FACTORS LEADING TO USER ACCEPTANCE AND TO USER SATISFACTION WITH A COMPUTER BASED INFORMATION SYSTEM

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CHAPTER I

Introduction

The past ten to fifteen years have witnessed an enormous growth in the use of computerized procedures in business, education, health, and many other sectors of the economy. The growth has been so pervasive that it is difficult to find instances where the use of computers has not impinged directly or indirectly on every aspect of life. This widespread use has been partly due to the old dream of technology as a "mean to free humanity from toil", in the hope that "computers will enrich our jobs, free us from disagreeable labor, and increase our productivity"[1], and partly due to the particular characteristic that computers hold which distinguishes them from any other tool ever created, and that is they are amorphous objects capable of fitting any particular application. A third reason for their widespread use is the tremendous advancements in technology and mass production that have rendered hardware and software costs less

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1- R. Lucky, "The social impact of the computer" in <u>Computer Culture; the scientific, Itellectual and Social Impact of the Computer</u>, (New York: Academy of Sciences, 1983), p. 20.

expensive. In addition, technological advancements have resulted in smaller and more powerful machines as evidenced by the breakthrough with the invention of the micro processor and the introduction of Personal Computers or more user friendly machines into the market. Together these factors have enabled almost every organization to buy or at least to lease a computer system.

The technological advances coupled with the side tasks this new technology has created; programmers, systems analysts, computer engineers, network engineers, etc..., have led to major impacts on modern living.

Most organizational computer usage falls into one of three categories. The first include using the computer to receive, transmit, and process information in a variety of ways and this is known as "Information Handling". The second, "Transaction Processing", where computers are used to gather, transmit, store and retrieve transaction data. The third category, "Data-base applications" where the computer is used to access and maintain various data files. All of the aforementioned categories focus primarily at clerical replacement. Under this approach the computer is used because, on one hand it is a very fast arithmetic device and, on the other, it is an extremely efficient file cabinet that does not require a lot of space.

Using the computer as an "efficiency" oriented application did not sufficiently satisfy human ambition. Nowadays, another management activity, decision-making, is being supported by computers. Managers are always involved in decision making activities and the more unstructured the problem the more difficult this activity becomes. The use of Decision Support Systems has increased recently in an attempt to join forces between machine power and managers experience and know how. In such projects, selection does not depend solely upon cost reduction criteria, but rather on improving the quality of the decision made. This shift in emphasis has given the rise to interactive systems, time-sharing, and a multiple of other philosophies, for facilitating "Man/ Machine symbiosis". Witnesses of this trend have used or even introduced the term "Management

Information System" (MIS) to describe the new managerial support system. Implicit in the MIS concept is the use of computers as an aid to managers in making decisions relevant to their domains of responsibility.

Despite more than thirty years of exposure to computer systems, organizational coherence with the machinehas not yet been reached. This has been partly due to the lack of managerial expertise. Many managers have received their education and early work training in an environment "free" of computers in a setting where the firm could operate and choose its method of competition without the presence of an Information System. Managers tend to be uncomfortable with the subject and try to avoid it as much as they can, because they lack confidence in their ability to assimilate and implement a somewhat different way of managing the organization. Another important reason for this lack of coherence might be due to behavioral reasons. It has been frequently observed that when this new technology is introduced to any organization, the outcome of people's behavior has been of three types:

Aggressive behavior represents an attack intended to injure the object causing the problem. The most dramatic aggression toward the system occurs as overt sabotage[2] . A second reaction to computers is **Projection** which exist when people blame the system for causing difficulties that are in fact caused entirely by something else. A third reaction is **Avoidance** in which users ignore the system, particularly when it does not fulfill organizational information needs.

One explanation for such reactions may lie in the fact that people usually resist change. By nature human beings avoid innovations because they are not confident of their ability to cope with the new procedure. Greenberger highlights this phenomenon in commenting that the "explanation of human inertia would cite man's tendency to resist the new and espouse the old, his need for security, and his fondness for familiar objects even while exploring the unfamiliar"[3]. Another explanation may be that computerization has made the job of many employees redundant, so, many employees who either could not cope with the new technology or did not have the opportunity to be transferred

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2. P.G.W Keen, "Information Systems and Organizational Change", Communications of the ACM, (24:1, 1981), pp. 24-33.

3. M. Greenberger, "The computer in organizations " ed. C.A. Wolker, In Technology, Industry, and Man (New York: Mc Graw Hill book company 1968) p. 304.

to perform another task, were fired. That is why Computers are seen as a cancer driving people who are below the standard imposed by this technology away from their right to have a decent job. Mowshowitz observes:

"The critical observation is that new machines and methods are introduced for the purpose of increasing productivity and reducing labor requirements"[4]. The issue of depriving employees from their right to having a decent job is still debatable. Peter Drucker argues that instead of eliminating clerks, the computer age has replaced them with new clerks called "operators" and "programmers"[5].

Jaffe and Fromkin observed "... it is only possible to generalize that the impact of technological changes on unemployment is temporary and generally self-corrective"[6]. Accordingly one can argue that it is not true that computers eliminate jobs. Rather, their use requires staff who can do new jobs. Consequently the value added by automation is not the result of eliminating the personnel factor but of altering it and making it more innovative and creative.

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4. A. Mawshowitz, The Conquest Of Will, Information Processing In Human Affairs. Addison-Wesley, Reading, Mass. (1976).

5. Peter F. Druker, Managing In Turbulant Times (New York: Hurper & Row publishing Inc. 1980) pp.16-25.

6. A.J. Jaffe & J. Froomkin, Technology and Jobs. ed. Preager,(New York, publishing co., 1968), p 50.

Resistance to change is an important factor affecting the success or failure of an information system. It is only natural for the employees to resist when there are changes in the way they used to perform their work. Reif points out that "resistance will be inevitable as departmental boundaries are violated and entire functions are deleted or several combined in the name of greater operating efficiency"[7]. However, having understood the fear of employees, managers, by establishing a suitable "climate" for change within the organization[8] could overcome the resistance to change and manage it in the right way over time. What is noticeable is the fact that even though the resistance to change factor has been overcome or reduced to a minimum level, users are still unwilling to accept and use the implemented information system. Organizations continue to witness periods of stress because users are not satisfied with the computerized procedures they have. Consequently the ability of CBIS to "substantially improve white collar performance"[9], are obstructed by the userrs' negative stand towards

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[7]. W.E Reif, Computer Technology And Management Organization (Iowa City: Bureau Of Business And Economic Research, University Of Iowa, 1968), pp. 37-38.

[8]. E.H. Schein, "The Mechanisms of Change," in Interpersonal Dynamics, W.Bennis, E.Schein, F.Steel, and D.Berlew(eds.), (Dorsey, Homewood, IL, 1964), pp.362-378.

[9]. K.F Curly, "Are There Any Real Benefits From Office Automation?" Business Horizons (4), (July-August 1984), pp. 37-42.

accepting and using the available computerized procedure.[10] But what causes users to accept, use, and be satisfied with a CBIS ?

Among the many variables that may impede system acceptance, use, and user satisfaction, three variables are of major importance: ease of use, usefulness, and user involvement. For the purpose of being on solid ground, a definition of the aforementioned concepts might prove useful.

User Involvement, refers to having the "user" create his own product through his participation in all phases of systems activity: systems planning, project team organization, system development, and post audits. Possibly that the real benefit of a user involvement strategy is that it helps insure that users get what they want and thus assures success because users feel it is **their** system.

Ease of Use, refers to "The degree to which an effort has to be made by a user while using a particular system". This follows from the definition of "ease": "freedom from difficulty or great effort". It is claimed that an easy to use system is more likely to be accepted by users.

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[10]. W. Bowen, "The Pury Payoff From Office Computers", Fortune, (May 26, 1986), pp. 20-24.

Usefulness, is defined as "To what extent a particular system would enhance an employee's job performance". This is because "useful" is defined as "capable of being used advantageously". It is believed that a useful system is more likely to increase user satisfaction.

User satisfaction, refers to "What extent a user is happy with the services received". It is claimed that the "Acid test" of successful systems projects is, the overall Satisfaction of the user with the results of these projects. The objective is to place greater emphasis on services and effectiveness (results achieved, value of product) than on efficiency (cost control).

Because user acceptance and user satisfaction have been long standing concepts in the field of Management Information System[11] and because no clear cut answers are yet available, this study will shed some light upon factors leading to user information satisfaction. Aside from the aforementioned reasons, determining why some of the implemented information systems are accepted and thus lead to user satisfaction while others are not,

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[11]. E.B. Swanson, "Information Channel Disposition and Use", Decision sciences (18:1 , Winter 1987), pp. 131-145.

will enable managers not only to avoid unwanted periods of stress and frustration, but it will also enable them to evaluate vendor's offerings and select the most appropriate computerized information system.

This study will focus on the banking sector in Lebanon; a sector which is witnessinga growth in computer usage. The introduction of computers in the Lebanese banking sector took place in the late 70's. However computer usage was confined to administrative purposes (such as customer card maintenance and interest calculation). Nowadays, computer usage has spread to other applications in our banks; however, it is still used for structured reporting systems (SRS) rather than for Decision Supporting System (DSS) facilities.

Need For The Study

Computer-Based Information systems are an important component of modern living that should be tailored to satisfy the needs of the users involved, and enable organizations to achieve a better competitive edge. Today, with competitive pressures in most economic sector, especially banking, insurance and airline reservation sectors, one cannot imagine their functioning adequately without sophisticated computer systems supporting managers in the decision- making process.

However, for organizations to enjoy the technical benefits of computerization, it is necessary to address the disfunctional side effects stemming from the human component. **User Satisfaction** or **User Acceptance** is the key element determining the success or failure of the acquired information system. If the appropriate information system satisfies end-users, then it will enable the organization - by the effective use of this competitive tool- to achieve high cost reduction, improve product quality, increase productivity, efficiency and effectiveness in work output.

Statement Of Problem

A big challenge facing organizations today is the ability to manage information resources in an efficient way so that it would be able to achieve competitive advantage. Management should control and guide the users of the information system adopted. However this control and guidance will not be sufficient if users resist accepting the computerized procedure. This is not only due to behavioral reasons, the cause might be in the way the system was initiated. That is why the system should be tailored to satisfy the needs of those who are going to use it, otherwise, failure will be the result.

Due to the fact that usually huge amounts of money, in some cases more than 40% of the firm's revenues are involved, and due to the time element, effort and risk derived from the effect of the new system on all organizational levels[12], it seems that there is no room for any failure. That is why if the system were to be accepted it would increase productivity and organizational efficiency. Many

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[12]. F.W., McFarlan, "Portfolio Approach to Information Systems", Harvard Business Review, (September-October 1981), pp.142-159.

organizations are still not satisfied with their computer system. The reason is the acquired system can do anything but satisfying the needs of those using it. The system was designed and implemented without taking into consideration the critical success factors (CSF's) of those who are going to use it. Often, "because of inadequate specifications and lack of user involvement, these systems often performed well short of expectations".[13]

Due to the high cost associated with it, and due to the fact that managers rarely admit that they have made a mistake, the organization will be stuck with a deficient system, to which it will be forced to adapt itself to it for many years to come.

Statement of hypotheses

Based on existing literature and the conceptual assessment of factors leading to user information satisfaction, the following research hypotheses were constructed.

H1. User acceptance is dependent upon factors such as : user involvement, usefulness, and ease of use.

H2. User involvement leads to user satisfaction with the system.

H3. There is a two way positive relationship between user acceptance and user information satisfaction.

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[13]. W.R Synott & W.H. Gruber , Information Resource Management (John Wiley & Sons, Inc 1981) p. 7

Statement Of Purposes

The purpose of this research is to try to investigate the concept of User Acceptance and its relationship to User satisfaction. The investigation will focus on the following constructs; user involvement, ease of use, usefulness, and use which are theorized to be fundamental determinants of user satisfaction. For the purpose of this study the banking sector was selected as the sole source of data collection. The investigation will be concerned with those that are heavily and directly involved with computer usage : programmers, operators, and EDP heads.

Developing a better measure for explaining acceptance and satisfaction will help in suggesting solutions for some of the problems related to the human component while implementing a CBIS. Because it is not enough to acquire the most advanced hardware and the most sophisticated software, the third component the "User" should accept, use, and be satisfied with the acquired system. Success or failure of an information system depend to a great extent on the user satisfaction with the information provided by the system. The objective of this study is to show that if users are provided with proper, flexible, and easy to use systems, get involved in at least one of the phases of the system development, and perceive the system as being useful, then the system will have a high chance of being accepted .Figure 1. represents an illustration of the proposed model. It describes two sets of relationships: User Involvement, Usefulness, and Easy to use system, as factors affecting User Acceptance; and the effect of those variables and of Acceptance on User Satisfaction.

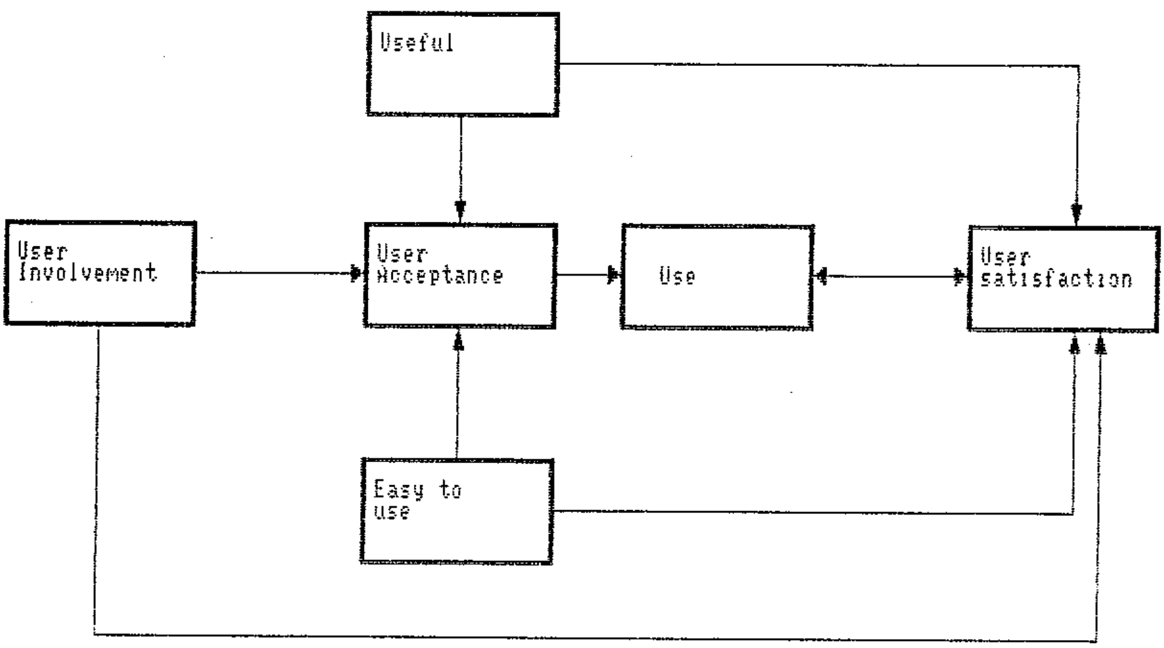

Figure 1. Factors Leading to User Acceptance and to User Information Satisfaction.

Chapter II

Review of Literature

2.1. Introduction.

There have been rapid advancements in the world of information technology, which have forced companies to change, and to adapt to changes made by their competitors, in order to retain or improve their share of the market. As companies change, their employees will have to adapt to these changes.

In fact, one of the most overlooked aspects of computing has been the human side. Users have continually complained about the effect that the new systems have had on their work life - the systems do not function as expected, the operating procedures are difficult, and so on.

Because people are the most critical element of the organization's transformation, if they cannot or will not use the computer-based information system (CBIS), then the automation effort fails. Many users show resistance to change in the work environment. After the

CBIS is implemented, we can find many users making decisions and taking actions based on the old work processes, and thus failing to utilize the new system in an efficient way. In severe cases, workers sabotage the CBISin an attempt to return to old work procedures.

To minimize such a problem, researchers in the field of management information systems tried to determine the factors that would reduce such a resistance trend among the system users. A major point appears to be that the successful use of computers is now more of a managerial concern than a technical one. People are the major component in systems, and by acting as the bridge between the technology and the people, information systems departments are in a critical position to guide and control the various aspects of computer usage.

In Chapter I, it was suggested that user involvement, ease of use, and usefulness are critical factors in positively affecting user acceptance and user satisfaction. In the following sections there will be a presentation of the literature provided by many authors about various factors that might enhance the efficient and effective use of computers and thus lead to a successful implementation of CBIS.

2.2. The Various Measures of System Effectiveness:

Measurement of the effectiveness of a management information system (MIS) has been the subject of a substantial body of research. The wide range of approaches that have been suggested to deal with this issue presents various alternatives to researchers who intend to include MIS effectiveness or success as a dependent variable in the studies conducted. Approaches that have been used by various researchers include system usage and impact of use[1], MIS usage estimation[2], User acceptance[3], User satisfaction[4], incremental performance in decision making[5], and others.

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

[2]. P. Ein-Dor and E. Segev, "Organizational Context and the Success of MIS", Management Science, (Vol.24, No.10, June 1978), pp. 1064-1077.

[3]. Fred Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology", MIS Quarterly, (Vol.13, No.3, September 1989), pp. 319-340.

[4]. J.E. Baily and S.W. Pearson, "Development of a Tool for Measuring and Analysing Computer User Satisfaction", Management Science, (Vol.29, No.5, May 1983), pp. 530-545.

[5]. W.R. King and J.I. Rodriguez, "Evaluating Management Information Systems", MIS Quarterly, (Vol.2, No.3, September 1978), pp. 43-51.

Most of the research conducted in this field has focused upon the system usage or upon "user perceived system effectiveness" thus responding to "the shifting emphasis from efficiency to user effectiveness"[6]. The user perceived effectiveness approach uses indicators or measures of effectiveness as perceived by the users of the system; such measures include user satisfaction, perceived system quality, user acceptance, and so on. Conducting a review of literature concerning these approaches could present some arguments both for and against the use of these approaches. For example, an argument concerning system usage provided by Ein-Dor and Segev states[7]:

> "[Various] criteria [for success that are mentioned in the literature] are clearly mutually dependent; profitability is correlated with performance, application to major problems, and actual use. We claim that a manager will use a system intensively only if it meets some of the criteria, and that use is highly correlated with them".

Ginzberg argument was against the system usage approach by stating that the link between system usage and the effectiveness or quality of decision making was a weak

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6. Ananth Srinivasan, "Alternative Measures of System Effectiveness: Associations and Implications", MIS Quarterly, (Vol.9, No.3, September 1985), pp. 243-253.

7. Ein-Dor and Segev, "Organizational context and the Success of MIS", pp. 1065-1066.

one[8]. "If one view the system as a service (instead of a product) that is designed to enable managers to perform more effectively, the extent of use measure would be a very misleading indicator of success". Based on this, Ginzberg advocated the approach of user perceived effectiveness.

In a research conducted by Ives, Olson, and Baroudi the researchers suggested that the use of both approaches- system usage and perceived effectiveness-may be warranted in many situations.[9] By this, a new situation where system usage may and may not be a measure of MIS success has been cited.

Because system usage and perceived system effectiveness play a key role in determining an MIS effectiveness, it is then important to study the relationship between the two and to understand this relationship as it was measured by many researchers. It is also important and interesting to present the factors identified as being the most likely associated with both measures.

2.3. Computer System Usage.

The degree or extent of computer system use has

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[8]. M.J. Ginzberg, "Finding an adequate measure of OR/MS Effectiveness", quoted from Ananth Srinivasan, "Alternative Measures of System Effectiveness", MIS Quarterly, (Vol.9, No.3, September 1985), pp. 243-253.

[9]. B. Ives, M. Olson, and J. Baroudi, "The Measurement of User Information Satisfaction", Communications of the ACM, (Vol.26, No.10, October 1983), pp. 785-793.

been widely used in many studies as a measure of success of an information system. This measure has been investigated along various dimensions, and its relationship with various characteristics such as user organizational factors has also been the subject of many works of research.

2.3.1. Measurement of System Usage:

Measuring the extent of system usage has been done along various dimensions. In the research conducted by Srinivasan, system use was measured along certain behavioral measures[10]. These were: Frequency of use (number of accesses/ month), time per session (minutes of connect time), number of reports/ documents generated using the system output (average number of reports per month), and type of user relative to other users in the firm (light, average, heavy). In another study conducted by Delone for determining the factors of success for computer usage in small business[11], use was used as a CBIS success measure and was measured along 2 factors: (1) computer report usage (time spent) which had, as a measure of average, a median of four hours/month and (2) computer report frequency of use (frequency) which had a median of 10 times/month.

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[10]. Srinivasan, "Alternative measures of System Effectiveness", pp. 247-248.

[11]. W.H. Delone, "Determinants of Success for Computer Usage in Small Business", pp. 51-61.

In his study about perceived usefulness and perceived ease of use and their effect upon user acceptance of an information system[12], Davis measured system usage by asking respondents to self-report their degree of current usage of certain systems (such as electronic mail and the XEDIT editor) on six-position categorical scales with boxes labeled "Don't use at all", "Use less than once each week", "Use about once each week", "Use several times a week", "Use about once each day", and "Use several times each day" . Another study conducted by Lee[13] for investigating the usage pattern and sources of assistance for personal computer (PC) users measured computer usage along three factors: (1) Actual time spent, (2) frequency of use, and (3) number of application packages used (such as wordprocessing, spreadsheet, database, graphics, other packaged programs, own programming, mainframe connections, computer games, and others). The usage patterns reported showed that respondents spent a significant amount of time with personal computers, averaging 9.48 hours per week (median = 6.0 hours). Respondents were also asked about the amount of time

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[12]. Fred B. Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology", MIS Quarterly, (Vol.13, No.3, September 1989), pp. 319-340.

[13]. Denis S. Lee, "Usage Pattern and Sources of Assistance for Personal Computer Users", MIS Quarterly, (Vol.10, No.4, December 1986), pp. 313-325.

they spent per week on each of the nine major categories of applications. Spreadsheet applications were the most popular with users spending the greatest amount of time on this application, averaging 5.38 hours per week. Next to spreadsheet users, respondents who wrote their own programs or used their PCs for mainframe connections also spent a significant amount of time on these applications, averaging 4.24 and 3,90 hours per week respectively. This was then followed by users of wordprocessing (3.71 hours), other packaged programs (3.65 hours), and database (3.42 hours). Finally, graphics users and computer games players only averaged about (1.68 and 1.54 hours per week respectively).

Based on previous research on MIS usage such as Delone (1988), Srinivasan (1985), Lee (1986), Pavri (1988)[14], Chenney and Dickson (1982)[15], Lucas (1973)[16], Mittman and Moore (1984)[17]

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[14]. F.N. Pavri, "A Study of the Factors Contributing to Microcomputer Usage", Phd. Dissertation, University of Western Ontario, London, Canada, 1988.

[15]. P. Cheney and G.B. Dickson, "Organizational Characteristics and Information Systems Success: An Extrapolation Investigation", Academy of Management Journal, (Vol.25, No.1, March 1982), pp. 170-184.

[16]. H.C. Lucas, "User Reaction and the Management of Information Service", Management Informatics, (Vol.2, No.4, August 1973), pp. 165-172.

[17]. B.S. Mittman, and J.H. Moore, "Senior Management Computer Use": Fourth International Conference on Decision Support Systems, Dallas, Texas, April 1-4, 1984, pp. 42-49.

Raymond (1985)[18], and Maish (1979)[19], Igbaria et al used five dimensions to measure system usage, these were the following:

(1) Inclusion of computer analysis in decision making, (2) actual daily use of microcomputers, with self reported time being used, as measured on a six point scale ranging from "almost never" to "more than 3 hours per day", (3) frequency of use which was measured on a six point scale ranging from "several times a day" to "less than once a month", (4) number of packages used, including word processors; communication packages; spreadsheets; graphical packages; third generation programming languages (e.g. Fortran, Cobol); Fourth generation languages (e.g SQL); data management packages; data analysis (e.g. SAS/PC); and modeling systems, and (5) level of sophistication of usage to measure proficiency of use of the computer, using a five point scale ranging from "novice" to "expert". Concerning actual time spent in computing, results showed that respondents spent a significant time using microcomputers. Most of the respondents reported using the computer from one to two hours per day, where the

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18. L. Raymond, "Organizational Characteristics and MIS Success in the Context of the Small Business", <u>MIS Quarterly</u>, (Vol.9, No.1, March 1985), pp. 37-52.

19. A.M. Maish, "A User's Behavior Toward his MIS", <u>MIS Quarterly</u>, (Vol.3, No.1, March 1979), pp. 39-52.

median was category 4 (indicating 1 to 2 hours per day). At least 12% of the respondents had used microcomputers more than three hours per day. This group was termed as "heavy computer users". The method of measurement used by Igbaria[20] was different from that used by Lee. Because of this, his results could not be directly compared with Lee's, where the actual use of microcomputers averaged 9.48 hours per week. However, such a result could fall within a comparable range of Igbaria's figure (1 to 2 hours per day in a 5 day work week). Also, this result could not be directly compared with Delone's and Srinivasan's, since the measure used was the number of hours spent per month and the minutes of connect time per access respectively.

As to the frequency of use, 50% of the respondents classified themselves as "heavy users", using microcomputer for several times a day. The results presented by Delone and Srinivasan also cannot be directly compared with Igbaria's figure since Delone had used the number of times the microcomputer was used per month, and Srinivasan used the number of access per month measure.

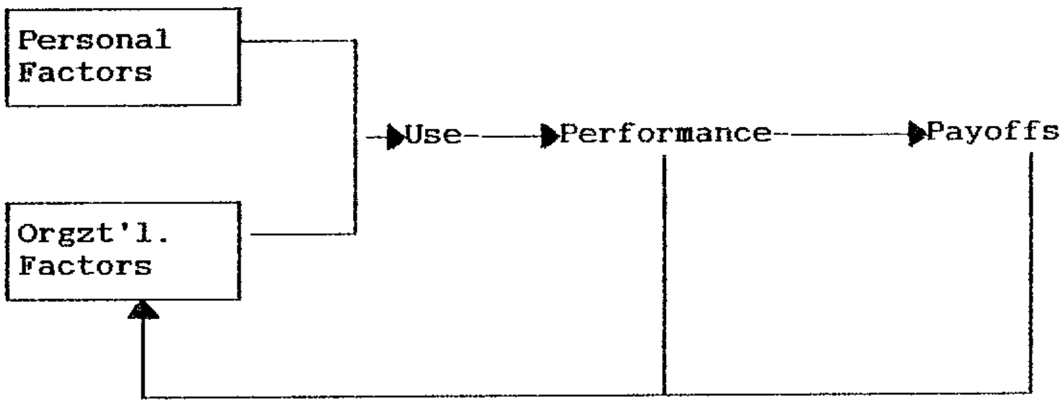
2.3.2. Determinants of Success for System Usage

Based on past pertinent studies, a computer system usage could be viewed as being associated to many

[20]. Magid Igbaria et al., "Microcomputer Applications: An Empirical Look at Usage", Information & Management, (Vol.16, 1989), pp. 187-196.

factors that could be categorized into personal, organizational, and environmental.

In their study, Vertinsky, Barth and Mitchell developed a model that included contextual, use and performance variables as follows[21]:



Personal factors, such as managerial style, past experiences and perceptions, abilities and self esteem, as well as organizational factors such as qualifications of designer, user interaction and induced organizational change, were suggested to play a role in determining use. Use, in turn, affects performance, which ultimately impacts payoffs to users. Payoffs

[21] I. Vertinsky, R.T. Barth, and V.F. Mitchell, "A Study of OR/MS Implementation as a Social Change Process", in R.L. Schultz and D.P. Slevin (eds.), Implementing Operations Research/Management Science, (N.Y: American Elsevier, 1975), p. 253-270, quoted from R.L. Schultz, M.J. Ginzberg, and H.C. Lucas, "A Structural Model of Implementation", <u>Working Paper Series</u>, (No.60, September 1983), p. 1-46.

feedback to the personal and organizational factors through induced change in the organization.

In his study about the usage pattern and sources of assistance for personal computer users[22], Lee has studied the relationship between computer usage (as measured by the average number of hours per week, and number of different applications) and user background and organizational position. Concerning the relationship between use and user background Lee's study showed that there is a negative correlation between age and hours of usage, but no relation between age and diversity of applications. This indicates that while younger users tend to spend more hours using the computer systems, there is no evidence that they are more sophisticated users (with the level of sophistication being indicated by the number of applications). Also there was no relationship between education level and computer usage. Another result indicated by Lee's study was that users with a strong background in computers clearly seem to use PCs to a greater extent than users with a weak computer background. Also, the evidence was strong that users who had prior experience in using computers (PCs)

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[22]. Lee, "Usage Patterns and Sources of Assistance for Personal Computer Users", pp. 317-320.

use a wide variety of applications; however the time spent using the personal computer had no relation with the prior experience of using computers.

Concerning usage pattern and organizational position, results were found interesting, regarding the relationship between the two. The upper level managers tend to use PCs for fewer hours than lower level managers and staff people; however, there is no relationship between the variety of applications and the organizational level of the user. These results could be summed up as shown in Table I.

Table I.

Relation Between Personal Computer Usage and Background of Users.

Correlations Between :	Age	Education Level	No. of College level Courses completed
NO. of hours spent per week using personal computers	-0.15**	0.03	0.17**
No. of different Applications	-0.02	0.03	0.14**
Correlations Between :		**Prior exp. with computers**	**Organizational Position**
NO. of hours spent per week using personal computers		0.12	-0.14**
No. of different Applications		0.24**	-0.01

** $p < 0.01$ *** $p < 0.001$

Source: Lee, "usage Patterns and Sources of Assistance for Personal Computer Users", p. 318.

Another study conducted by Delone used the extent to which the information system (or MS/OR) is used by management, and the impact of an MIS on individual or organizational performance[23]. The selected success factors of computer usage for Delone's study were as follows: knowledge about computers which had a median of 4 years, the use of external programming support (median= 100%), the level of CBIS planning (median = 7 in a scale from 0 to 10), top management involvement in computerization (2 hours/month), personnel acceptance of computers (measured in number of computer related complaints; median = 1/month), the sophistication of computer controls (12 in a score ranging from 0 to 18), the age of computer operations (48months), the level of computer training (3 hours/month), and the type of computer use (measured as on site vs. service bureau; median = 70% on site). The primary finding of the study was that the chief executive- his computer knowledge and involvement- is the key to the success of CBIS performance (as measured by computer use and impact of use). Another finding was that the association of chief executive knowledge and involvement with success is not affected by the length of computer use. Therefore, chief

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[23] Delone, "Determinants of Success for Computer Usage in Small Busińess", p. 52-55.

executive knowledge and experience are important on an ongoing basis since computerization is a continuous and evolving process. Moreover, on-site computer use was significantly related to computer success. It was shown that in-house computers stimulate top management involvement. Several associations were not confirmed by the survey. The length of computer use (Age) was not associated with CBIS success. Apparently, the mere passage of time is not sufficient to guarantee more successful computer use. Similarly, the level of external support was not associated with success. This result indicates that it is not the source (external or internal) of software development which is important but rather how that support is directed toward critical decision areas through the direct involvement of top management. Also, greater levels of employee acceptance were not associated with higher levels of CBIS success measured by computer use. Formal training alone did not result in greater CBIS success, and the association between planning and success was weak. The results are similar to the findings reported by Raymond (1985) in his study about the organizational characteristics and MIS success as shown in Table II.

Table II.

Firm Characteristics and Associations with Computer Use- Comparative Findings of Delone's and Raymond's.

Average Sample Firm Characteristics	**Delone's**	**Raymond's**
Size	62 employees	80 employees
Age of Computer Use	48 months	72 months
Use of External Support	83%	70%
Type (in-house)	70%	74%
Association with Computer use(Success)	**Delone's**	**Raymond's**
Age	None	None
External Support	None	None
Type	Yes	Yes

Source: W.H. Delone, "Determinants of Success for Computer Usage in Small Business", p. 59.

In his study about microcomputer applications, Igbaria[24] investigated the relationship between microcomputer usage (as measured along five dimensions) and the relationship between microcomputer usage and the individual's background and characteristics, and the organizational characteristics of respondents. The factors included were gender, age, education, organizational level, computer experience, user training, system quality and computer anxiety. The

[24] Igbaria et al., "Microcomputer Applications", p.187-196.

results obtained show that the level of education is unrelated to the use of microcomputers in decision making, level of sophistication, and number of packages used, but is positively related to duration (time spent) and frequency of use. It was shown that microcomputers were used more extensively and more often by more educated respondents. Moreover, although users who are in lower levels of the organization used microcomputers more extensively and for less tasks than those in upper levels, there was no relation between the level of sophistication, diversity of applications, or frequency of use and the organizational level. Higher level managers and professionals used microcomputers for the same number of applications but for a larger number of tasks and for fewer hours. As expected, the respondents' age was negatively related to diversity of applications, durations of use, and level of sophistication. It was also found that older managers exhibit higher levels of computer anxiety. Finally, contrary to the popular literature which states that computers are widely perceived as belonging to the "male domain" of mathematics, electronics, and machinery, and that women are likely to be more anxious about computers and to use them less, Igbaria's study showed no relationship between gender and computer usage. These results are shown in Table III.

Table III.

Pearson Correlations Between Microcomputer Usage and Antecedent variables.

Variables	Information Inclusion	Time Spent	Frequency of use
Gender	-0.07	0.02	-0.05
Age	-0.09*	-0.17***	-0.05
Education	0.02	0.10*	0.11**
Org. Level	0.05	-0.021***	-0.05
Computer Experience	0.26***	0.24***	0.19***
User Training	0.15**	0.14**	0.10*
System Quality	0.22***	0.28***	0.31***
Computer Anxiety	-0.23***	-0.28***	-0.27***
Variables	**Number of Applications**		**Level of Sophistication**
Gender	-0.02		-0.07
Age	-0.11*		-0.17***
Education	0.04		0.03
Org. Level	-0.03		-0.07
Computer Experience	0.41***		0.46***
User Training	0.28***		0.32***
System Quality	0.15**		0.14**
Computer Anxiety	-0.24***		-0.32***

* $p <= 0.05$ ** $P <= 0.01$ *** $P <= 0.001$

__Source:__ Igbaria et al., "Microcomputer Applications", p.193.

As seen , Igbaria's findings are partly similar to those reported by Lee. Lee found that there was a negative relationship between the organizational level and time spent on computer use. It was also found that young people tend to spend more time using microcomputers; however, no relationship between level of sophistication (number of different applications) and age was indicated by the study (refer to Table I). Computer anxiety was negatively related to duration of use, frequency of use, level of sophistication, information inclusion, and diversity of applications. Moreover, the relationship between computer experience and user training and microcomputer usage were also investigated. The result was that people with a stronger computer experience clearly seemed to use microcomputers more often than others. Thus, the implication was that the larger their years of experience with computer use, the more managers will use microcomputers in their tasks and for a larger number of applications. It was also found that the extent of microcomputer usage was positively correlated with prior user experience. This finding was also partly confirmed by the findings reported by Lee. While prior experience with computers was positively correlated with the number of different applications used, there was no relationship between computer experience and the number of hours spent on using microcomputers as shown in Table I.

Based on the literature presented above, this study will attempt to investigate computer usage along two dimensions: (1) Actual time spent on using the computer system, and (2) Frequency of computer system usage. The research also intends to study the relationship between computer system usage and factors belonging to individual, organizational, and system characteristics such as user involvement, ease of use, usefulness, computer experience, computer knowledge, age, sex, organizational position, type of system used (whether in-house developed or vendor supplied), and educational level.

2.4. User Acceptance as a Measure of System Effectiveness

This variable, as indicated in many MIS studies, could be used as one of the system perceived effectiveness measures. User acceptance measures "The potential user's predisposition to personally use a specific system. It is a measure of behavioral intention that, other things being equal, will be reflected in actual use".[25] Being considered as a dependent variable

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25. Rendall Schultz, Michael J. Ginzberg, and Henry C. Lucas, p.21.

reflecting CBIS success or effectiveness, it seems reasonable and important to identify the factors that are thought to affect this variable. In the user model proposed in their research, Schultz et al. presented various factors that could play a role in affecting acceptance of the system by its users. Such factors included:

(1) User knowledge of system: here the suggestion was that better knowledge of a system's design and aspects should directly lead to increased acceptance.

(2) User confidence in system and support : this measures the user's confidence in the system and its supporting mechanism. Greater confidence should result in increased acceptance.

(3) User decision style: reflecting the user's characteristic method of making a decision, this suggests that users with more analytic styles in solving problems and making decisions should be more willing to accept CBISs and learn about them.

(4) Goal congruence: measuring the fit between the user's goals and those of the organization, the researchers (Shultz, Ginzberg, and Lucas) hypothesize that the better this fit, the more likely the user will accept the system.

(5) User job characteristics: this variable is a measure of the task responsibilities of the user. The more a user's job is amenable to computer support, the more likely he is to accept the system.

(6) User demographics: age, time with company and in job educational level, experience with computer systems, etc. may all affect a user's willingness to accept a system.

(7) System characteristics: this variable represents the features of the system. As stated by the researchers, one of these characteristics might be the "friendliness", the ease of use of the system, or the fit between system capabilities and the requirements of the user's job. Friendly and easy to use systems which meet the user's information requirements and needs are more likely to be accepted with users.

Moreover, the study also suggested other variables such as user-researcher involvement, system use and user satisfaction to be included in the model as being critical in affecting user acceptance. Because of their importance, and because of the interrelationships available between them, these factors will be dealt with in detail in later sections of this chapter.

The model suggested by Schultz et al. (1983) used a data base that is cross-sectional. for most of the variables included in the model, "there were no well established, validated scales or measures".[26] Another study conducted by Fred Davis[27] developed and validated new scales for two specific variables, perceived usefulness and perceived ease of use, which were hypothesized to be critical determinants of user acceptance. As a result, several new insights were generated about the nature of perceived usefulness and ease of use, and their roles as determinants of user acceptance. Based on certain stated definitions of usefulness and ease of use, initial scale items were generated. The initial scale items are presented in tables IV and V. To improve content validity, these were pretested in a small pilot study, and several items were dropped. The remaining items, 10 for each of the two constructs, were tested for validity and reliability the factor analysis performed on the ten items are shown in table VI. Here, Cronbach alpha reliability was reported to be 0.97 for usefulness and 0.91 for ease of use. Moreover, item analysis was performed to eliminate more items and refine others. The result was a six-item scale for each of the variables: usefulness and ease of

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[26]. Ibid, p. 38

[27]. Fred B. Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of IT", p. 319-340.

Table IV.

Initial Scale Items for Perceived Usefulness

1.	Job difficult without system
2.	Control over work
3.	Job performance
4.	Addresses my needs
5.	Saves me time
6.	Work more quickly
7.	Critical to my job
8.	Accomplish more work
9.	Cut unproductive time
10.	Effectiveness
11.	Quality of work
12.	Increase productivity
13.	Makes job easier
14.	Useful

Source: F.B. Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of IT", p. 326.

Table V.
Initial Scale Items for Ease of Use

1.	Confusing
2.	Error prone
3.	Frustrating
4.	Dependence on manual
5.	Mental effort
6.	Error recovery
7.	Rigid and inflexible
8.	Controllable
9.	Unexpected behavior
10.	Cumbersome
11.	Understandable
12.	Ease of remembering
13.	Provides guidance
14.	Easy to use
NA.	Ease of learning
NA.	Effort to become skillful

Source: Ibid, p. 326

use. The result of the factor analysis applied on the resulting six-item scale is shown in Table VII. As reported by Davis, and as shown in the table, the new scales exhibited "excellent psychometric characteristics... these two data sets also provided strong support for factorial validity: the pattern of

Table VI.

Factor analysis of Perceived Usefulness and Ease of Use questions.

Scale items	Factor 1	Factor 2
Usefulness		
1. Quality of work	0.80	0.10
2. Control over work	0.86	-0.03
3. Work more quickly	0.79	0.17
4. Critical to my job	0.87	-0.11
5. Increase productivity	0.87	0.10
6. Job performance	0.93	-0.07
7. Accomplish more work	0.91	-0.02
8. Effectiveness	0.96	-0.03
9. Makes job easier	0.80	0.16
10. Useful	0.74	0.23
Ease of Use		
1. Cumbersome	0.00	0.73
2. Ease of learning	0.08	0.60
3. Frustrating	0.02	0.65
4. Controllable	0.13	0.74
5. Rigid and inflexible	0.09	0.54
6. Ease of remembering	0.17	0.62
7. Mental effort	-0.07	0.76
8. Understandable	0.29	0.64
9. Effort to be skillful	-0.25	0.88
10. Easy to use	0.23	0.72

Source: Ibid, p. 329.

factor loadings confirmed that a priori structure of the two instruments, with usefulness items loading highly on one factor, ease of use items loading highly on the other factor, and small cross-factor loadings". Here, Cronbach alpha reliability for perceived usefulness was reported to be 0.98 for perceived usefulness and 0.94 for ease of use. These findings, of course, confirm the strength and the validity of the new measurement scales.

Table VII.
Factor Analysis of Perceived Usefulness and Ease of Use Items (for the six-item scales).

Scale Items
Usefulness
1. Work more quickly
2. Job performance
3. Increase productivity
4. Effectiveness
5. Makes job easier
6. Useful
Ease of Use
1. Easy to learn
2. Controllable
3. Clear and understandable
4. Flexible
5. Easy to become skillful
6. Easy to use

Source: Ibid, p. 333.

2.5. User Satisfaction As Measure of System Effectiveness.

User satisfaction has been extensively used by many researchers as a measure of effectiveness as perceived by users. It is well noticed that productivity in computer services means efficient allocation of the resources available for effective utilization of the outputs of data processing. Moreover, it is also argued that utilization is directly connected to the user's sense of satisfaction with those services.

The literature contains a number of attempts at measuring user satisfaction. In each case the users were asked to evaluate their computer services relative to a sense of satisfaction.

A study conducted by Bailey and Pearson reported on a technique for measuring and analysing computer satisfaction.[28] An adequate review of literature was presented by the authors of this study. Noland and Seward, as Bailey and Pearson stated, gave questionnaires to several users of specific reports. On a five point scale they asked the users to rate their satisfaction with the report as a whole; however, no attempt was made to ascertain why the report received a given rating. Also, Neumann and Segev asked users to respond to a similar satisfaction question using four factors: accuracy, content, frequency and recency. Here again, the question as to why a factor was or was not considered satisfactory was not considered in the study. For example, "was the report's content unsatisfactory because it was insufficient in detail or because it was irrelevant to the need?"[29] In another study, Debons et al. developed a list of 10 items affecting satisfaction: accuracy, reliability, timeliness, assistance, adequacy, accommodation, communication, access, cost and environment. The respondents were then asked to evaluate each item on a five point scale from very unsatisfactory to very satisfactory. Once again, no questions were

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[28]. James A. Bailey and Sammy W. Pearson, "Development of a Tool for Measuring and Analysing Computer User Satisfaction", Management Science (Vol.29, No.5, May 1983), p. 530-545.

[29]. Ibid, p. 531.

asked to identify why an attribute was unsatisfactory. Finally, Swanson used a measure for satisfaction which he called "appreciation". Quoted from Bailey and Pearson's study, he defined this construct as "manifold of beliefs about the relative value of the MIS as a means of inquiry". His operational definition consisted of 16 items such as timeliness and adequacy. Responses were on a five point scale using indicators such as very, somewhat and neither. No evidence, as in the other studies mentioned, as to the completeness of his list of factors was given.

Based on the literature they reviewed, Bailey and Pearson found that there was a clear need for a definition of satisfaction which contained a complete and valid set of factors and an instrument which could measure not only user's reaction to each factor but why users responded and reacted as they did. Of course, there clearly a number of factors affecting computer user satisfaction. Based on the literature they reviewed, Bailey and Pearson identified 36 distinct factors. Next, tests for completeness and accuracy were conducted. As a first step, data processing professionals were interviewed and asked to review the list. Upon their review, two additional factors were recommended to be added. This expanded list was then empirically tested in 8 different organizations using the responses of the 32 middle managers. Interviews here were also conducted to investigate the respondents' attitudes toward the computer services and products. The completeness of the expanded list was then examined using a critical incident analysis technique. According to the researchers' assumption, the list would be assumed complete if, at an alpha = 0.01, any factor mentioned in an interview appeared on the list with probability of 0.90. This analysis resulted in 638 mentions of factors of which 625 could be placed on the list. Using the normal approximation to the binomial, they had $Pr(x >= 6.73) = 0.0$. Thus completeness of the list could easily be concluded. The factors included in the list and tested are presented in Table VIII. Respondents then were asked to rank order the factors in terms of importance relative to their own satisfaction. At the end, each respondent was asked to evaluate his overall satisfaction on a seven interval scale ranging from "extremely satisfied" to "extremely dissatisfied".

Moreover, this tool which was developed for measuring and analysing user satisfaction was tested for both reliability and validity. reliability of the satisfaction questionnaire was calculated for each factor. The results reported very high reliability coefficients. Of the 39 factors, 32 resulted in a coefficient greater than 0.90. The average coefficient was 0.93 and the minimum was 0.75, which means that the reliability of the measurement was attained. As for validity, the researchers reported, "Although no statistical measure of construct validity was available, there is significant intuitive evidence to support a positive contention. The fact that unexpected results did not occur is evidence that the measurement questionnaire does reflect the true user satisfaction construct.

Another study conducted by Srinivasan examined behavioral (in terms of system usage) and user perceived effectiveness (in terms of user satisfaction) in 29 organizations in order to investigate the critical relationships between the two measures. The importance of doing this was demonstrated by the "application of both measures as dependent variables in examining the suitability of the characteristics of information systems in a number of organizations".[30] The initial step in the methodology he used was to choose a measurement of user perceived effectiveness of the

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

Table VIII.

List of Factors Included in the Tool Used for Measuring User Satisfaction as Proposed by Bailey and Pearson (according to rank order).

Factor
1. Flexibility
2. Accuracy
3. Timeliness
4. Reliability
5. Completeness
6. Confidence in systems
7. Relevancy
8. Precision
9. Technical competence of the EDP staff
10. Currency
11. Priorities determinations
12. Error recovery
13. Response/ turnaround time
14. Convenience of access
15. Attitude of the EDP staff
16. Time required for new development
17. Perceived utility
18. Documentation
19. Feeling of participation
20. Processing of change request
21. Communication with EDP staff
22. Relationship with the EDP staff
23. Understanding of systems
24. Degree of training
25. Job effects
26. Top management involvement
27. Feeling of control
28. Schedule of products and services
29. Format of output
30. Mode of interface
31. Security of data
32. Expectations
33. Organizational position of the EDP function
34. Volume of output
35. Language
36. Charge-back method of payment for services
37. Organizational competition with the EDP unit
38. Vendor support
39. Integration of systems.

Source: Bailey and Pearson, p. 532.

system. For this purpose, he followed the approach reported by Tenkins and Ricketts.

In evaluating this approach, Srinivasan states "It was 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. Despite the fact that Ives, et al., point out shortcoming to this approach, the procedure adopted by Jenkins and Ricketts in developing and testing a satisfaction measure provides a firm basis for researchers interested in this issue". In this model, perceived system effectiveness was measured along five dimensions: (1) Input Procedures, (2) System Stability, (3) Problem Solving, (4) Report Contents, (5) Report Form. Under each dimension, certain issues were outlined as follows:

Report Content	**Problem Solving**	**Input Proced.**
Accuracy of report contents	Usefulness for identifying and solving problems	Ease of input procedures
Relevancy of report contents	Usefulness for selecting among alternatives	Comprehension of documen.
Adequacy of report contents	Power of the modeling language	Interfacing languages
Understandability of report contents	Flexibility of the modeling language employed	Editor charac

Report Form	**System Stability**
Quality of format	Response time
Timeliness of rep.	Error Proness
Mode of presentation	Reliability of the system
sequencing of information	Accessibility of the system.

A pilot study was conducted in two large organizations. The people responsible for the functioning of the system there were interviewed to obtain a general understanding of the system environment, to identify certain behavioral measures of system use, and to have the perceived system effectiveness instrument examined for content validation. It was noted that the issues identified for the measurement of perceived effectiveness were relevant. A review of these issues with the people interviewed resulted in applying minor changes being made to the instrument while retaining the basic dimensionality put by Jenkins and Ricketts.

A study about user satisfaction conducted by Rushinek and Rushinek investigated the 17 different independent variables on user satisfaction.[31] A total of 179 computer systems were evaluated by the respondents. The question responses (variables) were coded and stored by the computer as shown in Table IX. As reported by the researchers, the data were tested for validity and consistency. Non response bias was evaluated with an F-test and found to be significant.

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[31]. Avi Rushinek and Sara F. Rushinek, "What Makes Users Happy?", Communications of the ACM, (Vol.29, No.7, July 1986), p. 594-598.

Table IX.
The 17 Independent and 1 Dependent Variables Bearing on User Satisfaction.

1. Response time
2. Efficiency & effectiveness of database language
3. User expectation
4. Equipment delivery
5. Productivity aids
6. Percentage of mainframe systems
7. Compatibility of peripherals
8. Percentage of microcomputer systems
9. Compatibility of programs
10. Power/energy efficiency of system
11. System cost
12. Number of users
13. Number of system
14. System life in months
15. Promptness of software delivery
16. Percentage of minicomputer systems
17. System expandability
18. Overall user satisfaction

Source: Rushinek and Rushinek, p.595

Forward stepwise multiple regression analysis was used to determine the relationship between the overall satisfaction variable and the various independent variables. Table X shows the results of this analysis that were used for the overall test for goodness of fit of the regression model. According to these tests, it was concluded that R^2 was 0.59 indicating that 0.6 or

Table X.
Multiple Regression Overall Significance Test for Goodness of Fit

Multiple R	0.77
R Square	0.59
Adjusted R Square	0.56
Standard error	6.20
Critical F	1.67
F value	15.97**

** R square is significant at the 0.01 level

Source: Ibid, P. 595

60% of the variation in overall satisfaction could be explained by these independent variables. The relative importance of each of these indicators on the dependent variable was described by the value of beta which shows the association between each factor and overall user satisfaction. The larger this coefficient, the greater the satisfaction provided by a certain independent variable. Results showed that good response time (beta = +0.32) was the most prominent factor for inducing user satisfaction, since in general users do not like to wait for the system to respond. The number of systems and users in an installation was the second most important satisfaction inducer (beta = +0.23 and +0.26 respectively). This was followed by users' expectations and productivity aids (+0.21 each), language (+0.20), equipment delivery (0.14), peripherals (+0.11), microcomputers (+0.10), program compatibility (+0.07), power/ energy efficiency (+0.05), and software delivery (+0.03). Others factors had a contracting effect on user satisfaction such as mainframes (-0.18), system cost (-0.05), and system life (-0.03). Concerning mainframes, this finding supported the theory that users may tend to feel more in control of micros than they do of larger computers.

2.6. Relationship between the various measures of system effectiveness.

After presenting the literature pertaining to the factors that were used as a measure of perceived system effectiveness by previous studies, the relationship between these various variablesas found in previous research is now examined.

2.6.1. Association between Usage and Acceptance.

Use of a system (a behavior) should be closely related to acceptance of the system (an attitude). This was clearly shown by a study done by Ives and Olson.[31] Schultz, Ginzberg and Lucas did not, however, arrive at the same result: "The association, however, is not likely to be perfect as Ives and Olson (1981) have recently shown". their interpretation of the result was that although use is measured at a point in time, it represents an activity that is always repeated, the thing that makes the relationship between acceptance and use complex. Theoretically, acceptance should result in use. This use experience and its impact on performance will subsequently influence acceptance. This implies that the "use of a technically and organizationally valid system should be a positive experience, resulting

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[31]. Rephrased from Schultz, Ginzberg and Lucas, "A Stuctural Model of Implementation", p. 25.

in better performance and satisfaction, and ultimately increasing user acceptance of the system"[32]

In the study conducted by Davis, both factors ease of use and usefulness, which were used as a measure of user acceptance, were significantly correlated with system use.[33] In study 1, self- reported current use had a correlation coefficient of 0.63 and 0.45 with perceived usefulness and perceived ease of use respectively. In study 2, self-predicted use had high correlation coefficients of 0.85 and 0.69 with perceived ease of use and usefulness. These correlations, as reported by Davis, compare favorably with other correlations between subjective measures and self-reported use found in the MIS literature.

2.6.2. Association Between User Satisfaction and System Usage.

Past studies that pertain to the field of MIS success argued that utilization of a computer information system is directly connected to the user's sense of satisfaction with the system. Satisfaction is the user's overall evaluative attitude toward the

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32. Ibid, p.25

33. F.B. Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology", p.319-340.

system. "It is based on the experience of using the system and its impact on performance. Like performance, increased satisfaction with a system should have a positive feedback effect on use. An opposite effect could be also obtained".[34] That is what Schultz, Ginzberg, and Lucas heve reported in their study. The study conducted by Srinivasan presented a good review of literature concerning this aspect. Their review was reported as follows:

The studies reported by Lucas have examined the relationship between system use and some measures of user satisfaction with the system. In these studies, direct positive relationships were obtained. In his study of information systems in certain firms, Schewe reported a lack of significance association between certain attitudes which are now considered as important factors of user satisfaction and the use of the system. Robey also reported a positive association between system usage and user perceived worth of a system. Moreover, as was mentioned earlier in this chapter, Maish reported positive associations between usage and some attitudes pertaining to user satisfaction. Swanson also reported a similar association in the case of an MIS used in certain organizations.

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[34]. Schultz, Ginzberg and Lucas, "A Structural Model of Implementation", p. 26.

In his study Srinivasan reported the absence of pervasive association between actual use and perceived system worth. The associations between perceived (user satisfaction) and behavioral (system usage) measures as were reported in the study are shown in Table XI.

Table XI.
Associations Between Perceived and Behavioral Measures of Effectiveness.

		Perceived Measures		
		Output Contents	Output Form	Problem-solving Capabilities
Behav. Measures	Freq. of use	0.040	-0.173	0.218
	Time per session	-0.013	-0.402**	0.382*
	# of reports	0.221	0.194	-0.237
	User type	0.395*	-0.053	0.620***

		Perceived Measures	
		Input procedures	System stability
Behav. Measures	Freq. of use	0.086	0.198
	Time per session	-0.311	-0.283
	# of reports	0.052	-0.021
	User type	0.014	0.045

Kendall's tau * p< 0.10 ** p< 0.10 *** p< 0.01

Source: Srinivasan, "Alternative Measures of System Effectiveness", p. 249.

Finally, in a study conducted by Baroudi, Olson and Ives[35], it was reported that as system usage increases, it leads users to be more familiar with the system. This, in turn, leads to enhanced user satisfaction with the system. The opposite was also reported. The more satisfied the users are with the system, the more they will tend to use it. The results of the study indicated a positive and a significant relationship between system usage and user information satisfaction (correlation coefficient = 0.28).

2.7. User Involvement as a Factor Affecting User Perceived Effectiveness.

User involvement in CBIS development is generally considered an important factor to insure system quality improvement and system implementation success. A review of the pertinent literature shows that user involvement has been studied in many works of research. In a review of research conducted by Ives and Olson[36], it was stated that the common views were that, "Participation by those who will be affected by the system is essential. (Powers and Dickson, 1973)", and "In relation to other factors, e.g., top management support, competence of EDP staff, quality of goal setting, user involvement seems to be

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[35]. Jack J. Baroudi, Margrethe H. Olson, and Blake Ives, "An Emperical Study of the Impact of User Involvement on System Usage and Information Satisfaction", Communications of the ACM, (Vol.29, No.3, March 1986), p. 232-238.

[36]. Blake Ives and M. H. Olson, "User Involvement and Mis success : A review of research", Management science, (Vol.30, No.5, May 1984), p. 586-603.

the only one which is consistently related to the quality of final outcomes (De Brabander and Edstrom 1971, p. 191)". A variety of reasons have been given for following such courses. As outlined in the review by Ives and Olson, user participation in systems development is predicted to improve system quality by:

1. Providing a more accurate and complete assessment of user information requirements (Norton and McFarland 1975, Robey and Farrow 1982);

2. Providing expertise about the organization that the system is to support; expertise usually unavailable within the information systems group (Lucas, 1974).

3. Avoiding development of unacceptable or unimportant features (Robey and Farrow, 1982);

4. Improving user understanding of the system (Lucas 1974, Robey and Farrow, 1982).

Participation may lead to increased user acceptance by:

1. Developing realistic expectations about the system (Gibson, 1977);

2. Providing an arena bargaining and conflict resolution about design issues (Keen 1981);

3. Leading to system ownership by users (Robey and Farrow 1982);

4. Decreasing user resistance to change (Lucas 1974);

5. Committing users to the system (Lucas 1974, Markus).

Although such views are positively appealing, the benefits of user involvement have not been strongly demonstrated. The result was as Ives and Olson have noted, "positive results frequently may be attributable to common method variance, 'halo' effects or statistical artifice. Nonsignificant results may often be a result of poor instruments or lack of control over the research setting... Future research requires rigorous attention to measurement and methodology... A rigorous conceptual foundation is also needed".

In a study conducted by Baroudi, Olson, and Ives[37], the hypothesis that user involvement leads to system usage and/or information satisfaction was examined in a survey of 200 production managers. In this study, various models investigating the causal ordering of the 3 variables were developpped and tested using path analysis. The result showed that user involvement is positively associated with both system usage and user information satisfaction. This was demonstrated by calculating zero-order correlations, which showed that user involvement correlated positively and significantly with both system usage and user information requirements (correlation coefficient = 0.28 and 0.18

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[37]. Baroudi, Olson and Ives, "An Empirical Study of The Impact of User Involvement on System Usage and Information Satisfaction", p. 232-238.

respectively). Also, in another study conducted by Tait and Vessey,[38] it was found that system complexity and resource constraints had strong effects on system success, either directly or indirectly through their influence on user involvement.

What was presented above was a review of the literature reported by previous researchers about the various measures of system effectiveness and the various factors affecting them. This study will examine the impact of user involvement, ease of use, and usefulness on the three system effectiveness measures (taken as dependent variables): user acceptance, system usage, and user information satisfaction. The study also intends to investigate the association between these three measures.

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[38]. Peter Tait and Iris Vessey, "The effect of User Involvement on system Success", MIS Quarterly, (March 1988), p. 91-108.

Chapter III.

Research Design and Methodology

3.1. The Basic Approach:

This survey has been conducted with the intent of determining the factors that are most likely to be associated with user acceptance and user satisfaction- the two variables selected as measures of CBIS success in this study. Moreover, the study also attempts to examine the various aspects related to computer use, and the relationship between computer use and satisfaction and between user acceptance and user satisfaction. The measures used and the type of analysis followed were selected according to the model proposed in chapter I.

3.2. Sources of Information.

A field survey was conducted to test the hypotheses presented in chapter I. The survey was limited to the banking industry. More specifically, to banks operating in West Beirut. The target population was comprised of all banks operating in West Beirut that satisfied the following criteria:

1- Operating in Lebanon for at least 10 years
2- Being exposed to computers for at least 5 years.
3- Having an independent EDP department in the organization hierarchy.

Those conditions were set so as to ensure that banks have been sufficiently exposed to information systems.

Several sources of banking data were used, including a personal survey, and report published by the Central Bank. This yielded a list of thirty five banks operating in West Beirut that satisfied the aformentioned conditions. From the thirty five, twenty five banks were selected randomly.

It is important to mention that the strategy used by this research follows that used in previous studies (Olson and Ives, 1981; Tait and Vessey, 1988).

3.3. Survey Design.

A questionnaire and follow-up interviews were used to collect data from the staff that are daily exposed to the computerized information system in the banking sector.

The questionnaire was developed to measure factors leading to first user acceptance and second to user information satisfaction. The instrument included seven sections. It contained five questions on **Demographic Characteristics**, six questions on **Computer Knowledge**, ten questions on **Ease of Use**, thirteen questions on **Usefulness**, twenty questions on **User Satisfaction**, the first dependent variable, sixteen questions on **User Acceptance**, the second dependent variable, five questions to test whether the user was involved in at least one of the phases of a CBIS, and seven questions on the user perception about the benefits derived from **User Involvement**. (See appendix A for a sample of the questionnaire). A pilot study was conducted on three banks to pretest the validity of the questionnaire. The instrument was modified according to the feedback obtained from the ten respondents that participated in the pilot study. It was realized that those users were not involved even superficially in any of the phases of the CBIS they were using. Because User Involvement is an important factor leading to system success as mentioned in the literature, and because users expressed an interest in user involvement, another section was added to the User Involvement factor. This section was developed to asses how the user perceives the impact of his involvement on system success. Moreover, some users had difficulty in understanding some of the questions. The difficulty was removed by rephrasing the questions concerned. Having modified the questionnaire it was then distributed to twenty five banks that constituted the final sample.

All responses concerning the dependent and the independent variables presented in the model Figure 1.1 were scored on a five-point scale, ranging from (1) strongly agree to (5) strongly disagree. For example on the Ease of Use factor a score of (1) meant that the system is not difficult to use while a score of (5) meant that the system is extremely difficult to use.

The study included 95 respondents from the twenty organizations. The questionnaire was distributed to the respondents after having obtained the authorization of the manager of the data processing center (EDP head). In order to avoid any misunderstanding of any question a field surveyer was present while respondents were filling out the questionnaire. His presence was also important because his job was to make sure that the questionnaire was completed on an individual basis, and that respondents did not influence the answers of each other. When the questionnaire was distributed, it was explained to respondents that they have to rely on the current system they are using and not on previous experience with other systems, or on their attitudes about factors leading to system success in responding to the questionnaire.

Having realized that the majority of the users were not involved as they should, in the adoption of their system, a second instrument including interviews with three software houses operating in West Beirut and having implemented the majority of the systems used by the banks in the sample was developed. The purpose was to identify the complexities of some systems, the financial restrictions, and what user involvement meant to them. In order not to influence their responses the third purpose was not revealed to them. Simply, system analysts and group leaders in the software houses were asked to rank in the order of their importance the major factors leading to system success. Follow-up phone calls and visits were made to those software houses one week after the data was collected . It is important to mention that the purpose of this study was not to assess the importance of user involvement as seen by system analysts. However, the interviews were important to find the reasons beyond the fact observed that respondents did not mention the existence of user involvement.

3.4. Sample and Data Collection.

Twenty five banks were approached for data collection purposes. Five banks subsequently refused to participate for many reasons; some for the lack of time others for no valid reasons. Moreover, some employees in some banks refused to participate, because they were afraid that their ideas will have a negative effect on their promotion. The majority of the banks contacted were exposed to computers for at least 5 years. The sample presented diverse volume of banks. However, it is worth mentionning that the bank volume was not by itself an important criteria i.e. we were not after that the sample include diverse volume of banks and compare system success according to the bank volume.

All banks in the sample had a centralized data processing with an EDP head responsible for data collection from all branches.

Users of the system were surveyed to measure the two important variables, User Acceptance and User Satisfaction- the surrogates for system success- the extent of User Involvement in at least one of the phases in the system development life cycle, to what extent users see the system as useful and easy to use, how much they use it, and the attitudes of users toward the system.

3.5. Measurement of The Model Variables.

The following subsections outline the source of data used in the design of the questionnaire presented in appendix (A).

User Satisfaction

The instrument used to measure user satisfaction, the surrogate for system success, depended heavily on Pearson's questionnaire (Baily and Pearson, 1983). This instrument after being heavily tested on many organizations in the United Sates, and Europe proved its validity due to the number of respondents that have taken part in those surveys. To verify the construct validity of the questions suggested, an oblique rotational factor analysis was performed. This analysis was carried out using items thirty six to fifty five the questions measuring the user satisfaction factor.

User Involvement

Five questions were included under the factor user involvement. The instrument, meant not to assess the extent of user involvement as outlined in the section on user involvement by Keen (1981), but rather to assess whether the user was involved or not in at least one of the phases of the CBIS.

Ease of Use

The instrument developed by Davis (1989) was used in this study to measure whether the system being used is seen by the user as an easy to use system. To verify the construct validity of the questions suggested by Davis an oblique rotational factor analysis was performed. This analysis was carried out using items thirteen to twenty two, the questions measuring the ease of use factor.

Usefulness

The instrument used to measure the usefulness of the system was from Davis' questionnaire (Davis 1989). This instrument proved its validity by the factor analysis performed by Davis, and by the number of respondents used in his survey. For the purpose of this study to verify the construct validity of the questions suggested by Davis an oblique rotational factor analysis was performed on questions 23 through 35 which measure the usefulness factor.

Use

Three questions were developed to measure this factor. The intention was to assess the extent to which the system was used. The administration of the three questions depended on previous literature (Gould and Lewis 1985; Goodwin 1987), which related user satisfaction to the use of the system.

Acceptance

The instrument used to measure user acceptance, one of the important variables measuring system success, was based on previous literature (Davis 1989; Pearson 1977). For the purpose of this study in order to verify the construct validity of the questions suggested, an obl ique rotational factor analysis was performed. This analysis was carried out using items 56 through 71, the questions measuring the acceptance factor.

Also, single item questions were used to collect data concerning certain demographic characteristics such as sex, age, position, educational level, and computer experience.

3.6. Data Analysis

Responses were analyzed by means of the statistical package SPSS (Statistical Package for Social Sciences). The facilities used and the reasons behind their use were as follows:

- To study the various aspects related to computer use and user acceptance and satisfaction among clerks and EDP managers, the correlation, crosstabulation, and one way ANOVA tools were used.

- To validate the reliability of the questionnaire used as a measure in this sample for the various variables included, a factor analysis was done on all the question items.

- To build a regression equation that includes the variables that are most likely to be associated with user satisfaction and user acceptance, the regression analysis was used.

The findings of the analysis as obtained from the analysis presented above will be portrayed in the following chapter.

Chapter IV

Research Findings

After presenting the methods followed and tools used for analysing the data collected for this study, it is the intent of this chapter to present the findings obtained and to analyze them. In chapter I, the hypotheses to be tested were listed as follows:

1- User acceptance is dependent upon factors such as user involvement, usefulness, and ease of use.

2- User involvement leads to user satisfaction with the system.

3- There is a two way positive relationship between user acceptance and user information satisfaction.

This chapter intends to test these hypotheses in the light of the results obtained and the analyzed findings.

4.1. Profile of Respondents.

The respondents included in the study, as was mentioned in chapter III, formed 80% response rate and the size of the sample upon which the study was conducted was 95 computer users. People surveyed by this study are bank employees that interact with a computer as an essential part of their job, mostly on a regular basis. It is worthmentioning here that a residual analysis was applied on the data. Residuals in regression analysis are measures of error component. Their examination provides valuable information about outliers and the assumption underlying the error component. The result of the analysis showed that 14 cases should be dropped. Examinination of the data in this study showed that these 14 outliers could not be attributed to coding or data entry errors. Rather, they might be attributed to the fact that some respondents might have given random responses on the various question items found in the questionnaire. Anscombe notes that, "in statistical analysis it is a common practice to treat outliers differently from the other readings; for example, outliers are often omitted altogether from the analysis"[1]. As a result, the hereinafter analysis will be done on 81 cases (n=81) only.

Coming to their general characteristics, of the 81 respondents, 34.6% were females and 65.4% were males. These were employed in banks and belonged to 3 various positions:

1- F.J. Anscombe, "Rejection of Outliers", Technometrics, 2(May 1960), 123-147.

Data entry clerk, first level supervisor, and EDP manager (department head or middle manager). The ages of the respondents ranged between 22 and 35 years, thus resulting in an average age of 27.6 years. These characteristics along with the education level and experience in the computer field are shown in Table XII which presents the profile of the respondents.

Table XII.
General Characteristics of Respondents.

Characteristic	Range	Percentage
Age	21-25	24.7%
	26-30	60.5%
	31-35	14.8%
Mean = 27.62	Median = 27	Range = 22-35
Sex	Male	65.4%
	Female	34.6%
Position	Data entry clerk	49.9%
	1st level supervisor	43.2%
	EDP manager	7.4%
Education	< high school	2.5%
	High school	13.6%
	Some college	29.6%
	B.S. degree	50.6%
	M.S. degree	3.7%
Years of exposure to computers	2-4	42.0%
	5-7	44.4%
	8-10	13.6%

4.2. System Use.

System usage was investigated along two dimensions: (1) hours spent on the system, and (2) frequency of system usage. A descriptive analysis was used to study the system use along the two dimensions, and to identify the relationship between each dimension and demographic variables, experience, position, and other variables. The distribution of the two dimensions could be presented as follows:

4.2.1. Actual time spent on system usage.

The frequency of this dimension is shown in Table XIII and in Fig. 4.1.

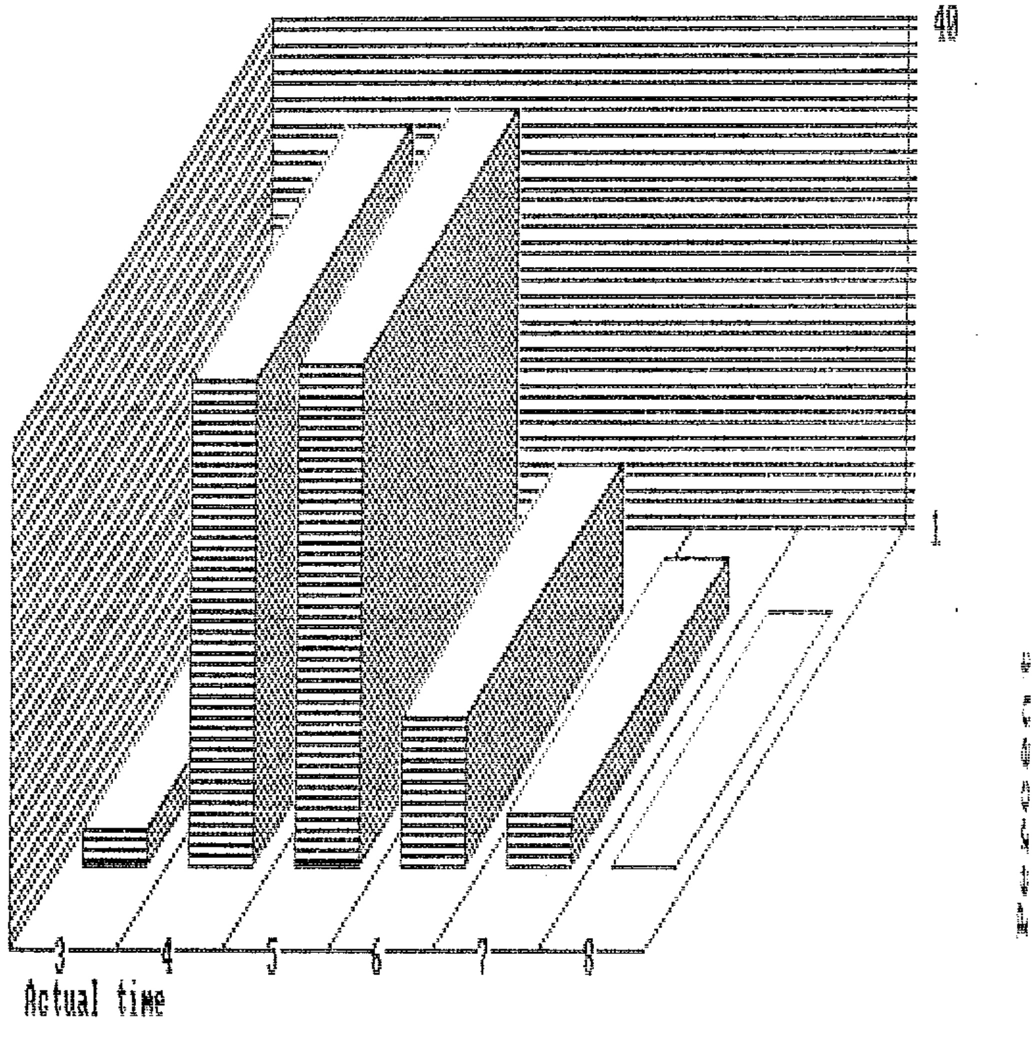
Table XIII.

Actual time spent.

Hours spent	Frequency	Percent	Cumulative Percentage
3	3	3.7	3.7
4	31	38.3	42.0
5	32	39.5	81.5
6	10	12.3	93.8
7	4	4.9	98.8
8	1	1.2	100.0
	81	100.0	

As could be noticed, respondents spent a significant time using the banking computer system. Most of the respondents reported using the system for more than 4 hours per day (median is 5.0 hours/day). At least

Fig. 4.1 Actual Time Spent on System



77.8% of the respondents had used the system for 4 to 5 hours/day. This heavy use of the system could be attributed to the fact that the major part of the work of these respondents involves the use of the computer.

4.2.2. Frequency of system use.

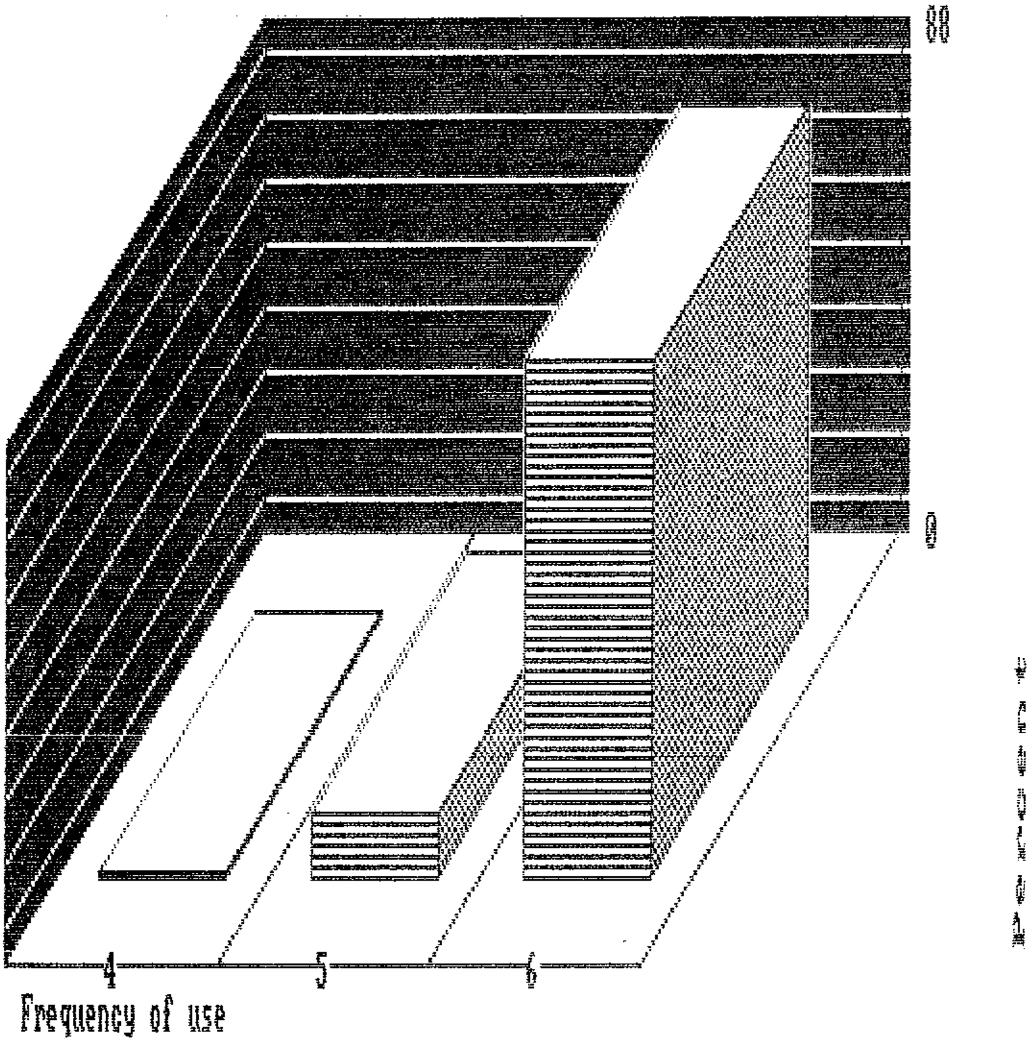
The extent of system usage could also be measured by the frequency of use. The respondents' reported frequency of use is presented in Table XIV, and a graphical presentation of this measure is shown in Fig. 4.2.

Table XIV.

Frequency of use.

Frequency of use	Frequency	Percent	Cumulative Percentage
Several times a week	1	1.2	1.2
Once a day	9	11.1	12.3
Several times a day	71	87.7	100.0
	81	100.0	

Fig. 4.2 Frequency of Use



The results show that 87.7% of the respondents classified themselves in the category indicating the use of the system for several times/day (Median is category 6; implying several times/day).

Because of the high level of system use, indicated by the 2 measures just mentioned, it isnot possible to investigate relationships between system usage and other variables, and to identify who used the system frequently. In fact, no significant differences were found across various positions because of the lack of variability in the system use variable.

A Chi-square test was used to examine the relationship between organizational position and frequency of use. In a Chi-square test, the calculated χ^2 will be compared with the critical χ^2. The criterion to be used is that if the calculated χ^2 gets too large, it should be included that the populations under study have unequal variance. The results, reported at a significance level of 0.05 and presented in table a show that χ^2 calculated = 1.33071; whereas χ^2 significant (χ^2 critical) = 0.5141. This leads to the conclusion that since the χ^2 calculated is not much larger than χ^2 significant, then there are no significant variations in the frequency of use level along the three organizational positions.

Table XV.

Crosstabulation of frequency of use by position. Chi-Square test.

Crosstabulation: X10 Freq. of use
By X5 Position

X5-> / X10	Count / Row Pct / Col Pct	1	2	3	Row Tot
X10	0		1 100.0 2.9		1 1.2
	1	40 50.0 100.0	34 42.5 97.1	6 7.5 100.0	80 98.8
	Column Total	40 49.4	35 43.2	6 7.4	81 100

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
1.33071	2	.5141	.074	3 of 6 (50.0%)

Moreover, 98.8% of users were heavy users, which led to a lack of variability among respondents. For this characteristic, the existence of a relation between frequency of use and position could not be tested. Igbaria et al. (1989) found that the organizational level was negatively related to time spent but unrelated to frequency of use. The comment of the researchers was that higher level managers and professionals used microcomputers for the same number of applications but for a larger number of tasks and for fewer hours. Similarly, Lee (1986) reported that organizational position was negatively related to the number of hours spent and unrelated to the number of different applications. The lack of similar findings in this study could be attributed to the nature of the sample used and the little variability in the use variable. All the respondents were chosen to belong to the EDP departments in banks. It then comes as a consequence that, in general, all of them are required to use the computer system frequently and for several hours/day.

Moreover, the relationships between computer system usage and other variables (sex, age, and educational level) were also investigated. A Chi-Square test was used to test for differences in frequency of use among the age groups. The result of this computation is shown in Table **XVI**.

Table XVI
Crosstabulation Frequency of Use By Age (Chi-Square)

Crosstabulation: X10 Freq. of use
By X1 Age

X1->	Count / Row Pct / Col Pct	1	2	3	Row Total
X10	0			1 100.0 8.3	1 1.2
	1	20 25.0 97.1	49 61.3 100.0	11 13.8 91.7	80 98.8
	Column Total	20 24.7	49 60.5	12 14.8	81 100

Chi-Square	D.F.	Significance	Min E.F.	Cells with E.F. < 5
5.82187	2	.0544	.148	3 of 6 (50.0%)

As the table shows, the calculated χ^2 (or χ^2 ratio) is

5.82187 and the critical χ^2 (χ^2 prob.) is 0.0544. Since the calculated χ^2 value is greater than the critical χ^2 value, it should be concluded that the average frequency of use per user among the various age groups could, in fact, show significant variations (although not significant). Respondents below 30 years old reported using the computer for more hours and more frequently than those above 30 years old. Those below 30 years old and reported using the computer system once per day and several times a day rated 86.3%; whereas, those above 30 formed only 13.8% of the respondents using the system once a day. These results show that the extent of computer usage varies with age. This could be attributed to the possibility that the respondents belonging to the higher age groups also belong to higher positions, thus entailing more supervision and control of the computer system.

Also, a Pearson correlation was used to test the relationship between number of hours spent and age. Results, represented in Table XVII show that, contrary to expectations, age is unrelated to hours spent. This findingdiffers from Lee's and Igbaria's findings. Lee's findings showed that age was negatively correlated with the number of hours spent but unrelated to the level of sophistication measured by (No. of different applications). Igbaria's findings were partly consistent with Lee's. Igbaria reported that age was negatively related to diversity of applications, duration of use and level of sophistication, but unrelated to the frequency of use. The finding of this study could be explained, as mentioned earlier, by the small range of the respondents' ages (22-35 years old).

Table XVII
Pearson correlation between hours spent, Age, and Sex.

	Hours spent
Age	-0.0241
Sex (0=M, 1=F)	0.0954

As to sex, consistent with Igabaria's findings and contrary to the popular literature, Table XVI shows no relationship between gender and number of hours spent.

Concerning educational level, a one-way ANOVA was used to test for significant differences. The results of this analysis, presented in table XVIII, show that F_{ratio} 0.1787 is less than F_{prob}, 0.9487. This means that there is no significant difference in the duration

Table XVIII

Duration of use by educational level. (One-way ANOVA).

- - - - - - -O N E W A Y- - - - - - -

	Variable X11	Hours spent.
By	Variable X3	Educational level

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	4	.6975	.1744	.1787	.9487
Within Groups	76	74.1420	.9756		
Total	80	74.8395			

of use measured in hours spent along the various levels of education. Also, a Chi-square test was used to test for significant differences in frequency of use along the levels of education. Results showed that there is a significant difference in the frequency of use along them (χ^2 calculated = 5.338 > χ^2 significant = 0.721) at 0.05 level of significance. Respondents with an educational level of high school or less formed 18.3% of the users using the computer for several times per day; whereas, those with a higher educational level (some college, B.S degree and M.S degree) formed a higher percentage (81.7%). This illustrates the common belief that higher levels of education enhances one's ability to understand a computer system, and consequently leads to higher duration and frequency of use. The low relationships observed could be partially explained by the fact that a high level of education was attained by the majority of the respondents (83.9% of the respondents had an educational level of some college, B.S degrees, and M.S degrees). This finding does not compare with Igbaria's findings but compares partly with Lee's findings. Igbaria et al. (1989) reported that the level of education was unrelated to the use of microcomputers in decision making, level of sophistication and number of packages used, but it was positively related to duration and frequency of use. Lee (1986) reported that the level of education was unrelated to computer usage in both number of hours spent and number of different applications.

Finally, a one-way ANOVA was used to test for significant differences in computer usage along computer knowledge and experience measured in number of years of exposition to computers. A one-way ANOVA used to test for significant differences in the frequency of use along computer years shows, as illustrated in Table XIX that there is a variation in usage frequency along the years of exposure to computers.

Table XIX .
Frequency of use by computer years. (one-way Anova).

- - - - - - -O N E W A Y- - - - - - -

	Variable	X10	Freq. of use
By	Variable	X7	Computer years

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	8	1.7067	.2133	1.5675	.1499
Within Groups	72	9.7995	.1361		
Total	80	11.5062			

A Pearson correlation was performed to examine the reletionship between the number of hours and computer years. The findings showed that years of exposure to computers is unrelated to duration of use. This could be partially explained by the fact that most respondents had a computer experience that fell within the range of 2 to 3 years (72% as could be noticed in the frequency distribution of variables listed in appendix B), the thing that did not allow for variations to show up.

4.3. Factorial Validity and Reliability of The Measurement.

Reliability and factor validity were tested using the factor analysis technique. This technique is used to identify a relatively small number of factors that can be used to represeht relationships among sets of many unrelated variables.

4.3.1. Measurement of the User Acceptance.

Applying the factor analysis technique on the scales of the user acceptance, ease of use, and usefulness showed that these three factors explain 76.3% of the total variance. This is presented in table XX . The proportion of the total variance explained by each factor is presented by the eigenvalue displayed in the table. Thus the total variance attributed to the factor 1 (user acceptance) is 24.927, forming a 67.4% of the total variance explained by the three factors. Factor 2 (usefulness) has an eigenvalue of 1.941 (5.2%), and factor 3 (ease of use) has an eigenvalue of 1.347 (3.6%). Thus the scales used to measure user acceptance and its determining factors had an internal consistency reliability of 76.3%, which means that the measurement tool could be considered reliable.

Moreover, factorial validity was tested. Factorial validity is concerned with whether the user acceptance, usefulness, and ease of use items form distinct contructs. A principal components (factors) analysis using oblique rotation was performed on the acceptance, usefulness and ease of use items for a total of 81 observations. The results of the factor pattern matrix are presented in table XXI.

Table XX .
Maximum-likelihood final statistics.

Final Statistics:

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
X13	.86549	*	1	24.92737	67.4	67.4
X14	.78540	*	2	1.94132	5.2	72.6
X15	.81094	*	3	1.34692	3.6	76.3
X16	.82951	*				
X17	.66294	*				
X18	.72932	*				
X19	.76811	*				
X20	.74343	*				
X21	.80630	*				
X23	.76398	*				
X24	.79575	*				
X25	.79338	*				
X26	.71878	*				
X27	.80916	*				
X28	.71231	*				
X29	.73489	*				
X30	.81626	*				
X31	.78522	*				
X32	.83538	*				
X33	.71053	*				
X34	.72182	*				
X56	.68398	*				
X57	.73463	*				
X58	.72612	*				
X59	.71311	*				
X60	.73388	*				
X61	.65237	*				
X62	.77524	*				
X63	.71934	*				
X64	.74780	*				
X65	.77606	*				
X66	.77706	*				
X67	.78884	*				
X68	.76509	*				
X69	.82090	*				
X70	.82048	*				
X71	.78178	*				

Table XXI
Factor Analysis of the User Acceptance, Usefulness and Ease of Use Questions.

Oblimin Rotation 1, Extraction 1, Analysis 1 - Kaiser Normalization.

Oblimin converged in 20 iterations.

Pattern Matrix:

	FACTOR 1	FACTOR 2	FACTOR 3
X65	.98577	-.10205	-.05113
X69	.87429	.00532	.04052
X66	.85046	.06397	-.02524
X62	.82955	.13530	-.07850
X64	.79535	-.06638	.16556
X60	.79147	.11943	-.03860
X63	.76924	-.00755	.11906
X61	.76787	.11800	-.07518
X71	.74707	-.11385	.29583
X70	.71908	.00274	.24665
X58	.68673	.13778	.07973
X67	.68359	.25987	-.00628
X68	.66570	.25527	.00476
X59	.63035	.11898	.16155
X57	.45459	.34591	.14071
X30	-.13081	.96878	.03767
X24	-.08142	.90473	.06280
X23	-.05654	.87262	.05796
X32	.06498	.85047	.01966
X29	-.02605	.82442	.07021
X31	.20171	.80695	-.11050
X27	.09308	.79090	.05026
X33	.09271	.77340	-.00163
X26	.10939	.73429	.03932
X28	.07709	.72774	.07623
X25	.19349	.67762	.07832
X34	.35306	.44131	.13785
X20	.32641	.35575	.27568
X13	-.01538	.03431	.91562
X15	-.18772	.16705	.89657
X14	.07263	.03404	.81008
X17	.14111	.02459	.69350
X19	.18276	.10362	.65950
X16	.41000	-.01050	.59174
X21	.31423	.11221	.56094
X18	.21463	.26339	.46669

The coefficients presented are factor loadings, since they indicate how much weight is assigned to each factor. Factors with large coefficients (in absolute value) for a variable are closely related to that variable. For example, Factor 1 is the factor with the largest loading (0.98577) for the X65 variable.

As the results of the table show, the acceptance, usefulness and ease of use items load on distinct factors, except for X20 which has a low load with any of the 3 factors. This result has, in fact, supported the contruct validity of the 3 factors item scales.

4.3.2. Measurement of User Satisfaction.

The factor analysis techniques was also applied on the scales of user satisfaction and the variables assumed to play a role in determining it, namely ease of use and usefulness. The results presented in tableXXII show that the 3 factors explain 76.1% of the total variance. The proportion of the total variance explained by each factor is presented by the eigenvalue. For factor 1, (user satisfaction), the eigenvalue is 28.12 forming 68.6% of the total variance; for factor 2 (usefulness), it is 1.74 (4.2%); and for factor 3 (ease of use), it is 1.34 (3.3%). Explaining 76.1% of the total variance could lead to the conclusion that the mesurement tool used for mesuring user satisfaction, ease of use, and usefulness is reliable.

To check whether satisfaction, ease of use and usefulness items form distinct constructs, factorial validity was tested. Again here, a factor analysis using blique rotation was used. The results of this analysis is shown in table XXIII . As the findings in the table present, satisfaction, usefulness and ease of use items load on distinct factors. As the table shows, some items have high factor loadings (coefficients) indicating that they have high weights assigned to one of the factors. These results support the construct validity of the three factor-item scales.

Table XXII
Maximum-likelihood final statistics. User Satisfaction .

SPSS/PC+ 11/08/90

---- FACTOR ANALYSIS ----

Final Statistics:

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
X13	.86310	*	1	28.12129	68.6	68.6
X14	.80135	*	2	1.74133	4.2	72.8
X15	.76597	*	3	1.33593	3.3	76.1
X16	.82182	*				
X17	.66492	*				
X18	.72202	*				
X19	.77608	*				
X20	.73574	*				
X21	.79219	*				
X23	.77471	*				
X24	.80784	*				
X25	.80195	*				
X26	.71578	*				
X27	.81220	*				
X28	.71012	*				
X29	.73662	*				
X30	.82499	*				
X31	.77917	*				
X32	.83440	*				
X33	.70172	*				
X34	.75384	*				
X36	.79516	*				
X37	.74788	*				
X38	.66346	*				
X39	.80005	*				
X40	.76999	*				
X41	.71442	*				
X42	.73236	*				
X43	.70527	*				
X44	.77790	*				
X45	.76947	*				
X46	.70424	*				
X47	.69782	*				
X48	.79333	*				
X49	.81757	*				
X50	.77054	*				
X51	.81047	*				
X52	.70281	*				
X53	.72999	*				
X54	.77246	*				
X55	.72681	*				

Table XXIII
Factor Analysis of User Satisfaction, Usefulness and Ease of Use questions.

Oblimin Rotation 1, Extraction 1, Analysis 1 - Kaiser Normalization.

Oblimin converged in 12 iterations.

Pattern Matrix:

	FACTOR 1	FACTOR 2	FACTOR 3
X46	.96441	-.19108	.00923
X49	.90258	.05083	-.05238
X50	.84114	.11285	-.07066
X47	.79805	-.14273	.18954
X55	.79292	.07704	.00153
X52	.79230	.11768	-.06278
X48	.75934	.22421	-.06419
X54	.75805	.15326	.00203
X51	.73458	.05664	.16172
X43	.68472	.05865	.14570
X37	.64964	.09848	.17954
X39	.56031	.23144	.18434
X42	.53621	.18981	.20886
X34	.53555	.31758	.08824
X40	.53159	.24517	.18267
X45	.51479	.04963	.39144
X53	.50913	.22808	.19860
X36	.49274	.32276	.16128
X44	.48932	.23832	.24254
X38	.45172	.10301	.33864
X41	.43649	.39616	.08735
X30	-.11594	.95449	.05031
X24	-.06313	.89404	.06882
X23	-.10057	.87339	.10668
X32	.08279	.82864	.02929
X29	-.03925	.77984	.14128
X31	.21713	.77468	-.08693
X27	.17495	.74230	.02859
X33	.19946	.72612	-.06241
X26	.09163	.71200	.08349
X28	.11588	.68060	.09392
X25	.27189	.65948	.02065
X13	-.01398	-.00105	.93954
X14	.04112	.00300	.86364
X15	-.11980	.12838	.86146
X17	.05613	.06270	.72740
X19	.27232	.04557	.63126
X21	.18850	.15547	.62045
X16	.40099	-.01998	.59550
X18	.14328	.28704	.49962
X20	.22602	.34012	.48175

4.4. Regression Analysis.

To study the goodness of fit of the model proposed in Chapter I, the regression analysis was used to build regression equations that could depict the potential relationships between dependent variables and independent variables. A dependent variable is the variable whose variation is to be likely to be explained. An independent variable is a variable used to explain variation in the dependent variable. The intention was to build two regression equations, taking user acceptance and user satisfaction as dependent variables, and other variables as independent variables.

4.4.1. Building a Regression Equation With User Acceptance Being the Dependent Variable.

As a first step in developing the regression model was to examine the relationship between each independent variable and the dependent variable, and between each independent variable and other independent variables. The dependent variable was User Acceptance (XACC),the independent variables selected were ease of use (XEU), usefulness (XUSEF), user involvement (XUI), user perception about involvement (XUIP), computer type used (X6) , and computer years (X7).

The resulting correlation matrix is shown in table XXIV As could be noticed, there are high correlation coefficients between ease of use and the variables usefulness, user involvement and user acceptance. The correlation coefficient could also assist in assigning a

Table XXIV
Correlation Matrix between User Acceptance and and Independent Variables.

N of Cases = 81

Correlation:

	X3	X6	X7	XUI	XUIP	XEU	XUSEF	XACC
X3	1.000	.248	.635	-.471	.077	-.256	-.251	-.206
X6	.248	1.000	.221	-.266	-.063	-.289	-.313	-.265
X7	.635	.221	1.000	-.503	-.101	-.261	-.290	-.293
XUI	-.471	-.266	-.503	1.000	.159	.728	.780	.801
XUIP	.077	-.063	-.101	.159	1.000	.295	.230	.304
XEU	-.256	-.289	-.261	.728	.295	1.000	.801	.847
XUSEF	-.251	-.313	-.290	.780	.230	.801	1.000	.840
XACC	-.206	-.265	-.293	.801	.304	.847	.840	1.000

relative importance to each independent factor in explaining the variations in the dependent variable. This could be done by looking at the correlation coefficients between XACC (the User Acceptance) and the independent variables. The larger the correlation coefficient, the stronger the linear association. Table XXIV shows that XEU (ease of use) has the highest correlation coefficient among all the independent variable with XACC, followed by usefulness, user involvement, and so on. Thus, the independent variables could be ranked in the order of their importance as potential predictors of XACC. Also, a stepwise regression analysis was used to build the regression equation through a forward selection of variables.

As expected, the first independent variable entered to the regression equation was ease of use (XEU). Table XXV shows the results of the first regression output at significance level of 0.05. R square, the coefficient

Table XXV

Regression Output-Dependent Variable = XACC (First run).

```
        SPSS/PC+ The Statistical Package for IBM PC              22/8/90
The raw data or transformation pass is proceeding
    81 cases are written to the uncompressed active file.
--------------------------------------------------------------------------
Page  1                        SPSS/PC+                          22/8/90

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

Listwise Deletion of Missing Data

--------------------------------------------------------------------------
Page  3                        SPSS/PC+                          22/8/90

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

Equation Number 1    Dependent Variable..   XACC   User acceptance

Beginning Block Number  1.  Method:  Stepwise

Variable(s) Entered on Step Number
   1..      XEU          Ease of use

Multiple R              .84692
R Square                .71728
Adjusted R Square       .71370
Standard Error          .70846

Analysis of Variance
                       DF
Regression              1
Residual               79

F =      200.42710       Signif F =  .0000
-------------------------------------------
```

of determination, shows how much of the variations in the dependent variable could be explained by the independent variables included. In this output, R^2 = 0.717, i.e. 71.7%, which means that about 72% of the variations in the user acceptance could be explained by the "ease of use" factor. In step number 2, usefulness was included, folowed by user involvement (For a detailed regression output, refer to Appendix C). The final regression output was as follows:

```
          SPSS/PC+ The Statistical Package for IBM PC                22/8/90
The raw data or transformation pass is proceeding
     81 cases are written to the uncompressed active file.

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

Equation Number 1    Dependent Variable..   XACC   User acceptance

Beginning Block Number  1.  Method:  Stepwise


Multiple R             .91054
R Square               .82908
Adjusted R Square      .82009
Standard Error         .56160

Analysis of Variance
                      DF
Regression             4
Residual              76

F =       92.16633       Signif F =  .0000
```

---

the coefficients of the independent variables are the beta values listed in table XXVI . Beta shows the value of change in the dependent variable due to one standard deviation change in a given independent variable, holding other variables constant. As a result, the resulting regression equation is:

$$XACC = \underset{(0.2075)}{-0.42827} + \underset{(0.0000)}{0.42944\ XEU} + \underset{(0.0040)}{0.27164\ XUSEF} + \underset{(0.0001)}{0.95620\ XUI} + \underset{(0.0171)}{0.20632\ X3}.$$

$$R^2 = 0.829 = 82.9\%.$$

Table XXVI
Beta Coefficients and the Test for Significance of the Independent Variables.

Variable	Beta	T	Sig T
XEU	0.42944	4.875	0.0000
XUSEF	0.27164	2.965	0.0040
XUI	0.95620	4.085	0.0001
X3	0.20632	2.439	0.0171
(Constant)	-0.42827	-1.271	0.2075

A- The Significance of the Overall Rgression Model.

The R square (multiple coefficient of determination) is given in the output run generated by the computer (Appendix C) as 0.829. Therefore, almost 83% percent of the variation in User Acceptance can be explained by the four independent variables included in the regression model.

An analysis of variance F test can be used to test the overall significance of the regression model. To test the model's significance, the calculated F value, 92.1663 is compared to the critical F value, 0.0000. Since F calculated › F critical, the regression model is considered significant.

B- The significance of the Individual variables.

We can test the significance of each independent variable using a t-test. The calculated t value for each variable is provided in table XXVI and put in parantheses under each relevant independent variable in the equation as taken from the computer printout (Appendix C). The significance is achieved if the t calculated for each independent variable exceeds the significant t. The test is:

For XEU: calculted t (from printout) = 4.875.
Since 4.875 › 0.0000 (Significant t), XEU is a significant variable.

For XUSEF : calculated t = 2.965.
Since 2.965 › 0.0040, XUSEF is significant.

For XUI: calculated t = 4.085
Since 4.085 › 0.0001, XUI is significant.

For X3 : calculated t = 2.439.
Since 2.439 › 0.0171, X3 is significant.

It could be concluded that the four variables included in the model are significant.

C- Interpretation of the Equation.

The resulting regression equation could be easily interpreted. As for XEU, the value of beta, 0.42944, indicates that for each added value in ease of use (holding other variables constant), user acceptance would directly vary by the value of 0.4944. Moreover, the positive sign of the beta coefficient of this variable indicates that the linear relationship between ease of use and user acceptance is positive. The higher the degree of ease in using a system, the higher would be the degree of the user's acceptance of the system. The importance of perceived ease of use is supported by the self-efficacy theory proposed by Bandaura[2] (1982). The self-efficacy research suggested tha ease of use, which relates to the effort required by the user to take advantage of a certain application, is one of the basic determinants of use behavior.

As for usefulness, the positive beta coefficient of this variable suggests that the more useful the system is for the performance of the user's tasks, the higher will be the user's tendency to accept the system. Since, usefulness depends on the extent to which an application system contributes to the enhancement of the user's performance (taking less time to accomplish a required task, achieving more productivity in work, etc.), Robey theorized that : " A system that does not help people perform their jobs is not likely to be

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2. Rephrased from F.B. Davis, "Perceived Usefulness perceived Ease of Use, and User Acceptance of Information Technology", MIS Quarterly, (Vol.13, No.3, September 1989), p.321.

perceived favorably in spite of careful implementation efforts".[3] Perceived usefulness was thus suggested as another basic determinant of user behavior.

The findings of the regression analysis provided by this study are partly consistent with the findings reached by F.B. Davis. Davis reported the importance of both variables ease of use and usefulness as determinants of user acceptance. However, the regression analysis done in this study suggested that "perceived ease of use may actually be a causal antecedent to perceived usefulness, as opposed to a parallel, direct determinant of system usage".[4] This aspect was not confirmed by this study.

Moreover, user involvement was found to play a role in determining user acceptance. the higher the degree of user involvement, the more will the user understand the various aspects of the developed system at its various stages of development, and thus the higher will be the tendency to accept the system. This finding conforms with the literature provided by Ives and Olson, supporting the concept that participation may lead to increased user acceptance by "developing realistic expectations about the system (Gibson, 1977), decreasing user resistance to change, and commiting users to the

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[3]. Ibid, p. 320

[4]. Ibid, p. 319.

system (Lucas, 1974)"[5]. It also conforms with the findings reported by Baroudi, Ives and Olson who concluded that there was a positive association between user involvement and MIS success. Finally, the educational level was found to have an impact in determining user acceptance. The positive beta coefficient of the variable suggests that the higher the educational level of the users, the more will be their tendency to accept a give computer system. This could be explained by claiming that the more educated the user is, the more he/she will be able to understand the various characteristics of the system and its effect on his/her job performance, and thus the higher will be the probability of accepting the system.

4.4.2. Building a Regression Model for User Satisfaction

The same procedure followed with user acceptance would be followed here to derive a regression equation that could help in explaining variations in the dependent variable User Satisfaction. The independent variables selected were: Usefulness (XUSEF), ease of use (XEU), user involvement (XUI), user perception of involvement (XUIP), computer type (X6), computer years (X7), computer system development (X9), and computer

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[5]. Ives and Olson, "User Involvement and MIS Success: A review of research", Management Science, (Vol. 30, No.5, May 1984), p. 586-603.

expertise (X12). The correlation matrix presented in Table XXVII. shows the relationship between the dependent variable (XUS) and each of the independent variables, and the relationship between each independent variable and other independent variables. The Table shows that XEU is the most important factor in determining user satisfaction since it has the strongest positive linear relationship with XUS. This is followed by XUSEF, XUI, and so on.

Table XXVII

Correlation Matrix among Variables.

N of Cases = 81

Correlation:

	XEU	XUSEF	XUS	XUI	XUIP	X6	X7	X12	X9
XEU	1.000	.801	.850	.728	.295	-.289	-.261	-.419	.127
XUSEF	.801	1.000	.836	.780	.230	-.313	-.290	-.474	.050
XUS	.850	.836	1.000	.831	.284	-.310	-.351	-.548	.093
XUI	.728	.780	.831	1.000	.159	-.266	-.503	-.437	.071
XUIP	.295	.230	.284	.159	1.000	-.063	-.101	-.168	.072
X6	-.289	-.313	-.310	-.266	-.063	1.000	.221	.292	.039
X7	-.261	-.290	-.351	-.503	-.101	.221	1.000	.460	-.084
X12	-.419	-.474	-.548	-.437	-.168	.292	.460	1.000	- 066
X9	.127	.050	.093	.071	.072	.039	-.084	-.066	1.000

Here also, a stepwise regression method was used to examine the foreward selection of variables, and the extent of each variable's influence on user satisfaction. The variables that were included in the equation were:

XEU, XUI, X12, and XUSEF. the inclusion of these variables on step number, and the effect of their inclusion upon the multiple coefficient of determination, R^2, could be referred to in Appendix C. The final regression output was as follows:

```
     * * * *  M U L T I P L E   R E G R E S S I O N  * * * *
Equation Number 1    Dependent Variable..   XUS   User satisfaction

Multiple R           .92225
R Square             .85055
Adjusted R Square    .84268
Standard Error       .52511

Analysis of Variance
                    DF
Regression           4
Residual            76

F =      108.13242       Signif F =  .0000
```

The coefficient of the independent variables are the beta values listed in table XXVIII. As a result, the regression equation that could be built for predicting user satisfaction is:

$$
\begin{aligned}
XUS = &\ \underset{(0.0003)}{1.054449} + \underset{(0.0000)}{0.41820}\ XEU + \underset{(0.0000)}{0.86824}\ XUI - \underset{(0.0050)}{0.20841}\ X12 \\
&+ \underset{(0.0235)}{0.19857}\ XUSEF
\end{aligned}
$$

$$R^2 = 0.850 = 85\%.$$

Table XXVIII
Beta Coefficients and the Test for Significance of the Independent Variables.

Variable	Beta	T	Sig. T
XEU	0.41820	5.076	0.0000
XUI	0.86824	4.411	0.0000
X12	-0.20841	-2.890	0.0050
XUSEF	0.19857	2.311	0.0235
(Constant)	1.05449	3.767	0.0003

A- The significance of the overall regression model.

The R square (multiple coefficient of determination) is given in the computer printout (Appendix C) as 0.8505. This means that almost 85% of the variation in user acceptance could be explained by the four independent variables included in the model.

Moreover, to test the model's significance, the calculated F value, 108.13, is compared to the critical F value, 0.0000. Since F calculated › F significant the regression model could be considered significant.

B- The significance of the individual variables.

the significance of each independent varaible could be tested using the t-test. The calculated t- values are presented in table XXVIII, and put in parentheses under each relevant independent variable. Taking into consideration that the significance of each variable is achieved if the t calculated exceeds the t significant, then it could be concluded that the four variables (XEU, XUI, X12, and XUSEF) included in the regression model are significant in explaining the variation of user satisfaction.

C- Interpretation of the Equation.

The interpretation of the regression equation of user acceptance is straightforward. As for ease of use, the beta coefficient is 0.4182 , indicating that, holding other variables constant, if ease of use changes by one unit, the user satisfaction value will change by 0.41820. The positive sign of the beta coefficient suggests that there is a positive linear relationship between user sasatisfaction and ease of use. This means that the more the system is easy to use, the more satisfied will the user be with the system, and the more will he use it. This, again, conforms with Bandaura's (1982) self-efficacy theory, and with Davis' results that showed a positive relationship between ease of use and system usage.

Concerning user involvement, it also has a positive beta coefficient indicating that it has a positive linear relationship with user satisfaction. It could thus be claimed that the higher the level of user involvement in a system development, the more will he understand the various system aspects, the more will he participate in developing the system he is going to use to get the required information necessary for the performance of his job tasks, and thus the more will he be satisfied with the system. This finding is perfectly consistent with the findings reported by Baroudi, Olson, and Ives (1986). the results they reported demonstrated that user involvement in the development of information systems would enhance the user's satisfaction with the system. The importance of user involment is highly emphasized by Baronas and Louis[6] in their attempt to identify the methods that would help restore the users' sence of control during implementation. They started, "We proposed that the process of implementing a new CBIS represents a situation of transition in which workers experience a threat to their sence of control over work, if not a direct loss of control. We argued that interventions which restore a worker's sense of control would reduce the threatening quality of the implementation experience and, as a result, would heighten a user's satisfaction with the system. In their view, the active ingredient in user involvement is perceived control; user involvement is effective because it restores or enhances perceived control"[7].

A surprising result is the relationship between user satisfaction with a system and his/her computer expertise. The beta coefficient has a negative sign

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[6]. Anne-Marie K. Baronas and Meryl R. Louis, "Restoring a sence ðf Control During Implementation: How User Involvement Leads to System Acceptance", MIS Quarterly, (October, 1987), p. 1-22.

[7]. Ibid, p. 18.

suggesting that there is a negative linear relationship between the two. this means that the higher the user's computer knowledge or expertise, the less will be his satisfaction with the system. This finding contradicts with the literature that confirms that computer knowledge is a key factor in determining CBIS success (Delone, 1988). The result reached to in this study could be explained by building up an assumption that if users have a high computer knowledge, then they will not feel satisfied with a computerized banking system confined for a limited number of tasks only and imposed on them. The variety of applications might help reduce this effect.

Finally, usefulness was found to have a positive beta coefficient with user satisfaction indicating a positive linear relationship between usefulness and user satisfaction. The more useful the system is, the more will it meet the users' requirements and help perform their tasks, and thus the more will they be satisfied with the information system. This again conforms with the self-efficacy theory presented by Bandaura (1982), and with the findings reported by Davis (1989).

4.5. Relationships among the various dependent variables used in the study.

The objective of this section is to examine the relationships among the three dependent variables used in the study as measures of computer-based information system effectiveness or success: system usage, user acceptance, and user satisfaction.

4.5.1. Association Between System Usage and User Acceptance.

Two tests were used to study the relationship between system usage and user acceptance. The variables used as measures of system usage are number of hours spent and frequency of use. A Pearson correlation was performed to examine the relationship between number of hours spent (X11) and user acceptance (XACC) and factors determining user acceptance (XEU and XUSEF). The results shown in table XXIX reveal no relationship between user acceptance and system usage.

Table XXIX
Pearson correlation between duration of use and user acceptance.

Correlations:	X11
XUSEF	.0773 (81) p= .493
XEU	-.0738 (81) p= .513
XACC	.0674 (81) p= .550

Also, a one-way ANOVA was used to test for significant variations in user acceptance along the various levels of usage frequency. the results showed that there were no significant relationships between them. This finding contradicts with the theory presented by Schultz, Ginzberg and Lucas (1983), and also contradicts with the significant relationships between system usage and acceptance (Ease of use and Usefulness) reported by Davis (1989). The finding of this study could be attributed to two factors observed in the surveyed banks. The first factor is that the computer systems installed or adopted in the banks are imposed upon the users to use them in performing their work. The second factor lies in the nature of the sample selected for the study. All respondents belonged to the EDP department which required using the system by all its staff for several hours/day and frequently, regardless of whether the system was accepted or not.

4.5.2. Association Between System Usage and User Satisfaction.

The pearson correlation matrix presented in table XXX shows the relationship between system usage (hrs spent and frequency of use) and user satisfaction.

Table XXX
Correlation Between User Satisfaction, Acceptance and System Usage.

	XUS
XEU	0.8498**
XUSEF	0.8365**
X10	-0.0424
X11	-0.0419
XACC	+0.9394***

* P<= 0.01; ** P<= 0.05; *** P<=0.001

The results of the table show that there are no relationship between hours spent (X11) and frequency of use (X10), the measure of system usage and user satisfaction. This finding is perfectly consistent with the finding reported by Srinivasan (1985) which he attributed to the type of measurement used. This finding, however, contradicts with the findings reported by Ives, Olson, and Baroudi (1983) who found that system usage is highly related to user satisfaction.

4.5.3 Association between user acceptance and user satisfaction.

As table XXX shows there is a positive and a significant relationship between user satisfaction and user acceptance,and between user satisfaction and the determining factors of user acceptance (ease of use and usefulness). This finding supports the theory provided by Schultz, Ginzberg, and Lucas (1983).

This chapter provided a detailed analysis of all the findings of this study. A part of the findings conforms with the literature reviewed, while the other part showed some inconsistencies with the findings provided by previous researchers.

Chapter V

Conclusion and Recommendations

The purpose of this study was to identify the factors that are most likely to be associated with MIS success or effectiveness. Two measures of MIS success were used in this study. These are: user acceptance and user satisfaction with an information system. Also, ease of use, usefulness and user involvement were hypothesized in this study to be determinants of user acceptance and user satisfaction.

As a first step, based on previous research, measurement scales for the two dependent variables and the two independent variables ease of use and usefulness were adopted and modified to fit the sample selected. Following this, computer system usage was investigated along individual demographic variables, and then a regression analysis was performed to identify the factors that have a high potential in determining or in predicting user satisfaction and user acceptance. Finally, the relationship between computer system usage, acceptance and satisfaction was examined.

As for the measurement scales, they were based on previous researches. To enhance their content validity for the sample selected, they were pretested in a small pilot study involving three banks. This resulted in two things: first, some questions were rephrased since they were considered unclear by some respondents. Second, because most respondents reported that they did not get involved in any of the phases of the system development, another section was added to the questionnaire to examine the user's perception about involvement and its effect upon system success. After this, the measurement scales were tested for both reliability and validity. The results showed that the acceptance measurement scale had an internal consistency reliability of 76.3%, whereas that of satisfaction had an internal consistency reliability of 76.1%. Moreover, since in both scales, question items loaded on distinct factors, construct validity was also proved.

Concerning computer system usage, various statistical techniques were used to examine the relationship between use and other individual variables such as sex, educational level, position, age, and so on. It was found that there were no significant variations in computer use along the various position levels. Also, no variations in use across the various educational levels and along the two sex groups could be reported. Computer usage was however found to vary along age where younger users were found to use the computer more frequently than the older ones. Variations were also found among users with different levels of computer knowledge. Users with a higher computer expertise level reported using the computer more extensively and more frequently than those with a lower level.

Coming to the regression analysis, it was performed to identify the factors that are most likely to be associated with user acceptance and user satisfaction. Two regression equations were built. The first related user acceptance to the independent variables ease of use, usefulness, user involvement and educational level. The coefficient of determination, R^2, was 82.9%, indicating that 83% of the variations in user acceptance could be explained by these four factors. The second regression equation related user satisfaction to the independent variables ease of use, usefulness, user involvement and computer expertise (number of computer courses taken). R^2 here was computed to be 0.85 implying that 85% of the variation in user satisfaction could be explained by these 4 factors. In both equations, the individual independent variables were tested for significance, and they were shown to be highly significant in predicting the dependent variables.

Finally, the relationship between system usage, satisfaction, and acceptance was examined. It was found that there was no relationship between usage and acceptance, the thing that was attributed to the nature of the sample selected. The respondents were required to work with the computer system as a part of their job whether they accepted it or not. Similarly, no relationship between computer usage and satisfaction could be reported. Acceptance and satisfaction were, however, related to each other. This indicated that users accept the system, then there is a high probability that they would be satisfied with it, and if they are satisfied with the system, then they will be more apt to accept it.

Limitations Of The Study.

There are two major limitations in this study. First, data gathering and sample selection were confined to the banks operating in West Beirut only. The security situation that was prevailing did not allow for the expansion of the research to other areas. The other limitation has really been raised by the nature of the sample selected itself. The sample included, as was previously mentioned, users belonging to the EDP departments of banks. Because of this, variability in computer usage could not be investigated.

Recommendations

Further research is needed that would take the above mentioned limitations into consideration, and would thus allow for variability in computer usage to be tested. Moreover, an important recommendation here is for managers and system developers to give user involvement more attention and better care for the critical role this factor plays in determining MIS success. Finally, to diagnose the "reasons underlying lack of acceptability and to formulate interventions to improve user acceptance" is important "In this sense, research on how usefulness and ease of use can be influenced by various externally controllable factors, such as the functional and interface characteristics of the system, development methodologies, training and education and user involvement in design is important".[1]

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[1] F.B. Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology", MIS Quarterly, (Vol. 13, No. 3, September 1989), p. 335.

APPENDIX A

A

SAMPLE

QUESTIONNAIRE

Demographic Characteristics

1- Age :

_____ 1) Below 20
_____ 2) 20 To 30
_____ 3) 31 To 40
_____ 4) 41 To 60
_____ 5) Above 60

2- Sex :

_____ Male
_____ Female

3- Education level :

_____ 1) Less than high school
_____ 2) High school
_____ 3) Former college student
_____ 4) Bachelor degree
_____ 5) M.S. degree
_____ 6) P.h.d
_____ 7) Others please specify : ______________________________

4- How long have you been employed ?

_______ Months _______ Years.

5- What is your level in the organization hierarchy ?

____

Computer knowledge and/or experience

1- What kind of computer(s) are you using ?

____ 1) P.C.
____ 2) Mini
____ 3) Both P.C & Mini
____ 4) Others, please specify ______________________________

2- For how many years were you exposed to computers in general ?

______ Months ______ Years

3- What kind of package(s) are you using, please specify.

____
____

4- The computer system you are using was:

____ 1) In-house developed
____ 2) Purchased from a vendor
____ 3) Others, please specify ______________________________

5- How frequently do you use the system ?

____ 1) Not at all
____ 2) Less than once a week
____ 3) About once each week
____ 4) Several times a week
____ 5) Once a day
____ 6) Several times a day.

6- For how many hours?

______Hours/day.

7- In how many computer languages can you develop programs ?

______ languages.

8- The report layouts are presented in a readable form .	1	2	3	4	5
9- The screen displays are presented in a clear form .	1	2	3	4	5
10- The data in the computer system are secured .	1	2	3	4	5
11- I have received the sufficient training and this has increased my proficiency in utilizing the computer capabilities available .	1	2	3	4	5
12- My job freedom has been tightened due to the introduction of the I.S into the organization .	1	2	3	4	5
13- The information I can retrieve and/or the speed in doing my work were worth the changes I had to make to adopt myself to the procedure .	1	2	3	4	5
14- All what I need is present in our system .	1	2	3	4	5
15- The queries and/ or reports provide me with relevant, clear, useful information.	1	2	3	4	5
16- I can use the system, whenever it is convenient to me.	1	2	3	4	5
17- I usually do not double check the output presented by the system because I have confidence in it.	1	2	3	4	5
18- The benefits derived from the system are cost justifiable	1	2	3	4	5
19- The system response time is high	1	2	3	4	5
20- It takes only a short time to perform a given task using the system	1	2	3	4	5

EASE OF USE

Please answer the following questions by choosing one of the following answers :

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

1- I am often confused when I use the computer system.	1 2 3 4 5
2- I make errors frequently when I use the computer system.	1 2 3 4 5
3- I find that information systems are frustrating.	1 2 3 4 5
4- I often press the on-line help and/ or consult the user manual when I am using the computer system.	1 2 3 4 5
5- I believe that the manipulation of the computer system requires a lot of my mental effort.	1 2 3 4 5
6- The system I am using is inflexible & rigid to react with.	1 2 3 4 5
7- I find it easy to remember how to perform a given task using the computer system.	1 2 3 4 5
8- The on-line help provides helpful guidance about how to perform a given task.	1 2 3 4 5
9- The system behaves sometimes in unexpected ways.	1 2 3 4 5
10- Overall, I find the information system easy to use.	1 2 3 4 5

USER ACCEPTANCE

Please answer the following questions by choosing one of the following answers :

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

1- I frequently use the computer system.	1 2 3 4 5
2- The computer system I am using meets all the information requirements for the success of the organization.	1 2 3 4 5
3- I am satisfied with the computer system capabilities, I do not expect it to do unrealistic things.	1 2 3 4 5
4- The computer system has satisfied all my needs.	1 2 3 4 5
5- I would be very confused or upset If our computer system is to be removed or replaced.	1 2 3 4 5
6- I am totally committed to the system.	1 2 3 4 5
7- I feel that I own the system.	1 2 3 4 5
8- Without the computer system I cannot work.	1 2 3 4 5
9- I usually consult the system before performing my job.	1 2 3 4 5
10- I feel that the computer system is a direct threat to my continuity in my job.	1 2 3 4 5
11- I know all the capabilities of the computer system.	1 2 3 4 5
12- I believe the computer system meets all the informations required by our organization.	1 2 3 4 5
13- I believe the changes introduced to our organization due to the computer system were justifiable.	1 2 3 4 5
14- One of the reasons behind my devotion to my job is the computerized procedure we have.	1 2 3 4 5
15- I usually do not care if the system was criticized.	1 2 3 4 5
16- The computer system conflicts with some aspects of my job.	1 2 3 4 5

USER INVOLVEMENT

If you were not involved in any of the system development phases please skip to part B.

Part A

1- Please specify in which of the following phases you were involved.

_____ 1) system definition
_____ 2) system design
_____ 3) implementation
_____ 4) others, please specify ______________________________
____

2- How would you rate the degree of your participation over 100.
____ 1) less than or equal to 10 %
____ 2) 11- 20 %
____ 3) 21- 30 %
____ 4) 31- 40 %
____ 5) 41- 50 %
____ 6) above 50 %

3- I believe my ideas were taken into consideration ?

_____1) Strongly agree
_____2) Agree to some extent
_____3) Agree
_____4) Disagree
_____5) Strongly disagree

4- My participation has made me assess the worth of the system in a better way ?

_____1) Strongly agree
_____2) Agree to some extent
_____3) Agree
_____4) Disagree
_____5) Strongly disagree

5- In what ways your participation has been rewarded ?

____
____

Part B.

Please answer the following questions by choosing one of the following answers :

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

1- Participation will have a positive impact upon the development of the system.	1 2 3 4 5
2- User involvement would eliminate much of the mistakes found in the system.	1 2 3 4 5
3- As involvement increases system usage will increase.	1 2 3 4 5
4- I believe that user participation is critical for the success of a computerized system.	1 2 3 4 5
5- I believe that I would have understood the value of the system easily if I was involved in one phase of the system development life cycle.	1 2 3 4 5
6- User involvement will reduce the resistance towards the acceptance of the new system.	1 2 3 4 5
7- User involvement will increase the usage of the system.	1 2 3 4 5

Thank you for your cooperation. Your answers are central to the success of this research

APPENDIX B

FREQUENCY DISTRIBUTION

OF

VARIABLES

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

Equation Number 1   Dependent Variable..   XUS   User satisfaction

Variable(s) Entered on Step Number
4..   XUSEF   Usefulness

Multiple R	.92225
R Square	.85055
Adjusted R Square	.84268
Standard Error	.52511

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	4	119.26595	29.81649
Residual	76	20.95628	.27574

F =   108.13242   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   User satisfaction

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

Variable	B	SE B	Beta	T	Sig T
XEU	.41820	.08239	.39150	5.076	.0000
XUI	.86824	.19682	.32689	4.411	.0000
X12	-.20841	.07212	-.14678	-2.890	.0050
XUSEF	.19857	.08592	.19833	2.311	.0235
(Constant)	1.05449	.27994		3.767	.0003

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

Variable	Beta In	Partial	Min Toler	T	Sig T
XUIP	.05168	.12691	.26693	1.108	.2714
X6	-6.071E-03	-.01467	.26507	-.127	.8992
X7	.06635	.13438	.25741	1.174	.2440
X9	7.9404E-04	.00203	.26497	.018	.9860

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

Equation Number 1   Dependent Variable..   XUS   User satisfaction

End Block Number   1   PIN =   .050 Limits reached.

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. XUS User satisfaction

Variable(s) Entered on Step Number
3.. X12 Comp. expertise

Multiple R	.91654
R Square	.84005
Adjusted R Square	.83381
Standard Error	.53971

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	3	117.79301	39.26434
Residual	77	22.42921	.29129

F = 134.79537 Signif F = .0000

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. XUS User satisfaction

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

Variable	B	SE B	Beta	T	Sig T
XEU	.51862	.07195	.48550	7.208	.0000
XUI	1.07323	.18059	.40407	5.943	.0000
X12	-.23795	.07295	-.16759	-3.262	.0017
(Constant)	1.25958	.27288		4.616	.0000

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

Variable	Beta In	Partial	Min Toler	T	Sig T
XUSEF	.19833	.25626	.26706	2.311	.0235
XUIP	.05401	.12823	.42881	1.127	.2632
X6	-.01546	-.03624	.44844	-.316	.7528
X7	.08838	.17623	.36503	1.561	.1227
X9	-8.361E-03	-.02072	.44880	-.181	.8571

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

Equation Number 1 Dependent Variable.. XUS User satisfaction

Variable(s) Entered on Step Number
2.. XUI User involvement

Multiple R	.90440
R Square	.81794
Adjusted R Square	.81327
Standard Error	.57209

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	114.69372	57.34686
Residual	78	25.52850	.32729

F = 175.21806 Signif F = 0.0

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

Equation Number 1 Dependent Variable.. XUS User satisfaction

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

Variable	B	SE B	Beta	T	Sig T
XEU	.55713	.07524	.52156	7.405	.0000
XUI	1.19818	.18707	.45111	6.405	.0000
(Constant)	.48042	.13985		3.435	.0010

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

Variable	Beta In	Partial	Min Toler	T	Sig T
XUSEF	.24227	.29815	.27572	2.741	.0076
XUIP	.06473	.14442	.43747	1.281	.2041
X6	-.04359	-.09746	.46073	-.859	.3929
X7	.01693	.03375	.36533	.296	.7678
X12	-.16759	-.34843	.44934	-3.262	.0017
X9	-5.130E-03	-.01192	.46486	-.105	.9170

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

Equation Number 1 Dependent Variable.. XUS User satisfaction

Beginning Block Number 1. Method: Stepwise

Variable(s) Entered on Step Number
1.. XEU Ease of use

Multiple R	.84982
R Square	.72219
Adjusted R Square	.71868
Standard Error	.70221

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	101.26743	101.26743
Residual	79	38.95479	.49310

F = 205.36952 Signif F = .0000

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

Equation Number 1 Dependent Variable.. XUS User satisfaction

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

Variable	B	SE B	Beta	T	Sig T
XEU	.90778	.06334	.84982	14.331	.0000
(Constant)	.32972	.16921		1.949	.0549

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

Variable	Beta In	Partial	Min Toler	T	Sig T
XUSEF	.43457	.49343	.35816	5.010	.0000
XUI	.45111	.58708	.47051	6.405	.0000
XUIP	.03675	.06662	.91280	.590	.5571
X6	-.07068	-.12839	.91661	-1.143	.2564
X7	-.13842	-.25349	.93166	-2.314	.0233
X12	-.23235	-.40018	.82408	-3.857	.0002
X9	-.01474	-.02774	.98389	-.245	.8070

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

Equation Number 1   Dependent Variable..   XACC   User acceptance

End Block Number   1   PIN =   .050 Limits reached.

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This procedure was completed at 13:02:29

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**** 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 =   81

Correlation:

	XEU	XUSEF	XUS	XUI	XUIP	X6	X7
XEU	1.000	.801	.850	.728	.295	-.289	-.261
XUSEF	.801	1.000	.836	.780	.230	-.313	-.290
XUS	.850	.836	1.000	.831	.284	-.310	-.351
XUI	.728	.780	.831	1.000	.159	-.266	-.503
XUIP	.295	.230	.284	.159	1.000	-.063	-.101
X6	-.289	-.313	-.310	-.266	-.063	1.000	.221
X7	-.261	-.290	-.351	-.503	-.101	.221	1.000
X12	-.419	-.474	-.548	-.437	-.168	.292	.460
X9	.127	.050	.093	.071	.072	.039	-.084

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

	X12	X9
XEU	-.419	.127
XUSEF	-.474	.050
XUS	-.548	.093
XUI	-.437	.071
XUIP	-.168	.072
X6	.292	.039
X7	.460	-.084
X12	1.000	-.066
X9	-.066	1.000

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. XACC User acceptance

Variable(s) Entered on Step Number
4.. X3 educational level

Multiple R	.91054
R Square	.82908
Adjusted R Square	.82009
Standard Error	.56160

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	4	116.27660	29.06915
Residual	76	23.97031	.31540

F = 92.16633 Signif F = .0000

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. XACC User acceptance

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

Variable	B	SE B	Beta	T	Sig T
XEU	.42944	.08809	.40199	4.875	.0000
XUSEF	.27164	.09162	.27128	2.965	.0040
XUI	.95620	.23406	.35998	4.085	.0001
X3	.20632	.08459	.13423	2.439	.0171
(Constant)	-.42827	.33690		-1.271	.2075

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

Variable	Beta In	Partial	Min Toler	T	Sig T
X6	-1.629E-03	-.00367	.26280	-.032	.9748
X7	-.02539	-.04490	.26757	-.389	.6982
XUIP	.06236	.14211	.26858	1.243	.2176

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

Equation Number 1   Dependent Variable..   XACC   User acceptance

Variable(s) Entered on Step Number
3..   XUI   User involvement

Multiple R	.90316
R Square	.81570
Adjusted R Square	.80852
Standard Error	.57937

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	3	114.40006	38.13335
Residual	77	25.84685	.33567

F = 113.60256   Signif F = .0000

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

Equation Number 1   Dependent Variable..   XACC   User acceptance

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

Variable	B	SE B	Beta	T	Sig T
XEU	.43687	.09082	.40894	4.810	.0000
XUSEF	.30753	.09329	.30712	3.296	.0015
XUI	.70063	.21593	.26376	3.245	.0017
(Constant)	.31245	.15050		2.076	.0412

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

Variable	Beta In	Partial	Min Toler	T	Sig T
X3	.13423	.26945	.26861	2.439	.0171
X6	.02171	.04791	.27201	.418	.6770
X7	.04964	.09770	.27215	.856	.3948
XUIP	.07810	.17309	.27540	1.532	.1296

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. XACC User acceptance

Variable(s) Entered on Step Number
2.. XUSEF Usefulness

Multiple R	.88910
R Square	.79051
Adjusted R Square	.78513
Standard Error	.61374

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	110.86593	55.43297
Residual	78	29.38098	.37668

F = 147.16225 Signif F = 0.0

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. XACC User acceptance

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

Variable	B	SE B	Beta	T	Sig T
XEU	.51777	.09251	.48467	5.597	.0000
XUSEF	.45276	.08671	.45216	5.222	.0000
(Constant)	.16535	.15203		1.088	.2801

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

Variable	Beta In	Partial	Min Toler	T	Sig T
X3	.03360	.07074	.35491	.622	.5356
X6	.01850	.03830	.35092	.336	.7375
X7	-.03885	-.08112	.35125	-.714	.4773
XUI	.26376	.34682	.27572	3.245	.0017
XUIP	.06239	.13021	.34518	1.152	.2527

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. XACC User acceptance

Beginning Block Number 1. Method: Stepwise

Variable(s) Entered on Step Number
1.. XEU Ease of use

Multiple R	.84692
R Square	.71728
Adjusted R Square	.71370
Standard Error	.70846

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	100.59612	100.59612
Residual	79	39.65079	.50191

F = 200.42710 Signif F = .0000

**** MULTIPLE REGRESSION ****

Equation Number 1 Dependent Variable.. XACC User acceptance

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

Variable	B	SE B	Beta	T	Sig T
XEU	.90476	.06391	.84692	14.157	.0000
(Constant)	.34921	.17072		2.046	.0441

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

Variable	Beta In	Partial	Min Toler	T	Sig T
X3	.01136	.02065	.93454	.182	.8558
X6	-.02205	-.03970	.91661	-.351	.7266
X7	-.07702	-.13982	.93166	-1.247	.2161
XUI	.39232	.50611	.47051	5.183	.0000
XUIP	.05922	.10641	.91280	.945	.3475
XUSEF	.45216	.50893	.35816	5.222	.0000

Valid Cases 81 Missing Cases 0

This procedure was completed at 13:00:07

**** 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 = 81

Correlation:

	X3	X6	X7	XUI	XUIP	XEU	XUSEF
X3	1.000	.248	.635	-.471	.077	-.256	-.251
X6	.248	1.000	.221	-.266	-.063	-.289	-.313
X7	.635	.221	1.000	-.503	-.101	-.261	-.290
XUI	-.471	-.266	-.503	1.000	.159	.728	.780
XUIP	.077	-.063	-.101	.159	1.000	.295	.230
XEU	-.256	-.289	-.261	.728	.295	1.000	.801
XUSEF	-.251	-.313	-.290	.780	.230	.801	1.000
XACC	-.206	-.265	-.293	.801	.304	.847	.840

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

	XACC
X3	-.206
X6	-.265
X7	-.293
XUI	.801
XUIP	.304
XEU	.847
XUSEF	.840
XACC	1.000

APPENDIX C

DETAILED REGRESSION OUTPUT

XUIP Perception of involvement

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1.00	66	81.5	81.5	81.5
	2.00	15	18.5	18.5	100.0
	TOTAL	81	100.0	100.0	

```
1.00----------------------------------------------66
2.00-------------15
```

Mean	1.185	Std Err	.043	Median	1.000
Mode	1.000	Std Dev	.391	Variance	.153
Kurtosis	.746	S E Kurt	.529	Skewness	1.652
S E Skew	.267	Range	1.000	Minimum	1.000
Maximum	2.000	Sum	96.000		

Valid Cases 81 Missing Cases 0

XUS User satisfaction

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1.00	31	38.3	38.3	38.3
	2.00	9	11.1	11.1	49.4
	3.00	12	14.8	14.8	64.2
	4.00	29	35.8	35.8	100.0
	TOTAL	81	100.0	100.0	

```
1.00-----------------------------------------31
2.00--------------9
3.00------------------12
4.00-----------------------------------------29
```


XUS User satisfaction

Mean	2.481	Std Err	.147	Median	3.000
Mode	1.000	Std Dev	1.324	Variance	1.753
Kurtosis	-1.779	S E Kurt	.529	Skewness	.008
S E Skew	.267	Range	3.000	Minimum	1.000
Maximum	4.000	Sum	201.000		

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XACC User acceptance

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1.00	31	38.3	38.3	38.3
	2.00	8	9.9	9.9	48.1
	3.00	13	16.0	16.0	64.2
	4.00	29	35.8	35.8	100.0
	TOTAL	81	100.0	100.0	

```
1.00----------------------------------------31
2.00-------------8
3.00------------------13
4.00-------------------------------------29
```

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XACC User acceptance

Mean	2.494	Std Err	.147	Median	3.000
Mode	1.000	Std Dev	1.324	Variance	1.753
Kurtosis	-1.779	S E Kurt	.529	Skewness	-.019
S E Skew	.267	Range	3.000	Minimum	1.000
Maximum	4.000	Sum	202.000		

Valid Cases 81 Missing Cases 0

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XUI User involvement

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0.0	35	43.2	43.2	43.2
	1.00	46	56.8	56.8	100.0
	TOTAL	81	100.0	100.0	

```
0.0--------------------------------------35
1.00-----------------------------------------------46
```

Mean	.568	Std Err	.055	Median	1.000
Mode	1.000	Std Dev	.498	Variance	.248
Kurtosis	-1.971	S E Kurt	.529	Skewness	-.279
S E Skew	.267	Range	1.000	Minimum	0.0
Maximum	1.000	Sum	46.000		

Valid Cases 81 Missing Cases 0

```
1.00--------------------------------------------------29
2.00-------------------------------16
3.00-------------------------13
4.00----------------------------------------23
```


XEU Ease of use

Mean	2.370	Std Err	.138	Median	2.000
Mode	1.000	Std Dev	1.239	Variance	1.536
Kurtosis	-1.592	S E Kurt	.529	Skewness	.184
S E Skew	.267	Range	3.000	Minimum	1.000
Maximum	4.000	Sum	192.000		

Valid Cases 81 Missing Cases 0

XUSEF Usefulness

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1.00	33	40.7	40.7	40.7
	2.00	7	8.6	8.6	49.4
	3.00	14	17.3	17.3	66.7
	4.00	27	33.3	33.3	100.0
	TOTAL	81	100.0	100.0	

```
1.00------------------------------------------33
2.00------------7
3.00--------------------14
4.00-----------------------------------27
```


XUSEF Usefulness

Mean	2.432	Std Err	.147	Median	3.000
Mode	1.000	Std Dev	1.322	Variance	1.748
Kurtosis	-1.777	S E Kurt	.529	Skewness	.051
S E Skew	.267	Range	3.000	Minimum	1.000
Maximum	4.000	Sum	197.000		

Valid Cases 81 Missing Cases 0

Valid Cases 81 Missing Cases 0

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X12 Comp. expertise

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	8	9.9	9.9	9.9
	2	33	40.7	40.7	50.6
	3	25	30.9	30.9	81.5
	4	14	17.3	17.3	98.8
	5	1	1.2	1.2	100.0
	TOTAL	81	100.0	100.0	

```
1------------8
2-------------------------------------------33
3--------------------------------25
4-------------------14
5----1
```

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X12 Comp. expertise

Mean	2.593	Std Err	.104	Median	2.000
Mode	2.000	Std Dev	.932	Variance	.869
Kurtosis	-.536	S E Kurt	.529	Skewness	.245
S E Skew	.267	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	210.000		

Valid Cases 81 Missing Cases 0

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XEU Ease of use

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1.00	29	35.8	35.8	35.8
	2.00	16	19.8	19.8	55.6
	3.00	13	16.0	16.0	71.6
	4.00	23	28.4	28.4	100.0
	TOTAL	81	100.0	100.0	

X10 Freq. of use

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	4	1	1.2	1.2	1.2
	5	9	11.1	11.1	12.3
	6	71	87.7	87.7	100.0
	TOTAL	81	100.0	100.0	

```
4----1
5---------9
6-------------------------------------------------71
```

Mean	5.864	Std Err	.042	Median	6.000
Mode	6.000	Std Dev	.379	Variance	.144
Kurtosis	8.036	S E Kurt	.529	Skewness	-2.845
S E Skew	.267	Range	2.000	Minimum	4.000
Maximum	6.000	Sum	475.000		

Valid Cases 81 Missing Cases 0

X11 Hours spent

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	3	3	3.7	3.7	3.7
	4	31	38.3	38.3	42.0
	5	32	39.5	39.5	81.5
	6	10	12.3	12.3	93.8
	7	4	4.9	4.9	98.8
	8	1	1.2	1.2	100.0
	TOTAL	81	100.0	100.0	

X11 Hours spent

```
3-------3
4----------------------------------------31
5------------------------------------------32
6---------------10
7--------4
8----1
```

Mean	4.802	Std Err	.107	Median	5.000
Mode	5.000	Std Dev	.967	Variance	.935
Kurtosis	.933	S E Kurt	.529	Skewness	.835
S E Skew	.267	Range	5.000	Minimum	3.000
Maximum	8.000	Sum	389.000		

X8 Packages used

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	2	1	1.2	1.2	1.2
	3	1	1.2	1.2	2.5
	5	79	97.5	97.5	100.0
	TOTAL	81	100.0	100.0	

```
2----1
3----1
5-----------------------------------------79
```

Mean	4.938	Std Err	.044	Median	5.000
Mode	5.000	Std Dev	.398	Variance	.159
Kurtosis	44.345	S E Kurt	.529	Skewness	-6.619
S E Skew	.267	Range	3.000	Minimum	2.000
Maximum	5.000	Sum	400.000		

Valid Cases 81 Missing Cases 0

X9 Comp. dev

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	4	4.9	4.9	4.9
	2	76	93.8	93.8	98.8
	3	1	1.2	1.2	100.0
	TOTAL	81	100.0	100.0	

```
1-----4
2----------------------------------------76
3----1
```

Mean	1.963	Std Err	.027	Median	2.000
Mode	2.000	Std Dev	.247	Variance	.061
Kurtosis	13.467	S E Kurt	.529	Skewness	-2.081
S E Skew	.267	Range	2.000	Minimum	1.000
Maximum	3.000	Sum	159.000		

Valid Cases 81 Missing Cases 0

Valid Cases 81 Missing Cases 0

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X7 Computer years

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	2	8	9.9	9.9	9.9
	3	12	14.8	14.8	24.7
	4	14	17.3	17.3	42.0
	5	12	14.8	14.8	56.8
	6	13	16.0	16.0	72.8
	7	11	13.6	13.6	86.4
	8	6	7.4	7.4	93.8
	9	2	2.5	2.5	96.3
	10	3	3.7	3.7	100.0
	TOTAL	81	100.0	100.0	

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X7 Computer years

```
 2-----------------------8
 3---------------------------------12
 4--------------------------------------14
 5---------------------------------12
 6-----------------------------------13
 7--------------------------------11
 8------------------6
 9--------2
10----------3
```

Mean	5.173	Std Err	.232	Median	5.000
Mode	4.000	Std Dev	2.090	Variance	4.370
Kurtosis	-.523	S E Kurt	.529	Skewness	.362
S E Skew	.267	Range	8.000	Minimum	2.000
Maximum	10.000	Sum	419.000		

Valid Cases 81 Missing Cases 0

Valid Cases 81 Missing Cases 0

X5 Position

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	40	49.4	49.4	49.4
	2	35	43.2	43.2	92.6
	3	6	7.4	7.4	100.0
	TOTAL	81	100.0	100.0	

```
clerk    1--------------------------------------------------40
1st Sup  2---------------------------------------------35
  E.D.P  3----------6
```

Mean	1.580	Std Err	.070	Median	2.000
Mode	1.000	Std Dev	.630	Variance	.397
Kurtosis	-.546	S E Kurt	.529	Skewness	.613
S E Skew	.267	Range	2.000	Minimum	1.000
Maximum	3.000	Sum	128.000		

Valid Cases 81 Missing Cases 0

X6 Cmp. type used

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
P.C	1	1	1.2	1.2	1.2
Mini	2	41	50.6	50.6	51.9
P.C & Mini	3	39	48.1	48.1	100.0
	TOTAL	81	100.0	100.0	

```
1----1
2------------------------------------------41
3----------------------------------------39
```

Mean	2.469	Std Err	.058	Median	2.000
Mode	2.000	Std Dev	.526	Variance	.277
Kurtosis	-1.407	S E Kurt	.529	Skewness	-.138
S E Skew	.267	Range	2.000	Minimum	1.000
Maximum	3.000	Sum	200.000		

```
1-----2
2--------------11
3--------------------------24
4------------------------------------------41
5-----3
```

X3 educational level

Mean	3.395	Std Err	.096	Median	4.000
Mode	4.000	Std Dev	.861	Variance	.742
Kurtosis	.150	S E Kurt	.529	Skewness	-.749
S E Skew	.267	Range	4.000	Minimum	1.000
Maximum	5.000	Sum	275.000		

Valid Cases 81 Missing Cases 0

X4 Years employed

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	1	3	3.7	3.7	3.7
	2	16	19.8	19.8	23.5
	3	25	30.9	30.9	54.3
	4	9	11.1	11.1	65.4
	5	10	12.3	12.3	77.8
	6	8	9.9	9.9	87.7
	7	5	6.2	6.2	93.8
	8	2	2.5	2.5	96.3
	9	2	2.5	2.5	98.8
	10	1	1.2	1.2	100.0
	TOTAL	81	100.0	100.0	

X4 Years employed

```
1---------3
2-----------------------------------16
3-------------------------------------------------------25
4---------------------9
5-----------------------10
6-------------------8
7-------------5
8-------2
9-------2
10-----1
```

Mean	3.988	Std Err	.223	Median	3.000
Mode	3.000	Std Dev	2.003	Variance	4.012
Kurtosis	.360	S E Kurt	.529	Skewness	.926
S E Skew	.267	Range	9.000	Minimum	1.000
Maximum	10.000	Sum	323.000		

X1 Age

Mean	27.617	Std Err	.306	Median	27.000
Mode	26.000	Std Dev	2.750	Variance	7.564
Kurtosis	-.296	S E Kurt	.529	Skewness	.545
S E Skew	.267	Range	13.000	Minimum	22.000
Maximum	35.000	Sum	2237.000		

Valid Cases 81 Missing Cases 0

X2 Sex

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	0	53	65.4	65.4	65.4
	1	28	34.6	34.6	100.0
	TOTAL	81	100.0	100.0	

Male 0---53
Female 1-------------------------28

Mean	.346	Std Err	.053	Median	0.0
Mode	0.0	Std Dev	.479	Variance	.229
Kurtosis	-1.603	S E Kurt	.529	Skewness	.661
S E Skew	.267	Range	1.000	Minimum	0.0
Maximum	1.000	Sum	28.000		

Valid Cases 81 Missing Cases 0

X3 educational level

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Less h. sch	1	2	2.5	2.5	2.5
High school	2	11	13.6	13.6	16.0
Former std	3	24	29.6	29.6	45.7
B.S	4	41	50.6	50.6	96.3
M.S	5	3	3.7	3.7	100.0
	TOTAL	81	100.0	100.0	

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

***** Memory allows a total of 12840 Values, accumulated across all Variables.
There also may be up to 1605 Value Labels for each Variable.

X1 Age

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
	22	1	1.2	1.2	1.2
	23	1	1.2	1.2	2.5
	24	5	6.2	6.2	8.6
	25	13	16.0	16.0	24.7
	26	15	18.5	18.5	43.2
	27	7	8.6	8.6	51.9
	28	13	16.0	16.0	67.9
	29	6	7.4	7.4	75.3
	30	8	9.9	9.9	85.2
	31	1	1.2	1.2	86.4
	32	6	7.4	7.4	93.8
	33	4	4.9	4.9	98.8
	35	1	1.2	1.2	100.0
	TOTAL	81	100.0	100.0	

X1 Age

```
22-----1
23-----1
24---------------5
25------------------------------------13
26------------------------------------------15
27--------------------7
28------------------------------------13
29-------------------6
30------------------------8
31-----1
32-------------------6
33-------------4
35-----1
```

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