management packages (0.2664), Statistical Packages (0.3308) , and the use of third generation languages (0.2170).

2 - Vendor training was significantly correlated with modeling systems (0.2452) and graphical programs (0.2423) .

3 - In house company training was found to be highly correlated with the use of graphical programs (0.2177) , and modeling systems (0.2154).

4 - Finally, self training was significantly correlated with data management packages (0.2205) and to graphical programs (0.2827).

These findings are portrayed in table XIV.

Moreover, college training and training by vendor was positively correlated to the diversity of applications, and sophistication level. Overall, users with more training courses tend to use more varied and sophisticated applications more often. 90% of respondents reported to be self trained (the dominanat source) with the microcomputer applications, followed by training courses in the college (83.7%), vendor training (75%), and in house company training (50%). All individuals who will be required to use the new system should receive appropriate training until they understand it and feel comfortable in its use; better training might influence the individual's attitude towards computer usage and thus increase computer usage.

Table XIV. Pearson Correlations Between the Training Sources & Type of Package.

Variable	SU-SS	SU-WP	SU-DMP	SU-MS	SU-SP	SU-GRP
X35	.2094	-.0197	.2664*	.0910	.3308**	.2033
X36	.1212	.1016	.1052	.2452*	.1739	.2423*
X37	-.0892	-.0050	-.0346	.2154*	.0273	.2177*
X38	-.0456	.1962	.2205*	.0052	.0700	.2827**

* p <= 0.05
** p <= 0.01

Table XIV. Pearson Correlations (continued).

Variable	SU-CMP	SU-FGL	SU-TGL	SU-Other
X35	.2134	-.2007	.2170*	.0444
X36	.1468	-.0606	.1038	-.0182
X37	.1283	.1017	.0174	-.0256
X38	.1399	.0216	.0700	.0430

* p <= 0.05
** p <= 0.01

4.6 Regression Analysis: Building a model relating the independent variables to the dependent variable User satisfaction.

After investigating the various aspects related to computer usage, the intent of the study now is to answer the second major research question, i.e, identifying the critical factors that are likely to be associated with the successful implementation of end user computing. This section will describe the various steps followed in order to reach a regression equation that is most likely to form a reasonable fit for the model presented in the previous chapter.

The first step followed was to enter all the variables listed in Appendix B and find the most likely variables to be included in the equation. However, including a large number of independent variables in a regression model is never a good strategy. So, a correlation matrix and a stepwise method were implemented to select the most appropriate variables.

4.6.1 The corrolation matrix:

In order to avoid multicollinearity among independent variables, preparing a correlation matrix for all variables was an important step since large coefficients could always signal the existence of multicollinearity which could substantially affect the results of multiple regression analysis. After dropping the variables that had high correlation coefficients with others, the final correlation matrix presented in Table XV showed relatively low correlation coefficients among variables.

4.6.2 Determining Important Variables.

One of the researcher's interests in multiple

Table XV. Correlation coefficients among variables.

SPSS/PC+ The Statistical Package for IBM PC 7/15/90
The raw data or transformation pass is proceeding
80 cases are written to the uncompressed active file.

Page 2 SPSS/PC+ 7/15/90

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data

N of Cases = 80

Correlation:

	XUS	XJA	XMES	XACU	X5	X39	X42
XUS	1.000	.398	.395	.521	-.083	-.192	.279
XJA	.398	1.000	.264	.198	.058	-.046	.018
XMES	.395	.264	1.000	.241	.135	-.102	.016
XACU	.521	.198	.241	1.000	.124	.022	.059
X5	-.083	.058	.135	.124	1.000	.106	.183
X39	-.192	-.046	-.102	.022	.106	1.000	-.043
X42	.279	.018	.016	.059	.183	-.043	1.000
XT	.021	.180	.118	.155	.174	.314	-.165
X112	-.204	.285	.046	-.145	-.091	-.151	-.009
X113	.163	.106	.127	.010	-.009	.222	.162

Page 3 SPSS/PC+ 7/15/90

* * * * M U L T I P L E R E G R E S S I O N * * * *

	XT	X112	X113
XUS	.021	-.204	.163
XJA	.180	.285	.106
XMES	.118	.046	.127
XACU	.155	-.145	.010
X5	.174	-.091	-.009
X39	.314	-.151	.222
X42	-.165	-.009	.162
XT	1.000	.005	.200
X112	.005	1.000	.064
X113	.200	.064	1.000

regression could be to assign relative importance to each independent variable. For example, one might want to know whether Management and EDP Support (MES) is more important in predicting User Satisfaction than job and career attitudes (JA). In fact, there are two possible answers, depending on which of the following questions is asked:

- How important are MES and JA when each one is used alone to predict user satisfaction ?

- How important are MES and JA when they are used to predict user satisfaction along with other independent variables in the regression equation ?

The first question is answered by looking at the correlation coefficients between XUS (the user satisfaction) and the independent variables. The larger the correlation coefficient, the stronger the linear association. Table XV shows that XACU correlates more highly with XUS than does XJA. Thus from the results of the table, one can rank the independent variables in the order of their importance as predictors of XUS.

The answer to the second question is considerably more complicated. Since the independent variables are correlated among themselves, any statement about an

independent variable is contingent upon the other variable in the equation. Interpretation of the independent variables and the steps involved in the regression run to include them in the equation to explain the variations of XUS will be examined in the following section.

4.6.3. Results of the Rgression Analysis.

After preparing the correlation matrix, the regression analysis was started. The stepwise methid was selected to follow the inclusion of the independent variable one by one into the equation according to their significance as possible indicators of the XUS. The regression function worked on 9 independent variables:XACU, XMES, XJA, X39, X112, X42, X5, X113, XT. In step number 1, the regression function in SPSS included XACU as a variable that could possibly be used as an indicator of XUS. The regression output in step 1 resulted in a factor of determination, R^2 = 0.27 which means that 27% of the variations in user satisfaction could be explained by the attitudes towards and beliefs about computer usage.

The F ratio in the output was computed as: F-ratio = Sum of Squares/Mean Square = 29.04053. The F-statistic or Significant F = 0.0000. In step number 2, the regression analysis include XJA in the model, followed by X42, X112, X5, XMES, and last X39. A list of the overall regression output could be referred to in Appendix D. The final regression output resulted in the inclusion of 7 variables. These are: XACU, XJA, X42, X112, X5, XMES, X39. A list of these variables, their coefficient (B), Test statistic, T, and the P-value or the critical T (Sig T) is presented as follows:

Variable	B	T	Sig. T
XACU	0.33507	4.713	0.0000
XJA	0.27982	4.388	0.0000
X42	1.14195	3.809	0.0003
X112	-0.02945	-3.916	0.0002
X5	-0.24457	-3.210	0.0020
XMES	0.13719	3.066	0.0031
X39	-0.22870	-2.261	0.0268
(CONSTANT)	1.24468	2.567	0.124

The last step in the regression output, along with the information about the variable coefficients just listed, helped in deriving a regression model equation as follows:

XUS = 1.24468 + 0.33507 XACU + 0.27982 XJA +
(0.124) (0.0000) (0.0000)
1.4195 X42 - 0.02945 X112 - 0.24457 X5 +
(0.0003) (0.0002) (0.0020)
0.13719 XMES - 0.22870 X39.
(0.0031) (0.0268)

R2 = 0.61974

F = 16.76340 Signif. F = 0.0000

A. Significance of the Regression Equation:

R^2, the coefficient of determination, is equal to 62 %. This implies that the variations in XUS could be explained by these seven variables.

By use of analysis of variance, the usefulness of the regression equation can be tested by using the F-distribution. From the output presented, F = 16.76340 where p-value (the right tail area under the F-density function) = 0.0000 which is trivial. As a result, it could be concluded that there is a relationship between the user satisfaction and the seven variables included in the equation. This result shows that the regression model is a significant one.

B. Significance of the regression coefficients:

The significance of the correlation coefficients could be derived from examining the p-value of the T statistic. This p-value is listed above under Sig. T. Taking into consideration that the level of significance (alpha) is = 0.05, then one would conclude that a statistically significant relationship exists between each of the included variables (holding others constant) and the dependent variable XUS.

C. Interpretation of the equation:

The interpretation of this equation is quite straightforward (except for the constant term, a=1.24468). The value of b, 0.33507, indicates that for each added value in attitude (while other variables remain constant), user satisfaction would directly vary by the value of 0.33507. The positive sign shows that there is a positive relation between the attitude towards computer usage and the level of user satisfaction. The higher the user's positive beliefs about computer usage, the higher would be the degree of satisfaction with computer usage.

The same interpretation method could be applied on the variable XJA, career and job attitudes. The positive beta coefficient for this variable suggests

that the more satisfied the manager is with his job, the more likely will be his/her tendency to accept a new computer system and to feel satisfied with it. Most of the respondents indicated that the salary levels they get are relatively low, that the use of computers will somehow adversely affect their "security", "co-worker satisfaction", and "supervisory satisfaction (as reported by Yaverbaum (1988))", and that their work environment in general impedes work efficiency. Because such factors might lead to job dissatisfaction (as reported by Yaverbaum), then work redesign should be implemented to increase the internal motivation potential in employees and lead them to be satisfied with their jobs. This would positively affect the satisfaction with the new system since they would view it as a tool to increase their productivity and efficiency in work.

Computer knowledge and experience were also included as significant factors that would lead to EUC success. The more previous computer experience the user has, the more will be his satisfaction with new information systems. Concerning computer knowledge, computer course backgrounds, there is little significant difference in XUS scores associated with this variable. Moreover the nagative coefficient of

X39 suggests that the more background computer courses the user had had, the more would be his selectivity attitude towards computer systems, and, in consequence, the less would be his/her satisfaction with new information systems to be adopted and installed in the organization.

As to the use of a PC variable, X5, and contrary to expectations, the use of a PC did not reveal a positiv relationship with user satisfaction. Rather, a negative relation existed. This might be partially explained by the use of various software microcomputer systems that prove to be difficult or inflexible to use. It could also be explained by the fact that many respondents who reported using microcomputers also reported the use of mainframes and minicomputers. Thus trying to evaluate the PC users without changing the real data was not possible.

Coming to age it is observed that it shows a negative relationship with user satisfaction. This conforms with the general belief that the older the users are, the more will be their concern to use the computer output rather than directly using the computer to process their needs and get the information they require. This would lead to less EUC efficient application represented by the user satisfaction measure.

Finally, Management and EDP Support plays a crucial role in enhancing EUC success. It is one of the challenges of management to efficiently make use of the new information technologies, facilitate their installations, and motivate employees to use them. As a result, therefor, MES leads to a higher degree of user satisfaction .

This chapter presented a detailed description of all the findings obtained from the survey conducted. As was noticed, some of the findings were consistent, while others did not conform with other researchers' findings of surveys conducted within the same field.

CHAPTER V

CONCLUSION AND RECOMMENDATIONS

Although it is a relatively new phenomenon, EUC has stirred considerable interest in the information system community and has been the subject of many works of research. In fact, the declining cost of microcomputers (PCs) and the availability of easy to use software has hastened the spread of end user computing to a wide range of knowledge workers throughout the organization's hierarchy.

In Lebanon, it could be noticed that the use of computers is wide spread through various organizations belonging to different economic sectors: finance, merchandising, health care, and educational. What was noticed, however, is that some managers are still considering the use of computer technology as a cost rather than an asset that should be efficiently managed and guided towards the benefit of their organization.

In this study, computer usage was investigated. A

scale developed by previous researchers was used to study the computer usage along five dimensions. Actual time spent, frequency of use, level of sophistication, number of applications used, and the number of tasks performed with the aid of computers. the results of this investigation provided us with an insight about the various aspects related to computer usage. First, the most critical finding in this study was that most managers had a notably a positive attitude towards the use of computers. Computer usage as measured by the actual time spent on the system and the frequency of use tended to be relatively high (median = › 3 hrs/day and several times a day respectively), whereas, the diversity of applications and level of expertise tended to be moderate to low.

Another finding was that respondents, especially those reporting the usage of microcomputers, used the computer facilities for specific tasks such as aiding in increasing productivity, aiding in cutting costs, keeping activities up-to-date, and planning, mainly using the spreadsheet package. Moreover, managers felt that they lack good expertise in most of the software applications. This could be attributed to the lack of formal training with most managers indicating

themselves as self trained (90%). But to be self trained only is not adequate. There is a need to help users become proficient by improving end user training and providing end users with the adequate support they need.

Furthermore, the relationship between the training sources and computer applications and usage indicates a number of interesting implications: statistical packages and third generation languages were found to be supported by the courses learned at college. Modeling systems and the graphical programs, which are advanced packages, were found to be supported by vendor training. In-house training supported the same type of applications, and finally, self training seemed to support data management applications and other applications as needed.

With respect to the factors leading to the success of end user computing success, the regression equation derived showed the significance of the independent variables involved in interpreting the variation in the user satisfaction measure. The independent variables that were included in the equation were: management and EDP support, attitudes about computer usage, job attitudes, experience in using computers,

knowledge about computers, or number of computer courses taken, age, and the type of the computer.

The inclusion of certain variables into the equation has opened before us an avenue to draw some basic conclusions:

Top management guidance can play an important role in improving the management of the information system function. Although the information system activity is highly technical and complex, top management can provide adequate guidance without detailed technical knowledge. The problem of designing and implementing company-wide information systems are majorly managerial rather than technical. In these matters, top management has a wealth of experience (Doll, 1985).

Moreover, the job and the career attitudes of users may significantly affect their satisfaction with any information system.

Recommendations:

There are clear implications regarding the adoption or implementation of end user computing into organizations. Management should play a key role to assist users in exploring productive and efficient

applications. It should also emphasize the need for training programs that go into the depth of the system they would use as an aid to decision making. This, of course, calls for more training and for the adoption of highly flexible, user friendly systems. Which will lead to increased attractiveness of the computerized systems.

Another important recommendation here is that user involvement should be encouraged throughout all the phases of system development so that the user will understand the system better and will help identify to the developers the qualities of the system that would meet his information requirements, the thing that would lead to better user satisfaction. Also, management should always consider the aspect of work since it highly affects job attitudes and in turn user satisfaction.

Finally, It's worthmentioning here that two important things were not mentioned in the study: the war and the financial resources. Both elements might impede the installation of efficient, sophisticated, and up-to-date systems. This was mentioned by the respondents during the follow up visits paid to them.

A further research could be recommended here.

This can widen the range of data collection to include other places rather than West Beirut only, and to include other possible important factors such as the situation prevailing in the country, and funds available to study their effect upon user satisfaction, and the success of end user computing applications.

APPENDIX A

A Sample Questionnaire

COMPUTER USE

Please answer the next set of questions with regard to the computer that you are currently using.
If you are not using a Personal Computer (PC), please go to Part B.

Part A. 1. Personal Computer : type _____
_____ 1. Stand alone.
_____ 2. Connected to other computers or networks.

2. Is it your own computer? ____1. yes ____2. no

3. Do you have free access? ____1. yes ____2. no

4. Where do you use the PC? ____1. at home ____2. in my office ____3. both

Part B. **Are you using non-PC (mainframe or minicomputer)?** __ 1. yes __ 2. no

Part C.

1. On an ***average working day*** that you use a computer, how much time do you spend on the system?
   1. Almost never.
   2. Less than 1/2 hour.
   3. From 1/2 hour to 1 hour.
   4. 1 - 2 hours.
   5. 2 - 3 hours.
   6. More than 3 hours.

2. On the ***average***, how frequently do you use a computer?
   1. Less than once a month.
   2. Once a month.
   3. A few times a month.
   4. A few times a week.
   5. About once a day.
   6. Several times a day.

3. How long have you been using this system? _____ months _____ Years

---

SOFTWARE USE

Please respond to the next group of questions with regard to software packages and use. Please indicate your extent of usage and your level of expertise in the use of computer packages.

	Application Name	Extent of Usage (Not at all 1 2 3 4 5 To a great Extent)
1.	Spreadsheets (eg. Lotus 1-2-3)	1 2 3 4 5
2.	Word Processing (eg. Wordperfect, Wordstar)	1 2 3 4 5
3.	Data Management Packages (eg. dBase III)	1 2 3 4 5
4.	Modeling system (eg. IFPS)	1 2 3 4 5
5.	Statistical Packages (eg. SAS,SPSS)	1 2 3 4 5
6.	Graphical Programs (eg. Chartmaster)	1 2 3 4 5
7.	Communications Packages or Electronic Mail	1 2 3 4 5
8.	Fourth Generation Language (eg. FOCUS)	1 2 3 4 5
9.	Third Generation Languages (eg. Fortran)	1 2 3 4 5
10.	Other (Specify) _____	1 2 3 4 5

With respect to the requirements of your current job, please indicate to what extent do you use the computer to perform the following tasks.

		Not at all				To a great extent
1.	Looking for trend.	1	2	3	4	5
2.	Finding problems/alternatives.	1	2	3	4	5
3.	Planning.	1	2	3	4	5
4.	Budgeting.	1	2	3	4	5
5.	Taking actions.	1	2	3	4	5
6.	Communicating with others.	1	2	3	4	5
7.	Controlling and guiding activities.	1	2	3	4	5
8.	Making decisions.	1	2	3	4	5
9.	Historical reference.	1	2	3	4	5
10	Keeping me up-to-date on activities/performance.	1	2	3	4	5
11.	Aiding me in adequately reporting to superiors.	1	2	3	4	5
12.	Aiding me in increasing productivity of my area.	1	2	3	4	5
13.	Aiding me in cutting cost in my area.	1	2	3	4	5

COMPUTER TRAINING

Which of the following categories best describes the level of training you have had in the use of computers, both mainframe and/or microcomputers.

		None				Extremely extensive
1.	General courses at a community college or university.	1	2	3	4	5
2.	Training provided by vendors or outside consultants.	1	2	3	4	5
3.	In house company courses.	1	2	3	4	5
4.	Through self study.	1	2	3	4	5

COMPUTER KNOWLEDGE AND EXPERIENCE

The next set of questions assesses the actual experience you have working with computers and your knowledge about computers in general.

1. How many courses have you taken in computers? _____
2. How many courses have you taken in Information Systems? _____
3. How long have you used Personal computers? _____ years
4. How long have you used computers in general? _____ years
5. How long have you used printouts (periodic reports, for example) or outputs of ad-hoc inquiries? ____ years
6. How long have you participated in technical analysis and design of information systems? ____ years
7. How long have you written programs in computer language? ____ years
8. How long have you used financial, statistical or other models on a microcomputer or mainframe system? ____ years

BELIEFS ABOUT COMPUTER USAGE

In this section, we would like to find out what you believe are the advantages and disadvantages of your using computers in your job.

1 = Strongly disagree
2 = Disagree to some extent
3 = Uncertain
4 = Agree to some extent
5 = Strongly agree

1.	Using a computer could provide me with information that would lead to better decisions.	1	2	3	4	5
2.	Using a computer allows me to be more independent of my subordinates and secretaries.	1	2	3	4	5
3.	Using a computer exposes me to vulnerability of computer breakdown and loss of data.	1	2	3	4	5
4.	Using a computer allows me to be more innovative by providing the opportunities for more creative analysis and outputs.	1	2	3	4	5
5.	Using a computer improves my productivity on the job.	1	2	3	4	5
6.	Using a computer gives me the opportunity to enhance my managerial image.	1	2	3	4	5
7.	I'd hesitate to use a computer because of the difficulty of integrating it with existing information systems in my work.	1	2	3	4	5
8.	Using a computer can take up too much of my time in performing many tasks.	1	2	3	4	5
9.	Using a computer would involve too much time doing mechanical operations (e.g., programming, inputting data)to allow sufficient time for managerial analysis.	1	2	3	4	5
10.	Using a computer allows me to access, store and retrieve information easily without difficulties.	1	2	3	4	5
11.	I use a computer because my supervisor wants me to use it.	1	2	3	4	5

MANAGEMENT AND EDP SUPPORT

The next section is used to assess management and EDP support. Please circle the one number of each statement which corresponds most closely to your desired response.

1 = Strongly disagree
2 = Disagree to some extent
3 = Uncertain
4 = Agree to some extent
5 = Strongly agree

1.	I am convinced that management is sure as to what benefits can be achieved with the use of computers.	1	2	3	4	5
2.	There is always a person in the organization whom we can turn to for help in solving problems with the computer system.	1	2	3	4	5
3.	A central support (e.g., information center) is available to help with problems.	1	2	3	4	5
4.	Training courses are readily available for us to improve ourselves in the use of computers.	1	2	3	4	5
5.	I am always supported and encouraged by my boss to use the computers in the performance of my job.	1	2	3	4	5
6.	Management has provided most of the necessary help and resources to get us used to the computers quickly.	1	2	3	4	5
7.	We are constantly updated on new software that can help us to use the computers more effectively.	1	2	3	4	5
8.	Management is really keen to see that we are happy with using our computers.	1	2	3	4	5

USER SATISFACTION

Please circle the number that corresponds to your best description of the computer-based information products.

1 = Almost never
2 = Some of the time
3 = About half of the time
4 = Most of the time
5 = Almost always

1.	Does the system provide the precise information you need?	1	2	3	4	5
2.	Does the information content meet your needs?	1	2	3	4	5
3.	Does the system provide reports that seem to be just about exactly what you need?	1	2	3	4	5
4.	Does the system provide sufficient information?	1	2	3	4	5
5.	Is the system accurate?	1	2	3	4	5
6.	Are you satisfied with the accuracy of the system?	1	2	3	4	5
7.	Do you think the output is presented in a useful format?	1	2	3	4	5
8.	Is the information clear?	1	2	3	4	5
9.	Is the system user friendly?	1	2	3	4	5
10.	Is the system ease to use?	1	2	3	4	5
11.	Do you get the information you need in time?	1	2	3	4	5
12.	Does the system provide up-to-date information?	1	2	3	4	5
13.	Do you find the attitudes of the EDP staff cooperative?	1	2	3	4	5
14.	Are you satisfied with the processing of requests for changes to existing system?	1	2	3	4	5
15.	Do you find the degree of EDP training provided to you complete?	1	2	3	4	5
16.	Do you feel your participation in developing/revising the system is sufficient?	1	2	3	4	5
17.	Do you find the communication with the EDP staff harmonious?	1	2	3	4	5
18.	Do you find the output relevant?					

Overall, how satisfied are you with the system?

Extremely Satisfied 1 : 2 : 3 : 4 : 5 Extremely Dissatisfied

CAREER AND JOB ATTITUDES

Please indicate your agreement or disagreement with each of the following items by circling the one number to the right of each statement that corresponds most closely to your desired response.

1 = Strongly disagree
2 = Disagree to some extent
3 = Uncertain
4 = Agree to some extent
5 = Strongly agree

1.	I am satisfied with the success I have achieved in my career.	1 2 3 4 5
2.	I am satisfied with the progress I have made toward achieving my overall career goals.	1 2 3 4 5
3.	If I had it to do all over again I would never have made the career choices I have made.	1 2 3 4 5
4.	I would recommend my present career to college students who are looking for some directions.	1 2 3 4 5
5.	Overall, I would say that my personal needs have been met with my current career.	1 2 3 4 5
6.	I am satisfied with my rate of promotion during my career.	1 2 3 4 5
7.	I am satisfied with the pay level I have achieved during my career.	1 2 3 4 5
8.	I am satisfied with the status that I have achieved during my career.	1 2 3 4 5
9.	Generally speaking, I am very satisfied with my job.	1 2 3 4 5
10.	I frequently think of changing my job.	1 2 3 4 5
11.	I am generally satisfied with the kind of projects I work on in my job.	1 2 3 4 5
12.	The most important things that happen to me involve my present job.	1 2 3 4 5
13.	To me, my job is only a small part of who I am.	1 2 3 4 5
14.	I am very much involved personally in my job.	1 2 3 4 5
15.	I live, eat and breathe my job.	1 2 3 4 5
16.	Most of my interests are centered around my job.	1 2 3 4 5
17.	I have very strong ties with my present job which would be very difficult to break.	1 2 3 4 5
18.	Usually I feel detached from my job.	1 2 3 4 5
19.	Most of my personal life goals are job-oriented.	1 2 3 4 5
20.	I consider my job to be very central to my existence.	1 2 3 4 5
21.	I like to be absorbed in my job most of the time.	1 2 3 4 5

DEMOGRAPHIC CHARACTERISTICS

The remaining questions on this survey are concerned with your background and work experience. This information will help identify trends in the data for different groups of managers or users. Please remember that your responses are completely anonymous.

1. What is your functional area?

___ 1.	Accounting	___ 5.	Personnel	___ 9.	Engineering
___ 2.	Finance	___ 6.	Information Systems	___ 10.	R & D
___ 3.	Marketing	___ 7.	Sales	___ 11.	Other((Specify) _____
___ 4.	General Management	___ 8.	Manufacturing/Production		

2. What is your level in the organization hierarchy?

___ 1. Professional staff
___ 2. First level supervisor
___ 3. Middle management (Department Head)
___ 4. Strategic management (Executive)
___ 5. Other (specify) _____

3. What is your primary organization's business? (please check one)

___ 1.	Manufacturing	___ 5.	Health Care
___ 2.	Utility (Electronic, Gas, etc.)	___ 6.	Insurance
___ 3.	Merchandising	___ 7.	Educational
___ 4.	Public Sector	___ 8.	Financial Services (e.g. Banks)
		___ 9.	Other (specify) _____

4. For how many years have you been employed in this organization? _____ (to nearest year)

5. Number of subordinates reporting to you _____

6. What is the highest level of education you have completed?

___ 1. Some high school or less
___ 2. High school
___ 3. Some college
___ 4. Bachelor's degree
___ 5. Some graduate or professional study
___ 6. Graduate or professional degree

7. Age : _____

8. Gender:

___ 1. Male
___ 2. Female

WE APPRECIATE YOUR PARTICIPATION IN THIS STUDY. WHEN YOU ARE FINISHED, PLEASE RETURN THE SURVEY TO THE PERSON WHO IS COORDINATING THIS EFFORT.

APPENDIX B

Variables Used, Descriptions

&

Codes

Variable	Description	Code
1. PC-type (X1) Type of PC	1. Stand alone 2. Connected to others	1 0
2. PC-own (X2) Your own PC	1. Yes 2. No	1 0
3. PC-access (X3) Free access to PC	1. Yes 2. No	1 0
4. PC-place (X4) Place of PC-use	1. At home 2. In office 3. Both	1 2 3
5. PC-use (X5) Use a PC	1. Yes 2. No	1 0
6. PC-no (X6) Use mainframe or mini.	1. Yes 2. No	1 0
7. C-actuse (X7) Actual use of computers	1. Almost never 2. Less than 1/2 hour 3. From 1/2 hour to 1 hr 4. 1-2 hrs 5. 2-3 hrs 6. More than 3 hrs	1 2 3 4 5 6
8. C-frquse (X8) Frequency of use of computers	1. Less than once/month 2. Once/month 3. A few times/month 4. A few times/week 5. About once a day 6. Several times a day	1 2 3 4 5 6
9. C-sysulg (X9) Usage length of the system	1. Less than one year 2. 1-3 years 3. 4-6 years 4. More than 6 years	0 1 2 3
10. Swre-use (X10) Number of softwares used	1. Spreadsheet 2. Wordprocessing 3. Data Mgmt packages 4. Modeling system 5. Statistical package 6. Graphical programs 7. Communication packages 8. Fourth generation languages 9. Third generation languages 10. Others	# of packages reported (1-10)

11. Su-ss (X11)	Spreadsheet software use 1. Not at all (NAL) 2. Some of the time (ST) 3. About half of the time (HT) 4. Most of the time (MT) 5. To a great extent (TGE)	(1-5)
12. Su-wp (X12)	Wordprocessing software use	(1-5)
13. Su-dmp (X13)	Datamanagement package use	(1-5)
14. Su-ms (X14)	Modeling system use	(1-5)
15. Su-sp (X15)	Statistical package software use	(1-5)
16. Su-grp (X16)	Graphical packages software use	(1-5)
17. Su-cmp (X17)	Communication packages use	(1-5)
18. Su-fgl (X18)	Fourth generation languages use	(1-5)
19. Su-tgl (X19)	Third generation languages use	(1-5)
20. Su-other (X20)	Other software usage	(1-5)
21. Tsk-use (X21) # of tasks for which the computer is used	1. Looking for trend 2. Finding problems 3. Planning 4. Budgeting 5. Taking action 6. Communicating with others 7. Controlling & guiding activities 8. Making decisions 9. Historical reference 10. Keeping activities & performance up-to date 11. Aiding in reporting to superiors 12. Aiding in increasing productivity 13. Aiding in cutting costs	# of tasks reported

22. Tsk-lt (X22)	Look for trend task 1. NAL 2. ST 3. HT 4. MT 5. TGE	(1-5)
23. Tsk-fp (X23)	Finding problems	(1-5)
24. Tsk-pl (X24)	Planning	(1-5)
25. Tsk-bdg (X25)	Budgeting	(1-5)
26. Tsk-ta (X26)	Taking Actions	(1-5)
27. Tsk-Cwo (X27)	Communication With Others	(1-5)
28. Tsk-Cga (X28)	Controlling & Guiding Activities	(1-5)
29. Tsk-MD (X29)	Making decisions	(1-5)
30. Tsk-HR (X30)	Historical reference	(1-5)
31. Tsk-UTD (X31)	Up-To-Date Activities	(1-5)
32. Tsk-Ars (X32)	Reporting To Supervisors	(1-5)
33. Tsk-AIP (X33)	Aiding in Increasing Productivity	(1-5)
34. Tsk-Acc (X34)	Aiding in Cutting Costs	(1-5)
35. CT-CCU (X35) Computer Training	University Courses 1. None (N) 2. Few (F) 3. Some (S) 4. Extensive (E) 5. Extremely Extensive (EE)	 1 2 3 4 5
36. CT-VOC (X36)	Training by Vendors	(1-5)
37. CT-IHC (X37)	Inhouse Courses	(1-5)
38. CT-SS (X38)	Self Study	(1-5)
39. CE-Ncc (X39) Computer Experience	Had Computer Courses 1. Yes 2. No	 1 0
40. CE-NIC (X40)	Had Information Courses 1. Yes 2. No	 1 0

41.	Ce-pcu (X41)	Experience in pc-use	
		1. Yes	1
		2. No	0
42.	Ce-gcu (X42)	Experience in general comp. use	
		1. Yes	1
		2. No	0
43.	Ce-poiu (X43)	Printouts & inquiries use	
		1. Yes	1
		2. No	0
44.	Ce-ptad (X44)	Participation	
		1. Yes	1
		2. No	0
45.	Ce-wpcl (X45)	Experience in writing prgs	
		1. Yes	1
		2. No	0
46.	Ce-fsmu (X46)	Experience in model use	
		1. Yes	1
		2. No	0
47.	Acu-1 (X47) Attitude towards computer use	Providing better information	
		1. Strongly disagree (SD)	1
		2. Disagree to some extent (DE)	2
		3. Uncertain (UN)	3
		4. Agree to some extent (AE)	4
		5. Strongly agree (SA)	5
48.	Acu-2 (X48)	More independency	(1-5)
49.	Acu-3 (X49)	Less computer breakdown & data loss	(1-5)
50.	Acu-4 (X50)	More creativity	(1-5)
51.	Acu-5 (X51)	More productivity	(1-5)
52.	Acu-6 (X52)	Better managerial image	(1-5)
53.	Acu-7 (X53)	Better system integration	(1-5)
54.	Acu-8 (X54)	Time efficiency	(1-5)
55.	Acu-9 (X55)	Better managerial analysis	(1-5)

56. Acu-10 (X56)	Better information manipulation	(1-5)
57. Acu-11 (X57)	No supervisor influence	(1-5)
58. Mes-1 (X58) Management & EDP support	Better mgmt concept about computer usage	
	1. SD	1
	2. DE	2
	3. UN	3
	4. AE	4
	5. SA	5
59. Mes-2 (X59)	Source of help availability	(1-5)
60. Mes-3 (X60)	Central support availability	(1-5)
61. Mes-4 (X61)	Training courses availability	(1-5)
62. Mes-5 (X62)	Mgmt's motivational support	(1-5)
63. Mes-6 (X63)	Mgmt's help and resource supply	(1-5)
64. Mes-7 (X64)	Provision w/new softwares	(1-5)
65. Mes-8 (X65)	Mgmt's concern about user's satisfaction	(1-5)
66. U.S-1 (X66) User satisfaction	Precision information	
	1. Almost never (AN)	1
	2. Some of the time (ST)	2
	3. About half of the time (HT)	3
	4. Most of the time (MT)	4
	5. Almost always (AA)	5
67. U.S-2 (X67)	Useful information content	(1-5)
68. U.S-3 (X68)	Useful reports	(1-5)
69. U.S-4 (X69)	Sufficient information	(1-5)
70. U.S-5 (X70)	Accurate system	(1-5)
71. U.S-6 (X71)	Satisfaction w/accuracy	(1-5)
72. U.S-7 (X72)	Useful presentation format	(1-5)

73. U.S-8 (X73)	Clear information	(1-5)
74. U.S-9 (X74)	User-friendly	(1-5)
75. U.S-10 (X75)	Easy-to-use	(1-5)
76. U.S-11 (X76)	Good response time	(1-5)
77. U.S-12 (X77)	Up-to-date information	(1-5)
78. U.S-13 (X78)	EDP staff cooperative	(1-5)
79. U.S-14 (X79)	Rapid processing of changes requests	(1-5)
80. U.S-15 (X80)	Adequate EDP training	(1-5)
81. U.S-16 (X81)	Sufficient participation	(1-5)
82. U.S-17 (X82)	Good relation w/EDP staff	(1-5)
83. U.S-18 (X83)	Relevant output	(1-5)
84. U.S-OVL(X84)	Satisfied on the whole	(1-5)
85. JA-1 (X85) Job & career attitudes	1. SD 2. DE 3. UN 4. AE 5. SD	1 2 3 4 5
86. JA-2 (X86)		(1-5)
87. JA-3 (X87)		(1-5)
88. JA-4 (X88)		(1-5)
89. JA-5 (X89)		(1-5)
90. JA-6 (X90)		(1-5)
91. JA-7 (X91)		(1-5)
92. JA-8 (X92)		(1-5)
93. JA-9 (X93)		(1-5)
94. JA-10 (X94)		(1-5)
95. JA-11 (X95)		(1-5)

96. JA-12 (X96) (1-5)

97. JA-13 (X97) (1-5)

98. JA-14 (X98) (1-5)

99. JA-15 (X99) (1-5)

100. JA-16 (X100) (1-5)

101. JA-17 (X101) (1-5)

102. JA-18 (X102) (1-5)

103. JA-19 (X103) (1-5)

104. JA-20 (X104) (1-5)

105. JA-21 (X105) (1-5)

106. FA (X106)
Functional area

1.	Accounting (ACC)	1
2.	Finance (FNC)	2
3.	Marketing (MKG)	3
4.	General mgmt (GMG)	4
5.	Personnel (PRS)	5
6.	Information systems (INFS)	6
7.	Sales (SLS)	7
8.	Manufacturing/production (MFG)	8
9.	Engineering (ENG)	9
10.	R & D (R&D)	10
11.	Other (Other)	11

107. ORGL (X107)
Organizational level

1.	Professional staff (PFS)	1
2.	First level supervisor (FLS)	2
3.	Middle management (MDM)	3
4.	Strategic management (STM)	4
5.	Other (Other)	5

108. ORGB (X108)
Organization business

1.	Mnufacturing (MFG)	1
2.	Utility (UTY)	2
3.	Merchandising (MDG)	3
4.	Public sector (PLS)	4
5.	Health care (HCR)	5
6.	Insurance (INS)	6
7.	Educational (EDU)	7
8.	Financial services (FNS)	8
9.	Other (Other)	9

109. YOE (X109) number
Years of employment

110. NOS (X110) number
Number of subordinates

111. LOE (X111)	1. Some high school or less	(<HS)		1
Lev. of education	2. High school	(HS)		2
	3. Some college	(SC)		3
	4. Bachelor's degree	(BS)		4
	5. Some graduate study	(SG)		5
	6. Graduate degree	(GD)		6
112. Age (X112)				number
113. Sex (X113)	1. Male			1
	2. Female			0

114. U-Trng (XT) User Training
XT=(X35+X36+X37+X38)/4

115. U-EXPC (XE) User Experience
XE=(X39+X40+X41+X42+X43+X44+X45+X46)/8

116. Sophlv (XSL) Sophistication Level
XSL=(X11+X12+X13+X14+X15+X16+X17+X18+X19+X20)/10

117. MGEDPST (XMES) Management & EDP Support
XMES=(X58 TO X65)/8

118. CU-ATT (XACU) Attitude about Computer Usage
XACU=(X47 TO X57)/11

119. JOB-ATT (XJA) Career & Job Attitude
XJA=(X85 TO X105)/21

120. USER-SAT (XUS) User Satisfaction
XUS=(X66 TO X84)/18

APPENDIX C

List of Frequency Distribution

Of

Variables

The raw data or transformation pass is proceeding
80 cases are written to the uncompressed active file.

***** Memory allows a total of 7469 Values, accumulated across all Variables.
There also may be up to 933 Value Labels for each Variable.

X5 PC-USE

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NO	0	22	27.5	27.5	27.5
YES	1	58	72.5	72.5	100.0
	TOTAL	80	100.0	100.0	

Mean	.725	Std Err	.050	Median	1.000
Mode	1.000	Std Dev	.449	Variance	.202
Kurtosis	-.970	S E Kurt	.532	Skewness	-1.027
S E Skew	.269	Range	1.000	Minimum	0.0
Maximum	1.000	Sum	58.000		

Valid Cases 80 Missing Cases 0

X6 PC-NO

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NO	0	32	40.0	40.0	40.0
YES	1	48	60.0	60.0	100.0
	TOTAL	80	100.0	100.0	

Mean	.600	Std Err	.055	Median	1.000
Mode	1.000	Std Dev	.493	Variance	.243
Kurtosis	-1.874	S E Kurt	.532	Skewness	-.416
S E Skew	.269	Range	1.000	Minimum	0.0
Maximum	1.000	Sum	48.000		

Valid Cases 80 Missing Cases 0

X7 PC-ACTUSE

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
1/2 HR TO 1 HR	3	3	3.8	3.8	3.8
1-2 HRS	4	11	13.8	13.8	17.5
2-3 HRS	5	16	20.0	20.0	37.5
MORE THAN 3 HRS	6	50	62.5	62.5	100.0
	TOTAL	80	100.0	100.0	

Mean	5.413	Std Err	.097	Median	6.000
Mode	6.000	Std Dev	.867	Variance	.752
Kurtosis	.552	S E Kurt	.532	Skewness	-1.277
S E Skew	.269	Range	3.000	Minimum	3.000
Maximum	6.000	Sum	433.000		

Valid Cases 80 Missing Cases 0

X8 C-FRQUSE

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
FEW TIMES/WEEK	4	5	6.3	6.3	6.3
ABOUT ONCE/DAY	5	11	13.8	13.8	20.0
SEV TIMES/DAY	6	64	80.0	80.0	100.0
	TOTAL	80	100.0	100.0	

Mean	5.738	Std Err	.064	Median	6.000
Mode	6.000	Std Dev	.568	Variance	.323
Kurtosis	3.329	S E Kurt	.532	Skewness	-2.089
S E Skew	.269	Range	2.000	Minimum	4.000
Maximum	6.000	Sum	459.000		

Valid Cases 80 Missing Cases 0

X9 C-SYSULG

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
< 1 YEAR	0	13	16.3	16.3	16.3
1-3 YRS	1	38	47.5	47.5	63.8
4-6 YRS	2	21	26.3	26.3	90.0
> 6 YRS	3	8	10.0	10.0	100.0
	TOTAL	80	100.0	100.0	

Mean	1.300	Std Err	.096	Median	1.000
Mode	1.000	Std Dev	.863	Variance	.744
Kurtosis	-.423	S E Kurt	.532	Skewness	.342
S E Skew	.269	Range	3.000	Minimum	0.0
Maximum	3.000	Sum	104.000		

Valid Cases 80 Missing Cases 0

X10 SWRE-USE

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	5	6.3	6.3	6.3
	2	5	6.3	6.3	12.5
	3	14	17.5	17.5	30.0
	4	11	13.8	13.8	43.8
	5	16	20.0	20.0	63.8
	6	18	22.5	22.5	86.3
	7	6	7.5	7.5	93.8
	8	3	3.8	3.8	97.5
	9	2	2.5	2.5	100.0
	TOTAL	80	100.0	100.0	

X10 SWRE-USE

Mean	4.663	Std Err	.212	Median	5.000
Mode	6.000	Std Dev	1.896	Variance	3.594
Kurtosis	-.392	S E Kurt	.532	Skewness	-.024
S E Skew	.269	Range	8.000	Minimum	1.000
Maximum	9.000	Sum	373.000		
Valid Cases	80	Missing Cases	0		

X11 SU-SS

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	18	22.5	22.5	22.5
ST	2	6	7.5	7.5	30.0
HT	3	11	13.8	13.8	43.8
MT	4	18	22.5	22.5	66.3
TGE	5	27	33.8	33.8	100.0
	TOTAL	80	100.0	100.0	

Mean	3.375	Std Err	.175	Median	4.000
Mode	5.000	Std Dev	1.562	Variance	2.440
Kurtosis	-1.316	S E Kurt	.532	Skewness	-.467
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	270.000		

Valid Cases 80 Missing Cases 0

X12 SU-WP

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	10	12.5	12.5	12.5
ST	2	7	8.8	8.8	21.3
HT	3	13	16.3	16.3	37.5
MT	4	25	31.3	31.3	68.8
TGE	5	25	31.3	31.3	100.0
	TOTAL	80	100.0	100.0	

Mean	3.600	Std Err	.151	Median	4.000
Mode	4.000	Std Dev	1.346	Variance	1.813
Kurtosis	-.618	S E Kurt	.532	Skewness	-.729
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	288.000		

Valid Cases 80 Missing Cases 0

X13 SU-DMP

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	22	27.5	27.5	27.5
ST	2	5	6.3	6.3	33.8
HT	3	12	15.0	15.0	48.8
MT	4	21	26.3	26.3	75.0
TGE	5	20	25.0	25.0	100.0
	TOTAL	80	100.0	100.0	

Mean	3.150	Std Err	.174	Median	4.000
Mode	1.000	Std Dev	1.560	Variance	2.433
Kurtosis	-1.447	S E Kurt	.532	Skewness	-.297
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	252.000		

Valid Cases 80 Missing Cases 0

X14 SU-MS

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	66	82.5	82.5	82.5
ST	2	5	6.3	6.3	88.8
HT	3	6	7.5	7.5	96.3
MT	4	2	2.5	2.5	98.8
TGE	5	1	1.3	1.3	100.0
	TOTAL	80	100.0	100.0	

Mean	1.338	Std Err	.092	Median	1.000
Mode	1.000	Std Dev	.826	Variance	.682
Kurtosis	6.513	S E Kurt	.532	Skewness	2.612
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	107.000		

Valid Cases 80 Missing Cases 0

X15 SU-SP

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	52	65.0	65.0	65.0
ST	2	9	11.3	11.3	76.3
HT	3	9	11.3	11.3	87.5
MT	4	2	2.5	2.5	90.0
TGE	5	8	10.0	10.0	100.0
	TOTAL	80	100.0	100.0	

Mean	1.813	Std Err	.148	Median	1.000
Mode	1.000	Std Dev	1.323	Variance	1.749
Kurtosis	.954	S E Kurt	.532	Skewness	1.500
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	145.000		

Valid Cases 80 Missing Cases 0

X16 SU-GRP

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	54	67.5	67.5	67.5
ST	2	6	7.5	7.5	75.0
HT	3	6	7.5	7.5	82.5
MT	4	8	10.0	10.0	92.5
TGE	5	6	7.5	7.5	100.0
	TOTAL	80	100.0	100.0	

Mean	1.825	Std Err	.151	Median	1.000
Mode	1.000	Std Dev	1.348	Variance	1.817
Kurtosis	.296	S E Kurt	.532	Skewness	1.345
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	146.000		

Valid Cases 80 Missing Cases 0

X17 SU-CMP

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	59	73.8	73.8	73.8
ST	2	1	1.3	1.3	75.0
HT	3	8	10.0	10.0	85.0
MT	4	2	2.5	2.5	87.5
TGE	5	10	12.5	12.5	100.0
	TOTAL	80	100.0	100.0	

Mean	1.788	Std Err	.160	Median	1.000
Mode	1.000	Std Dev	1.429	Variance	2.043
Kurtosis	.656	S E Kurt	.532	Skewness	1.506
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	143.000		

Valid Cases 80 Missing Cases 0

X18 SU-FGL

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	64	80.0	80.0	80.0
ST	2	3	3.8	3.8	83.8
HT	3	9	11.3	11.3	95.0
MT	4	3	3.8	3.8	98.8
TGE	5	1	1.3	1.3	100.0
	TOTAL	80	100.0	100.0	

Mean	1.425	Std Err	.103	Median	1.000
Mode	1.000	Std Dev	.925	Variance	.855
Kurtosis	3.477	S E Kurt	.532	Skewness	2.097
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	114.000		

Valid Cases 80 Missing Cases 0

X19 SU-TGL

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	33	41.3	41.3	41.3
ST	2	8	10.0	10.0	51.3
HT	3	9	11.3	11.3	62.5
MT	4	15	18.8	18.8	81.3
TGE	5	15	18.8	18.8	100.0
	TOTAL	80	100.0	100.0	

Mean	2.638	Std Err	.180	Median	2.000
Mode	1.000	Std Dev	1.609	Variance	2.588
Kurtosis	-1.573	S E Kurt	.532	Skewness	.278
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	211.000		

Valid Cases 80 Missing Cases 0

X20 SU-OTHER

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	1	1.3	1.3	1.3
NAL	1	48	60.0	60.0	61.3
ST	2	2	2.5	2.5	63.8
HT	3	2	2.5	2.5	66.3
MT	4	7	8.8	8.8	75.0
TGE	5	20	25.0	25.0	100.0
	TOTAL	80	100.0	100.0	

Mean	2.325	Std Err	.200	Median	1.000
Mode	1.000	Std Dev	1.792	Variance	3.209
Kurtosis	-1.451	S E Kurt	.532	Skewness	.659
S E Skew	.269	Range	5.000	Minimum	0.0
Maximum	5.000	Sum	186.000		

Valid Cases 80 Missing Cases 0

X21 TSK-USE

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	1	1.3	1.3	1.3
	2	1	1.3	1.3	2.5
	5	1	1.3	1.3	3.8
	6	2	2.5	2.5	6.3
	7	6	7.5	7.5	13.8
	8	5	6.3	6.3	20.0
	9	2	2.5	2.5	22.5
	10	2	2.5	2.5	25.0
	11	11	13.8	13.8	38.8
	12	18	22.5	22.5	61.3
	13	31	38.8	38.8	100.0
	TOTAL	80	100.0	100.0	

X21 TSK-USE

Mean	10.988	Std Err	.303	Median	12.000
Mode	13.000	Std Dev	2.712	Variance	7.354
Kurtosis	3.473	S E Kurt	.532	Skewness	-1.807
S E Skew	.269	Range	13.000	Minimum	0.0
Maximum	13.000	Sum	879.000		

Valid Cases 80 Missing Cases 0

X22 TSK-LT

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	22	27.5	27.5	27.5
ST	2	11	13.8	13.8	41.3
HT	3	13	16.3	16.3	57.5
MT	4	18	22.5	22.5	80.0
TGE	5	16	20.0	20.0	100.0
	TOTAL	80	100.0	100.0	

Mean	2.938	Std Err	.169	Median	3.000
Mode	1.000	Std Dev	1.512	Variance	2.287
Kurtosis	-1.470	S E Kurt	.532	Skewness	-.027
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	235.000		

Valid Cases 80 Missing Cases 0

X23 TSK-FP

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	12	15.0	15.0	15.0
ST	2	12	15.0	15.0	30.0
HT	3	17	21.3	21.3	51.3
MT	4	19	23.8	23.8	75.0
TGE	5	20	25.0	25.0	100.0
	TOTAL	80	100.0	100.0	

Mean	3.288	Std Err	.155	Median	3.000
Mode	5.000	Std Dev	1.389	Variance	1.929
Kurtosis	-1.141	S E Kurt	.532	Skewness	-.302
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	263.000		
Valid Cases	80	Missing Cases	0		

X24 TSK-PL

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	11	13.8	13.8	13.8
ST	2	12	15.0	15.0	28.8
HT	3	12	15.0	15.0	43.8
MT	4	26	32.5	32.5	76.3
TGE	5	19	23.8	23.8	100.0
	TOTAL	80	100.0	100.0	

Mean	3.375	Std Err	.152	Median	4.000
Mode	4.000	Std Dev	1.363	Variance	1.858
Kurtosis	-1.021	S E Kurt	.532	Skewness	-.468
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	270.000		
Valid Cases	80	Missing Cases	0		

X25 TSK-BDG

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	21	26.3	26.3	26.3
ST	2	9	11.3	11.3	37.5
HT	3	14	17.5	17.5	55.0
MT	4	13	16.3	16.3	71.3
TGE	5	23	28.8	28.8	100.0
	TOTAL	80	100.0	100.0	

Mean	3.100	Std Err	.177	Median	3.000
Mode	5.000	Std Dev	1.580	Variance	2.496
Kurtosis	-1.518	S E Kurt	.532	Skewness	-.129
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	248.000		
Valid Cases	80	Missing Cases	0		

X26 TSK-TA

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	12	15.0	15.0	15.0
ST	2	6	7.5	7.5	22.5
HT	3	20	25.0	25.0	47.5
MT	4	22	27.5	27.5	75.0
TGE	5	20	25.0	25.0	100.0
	TOTAL	80	100.0	100.0	

Mean	3.400	Std Err	.151	Median	4.000
Mode	4.000	Std Dev	1.346	Variance	1.813
Kurtosis	-.808	S E Kurt	.532	Skewness	-.516
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	272.000		

Valid Cases 80 Missing Cases 0

X27 TSK-CWO

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	28	35.0	35.0	35.0
ST	2	9	11.3	11.3	46.3
HT	3	11	13.8	13.8	60.0
MT	4	11	13.8	13.8	73.8
TGE	5	21	26.3	26.3	100.0
	TOTAL	80	100.0	100.0	

Mean	2.850	Std Err	.184	Median	3.000
Mode	1.000	Std Dev	1.647	Variance	2.711
Kurtosis	-1.630	S E Kurt	.532	Skewness	.124
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	228.000		

Valid Cases 80 Missing Cases 0

X28 TSK-CGA

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	17	21.3	21.3	21.3
ST	2	6	7.5	7.5	28.8
HT	3	9	11.3	11.3	40.0
MT	4	22	27.5	27.5	67.5
TGE	5	26	32.5	32.5	100.0
	TOTAL	80	100.0	100.0	

Mean	3.425	Std Err	.171	Median	4.000
Mode	5.000	Std Dev	1.533	Variance	2.349
Kurtosis	-1.198	S E Kurt	.532	Skewness	-.558
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	274.000		

Valid Cases 80 Missing Cases 0

X29 TSK-MD

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	13	16.3	16.3	16.3
ST	2	3	3.8	3.8	20.0
HT	3	9	11.3	11.3	31.3
MT	4	32	40.0	40.0	71.3
TGE	5	23	28.8	28.8	100.0
	TOTAL	80	100.0	100.0	

Mean	3.613	Std Err	.154	Median	4.000
Mode	4.000	Std Dev	1.373	Variance	1.886
Kurtosis	-.379	S E Kurt	.532	Skewness	-.918
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	289.000		

Valid Cases 80 Missing Cases 0

X30 TSK-HR

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	10	12.5	12.5	12.5
ST	2	6	7.5	7.5	20.0
HT	3	6	7.5	7.5	27.5
MT	4	21	26.3	26.3	53.8
TGE	5	37	46.3	46.3	100.0
	TOTAL	80	100.0	100.0	

Mean	3.863	Std Err	.157	Median	4.000
Mode	5.000	Std Dev	1.403	Variance	1.968
Kurtosis	-.266	S E Kurt	.532	Skewness	-1.047
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	309.000		
Valid Cases	80	Missing Cases	0		

X31 TSK-UTD

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	4	5.0	5.0	5.0
ST	2	5	6.3	6.3	11.3
HT	3	5	6.3	6.3	17.5
MT	4	28	35.0	35.0	52.5
TGE	5	38	47.5	47.5	100.0
	TOTAL	80	100.0	100.0	

Mean	4.138	Std Err	.124	Median	4.000
Mode	5.000	Std Dev	1.111	Variance	1.234
Kurtosis	1.559	S E Kurt	.532	Skewness	-1.472
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	331.000		
Valid Cases	80	Missing Cases	0		

X32 TSK-ARS

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	6	7.5	7.5	7.5
ST	2	1	1.3	1.3	8.8
HT	3	9	11.3	11.3	20.0
MT	4	23	28.8	28.8	48.8
TGE	5	41	51.3	51.3	100.0
	TOTAL	80	100.0	100.0	

Mean	4.150	Std Err	.130	Median	5.000
Mode	5.000	Std Dev	1.159	Variance	1.344
Kurtosis	1.789	S E Kurt	.532	Skewness	-1.550
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	332.000		

Valid Cases 80 Missing Cases 0

X33 TSK-AIP

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	4	5.0	5.0	5.0
ST	2	2	2.5	2.5	7.5
HT	3	9	11.3	11.3	18.8
MT	4	21	26.3	26.3	45.0
TGE	5	44	55.0	55.0	100.0
	TOTAL	80	100.0	100.0	

Mean	4.238	Std Err	.121	Median	5.000
Mode	5.000	Std Dev	1.082	Variance	1.171
Kurtosis	2.120	S E Kurt	.532	Skewness	-1.599
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	339.000		

Valid Cases 80 Missing Cases 0

X34 TSK-ACC

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NAL	1	11	13.8	13.8	13.8
ST	2	10	12.5	12.5	26.3
HT	3	18	22.5	22.5	48.8
MT	4	13	16.3	16.3	65.0
TGE	5	28	35.0	35.0	100.0
	TOTAL	80	100.0	100.0	

Mean	3.463	Std Err	.160	Median	4.000
Mode	5.000	Std Dev	1.432	Variance	2.049
Kurtosis	-1.138	S E Kurt	.532	Skewness	-.414
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	277.000		
Valid Cases	80	Missing Cases	0		

X35 CT-CCU

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
N	1	13	16.3	16.3	16.3
F	2	8	10.0	10.0	26.3
S	3	9	11.3	11.3	37.5
E	4	26	32.5	32.5	70.0
EE	5	24	30.0	30.0	100.0
	TOTAL	80	100.0	100.0	

Mean	3.500	Std Err	.160	Median	4.000
Mode	4.000	Std Dev	1.432	Variance	2.051
Kurtosis	-.935	S E Kurt	.532	Skewness	-.650
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	280.000		
Valid Cases	80	Missing Cases	0		

X36 CT-VOC

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
N	1	20	25.0	25.0	25.0
F	2	17	21.3	21.3	46.3
S	3	14	17.5	17.5	63.8
E	4	14	17.5	17.5	81.3
EE	5	15	18.8	18.8	100.0
	TOTAL	80	100.0	100.0	

Mean	2.838	Std Err	.163	Median	3.000
Mode	1.000	Std Dev	1.462	Variance	2.138
Kurtosis	-1.354	S E Kurt	.532	Skewness	.165
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	227.000		

Valid Cases 80 Missing Cases 0

X37 CT-IHC

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
N	1	40	50.0	50.0	50.0
F	2	10	12.5	12.5	62.5
S	3	6	7.5	7.5	70.0
E	4	15	18.8	18.8	88.8
EE	5	9	11.3	11.3	100.0
	TOTAL	80	100.0	100.0	

Mean	2.288	Std Err	.169	Median	1.500
Mode	1.000	Std Dev	1.511	Variance	2.283
Kurtosis	-1.211	S E Kurt	.532	Skewness	.645
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	183.000		
Valid Cases	80	Missing Cases	0		

X38 CT-SS

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
N	1	8	10.0	10.0	10.0
F	2	8	10.0	10.0	20.0
S	3	17	21.3	21.3	41.3
E	4	18	22.5	22.5	63.8
EE	5	29	36.3	36.3	100.0
	TOTAL	80	100.0	100.0	

Mean	3.650	Std Err	.149	Median	4.000
Mode	5.000	Std Dev	1.332	Variance	1.775
Kurtosis	-.717	S E Kurt	.532	Skewness	-.644
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	292.000		

Valid Cases 80 Missing Cases 0

X39 CE-NCC

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NO	0	10	12.5	12.5	12.5
YES	1	70	87.5	87.5	100.0
	TOTAL	80	100.0	100.0	

Mean	.875	Std Err	.037	Median	1.000
Mode	1.000	Std Dev	.333	Variance	.111
Kurtosis	3.427	S E Kurt	.532	Skewness	-2.311
S E Skew	.269	Range	1.000	Minimum	0.0
Maximum	1.000	Sum	70.000		

Valid Cases 80 Missing Cases 0

X40 CE-NIC

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NO	0	19	23.8	23.8	23.8
YES	1	61	76.3	76.3	100.0
	TOTAL	80	100.0	100.0	

Mean	.763	Std Err	.048	Median	1.000
Mode	1.000	Std Dev	.428	Variance	.183
Kurtosis	-.430	S E Kurt	.532	Skewness	-1.257
S E Skew	.269	Range	1.000	Minimum	0.0
Maximum	1.000	Sum	61.000		
Valid Cases	80	Missing Cases	0		

X41 CE-PCU

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NO	0	9	11.3	11.3	11.3
YES	1	71	88.8	88.8	100.0
	TOTAL	80	100.0	100.0	

Mean	.888	Std Err	.036	Median	1.000
Mode	1.000	Std Dev	.318	Variance	.101
Kurtosis	4.357	S E Kurt	.532	Skewness	-2.500
S E Skew	.269	Range	1.000	Minimum	0.0
Maximum	1.000	Sum	71.000		
Valid Cases	80	Missing Cases	0		

X42 CE-GCU

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NO	0	1	1.3	1.3	1.3
YES	1	79	98.8	98.8	100.0
	TOTAL	80	100.0	100.0	

Mean	.988	Std Err	.012	Median	1.000
Mode	1.000	Std Dev	.112	Variance	.012
Kurtosis	80.000	S E Kurt	.532	Skewness	-8.944
S E Skew	.269	Range	1.000	Minimum	0.0
Maximum	1.000	Sum	79.000		

Valid Cases 80 Missing Cases 0

X43 CE-POIU

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NO	0	8	10.0	10.0	10.0
YES	1	72	90.0	90.0	100.0
	TOTAL	80	100.0	100.0	

Mean	.900	Std Err	.034	Median	1.000
Mode	1.000	Std Dev	.302	Variance	.091
Kurtosis	5.524	S E Kurt	.532	Skewness	-2.718
S E Skew	.269	Range	1.000	Minimum	0.0
Maximum	1.000	Sum	72.000		
Valid Cases	80	Missing Cases	0		

X44 CE-PTAO

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NO	0	23	28.8	28.8	28.8
YES	1	57	71.3	71.3	100.0
	TOTAL	80	100.0	100.0	

Mean	.713	Std Err	.051	Median	1.000
Mode	1.000	Std Dev	.455	Variance	.207
Kurtosis	-1.112	S E Kurt	.532	Skewness	-.957
S E Skew	.269	Range	1.000	Minimum	0.0
Maximum	1.000	Sum	57.000		
Valid Cases	80	Missing Cases	0		

X45 CE-WPCL

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NO	0	11	13.8	13.8	13.8
YES	1	69	86.3	86.3	100.0
	TOTAL	80	100.0	100.0	

Mean	.863	Std Err	.039	Median	1.000
Mode	1.000	Std Dev	.347	Variance	.120
Kurtosis	2.670	S E Kurt	.532	Skewness	-2.146
S E Skew	.269	Range	1.000	Minimum	0.0
Maximum	1.000	Sum	69.000		
Valid Cases	80	Missing Cases	0		

X46 CE-FSML

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NO	0	19	23.8	23.8	23.8
YES	1	61	76.3	76.3	100.0
	TOTAL	80	100.0	100.0	

Mean	.763	Std Err	.048	Median	1.000
Mode	1.000	Std Dev	.428	Variance	.183
Kurtosis	-.430	S E Kurt	.532	Skewness	-1.257
S E Skew	.269	Range	1.000	Minimum	0.0
Maximum	1.000	Sum	61.000		

Valid Cases 80 Missing Cases 0

XT U-TRNG

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1.75	2	2.5	2.5	2.5
	2.00	9	11.3	11.3	13.8
	2.25	6	7.5	7.5	21.3
	2.50	10	12.5	12.5	33.8
	2.75	11	13.8	13.8	47.5
	3.00	8	10.0	10.0	57.5
	3.25	8	10.0	10.0	67.5
	3.50	5	6.3	6.3	73.8
	3.75	4	5.0	5.0	78.8
	4.00	8	10.0	10.0	88.8
	4.25	3	3.8	3.8	92.5
	4.50	4	5.0	5.0	97.5
	5.00	2	2.5	2.5	100.0
	TOTAL	80	100.0	100.0	

XT U-TRNG

Mean	3.069	Std Err	.091	Median	3.000
Mode	2.750	Std Dev	.811	Variance	.658
Kurtosis	-.622	S E Kurt	.532	Skewness	.442
S E Skew	.269	Range	3.250	Minimum	1.750
Maximum	5.000	Sum	245.500		
Valid Cases	80	Missing Cases	0		

XSL SOPHLV

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1.40	1	1.3	1.3	1.3
	1.50	5	6.3	6.3	7.5
	1.70	1	1.3	1.3	8.8
	1.90	6	7.5	7.5	16.3
	2.00	6	7.5	7.5	23.8
	2.10	5	6.3	6.3	30.0
	2.20	3	3.8	3.8	33.8
	2.30	7	8.8	8.8	42.5
	2.40	10	12.5	12.5	55.0
	2.50	3	3.8	3.8	58.8
	2.60	5	6.3	6.3	65.0
	2.70	7	8.8	8.8	73.8
	2.90	4	5.0	5.0	78.8
	3.00	1	1.3	1.3	80.0
	3.10	3	3.8	3.8	83.8
	3.20	2	2.5	2.5	86.3
	3.30	3	3.8	3.8	90.0
	3.50	4	5.0	5.0	95.0

XSL SOPHLV

	3.70	1	1.3	1.3	96.3
	3.80	2	2.5	2.5	98.8
	4.60	1	1.3	1.3	100.0
	TOTAL	80	100.0	100.0	

Mean	2.509	Std Err	.069	Median	2.400
Mode	2.400	Std Dev	.620	Variance	.385
Kurtosis	.691	S E Kurt	.532	Skewness	.683
S E Skew	.269	Range	3.200	Minimum	1.400
Maximum	4.600	Sum	200.700		

Valid Cases 80 Missing Cases 0

XACU CU-ATT

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
DE	2.00	1	1.3	1.3	1.3
UN	3.00	30	37.5	37.5	38.8
AE	4.00	47	58.8	58.8	97.5
SA	5.00	2	2.5	2.5	100.0
	TOTAL	80	100.0	100.0	

Mean	3.625	Std Err	.063	Median	4.000
Mode	4.000	Std Dev	.560	Variance	.313
Kurtosis	-.386	S E Kurt	.532	Skewness	-.292
S E Skew	.269	Range	3.000	Minimum	2.000
Maximum	5.000	Sum	290.000		

Valid Cases 80 Missing Cases 0

XMES MGEDPST

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
SD	1.00	1	1.3	1.3	1.3
DE	2.00	9	11.3	11.3	12.5
UN	3.00	31	38.8	38.8	51.3
AE	4.00	36	45.0	45.0	96.3
SA	5.00	3	3.8	3.8	100.0
	TOTAL	80	100.0	100.0	

Mean	3.388	Std Err	.088	Median	3.000
Mode	4.000	Std Dev	.787	Variance	.620
Kurtosis	.147	S E Kurt	.532	Skewness	-.495
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	271.000		
Valid Cases	80	Missing Cases	0		

XUS USER-SAT

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
ST	2.00	1	1.3	1.3	1.3
HT	3.00	33	41.3	41.3	42.5
MT	4.00	46	57.5	57.5	100.0
	TOTAL	80	100.0	100.0	

Mean	3.563	Std Err	.059	Median	4.000
Mode	4.000	Std Dev	.524	Variance	.275
Kurtosis	-1.133	S E Kurt	.532	Skewness	-.527
S E Skew	.269	Range	2.000	Minimum	2.000
Maximum	4.000	Sum	285.000		

Valid Cases 80 Missing Cases 0

XJA JOB-ATT

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
SD	1.00	1	1.3	1.3	1.3
DE	2.00	11	13.8	13.8	15.0
UN	3.00	56	70.0	70.0	85.0
AE	4.00	12	15.0	15.0	100.0
	TOTAL	80	100.0	100.0	

Mean	2.988	Std Err	.065	Median	3.000
Mode	3.000	Std Dev	.584	Variance	.342
Kurtosis	1.409	S E Kurt	.532	Skewness	-.389
S E Skew	.269	Range	3.000	Minimum	1.000
Maximum	4.000	Sum	239.000		

Valid Cases 80 Missing Cases 0

X106 FUNC-AREA

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
ACC	1	16	20.0	20.0	20.0
FNC	2	4	5.0	5.0	25.0
MKG	3	4	5.0	5.0	30.0
GMG	4	5	6.3	6.3	36.3
PRS	5	4	5.0	5.0	41.3
INFS	6	32	40.0	40.0	81.3
SLS	7	4	5.0	5.0	86.3
ENG	9	5	6.3	6.3	92.5
R&D	10	1	1.3	1.3	93.8
OTHER	11	5	6.3	6.3	100.0
	TOTAL	80	100.0	100.0	

X106 FUNC-AREA

Mean	5.075	Std Err	.320	Median	6.000
Mode	6.000	Std Dev	2.859	Variance	8.172
Kurtosis	-.486	S E Kurt	.532	Skewness	.153
S E Skew	.269	Range	10.000	Minimum	1.000
Maximum	11.000	Sum	406.000		

Valid Cases 80 Missing Cases 0

X107 ORGL

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
PFS	1	29	36.3	36.3	36.3
FLS	2	16	20.0	20.0	56.3
MDM	3	18	22.5	22.5	78.8
STM	4	12	15.0	15.0	93.8
OTHER	5	5	6.3	6.3	100.0
	TOTAL	80	100.0	100.0	

Mean	2.350	Std Err	.144	Median	2.000
Mode	1.000	Std Dev	1.284	Variance	1.648
Kurtosis	-.929	S E Kurt	.532	Skewness	.490
S E Skew	.269	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	188.000		
Valid Cases	80	Missing Cases	0		

X108 ORGB

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
MDG	3	13	16.3	16.3	16.3
HCR	5	16	20.0	20.0	36.3
INS	6	7	8.8	8.8	45.0
EDU	7	8	10.0	10.0	55.0
FNS	8	26	32.5	32.5	87.5
OTHER	9	10	12.5	12.5	100.0
	TOTAL	80	100.0	100.0	

Mean	6.438	Std Err	.225	Median	7.000
Mode	8.000	Std Dev	2.012	Variance	4.047
Kurtosis	-1.057	S E Kurt	.532	Skewness	-.490
S E Skew	.269	Range	6.000	Minimum	3.000
Maximum	9.000	Sum	515.000		

Valid Cases 80 Missing Cases 0

X109 YOE

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	2	2.5	2.5	2.5
	1	17	21.3	21.3	23.8
	2	21	26.3	26.3	50.0
	3	17	21.3	21.3	71.3
	4	4	5.0	5.0	76.3
	5	3	3.8	3.8	80.0
	6	7	8.8	8.8	88.8
	7	3	3.8	3.8	92.5
	8	3	3.8	3.8	96.3
	10	1	1.3	1.3	97.5
	16	2	2.5	2.5	100.0
	TOTAL	80	100.0	100.0	

X109 YOE

Mean	3.375	Std Err	.329	Median	2.500
Mode	2.000	Std Dev	2.944	Variance	8.668
Kurtosis	7.037	S E Kurt	.532	Skewness	2.307
S E Skew	.269	Range	16.000	Minimum	0.0
Maximum	16.000	Sum	270.000		

Valid Cases 80 Missing Cases 0

X110 NOS

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	25	31.3	31.3	31.3
	1	5	6.3	6.3	37.5
	2	17	21.3	21.3	58.8
	3	8	10.0	10.0	68.8
	4	4	5.0	5.0	73.8
	5	8	10.0	10.0	83.8
	6	5	6.3	6.3	90.0
	7	1	1.3	1.3	91.3
	8	3	3.8	3.8	95.0
	10	2	2.5	2.5	97.5
	15	1	1.3	1.3	98.8
	16	1	1.3	1.3	100.0
	TOTAL	80	100.0	100.0	

X110 NOS

Mean	2.888	Std Err	.365	Median	2.000
Mode	0.0	Std Dev	3.269	Variance	10.683
Kurtosis	4.180	S E Kurt	.532	Skewness	1.787
S E Skew	.269	Range	16.000	Minimum	0.0
Maximum	16.000	Sum	231.000		

Valid Cases 80 Missing Cases 0

X111 LOE

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
HS	2	4	5.0	5.0	5.0
SC	3	5	6.3	6.3	11.3
BS	4	45	56.3	56.3	67.5
SG	5	6	7.5	7.5	75.0
GD	6	20	25.0	25.0	100.0
	TOTAL	80	100.0	100.0	

Mean	4.413	Std Err	.122	Median	4.000
Mode	4.000	Std Dev	1.087	Variance	1.182
Kurtosis	-.337	S E Kurt	.532	Skewness	.079
S E Skew	.269	Range	4.000	Minimum	2.000
Maximum	6.000	Sum	353.000		

Valid Cases 80 Missing Cases 0

X112 AGE

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	22	7	8.8	8.8	8.8
	23	7	8.8	8.8	17.5
	24	9	11.3	11.3	28.8
	25	8	10.0	10.0	38.8
	26	9	11.3	11.3	50.0
	27	7	8.8	8.8	58.8
	28	7	8.8	8.8	67.5
	29	2	2.5	2.5	70.0
	30	6	7.5	7.5	77.5
	31	4	5.0	5.0	82.5
	32	5	6.3	6.3	88.8
	33	1	1.3	1.3	90.0
	35	3	3.8	3.8	93.8
	36	2	2.5	2.5	96.3
	42	2	2.5	2.5	98.8
	44	1	1.3	1.3	100.0
	TOTAL	80	100.0	100.0	

X112 AGE

Mean	27.625	Std Err	.528	Median	26.500
Mode	24.000	Std Dev	4.726	Variance	22.339
Kurtosis	2.127	S E Kurt	.532	Skewness	1.349
S E Skew	.269	Range	22.000	Minimum	22.000
Maximum	44.000	Sum	2210.000		

Valid Cases 80 Missing Cases 0

X113 SEX

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
FEMALE	0	26	32.5	32.5	32.5
MALE	1	54	67.5	67.5	100.0
	TOTAL	80	100.0	100.0	

Mean	.675	Std Err	.053	Median	1.000
Mode	1.000	Std Dev	.471	Variance	.222
Kurtosis	-1.457	S E Kurt	.532	Skewness	-.762
S E Skew	.269	Range	1.000	Minimum	0.0
Maximum	1.000	Sum	54.000		
Valid Cases	80	Missing Cases	0		

This procedure was completed at 4:56:38

APPENDIX D

List of Regression Analysis

Output

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

Beginning Block Number 1. Method: Stepwise

Variable(s) Entered on Step Number
1.. XACU

Multiple R	.52087
R Square	.27130
Adjusted R Square	.26196
Standard Error	.38842

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	4.38138	4.38138
Residual	78	11.76796	.15087

F = 29.04053 Signif F = .0000

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
XACU	.47657	.08844	.52087	5.389	.0000
(Constant)	2.11892	.36288		5.839	.0000

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

---------- Variables not in the Equation ----------

Variable	Beta In	Partial	Min Toler	T	Sig T
XJA	.30724	.35277	.96065	3.308	.0014
XMES	.28578	.32493	.94202	3.015	.0035
X5	-.15008	-.17447	.98469	-1.555	.1241
X39	-.20369	-.23855	.99952	-2.156	.0342
X42	.24980	.29212	.99657	2.680	.0090
XT	-.06113	-.07074	.97595	-.622	.5356
X112	-.13189	-.15288	.97907	-1.357	.1786
X113	.15716	.18409	.99989	1.643	.1044

*** * * * MULTIPLE REGRESSION * * * ***

Equation Number 1 Dependent Variable.. XUS

Variable(s) Entered on Step Number
2.. XJA

Multiple R	.60166
R Square	.36199
Adjusted R Square	.34542
Standard Error	.36580

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	5.84588	2.92294
Residual	77	10.30346	.13381

F = 21.84377 Signif F = .0000

*** * * * MULTIPLE REGRESSION * * * ***

Equation Number 1 Dependent Variable.. XUS

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
XACU	.42081	.08497	.45992	4.952	.0000
XJA	.24415	.07380	.30724	3.308	.0014
(Constant)	1.48748	.39144		3.800	.0003

*** * * * MULTIPLE REGRESSION * * * ***

Equation Number 1 Dependent Variable.. XUS

---------- Variables not in the Equation ----------

Variable	Beta In	Partial	Min Toler	T	Sig T
XMES	.22702	.26865	.89344	2.431	.0174
X5	-.16079	-.19963	.94803	-1.776	.0797
X39	-.18867	-.23583	.95810	-2.116	.0377
X42	.24798	.30992	.95762	2.842	.0058
XT	-.11062	-.13518	.93794	-1.189	.2380
X112	-.25737	-.30166	.86000	-2.758	.0073
X113	.12669	.15770	.94988	1.392	.1679

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

Variable(s) Entered on Step Number
3.. X42

Multiple R	.65059
R Square	.42327
Adjusted R Square	.40051
Standard Error	.35007

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	3	6.83555	2.27852
Residual	76	9.31379	.12255

F = 18.59257 Signif F = 0.0

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
XACU	.40780	.08145	.44570	5.007	.0000
XJA	.24294	.07063	.30572	3.440	.0009
X42	1.00284	.35289	.24798	2.842	.0058
(Constant)	.55446	.49812		1.113	.2692

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

---------- Variables not in the Equation ----------

Variable	Beta In	Partial	Min Toler	T	Sig T
XMES	.22675	.28223	.89343	2.548	.0129
X5	-.21160	-.27196	.94678	-2.448	.0167
X39	-.17819	-.23404	.95650	-2.085	.0405
XT	-.06728	-.08507	.92219	-.739	.4620
X112	-.25668	-.31643	.85996	-2.889	.0051
X113	.08866	.11455	.94976	.999	.3212

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

Variable(s) Entered on Step Number
4.. X112

Multiple R	.69356
R Square	.48102
Adjusted R Square	.45334
Standard Error	.33429

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	4	7.76815	1.94204
Residual	75	8.38119	.11175

F = 17.37853 Signif F = .0000

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
XACU	.35863	.07962	.39196	4.504	.0000
XJA	.30960	.07128	.38960	4.343	.0000
X42	1.00030	.33698	.24736	2.968	.0040
X112	-.02455	8.49983E-03	-.25668	-2.889	.0051
(Constant)	1.20118	.52571		2.285	.0251

*** * * * MULTIPLE REGRESSION * * * ***

Equation Number 1 Dependent Variable.. XUS

---------- Variables not in the Equation ----------

Variable	Beta In	Partial	Min Toler	T	Sig T
XMES	.22976	.30144	.82134	2.720	.0081
X5	-.23609	-.31854	.85665	-2.891	.0050
X39	-.21634	-.29658	.85914	-2.671	.0093
XT	-.07330	-.09768	.83889	-.844	.4012
X113	.09729	.13243	.85305	1.149	.2541

*** * * * MULTIPLE REGRESSION * * * ***

Equation Number 1 Dependent Variable.. XUS

Variable(s) Entered on Step Number
5.. X5

Multiple R	.73053
R Square	.53368
Adjusted R Square	.50217
Standard Error	.31901

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	5	8.61856	1.72371
Residual	74	7.53078	.10177

F = 16.93778 Signif F = .0000

*** * * * MULTIPLE REGRESSION * * * ***

Equation Number 1 Dependent Variable.. XUS

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
XACU	.37736	.07625	.41244	4.949	.0000
XJA	.32182	.06816	.40499	4.722	.0000
X42	1.16795	.32677	.28881	3.574	.0006
X112	-.02671	8.14548E-03	-.27920	-3.279	.0016
X5	-.23756	.08218	-.23609	-2.891	.0050
(Constant)	1.14804	.50202		2.287	.0251

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

---------- Variables not in the Equation ----------

Variable	Beta In	Partial	Min Toler	T	Sig T
XMES	.25863	.35592	.82013	3.254	.0017
X39	-.19425	-.27939	.85412	-2.486	.0152
XT	-.02866	-.03955	.83803	-.338	.7362
X113	.08782	.12600	.84939	1.085	.2814

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

Variable(s) Entered on Step Number
6.. XMES

Multiple R	.76990
R Square	.59275
Adjusted R Square	.55928
Standard Error	.30016

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	6	9.57255	1.59542
Residual	73	6.57680	.09009

F = 17.70862 Signif F = .0000

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
XACU	.33250	.07306	.36340	4.551	.0000
XJA	.27779	.06554	.34957	4.238	.0001
X42	1.18596	.30751	.29327	3.857	.0002
X112	-.02725	7.66582E-03	-.28482	-3.554	.0007
X5	-.26458	.07777	-.26294	-3.402	.0011
XMES	.14866	.04568	.25863	3.254	.0017
(Constant)	.92790	.47717		1.945	.0557

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

---------- Variables not in the Equation ----------

Variable	Beta In	Partial	Min Toler	T	Sig T
X39	-.16834	-.25743	.81997	-2.261	.0268
XT	-.03709	-.05475	.80454	-.465	.6432
X113	.06044	.09220	.81642	.786	.4347

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

Variable(s) Entered on Step Number
7.. X39

Multiple R	.78724
R Square	.61974
Adjusted R Square	.58277
Standard Error	.29205

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	7	10.00838	1.42977
Residual	72	6.14096	.08529

F = 16.76340 Signif F = .0000

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
XACU	.33507	.07110	.36622	4.713	.0000
XJA	.27982	.06378	.35213	4.388	.0000
X42	1.14195	.29983	.28238	3.809	.0003
X112	-.02945	7.52247E-03	-.30791	-3.916	.0002
X5	-.24457	.07618	-.24305	-3.210	.0020
XMES	.13719	.04474	.23867	3.066	.0031
X39	-.22870	.10117	-.16834	-2.261	.0268
(Constant)	1.24468	.48497		2.567	.0124

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

---------- Variables not in the Equation ----------

Variable	Beta In	Partial	Min Toler	T	Sig T
XT	.02030	.02940	.79774	.248	.8050
X113	.11408	.17345	.81640	1.484	.1422

End Block Number 1 PIN = .050 Limits reached.

*** * * * M U L T I P L E R E G R E S S I O N * * * ***

Equation Number 1 Dependent Variable.. XUS

Residuals Statistics:

	Min	Max	Mean	Std Dev	N
*PRED	2.9444	4.9823	4.0604	.3559	80
*RESID	-.5199	.4903	.0000	.2788	80
*ZPRED	-3.1353	2.5902	-.0000	1.0000	80
*ZRESID	-1.7800	1.6789	.0000	.9547	80

Total Cases = 80

Durbin-Watson Test = 1.63821

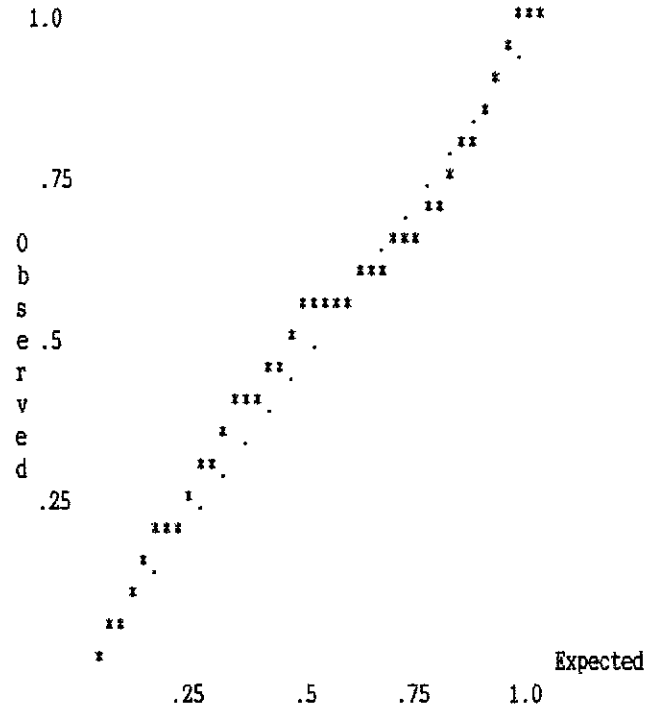
Outliers - Standardized Residual

Case #	XUS	*ZRESID
32	3.39	-1.78003
68	3.28	-1.75464
20	3.17	-1.72774
62	4.33	1.67890
58	4.56	1.65176
76	3.72	1.45196
52	3.61	-1.43810
56	3.50	-1.43785
77	4.28	1.41372
71	3.94	-1.38543

Histogram - Standardized Residual

```
NExp N      (* = 1 Cases,    . : = Normal Curve)
0  .06   Out
0  .12  3.00
0  .31  2.67
0  .71  2.33 .
0 1.46  2.00 .
2 2.67  1.67 **.
* 4.39  1.33 ***:*******
9 6.45  1.00 *****:***
7 8.50   .67 *******.
6 10.0   .33 ******    .
9 10.6  0.0  ********** .
8 10.0  -.33 ********  .
9 8.50  -.67 ********:*
9 6.45 -1.00 *****:***
7 4.39 -1.33 ***:***
3 2.67 -1.67 **:
0 1.46 -2.00 .
0  .71 -2.33 .
0  .31 -2.67
0  .12 -3.00
0  .06   Out
```

Normal Probability (P-P) Plot
Standardized Residual



This procedure was completed at 2:32:07

BIBLIOGRAPHY

Barki, Henri & Jon Hartwick, "Rethinking the concept of User Involvement", MIS Quarterly, VOL. 13, NO. 1, March 1989.

Brancheau, J.C, D.R. Vogel & J.C. Wetherbe, "An Investigation of the Information Center from the User's Perspective", Database, Fall 1985.

Carroll, John M. & Jean McKendree, "Interface Design issues for Advice - Giving Expert Systems", Communication of the ACM, VOL. 30, NO. 1, January 1987.

Davis, Fred B., "Perceived Usefulness, Perceived Ease of Use and User Acceptance of Information Technology", MIS Quarterly, VOL. 13, NO. 3, September 1989.

Davis, G.B. & Margrethe H. Olson, Management Information Systems, N.Y: McGraw Hill Book Company, 1985.

Davis, R., "A DSS for Diagnosis and Therapy", Database, VOL. 8, NO. 3, 1977.

Delone, W.H, "Determinants of Success for Computer Usage in Small Business", MIS Quarterly, VOL. 12, NO. 1, March 1988.

Doll, Dixon as quoted by Brad Schultz in "Interview with Dixon Doll", Computer World, March 18, 1981.

Dowling, A.F, "Implementation of Computer Based Information Systems in the Ambulatory Health Care Setting", Memeographed sheets.

Ein-Dor, P. & E. Segev, "Organizational Context and MIS Structure", MIS Quarterly, VOL. 6, NO. 3, September 1988.

Gould, John D. & Clayton Lewis, "Designing for Usability: Key Principles & What Designers Think", Communications of the ACM, VOL. 28, NO. 3, March 1985.

Henderson, J.C. & M.E. Treacy, "Managing End User Computing for Competitive Advantage", Sloan Management Review, Winter, 1986.

Igbaria, M. et al., "Microcomputer Applications: An Empirical Look at Usage", Information & Management, NO. 16, 1989.

Ives, Blake & M.H. Olson, "User Involvement & MIS success", Management Science, VOL. 30, NO. 5, May 1984.

Kroeber, D.W & H.J. Watson, Computer-Based Information Systems: A Management Approach, N.Y.: Macmillan, 1984.

Kuwan, S.K & Kathleen F. Curley, "Corporate MIS/DP End User Computing", Database, Summer, 1989.

Lee, D.S, "Usage Pattern and Sources of Assistance to Personal Computer Users", MIS Quarterly, VOL. 10, NO. 4, December 1986.

Maish, A.M, "A User's Behavior Toward His MIS", MIS Quarterly, VOL. 3, NO. 1, March 1979.

Mansour, Ali H, and H.J. Watson, "The Determinants of Computer Based Information System Performance", Academy of Management Journal, VOL. 23, NO. 3, 1980.

Markus, M. Lynne & Neils Andersen, "Power Over Users: Its Exercise by System Professionals", Communication of the ACM, VOL. 30, NO. 6, June 1987.

McGann, John A., "Meeting the Challenge of End User Computing", Journal of Systems Management, March 1990.

Nelson, R. & P. Cheney, "Training End Users: An Explatory Study", MIS Quarterly, VOL. 11, NO. 4, December 1987.

Nolan, R. & Cyrus Gibson, "Managing the Four Stages of EDP Growth", Harvard Business Review, Boston: Reprint Service, January/February, 1974.

Raymond, L. "Organizational Characteristics and MIS Success in the Context of the Small Business", MIS Quarterly, VOL. 9, NO. 1, March 1985.

Rockart, John F., "Chief Executives Define their Own Data Needs", Harvard Business Review, March-April, 1979.

Rockart, J.F. & M.E. Treacy, "The CEO goes on line", Harvard Business Review, VOL. 60, NO. 1, Jan-Feb., 1982.

Rushnik, Avi & Sara F. Rushnik, "What Makes Users Happy?", Communication of the ACM, VOL. 29, NO. 7, July 1986.

Sprague, R.H & B.C. McNurlin, Information System Management in Practice, N.Y.: Prentice Hall, Inc., 1986.

Srinivasan, Ananth, "Alternative Measures of System Effectiveness", MIS Quarterly, VOL. 9, NO. 3, September 1985.

Synnott, W.R. & William H. Gruber, Information Resource Management, N.Y.: A Wiley Interscience Publication, 1989.

Turoff, M. & Starr Hiltz, "Management Issue in Human Communication Via Computer", in Emerging Office Systems, ed., Robert Landau, N.J.: Ablex Publishing Corporation, 1982.

Uttal, B., "What's Detaining the Office of the Future", Fortune, VOL. 105, NO. 9, May 3, 1982.

Yaverbaum, Gayle J., "Critical Factors in tha User Environment", MIS Quarterly, VOL. 12, NO. 1, March 1988.