A Decision Support System for E-banking Adoption in Jordan: A Critical Success Factors Perspective

By

Mohammed AbdulKareem Abukhadegeh

Supervisors

Dr. Mohammad Al – Fayoumi
Prof. Dr. Asim Al-Sheikh

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جامعة الشرق الأوسط للدراسات العليا

إقرار تفويض

أنا, محمد عبد الكريم أبو خديجة، أفوض جامعة الشرق الأوسط للدراسات العليا بتزويد نسخ من رسالتي للمكتبات أو المؤسسات أو الهيئات أو الأشخاص عند طلبها حسب التعليمات النافذة في الجامعة|.

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This Thesis (A Decision Support System for E-banking Adoption in Jordan: A Critical Success Factors Perspective) was successfully defended and approved on June 9^{th,} 2008

Examination committee signatures

Dr. Mohammad A. Al-Fayoumi
Associate Professor Department of Computer Information Systems
(Middle East University for Graduate Studies)

....

Prof. Asim A.R. El Sheikh
Professor, Dean of Information System and Technology
(The Arab academy for Banking and Financial Science)

....

Prof. Sattar J. Aboud
Associate Professor Department of Computer Information Systems
(Middle East University for Graduate Studies)

....

Dr. Hasan Al-Sakran
Associate Professor Department of Management Information Systems
(Al-Yarmouk University)

....

Declaration

I do hereby declare the present research work has been carried out by me, under the supervision of Dr. Mohammad A. Al-Fayoumi and Professor Asim A.R. Al-Sheikh. And this work has not been submitted elsewhere for any other degree, fellowship or any similar title.

Date: Mohammed Abdulkareem Abukhadegeh

                         Department of Computer
                         Information Systems

Faculty of Information Technology

Middle East University for
Graduate Studies

DEDICATION

To my father, mother, brothers, and sisters, for their love and support, they were the light in my academic path and without them nothing of this would have been possible.

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List of Abbreviations

AHP: Analytical Hierarchy Process

ANN: Artificial Neural Network

ATM: Automatic Teller Machine

AVR: Automated Voice Response

BFI: Banking and Financial Industry

CBJ: Central Bank of Jordan

CBIS: Computer-Based Information System

CEO: Chief Executive Officer

CI: Consistency Index

CSF: Critical Success Factor

DSS: Decision Support System

EB: Electronic Banking

EC: Electronic Commerce

EDP: Electronic Data System

EIS: Executive Information System

ES: Expert System

I/O: Input/Output

IT: Information Technology

IS: Information System

MIS: Management Information System

PC: Personal Computer

PDA: Personal Digital Assistant

PEOU: Perceived Ease of Use

PU: Perceived Usefulness

RI: Random Index

SPSS: Statistical Package for the Social Science

TPS: Transaction Process System

WWW: World Wide Web

Terminology

▶ **E- Banking:** is an umbrella term for the process by which a customer may perform banking transactions electronically without visiting a brick-and-mortar institution..

▶ **Critical Success Factors:** is the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization.

▶ **Decision support system:** is an interactive computer system that uses models and data to identify and solve low-structure problems, in order to support decision-makers in the decision-making process.

▶ **Analytic Hierarchy Process:** The AHP can compute the weights of CSFs

Abstract

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The purpose of this study is to investigate factors which might be critical to the success of e-banking in Jordan, and develop a DSS that based on CSFs that will provide the decision maker in Jordanian banks with a powerful tool for making a successful e-banking adoption and implementation decisions. The study sample consists of six Jordanian banks. The study used some of statistical tools and programmable decision support system based on AHP Technique.

ملخص

نظام دعم القرار لتبني البنوك الإلكترونية في الأردن: منظور عوامل

النجاح الحرجة

إعداد

محمد عبد الكريم أبو خديجة

إشراف

الدكتور محمد الفيومي

الأستاذ الدكتور عاصم الشيخ

هدفت الدراسة إلى بحث العوامل الحرجة لنجاح البنوك الإلكترونية في الأردن، وتم تطوير نظام دعم قرار مستند على عوامل النجاح الحرجة والتي تعطي متخذ القرار في البنوك الأردنية أداة قوية لتحقيق نجاح تبني البنوك الالكترونية وتنفيذ القرارات. تكونت عينة الدراسة من ستة بنوك أردنية. وقد تم استخدام مجموعة من الأساليب الإحصائية في الدراسة ونظام دعم القرار المبرمج بالإستناد إلى تقنية عملية الهيكلة التحليلية.

CHAPTER 1

INTRODUCTION

In this chapter the researcher will give a brief background about the thesis subject, after that the problem of the thesis will be mentioned. The researcher then giving information about related works, the contribution of the thesis, and the outline of the thesisi chapter.

1.1 OVERVIEW

The fast advancing global information infrastructure, for example information technology (IT), computer networks such as the Internet and telecommunications systems enable the development of e-commerce (EC) at a global level [63]. The increasing popularity of the Internet as a business tool has created a new type of economy, which may be called the "digital economy". This emerging economy is bringing with it new forms of IT-enabled intermediation, Internet banking (e-banking), virtual supply chains, rapidly changing EC technologies, increasing knowledge intensity, and unprecedented sensitivity of time-to-market by customers.

To thrive or even to survive in the EC world, companies need to transform their internal foundations to be effective. Current business designs and organizational models are insufficient to meet the challenges of doing business in the EC era. The new type of business would consist of finely tuned integration of business, technology and processes. Financial services are not an exception [9]. Both researchers and practitioners in the banking and financial industry (BFI) have highlighted the need for banks to broaden their branch-based delivery channels by embracing e-banking. E-banking creates unprecedented opportunities for the banks in the ways they organize financial product development, delivery, and marketing

via the Internet. While it offers new opportunities to banks, it also poses many challenges such as the innovation of IT applications, the blurring of market boundaries, the breaching of industrial barriers, the entrance of new competitors, and the emergence of new business models [57]. Nowadays, the speed and scale of the challenge are rapidly increasing with the pervasiveness of the Internet and the extension of information economy [10]. However, to successfully cope with the challenge of the e-banking innovation, the incumbent banks must understand the critical success factors (CSFs) in e-financial services adoption and implementation [63]. Without this understanding, attempts to migrate to e-banking may be doomed to failure. Banks that are equipped with a good grasp of the e-banking phenomenon will be more able to make informed decisions on how to transform them into e-banks and to exploit the e-banking to survive in the new economy [26]. Given the e-banking is a financial innovation [60] the change may render the organizational capabilities of the traditional banks obsolete.

There have been significant developments in the structure of the Jordanian financial services sector in the past **30** years. According to the official figures from the central bank of Jordan (CBJ) report [8], until the early **1980s** functional demarcation was predominant with many regulator restrictions imposed, one main consequence being limited competition both domestically and internationally. As a result, there was heavy reliance on traditional branch based delivery of financial services and little pressure for change. This changed gradually with deregulation of the industry and the increasingly important role IT brought stiffer competition and pressure for quick changes. One such change is the establishment of electronic financial services. The evolution of electronic service started from the use of automatic teller machines (ATMs) and has passed through telephone banking, direct bill payment, e-fund transfer and the revolutionary online banking [60]. It has been forecasted that among all the categories, online banking is the future of e-financial

transactions. The rise in the EC and the use of Internet in its facilitation along with the enhanced online security of transactions and sensitive information has been the core reasons for the penetration of online banking in Jordan [64,54].

Despite the magnitude of the Internet banking phenomenon, relatively few studies investigate the factors influencing its adoption and success at the national level. Understanding the CSFs in e-banking is important for senior management of banking related organizations, because it would potentially help them improve their strategic planning process.

This research seeks to fill this gap by providing a better understanding of the CSFs of the Internet banking in Jordan. The decision of adopting and implementing e-banking is a difficult task [60].

This difficulty is due to the wide range of strategic, operational and technical factors that are involved. Managers must understand and take into account these CSFs before a decision is reached [57].

So far, little is available to guide managers in translating a set of CSFs into a successful adoption and implementation of e-banking especially in a Jordanian context [54,31]. This lack of guidance call for the creation of weighting DSS to help Jordanian decision makers in making a successful e-banking decision. Hence, our research will be carried out in two phases. At the first phase, a thorough survey study will be conducted to identify the CSFs in e-banking adoption and implementation within the Jordanian banks context. At the second phase the outputs from the first phase will be used as an input to develop a weighting DSS (WDSS) that could be used to help Jordanian banks managers in making a successful e-banking adoption and implementation decisions. Our proposed WDSS will be based on CSFs, where strategic, operational and technical factors are tackled and taken

into consideration as a key decision factors for a successful implementation of e-banking in Jordan.

Critical success factors have been defined in several ways depending on the purpose for which they were used. For the purpose of this research, Rockart's [51] definition will be used. He defines CSFs as "**The limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization**". The CSFs approach represents an accepted top-down methodology for corporate strategic planning, and while it identifies few success factors, it can highlight the key information requirements of top management [51]. In addition, if the CSFs are identified and controllable, management can take certain steps to improve its potential for success [9]. This technique has been widely used in many businesses and technology related contexts for over four decades and its use is still common "see for example" [59].

In the context of this research, CSFs theory will be used to pinpoint some areas that are critical for success of the e-banking adoption success.

To succeed in the e-banking arena, companies need to transform their internal foundations to be effective because of the reasons mentioned in previous paragraphs. Current business designs and organizational models are insufficient to meet the challenges of doing business in the EC era. Therefore one critical issue is re-engineering of the business processes which also include technological processes [17].

Security, which may include protection of consumers' personal data and safe transactions to prevent frauds, is paramount for the growth of any sort of online trade, including e-banking [18,60].

Enos [18] identified several success factors for online banking including: improving trust and security, simplifying and integrating basic services, such as

banking and lending, insurance, investment and payments, personalization and customization capabilities in order to provide each customer with unique offerings. Importance of trust in success of e-banking was also emphasized by Yoursfzai [66].

The interactive nature of e-banking creates an opportunity for gaining a much deeper understanding of the customers. The data gathered about the customer during their interaction with the bank can be analyzed using data mining techniques and this marketing decision support capability will ultimately determine the success of the bank's electronic channel [22].

King and Liou [32] see excellent customer services as a key factor in the success of e-banking. Their reason for this is that the Internet transfers power from supplier to the customer and superior customer service is absolutely essential for keeping customers loyal. The provision of a pleasant experience on this channel, according to Franco & Klein [22] is one of the key requirements for success of the channel. This level of integration however, needs very good technological infrastructure.

Mols [40] suggested that banks should use the Internet as an additional channel of distribution and must keep their traditional channels such as branches and phone banking intact. This gives the banks the opportunity for a gentle transition from a branch banking strategy to e-banking strategy, and it provides good market coverage. Similarly Riggins [49] identified a number of critical success factors of Internet banking in the context of the Australian banking industry. These include: developing the will to innovate rapidly, aggressively marketing the bank's website address to generate first time visitors, online decision support tools for personal financial management, the creation of an online 'virtual' community for financial services, and bundling of products/services.

Turban [60] identified several CSFs for EC initiatives. Most of these CSFs also apply to e-banking, including: only simple (Internet specific) products/services

should be offered online, top management support, a project team reflecting various related functional areas, a user-friendly web-interface and appropriate promotion of the project both internally and externally.

In the literature review on CSFs in e-banking a broad range of issues are identified including security of information and systems, privacy of customer information, stable systems, low cost of operation, metrics for EC operations and web sites, ease of use, proper presentation of information about goods and services, customer orientation, EC strategy, EC expertise in both technical and managerial perspectives, payment, delivery, competitive price, speed, services, variety of goods and services, proper web design, marketing, trust and loyalty of customers.

In total a list of **125** specific items was compiled from literature review. We have divided these factors into three categories: strategic, operational and technical. This categorization will help to explain our findings in terms of the nature of success factors in e-banking adoption. Successful implementation of e-banking in Jordan.

1.2 PROBLEM DEFINITION

Although the various aspects of banking business may have been studied for many decades, the area of e-banking has only appeared in information systems (IS) literature since the mid-1990s [10,32,64,66]. These researchers covered many aspects of e-banking but, still there is a lack of research into CSFs in e-banking adoption and associated organizational issues, especially in the Jordan context. There is also a lack of case studies reporting the actual experience of organisations in implementing e-banking. This gap in the research poses problems for banks, because the limitations in relation to this area usually mean difficulties for them in planning and implementing e-banking [57]. This research aims to help address some of these gaps in the current body of literature.

1.3 THESIS OBJECTIVES

In the light of limited empirical work which captures the nature and essence of e-banking adoption in the banking sector in Jordan, nor analyze of success factors to help form a strategic agenda, the researcher aims to:

1. Investigate factors which might be critical to the success of e-banking in Jordan.

2. Develop a DSS that based on CSFs that will provide the decision maker in Jordanian banks with a powerful tool for making a successful e-banking adoption and implementation decisions.

1.4 REQUIREMENTS

In our work, we used many tools to reach to our results, below is a brief description about those tools used in this work:

1.4.1 STATISTICAL PACKAGE FOR THE SOCIAL SCIENCEs

It is a computer program used to analyze the data which will be collected from the questionnaire

1.4.2 VISUAL BASIC.NET

Visual basic.net has been used to implement AHP technique to help the top management in taking fast and easy decisions.

1.5 SIGNIFICANCE

The significant of this thesis is to study CSFs in the successful adoption of e-banking in Jordan. The importance of e-banking as a financial services delivery channel is growing because of its wider reach and low cost per transaction. The Internet as a channel for services delivery is fundamentally different from other channels, such as branch networks or telephone banking, because of its interactive

nature. Therefore, it brings up unique types of challenges and requires novel solutions [32, 57,64].

Understanding the CSFs in e-banking is important for senior management of banking related organizations because it would help them improve their e-banking adoption process. Whilst there are many examples of empirical work on consumer related issues, limited empirical research related to the strategic, operational and technical CSFs in e-banking has been done so far. This research addresses this gap by reporting an exploratory case study of Jordanian banks, which have been successful in implementing e-banking. Specifically, the research aimed to explore how these banks went about managing successful adoption, what were the factors critical to their success and what key lessons came out of their experience which could be generalized.

In the light of the above, the researcher had a convincement about the importance and necessity to develop a DSS based on the CSFs for adoption and implementation of e-banking in Jordanian banks. The following three questions motivated this research:

- What is the experience of Jordanian banks in adopting e-banking?
- What are the CSFs that are particularly important in a success e-banking adoption in Jordanian banking sector?
- How these CSFs can be incorporated in a DSS that could be used to help the decision makers in Jordanian banks in making a successful e-banking adoption decisions?

1.6 RELATED WORK

Kumar [34] Undertital "Understanding DSS value: an options perspective" examined an important source of the value of decision support systems, namely

flexibility. It proposes the use of options theory for systematically analyzing, understanding, and possibly quantifying flexibility resulting from the use of DSS for a class of decision scenarios. A review of relevant literature on flexibility and options theory is provided. The flexibility resulting from DSS use is conceptualized as the change in value of a portfolio of options. Insight provided by options theory is compared with anecdotal evidence of DSS value that has been reported in the Management Information Systems (MIS) literature. Examples of DSS valuation using options theory are provided. Managerial and research implications for the evaluation and justification of DSS as well as for the development of DSS are discussed.

Tan & Teo [60] Undertital"Factors Influencing the Adoption of Internet Banking" identified the attitudinal, social and perceived behavioral control factors that would influence the adoption of Internet banking. An online questionnaire was designed on the World Wide Web (www). Respondents participated through extensive personalized email invitations as well as postings to newsgroups and hyperlinks from selected Web sites. Their results revealed that attitudinal and perceived behavioral control factors, rather than social influence, play a significant role in influencing the intention to adopt Internet banking. In particular, perceptions of relative advantage, compatibility, trainability, and risk toward using the Internet were found to influence intentions to adopt Internet banking services. In addition, confidence in using such services as well as perception of government support for electronic commerce was also found to influence intentions.

Jinghua & Chingting [28] Undertital "E-commerce Critical Success Factors for Chinese Enterprises: An Empirical Research on the Publishing

Industry". Determined the relationship between the assessment indicators and the impact factors, data are collected form the publishing industry in China. Data analysis result shows that factors such as "establish EC strategy fitted in with company's characteristic", "share information between systems", and "manage customer relationship" are critical factors for Chinese publishing companies. The findings are useful to guide the EC initiatives in China.

Laosethakul, et. al. [35] Undertital "Critical Success Factors for E-commerce in Thailand: A Multiple Case Study Análisis". Identified the CSFs for EC in Thailand. They conducted detailed case studies of nine EC companies from different industries in Thailand. Their results showed that social behavior and national culture, more specifically issues pertaining to trust and shopping behavior, were critical to the success of EC in Thailand. They also found that Thailand's infrastructure also played an important role in the success of its EC development. Their findings provided a framework to guide development of EC ventures in Thailand and other developing countries with similar culture and infrastructures.

Sung & Lee, [59] Undertital "Electronic Commerce in Korea: Critical Success Factors". Determined CSFs for EC and investigate the explanatory power of these CSFs on firm performance in Korea. Through a literature review and interviews with managers in Korean EC firms, a list of 16 CSFs consisting of 111 items was complied. In the second stage, questionnaires were administered to top EC managers of EC companies in Seoul, Korea. Survey results show that CSFs have very significant explanatory power for firm performance security, privacy, technical expertise, information about goods/services, and variety of goods/services is the most explanatory CSFs.

Olson, et al.. [42] Undertital "An E-Commerce Decision Support System Design for Web Customer Retention".Proposed a system that includes the idea

of an EC broker to improve customer retention and to increase the profitability of sales. The broker sits between the client and the web server, acting as an intermediate agent that monitors the customer's behavior on the client side and notifies the server when the customer takes some action that may precede early departure form the site. In conjunction with on-line customer activity monitoring, a customer value model will be built for each customer with the intent of identifying site products most likely to be wanted by that customer.

Shin. [55] Undertital "An Exploratory Investigation of System Success Factors in Data Warehousing ". Investigated success factors in data warehousing. An exploratory study was conducted to improve general understanding of data warehousing issues from the perspective of IS success. For this, the effect of variables pertaining to system quality, information quality, and service quality on user satisfaction for the data warehouse was studied. Additional characterization was made on data warehouse users, their organizational tasks, and data warehouse usage. Empirical data were gathered at a large enterprise from three different information sources: a survey, unstructured group interviews with end-users, and informal interviews with an IT manager who was in charge of the data warehouse. Data analysis showed that user satisfaction with the data warehouse was significantly affected by such system quality factors as data quality, data local; and system throughput. Interviews also supported the existence of system design and management issues that have to be addressed to optimize the utility of the data warehouse as an effective decision support environment. In the meantime, data analysis indicated that first-line (or lower) and middle managers were the main users of the system. Managers and knowledge workers were taking advantage of the system to perform complex tasks, to support decision making, and to seek information critical for enhanced productivity. The group interviews revealed

additional benefits of the data warehouse and major roadblocks in its successful usage.

Yiu,et..al, [65] Undertital "Factors affecting the adoption of Internet Banking in Hong Kong: implications for the banking sector". Explored the adoption of Internet banking by retail customers in Hong Kong. The research constructs were developed based on the technology acceptance model and incorporated two additional elements of personal innovativeness and perceived risk. Hypotheses were constructed and then tested using t-test and Pearson's correlation. It was found that certain factors did have a positive relationship with the adoption of Internet banking and as such strategy in the banking services sector can be refined to better meet the demands and profile of the Hong Kong market.

Daghfous & Toufaily, [13] Undertital "The adoption of E-banking by Lebanese Banks: Success and critical factors". Analyzed the organizational, structural and strategic factors which can accelerate or, on the contrary, slow the adoption of this electronic mode of distribution and communication by the banks, by analyzing the case of the Lebanese market. The results of the study indicate that the extent of penetration of "E-banking" in the growth phase of an emerging market has an important correlation with the improvement of commercial performance.

Alonso & Lamata [3], undertital "consistency in the analytic hierarchy process: a new approach". Present a statistical criterion for accepting/rejecting the pairwise reciprocal comparison matrices in the analytic hierarchy process. We have studied the consistency in random matrices of different sizes. We do not agree with the traditional criterion of accepting matrices due to their inflexibility and because it is too restrictive when the size of the matrix increases. Our system is capable of adapting the acceptance requirements to different scopes and consistency

necessities. The advantages of our consistency system are the introduction of adaptability in the acceptance criterion and the simplicity of the index we have used, the eigenvalue (lmax) and the simplicity of the criterion.

Eskandari & Rabelo [21], undertital " Handling uncairtinty in the analytic hierarchy process: as stochastic approach". Describes a methodology for handling the propagation of uncertainty in the analytic hierarchy process (AHP). In real applications, the pairwise comparisons are usually subject to judgmental errors and are inconsistent and conflicting with each other. Therefore, the weight point estimates provided by the eigenvector method are necessarily approximate. This uncertainty associated with subjective judgmental errors may affect the rank order of decision alternatives. A new stochastic approach is presented to capture the uncertain behavior of the global AHP weights. This approach could help decision makers gain insight into how the imprecision in judgment ratios may affect their choice toward the best solution and how the best alternative(s) may be identified with certain confidence. The proposed approach is applied to the example problem introduced by Saaty for the best high school selection to illustrate the concepts introduced in this paper and to prove its usefulness and practicality.

1.7 THESIS CONTRIBUTION

The contribution of the thesis briefly listed as bellow:

- Strategic factor has significant effect on e-banking adoption decision in Jordanian banks.

- Operational factor has significant effect on e-banking adoption decision in Jordanian banks.

▶ Technical factor has significant effect on e-banking adoption decision in Jordanian banks.

▶ The weighting decision support system gives a strong, and approved results based on AHP mathematical technique, which gives absolute results, help the decision maker in taking a correct and shortly time decision of e-banking adoption and implementation.

1.8 METHODOLOGY

The study will be carried out in two phases as following:

First phase

The researcher will design a survey instrument; the purpose of the survey is to collect data about CSF's which affect the e-banking adoption and implementation decision. The researcher designs a proposed model exaplain the CSF's in details which will be shown in chapter 4.

The gathered data from the survey will be analyzed by using the social sciences (SPSS); the researcher uses the suitable statistical methods as follow:
1. Arithmetic mean and standard deviation.
2. Sample linear regression

The collected data from the first phase will be taken into consideration as a reference to compare them with the result gotten from the second phase

Second phase:

In this phase; the researcher will build a programmable weighting decision support system depending on the AHP technique; this technique is a mathematical technique. AHP is a top management support decision technique; that follows a mathematical approach to approave the results. The top management (decision maker, top manager) will enter a values to a

3-dimensional axes: strategic, operational, and technical. The WDSS enables us to identify which banks are the most similar to a particular one in terms of strategy, operational, and technical.

The system allow the top managemement to enter the values upon their experience; and after that the decision maker and the top manager can know the weakness and strength points of their decisions.

1.9 DELIMITATIONS

To increase credibility in this study, it is important the sample chosen is representative of the population that the researcher will investigate. The samples of the study will be the whole of commercial banks in Jordan registered in Amman Stock Exchange Market.

This study is a survey research, so it's limited by the willingness of the participants to respond and provide accurate responses. Therefore, the extent to which the participants may not have sufficient knowledge to answer all the survey items or their responses become distorted due to personal biases, are areas for potential errors in measurements.

Unfortunately, this unpreventable aspect of descriptive research leads to rely on the honesty, accuracy, and knowledge of respondents. In addition, to implementing the study on the Banking Sector, specially, Commercial Banks in Jordan.

1.10 Thesis Organization

- This thtesis is devided into 5 chapters as follow:

Chapter 1: In this chapter the researcher will give a brief background about the thesis subject, after that the problem of the thesis will be mentioned. The researcher then giving information about related works, the contribution of the thesis, and the outline of the thesisi chapter.

Chapter 2: In this chapter the researcher will present the theoretical background which consists of CSF's, e-banking adoption, decision support system, analytic hierarchy process.

Chapter 3: In this chapter the researcher will present briefly the study design, then introduce the subjects, after that the instrument designs, the data collection, and at last the data analysis procedure.

Chapter 4: In this chapter the data, which have been collected through the survey, is presented and analyzed statistically. The **First section** analysis involves descriptive statistics and analytical statistics that related with hypothesis. **The Second section** the resecher used the AHP technique to putting up weights to factors then compare them to optimal results from first section, by using aprogrammable decision support system using VB.net.

Chapter 5: In this Chapter; the researcher will mention the conclusions of this work and mention an idea for a future work.

CHAPTER 2

THEORETICAL BACKGROUND

In this chapter the researcher will present the theoretical background which consists of CSF's, e-banking adoption, decision support system, analytic hierarchy process.

2.1 CRITICAL SUCCESS FACTORS

Daniel was the first to introduce the concept of CSF. This concept became popular when it was later used to assist in defining the CEO's information needs that are most critical to the success of the business [51].

CSFs have been defined in several ways depending on the purpose for which they were used. For the purpose of this study, Rockart, in 1979, define the concept of critical success factors. He defined them as ``the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization''. He indicated that CSF is a useful approach for identifying management's information requirements because it can focus attention on areas where ``things must go right''. In addition, if the critical success factors are identified and controllable, management can take certain steps to improve its potential for success [9].

Boynton and Zmud [6] also defined CSF as the ``few things that must go well to ensure success for a manager or an organization''. They recognized the CSF approach as an appropriate planning instrument.

The CSF method is applicated in the form of interviews usually conducted in two or three seperate sessions. Initially the goals of the manager are discussed and recorded and the CSFs that affect these goals are brought forth. In the second

session the information needed about these CSFs and a set of measures, of how and where to obtain the information, are established. The measures are treated as directions where to go in the planning process of the information system, i.e. where and how information should be collected and treated.

It is important to a manager to determine his goals but equally important to determine those variables that will affect the achievement of his goals, failure or success. These critical key variables, made explicit, should receive constant attention from the manager, i.e. have their current status continually measured.

CSFs are related to a specific individual in his specific situation. These must be tailored to the industry and company. These will vary, manager to manager, depending on position within the hierarchy of the organization. The CSFs will change when the environment of the industry changes, the position of the company within the industry changes and when new problems arises before the management [9].

Bullen and Rockart [7] Said CSFs do not have a standard set of measures, like key indicators, which can be applied to everything within the organization. These are not factors which solely take into consideration historical, aggregated or accounted information. CSFs are those specific variables of main eight importances to a specific manager at a specific point of time. These demand specific situational measures.

CSFs have been found to arise from five different sources:

▶ Industrial

The industry in itself hosts a set of CSFs which are defined by the characteristics of the industry. Each company within the industry must take these into consideration.

▶ Competitive and positional

Each company is in an individual situation within the industry depending on its history, geographical situation and competitive strategy. These dependencies will surely dictate some of the CSFs.

▶ Environmental

From environmental sources eminates those factors from areas which a company has little or no control of. Such as fluctuations of the economy or national politics. There could well be, for some companies, factors like different trends and energy sources.

▶ Temporal

CSFs arising from temporal sources are factors that become critical for a period of time and then decline in importance, e.g. breakdown of a firm's major computer system.

▶ Managerial

Depending on the manager's functional situation different CSFs will be generated, e.g. a manager concerned with economics will certainly not be concerned with those of a production manager.

These sources were discovered by Rockart (1979) in his early studies and have been acknowledge in a later study made by Rockart and Bullen (1981).

They classified CSFs in three dimensions; internal CSFs versus external CSFs, monitoring CSFs versus building/adaptive CSFs and the above mentioned five sources. These ways of classifying the CSFs are useful for an analyst in that they form a pattern that shows what the manager's world view looks like.

The first classification, internal versus external, meaning that internal CSFs are related to the manager's department or the staff of people he controls, i.e. CSFs

related to issues and situation within the managers control. External CSFs are those which most often are beyond the managerial influence such as the price of raw material.

The second classification, monitoring versus building/adaptive, meaning how the manager is related to his function. If he is concerned a lot with the performance of his department and puts a great amount of effort in guiding and measuring that performance the manager is monitoring and thus have CSFs related to monitoring. On the other hand a manager who is much concerned about future planning and changes is then building/adapting. Thus being concerned with CSFs related to building/adapting. A manager is **a mix of both but often tends towards one or the other**. The classification can help to visualize what kind of CSFs a manager is concerned with. From an individual manager's perspective he has his own CSFs that must be paid attention to from the company's perspective four hierarchical levels of CSFs can be discerned: industrial, corporative, sub-organizational and individual.

Industrial CSFs affects every organization within an industry in its development of strategies, objectives and goals. Strategies, objectives and goals developed by a company leads to a specific set of corporate CSFs. Every corporation's set of CSFs are unique to its own circumstances.

Corporative CSFs then becomes the input to a determination process for each suborganization within the corporate. Analysis of corporative strategies, objectives, goals and CSFs including environmental and temporal factors leads to a new set of CSFs for each suborganization.

The process can continue as deep as there are levels within the hierarchy. All sub organizations are affected in their development of strategies, objectives and goals by the temporal and the environmental CSFs as well as those from higher levels.

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Every manager at every level in the organization has specific CSFs that are determined by the role of the manager and the temporal factors. The above discussed is summarized in figure 2.1 below.
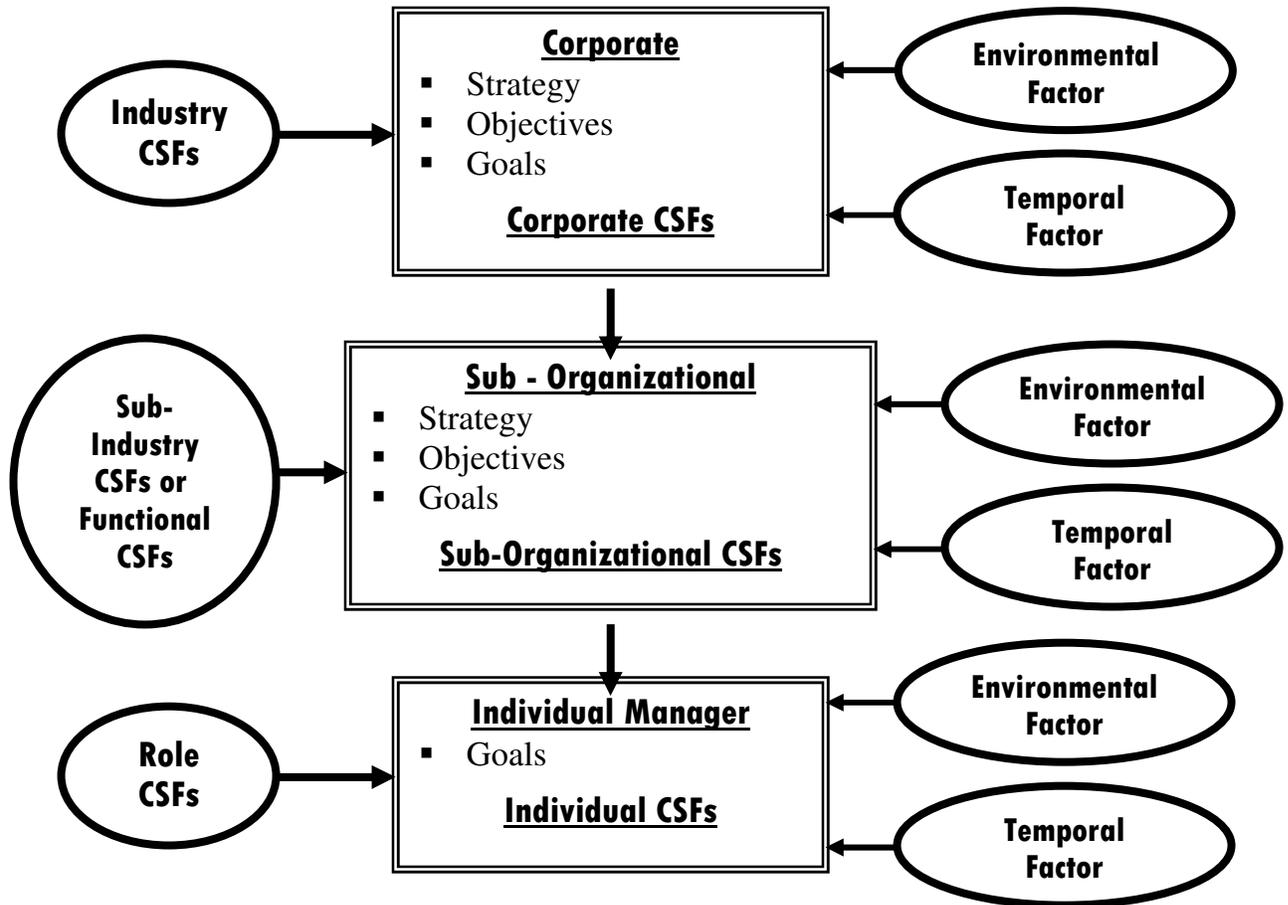

Figure 2.1 from "A Primer on Critical Success Factors" by C.V. Bullen and J.F. Rockart, 1981, Sloan School of Management, June.

The CSFs technique has been widely used in many businesses and technology related contexts for over four decades and its use is still common. In the context of this research, CSFs theory will be used to pinpoint some areas that are critical for success of the e-banking. The following are some of the most critical success factors of the Internet based services (with specific reference to e-banking) reported in the literature. These factors formed the basis for questions included in our data

collection instrument. Of the internal factors, most important is efficient and very quick customer service.

Legislation has increased customers' rights and technology and competition have increased their choice of products and providers. The increasing amounts of information on the Internet and changes in social behavior have decreased the loyalty factor considerably. These changes will result in growth in users with sophisticated needs [27].

To succeed in the e-banking arena, companies need to transform their internal foundations to be effective because of the reasons mentioned in previous paragraphs. Current business designs and organizational models are insufficient to meet the challenges of doing business in the e-commerce era [17]. Therefore one critical issue is re-engineering of the business processes which also include technological processes [17]. Security, which may include protection of consumers' personal data and safe transactions to prevent frauds, is paramount for the growth of any sort of online trade, including e-banking. This factor has been cited as very critical by Enos [18], Turban et al.,[60] and Regan and Macaluso [48]. Security in this context includes secure transactions as well as secure front end and back end systems.

Pinto and Slevin [45] published a major research study on CSF within project oriented environments. In their research, 418 project managers were requested to evaluate the importance of different factors relating to project success. The research identified 10 CSFs, including factors such as: top management support, project planning and customer involvement.

Many researchers followed this line of investigation to identify specific CSF for different types of projects. Cooper and Klein Schmidt [12] concentrated on the identification of CSF for new product development, including a defined strategy and

adequate R&D spending. Lester [37] found a different set of CSF for new product development projects, among which were senior management commitment, organizational structure and risk management. The Standish Group (Johnson et al. 2001) found management support, customer involvement and project planning among CSF for software projects. Abdel-Hamid et al. [1] found that defining the project team with specific project goals is a critical success factor in software organizations. The list of CSF literature also includes sources, such as Cooke-Davies (2001), Reel (1999), Freeman and Beale (1992), Soliman et al. (2001) and many others.

Table 2.1 compares CSF in selected project literature, sorted by the frequency of quotation of each success factor.

Table 2.1 Frequencies of CSFs in Project literature

Critical Success Factor	Literatura Source									
	1	2	3	4	5	6	7	8	9	∑
Project plan	+	-	+	+	+	-	+	+	+	7
Top management support	+	+	+	+	-	-	+	+	-	6
Personnel recruitment	+	+	+	+	+	-	-	+	-	6
Monitoring and feedback	+	-	-	+	+	-	+	+	+	6
Customer involvement	+	-	+	-	-	+	+	-	+	5
Project requirement and objectives	+	-	+	-	+	+	-	+	-	5
Adequate spending	-	+	-	+	+	+	+	-	-	5
Technical tasks	+	-	-	+	+	+	-	-	-	4
Communication	+	-	-	+	+	-	+	-	-	4
Project strategy	-	+	+	-	-	-	-	+	-	3
Trouble-shooting	+	-	-	-	-	+	-	-	-	2
High-quality processes	-	+	-	+	-	-	-	-	-	2
Ownership	-	-	+	+	-	-	-	-	-	2
Goal commitment of project team	-	-	-	+	+	-	-	-	-	2
Customer acceptance	+	-	-	-	-	-	-	-	-	1
Realistic expectations	-	-	+	-	-	-	-	-	-	1
Smaller project milestones	-	-	+	-	-	-	-	-	-	1
On-site project manager	-	-	-	-	+	-	-	-	-	1
Politics	-	-	-	-	-	+	-	-	-	1
Logistics requirements	-	-	-	-	-	-	+	-	-	1

Source: (**1**) Pinto and Slevin 1988; (**2**) Cooper and Kleinschmidt 1995; (**3**) Johnson et al. 2001.

2.2 Electronic Banking

Electronic banking is the automated delivery of new and traditional banking products and services directly to customers through electronic, interactive communication channels. Electronic banking includes the systems that enable financial institution customers, individuals or businesses, to access accounts, transact business, or obtain information on financial products and services through a public or private network, including the Internet. It should be noted that electronic banking is a bigger platform than just banking via the Internet. Electronic banking can also be defined as a variety of platforms such as Internet banking (or online banking), telephone banking, TV-based banking, mobile phone banking, and PC banking (or offline banking) whereby customers access these services using an intelligent electronic device, like a personal computer (PC), personal digital assistant (PDA), automated teller machine (ATM), point of sale (POS), kiosk, or Touch Tone telephone.

2.2.1. The History of Electronic Banking

Electronic innovation in banking can be traced back to the 1970s when the computerization of financial institutions gained momentum [43]. However, a visible presence of this was evident to the customers since 1981, with the introduction of the automatic teller machine (ATM). Innovative banking has grown since then, aided by technological developments in the telecommunications and Information Technology industry. The early decade of the 1990s saw the emergence of automated voice response (AVR) technology. By using the AVR

technology, banks could offer telephone banking facilities for financial services. With further advancements in technology, banks were able to offer services through personal computers owned and operated by customers at their convenience, through the use of Intranet proprietary software. The users of these services were, however, mainly corporate customers rather than retail ones by Sadiq and Shanmugham [53],. The Security First Network Bank was the first Internet banking in the world that was built in 1995, USA. After that some famous banks introduced their Internet banking one after another, such as Citibank and Bank of America.

2.2.2. Benefits of Electronic Banking

Electronic banking services have provided numerous benefits for banks, customers and Economics.

2.2.2.1. Benefits from the bank point of view

The first benefits for the banks offering Internet banking services is better branding and better responsiveness to the market. Those banks that would offer such services would be perceived as leaders in technology implementation. Therefore, they would enjoy a better brand image. The other benefits are possible to measure in monetary terms. The main goal of every company is to maximize profits for its owners and banks are not any exception. Automated e-banking services offer a perfect opportunity for maximizing profits.

According to a survey by Booz, Allen and Hamilton, an estimated cost providing the routine business of a full service branch in USA is $1.07 per transaction, as compared to 54 cents for telephone banking, 27 cents for ATM (Automatic Teller Machine) banking and 1,5 cents for Internet banking by Pyun et

[46]. In Nordea Bank, Finland, one online transaction costs the bank an average of just 11 cents, compared to $1 for a transaction in the branch. The difference in a net cost between the USA and Finnish banks can be explained by smaller population in Finland and the scale effect in case of the USA.

Comparing this information with price list fees, allows assuming the high profitability of e-channel banking services for banks. On the fee side (or income side from the bank point of view), average payment in Internet bank cost 4 times less, than payment in branch. On the actual cost side (or cost side from the bank point of view), payment in Internet bank cost 8 times less than payment in branch.

Some controversial explanations for this pricing strategy can be proposed:

1. The difference in actual net cost and actual transaction fees paid by customer is used by Estonian banks to cross subsidization of delivery channels.

2. Banks earn additional profits on transactions concluded via electronic channels.

3. The profitability of payments is not a priority for banks. Cross-subsidization between different services groups is used, for example profits from lending activity compensate poor profitability from payment services.

2.2.2.2 Benefits from the customers point of view

The main benefit from the bank customers' point of view is significant saving of time by the automation of banking services processing and introduction of an easy maintenance tools for managing customer's money. The main advantages of e-banking for corporate customers are as follows [53]:

- Reduced costs in accessing and using the banking services.
- Increased comfort and timesaving — transactions can be made 24 hours a day, without requiring the physical interaction with the bank.
- Quick and continuous access to information. Corporations will have easier

access to information as, they can check on multiple accounts at the click of a button.

- Better cash management. E-banking facilities speed up cash cycle and increases efficiency of business processes as large variety of cash management instruments is available on Internet sites of banks.

Private customers seek slightly different kind of benefits from e-banking. In the study on online banking drivers Aladwani has found, that providing faster, easier and more reliable services to customers were amongst the top drivers of e-banking development, The main benefits from e-banking for private customers are as follows [53]:

- Reduced costs. This is in terms of the cost of availing and using the various banking products and services.
- Convenience. All the banking transactions can be performed from the comfort of the home or office or from the place a customer wants to.
- Speed. The response of the medium is very fast; therefore customers can actually wait till the last minute before concluding a fund transfer.
- Funds management. Customers can download their history of different accounts and do a "what-if" analysis on their own PC before affecting any transaction on the web. This will lead to better funds management.

2.2.2.3. Economic benefits

The impact of the New Economy on the entire economic growth has been studied in several research projects. For example, the contribution of the use of information communication technology to growth of output in the Finnish market sector has increased from 0.3 percentage points in early 1990s to 0.7 points in late 1990s. However, unlike the US, there has been no acceleration in the trend rate of labor productivity in Finland.

2.3. Adoption of Electronic Banking

Customers are invariably the best source of ideas. Innovations have commercial value only if they meet the needs of customers better than current products. Innovative customers-those individuals who are at the forefront in buying new products or applying new ideas- are the most valuable sources. Such customers see problems and opportunities well ahead of typical buyers. But before customers can adopt an innovation, they must learn about it. This learning is called the — adoption process"[52] and consists of five stages as follow:

- **Awareness:** First the individual is exposed to the innovation but lacks complete information about it.
- **Interest:** Next the individual becomes interested in the new idea and seeks additional information about it.
- **Evaluation:** Individual mentally applies the innovation to his present and anticipated future situation, and then decides whether or not to try it.
- **Trial:** The individual makes full use of the innovation.
- **Adoption:** The individual decides to continue the full use of the innovation.

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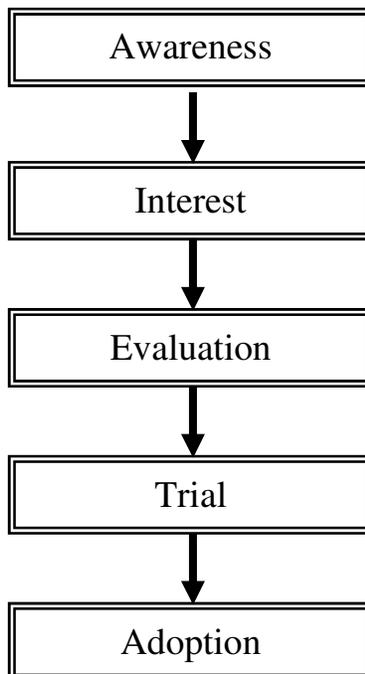
Figure2.2: Adoption Process

The literature on the adoption of innovation and specifically adoption of electronic banking services can be found in a broad range of academic research. These studies suggest that customers'adoption of electronic banking technologies may be related to a number of factors, some associated with the characteristics of the product or service and others associated with the characteristics of the customers [38,33].

2.3.1. Theory of Diffusion of Innovation

Rogers'[52] diffusion of innovation theory is a popular model used in explaining user adoption of new technologies. He defines diffusion as ⸺ the process by which an innovation is communicated through certain channels over time among the members of a social society". He also defines innovation broadly as ⸺ an idea, practice, or object that is perceived as new by an individual or other unit of adoption". An innovation can be described in terms of a number of different perceived attributes. According to the perceived attribute theory of Rogers [52], potential adopters evaluate an innovation based on innovation attributes such as relative advantage, compatibility, complexity, trialability and observability, which are described as below:

"**Relative advantage** is the degree to which consumers perceive a new product or service as different form and better than its substitutes. Relative advantage is an important factor in determining adoption of new innovations" [62]. In general, perceived relative advantage of an innovation is positively related to its rate of adoption (Rogers, 1995). In the case of electronic banking, savings of

time, money and convenience have been cited as relative advantages.

"**Compatibility** is the extent to which a new product or service is consistent with consumers' needs, beliefs, values, experiences, and habits". Tornatzky and Klein's study (1982) [62] states that an innovation is more likely to be adopted when it is compatible with individuals'job responsibilities and value system. The compatibility of an innovation, based on the perception of the members of a social system, is positively related to its rate of adoption. In the case of electronic banking, we must consider the degree to which a given technology fits in with the banking behavior of a consumer, or the way in which they have historically managed their finances.

"**Complexity** is the extent to which consumers perceive a new innovation as difficult to understand or use. Past research has indicated that an innovation with substantial complexity requires more technical skills and needs greater implementation and operational efforts to increase its chance of adoption [15]. Rogers suggests that the complexity of an innovation, according to the perception of members of a social system, is negatively related to its rate of adoption. For consumers without previous computer experience, or for those that believe that electronic banking is difficult to use, adoption of these innovations may be hindered.

"**Observability** is the extent to which an innovation is visible and communicable to consumers. The observability of an innovation, based on the perception of the members of a social system, is positively related to its rate of adoption. In case of electronic banking for example, seeing ATMs on the street corners may make this technology more observable than telephone banking which is conducted inside one's own home [33].

"**Trialability** refers to the ability of consumers to experiment with a new innovation and evaluate its benefits. Trialability can decrease uncertainty about a new idea and is positively related to the rate of adoption. In case of electronic banking, the extent to which various financial institutions offer electronic banking to their customers impacts on the trialability of the innovation. In addition, consumers who must supply a myriad of personal information before being permitted to use the innovation may be inhibited from adopting a given electronic banking service [33].

All of the attributes described above can affect the adoption rate of an innovation. As mentioned, perceived relative advantage, compatibility, trialability and observability of an innovation are positively related to its rate of adoption, while the perceived complexity of an innovation is negatively related to its rate of adoption [52].

A further refinement of Rogers' original model, done by Lockett and Littler in 1997 [38], added the dimensions of perceived risk and cost to the model. They believed that the decision to adopt an innovation is surrounded by uncertainty. Uncertainty does play a role in adoption decisions in the form of perceived risk. They measured the perceived risk in terms of the perceived risk of error and the risk of security in compare with conducting banking through the bank branch. The cost of an innovation consists of three components: purchase cost, switching cost and usage cost [24]. Perceived risk and cost are negatively related to the rate of adoption [38].

2.3.2. Technology Acceptance Model (TAM)

The technology acceptance model (TAM), proposed by Davis (1989) [14] is

one of the most utilized models in studying information system acceptance [39,25]. According to TAM, perceived usefulness (PU) and perceived ease of use (PEOU) influence one's attitude towards system usage. Attitude is defined as an individual's positive or negative feeling about performing a target behavior. Davis defines perceived usefulness (PU), as ― the degree to which a person believes that using a particular system would enhance his or her job performance".

He also defines Perceived ease of use (PEOU) as ― the degree to which a person believes that using a particular system would be free of effort," in terms of physical and mental effort as well as ease of learning. These two beliefs, according to TAM, determine one's intention to use technology. System acceptance will suffer if users do not perceive a system as useful and easy to use. TAM has emerged as a salient and powerful model that can be used to predict potential Information system usage by measuring users' beliefs after they are exposed to the system even for a short period of time through training, prototype or mock-up models.

Davis' results indicated that while ease of use is clearly significant, usefulness is even more important in determining user acceptance. The TAM has been tested widely with different samples in different situations and proved to be a valid and reliable model in explaining information system acceptance and usage [39].
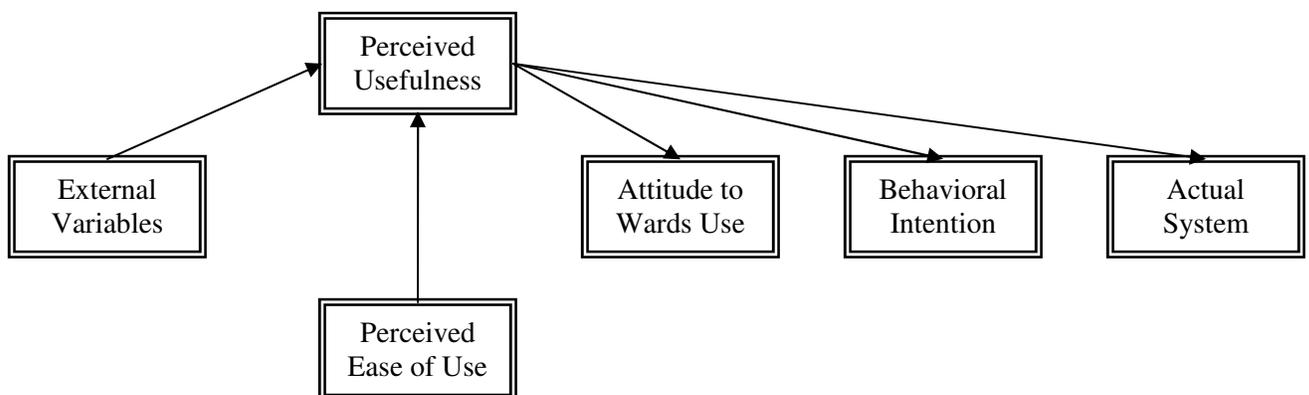
Figure 2.3: Technology Acceptance Mode

2.3.3. Characteristics of the new technology

According to the mentioned theories, the model of both Davis and Rogers are widely supported and followed, and are also complementary [50]. Davis's two main constructs can fit quite nicely within the Rogers model. Specifically, usefulness is similar to Roger's factor of relative advantage and ease of use can be considered as the exact opposite of Roger's factor of complexity. Therefore characteristics of the new technology, which are used in this study, can be stated as relative advantage (usefulness), compatibility, complexity (ease of use), observability, trialability, perceived risk and cost.

2.3.4. Demographic Characteristics

Innovativeness is the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a social system [52]. There are five adopter categories, or classifications of the members of a social system on the basis of their innovativeness: innovators, early adopters, early majority, late majority, and laggards. Figure 2.4 shows the adopter categories in diffusion process and describes the behavior of consumers as they purchase new products and services.

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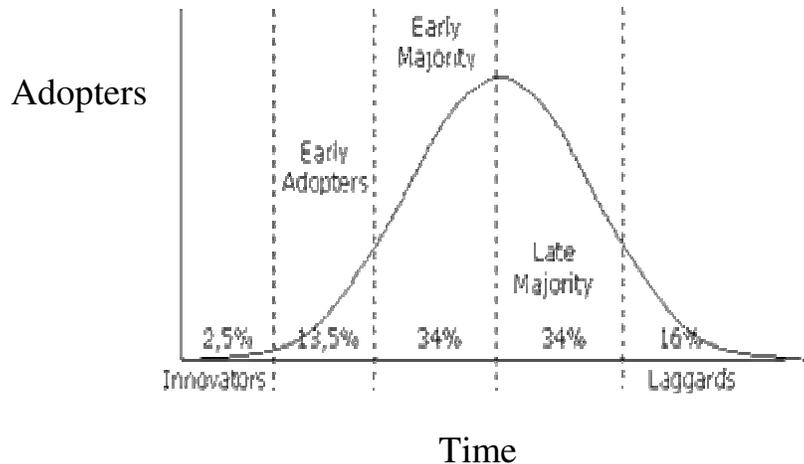
Figure 2.4: Diffusion Process

Innovators: These are the first to adopt the new product. Technically, innovators are defined as the first 2.5 percent of customers. Innovators are very venturesome- they are willing to take risks in trying new ideas. They are important first as the initial target segment for an innovative product. Second, they personally influence later adopters.

Early adopters: These are the next segment to adopt the product, technically 13.5 percent of the market. Early adopters tend to be opinion leaders and, since personal influence plays a large role in adoption of new products, they are particularly important.

Early majority: The next group, 34 percent, completes the first half of the potential market for the innovation. The early majority are deliberate-they adopt new ideas before the average person, although they are rarely leaders.

Late majority: These are more skeptical about new products and harder to persuade. Eventually they adopt because of economic necessity or social pressure.

Laggards: The last 16 percent of the market are the most reluctant,

and the most economically incapable of adopting the innovation. These are described as tradition bound- they are suspicious of changes, mix with other tradition-bound people, and adopt the innovation only when it takes on a measure of tradition itself.

Several studies have linked consumer characteristics to the adoption process. Age, income and education all have found to be directly related to the adoption of technology [16,36). Gender has not been found to have a direct effect on adoption of technology in general [61,25], but men and women appear to have different acceptance rates of specific computer technologies, with men more likely to adopt [25]. Also a set of demographic characteristics of adopter and non-adopters has been mentioned from different research. Adopters tend to have the following characteristics compared to non- adopters [15,24,52,67]: more educated and higher level of cognition and intelligence; more affluent; more favorable attitude towards risk; more active social participation; greater opinion leadership and younger. Lee and Lee's [36] study shows that these general characteristics also apply to adopter of electronic banking profile. Specifically, adopters of ATMs, bill payment, debit cards, and smart cards tend to be more highly educated, more affluent, and younger.

2.3 Decision Support Systems

Decision support systems are gaining an increased popularity in various domains, including business, engineering, the military, and medicine. They are especially valuable in situations in which the amount of available information is prohibitive for the intuition of an unaided human decision maker and in which precision and optimality are of importance.

Decision support systems can aid human cognitive deficiencies by integrating various sources of information, providing intelligent access to relevant knowledge,

and aiding the process of structuring decisions. They can also support choice among well-defined alternatives and build on formal approaches, such as the methods of engineering economics, operations research, statistics, and decision theory. They can also employ artificial intelligence methods to address heuristically problems that are intractable by formal techniques. Proper application of decision-making tools increases productivity, efficiency, and effectiveness and gives many businesses a comparative advantage over their competitors, allowing them to make optimal choices for technological processes and their parameters, planning business operations, logistics, or investments.

While it is difficult to overestimate the importance of various computer-based tools that are relevant to decision making (e.g., databases, planning software, and spreadsheets), this article focuses primarily on the core of a DSS, the part that directly supports modeling decision problems and identifies best alternatives. We will briefly discuss the characteristics of decision problems and how decision making can be supported by computer programs. We then cover various components of DSSs and the role that they play in decision support. We will also introduce an emergent class of normative systems (i.e., DSSs based on sound theoretical principles), and in particular, decision - analytic DSSs. Finally, we will review issues related to user interfaces to DSSs and stress the importance of user interfaces to the ultimate quality of decisions aided by computer programs.

Since the first electronic general-purpose computer was put into full operation in the early 1940s, data-processing techniques have been continuously advancing. It was in the late 1950s that many organizations began to utilize transaction processing systems (TPS) or electronic data processing (EDP) systems to automate routine clerical tasks such as payroll, inventory and billing. In the 1960s, we witnessed the emergence of management information systems (MIS) with the development of database management systems for collecting; organizing,

storing and retrieving data.

MIS were developed to extract valuable management information by aggregating and summarizing massive amounts of transaction data and allowing user-interactive managerial queries. The inclusion of simple modelling and statistical methods as a component of MIS permits computer systems to make routine (structured) decisions. It was not until 1970 that scholars began to recognize the important roles computer-based information systems (CBIS) play in supporting managers in their semi-structured or unstructured decision-making activities.

Since the 1970s, study of DSS has become an essential part of CBIS. In the 1980s, we witnessed another wave of information technologies, the artificial intelligence-based expert systems (ES), which are to replace and mimic human decision makers in making repetitive decisions in a narrow domain.

During the mid 1980s, executive information systems (EIS) emerged as an important tool to serve the information needs of executives. EIS provides timely and critical information which has been filtered and compressed for tracking and control purposes. The latest addition to CBIS is artificial neural networks (ANN). Neural network computing involves building intelligent systems to mimic human brain functions. ANN attempt to achieve knowledge processing based on the parallel processing method of human brains, pattern recognition based on experience, and fast retrieval of massive amounts of data. Fuzzy logic, genetic algorithm, and intelligent agents are some of other intelligent techniques that can be used along with neural networks to improve the effectiveness of personal, group, and organizational decision making.

Table 2.2 summarizes an evolutionary pattern of CBIS and shows the focus of a CBIS from data and information to knowledge and wisdom. The critical

information provided by EIS can be used to identify various symptoms of malfunctioning organizational activities in each functional department.

These symptoms can be the basis of diagnosing managerial problems. Decision support systems (DSS) are human–computer decision-making systems to support managerial judgements, and intuitions to solve managerial problems by providing necessary information, generating, evaluating and suggesting decision alternatives. Most organizational problems need a combination of quantitative and qualitative data processing. EIS are to deal with those organizational problems that can be better solved by qualitative data processing. Other subsets of CBIS such as TPS and MIS provide data into DSS to be processed by DSS models and managerial judgements.

Table 2.2 Taxonomy of Knowledge

		Technology	Analogy Management	Metaphor
Data	EDP	Elements: H2O, yeast bacteria, Starch molecules	Muddling through	KNOW - NOTHING
Information	MIS	Ingredients: Flour, sugar, spices, fixed recipe for bread only (OR/MS) type	Efficiency (Measurement + search)	KNOW - HOW
Knowledge	DSS, ESS	Choose among different recipes for bread	Effectiveness (decision making)	KNOW – WHAT
Wisdom	HSM, MSS	Why bread and not croissant	Explicability (judgment)	KNOW – WHY

Drawing on various definitions that have been suggested [5,30,58] a DSS can be described as a computer-based interactive human – computer decision-making system that:

1. Supports decision makers rather than replaces them.

2. Utilizes data and models.

3. Solves problems with varying degrees of structure:

    ▪ Non-structured (unstructured or ill-structured).

    ▪ Semi-structured.

    ▪ Semi -structured and unstructured.

4. Focuses on effectiveness rather than efficiency in decision processes (facilitating decision processes).

Typical application areas of DSSs are management and planning in business, health care, the military, and any area in which management will encounter complex decision situations. Decision support systems are typically used for strategic and tactical decisions faced by upper-level management decisions with a reasonably low frequency and high potential consequences in which the time taken for thinking through and modeling the problem pays generously in the long run.

There are three fundamental components of DSSs [4]:

▪ Database management system (DBMS). A DBMS serves as a data bank for the DSS. It stores large quantities of data that are relevant to the class of problems for which the DSS has been designed and provides logical data structures (as opposed to the physical data structures) with which the users interact. A DBMS separates the users from the physical aspects of the database structure and processing. It should also be capable of informing the user of the types of data that are available and how to gain access to them.

▪ Model-base management system (MBMS). The role of MBMS is analogous to that of a DBMS. Its primary function is providing independence between specific models that are used in a DSS from the applications that use them. The purpose of an MBMS is to transform data from the DBMS into

information that is useful in decision making. Since many problems that the user of a DSS will cope with may be unstructured, the MBMS should also be capable of assisting the user in model building.

▪ Dialog generation and management system (DGMS). The main product of an interaction with a DSS is insight. As their users are often managers who are not computer-trained, DSSs need to be equipped with intuitive and easy-to-use interfaces. These interfaces aid in model building, but also in interaction with the model, such as gaining insight and recommendations from it. The primary responsibility of a DGMS is to enhance the ability of the system user to utilize and benefit from the DSS. In the remainder of this article, we will use the broader term user interface rather than DGMS.

Whether or not one trusts the quality of human intuitive reasoning strategies has a profound impact on one's view of the philosophical and technical foundations of DSSs. There are two distinct approaches to supporting decision making. **The first** aims at building support procedures or systems that imitate human experts. The most prominent member of this class of DSSs is expert systems, computer programs based on rules elicited from human domain experts that imitate reasoning of a human expert in a given domain. Expert systems are often capable of supporting decision making in that domain at a level comparable to human experts. While they are exible and often able to address complex decision problems, they are based on intuitive human reasoning and lack soundness and formal guarantees with respect to the theoretical reliability of their results. The danger of the expert system approach, increasingly appreciated by DSS builders, is that along with imitating human thinking and its efficient heuristic principles, we may also imitate its undesirable flaws [4].

The second approach is based on the assumption that the most reliable method of dealing with complex decisions is through a small set of normatively sound principles of how decisions should be made. While heuristic methods and ad hoc reasoning schemes that imitate human cognition may in many domains perform well, most decision makers will be reluctant to rely on them whenever the cost of making an error is high. To give an extreme example, few people would choose to fly airplanes built using heuristic principles over airplanes built using the laws of aerodynamics enhanced with probabilistic reliability analysis. Application of formal methods in DSSs makes these systems philosophically distinct from those based on ad hoc heuristic artificial intelligence methods, such as rule-based systems. The goal of a DSS, according to this view, is to support unaided human intuition, just as the goal of using a calculator is to aid human's limited capacity for mental arithmetic.

An emergent class of DSSs known as decision-analytic DSSs applies the principles of decision theory, probability theory, and decision analysis to their decision models. Decision theory is an axiomatic theory of decision making that is built on a small set of axioms of rational decision making. It expresses uncertainty in terms of probabilities and preferences in terms of utilities. These are combined using the operation of mathematical expectation. The attractiveness of probability theory, as formalism for handling uncertainty in DSSs, lies in its soundness and its guarantees concerning long-term performance. Probability theory is often viewed as the gold standard for rationality in reasoning under uncertainty. Following its axioms offers protection from some elementary inconsistencies. Their violation, on the other hand, can be demonstrated to lead to sure losses.

Decision analysis is the art and science of applying decision theory to real-world problems. It includes a wealth of techniques for model construction, such as methods for elicitation of model structure and probability distributions that allow

minimization of human bias, methods for checking the sensitivity of a model to imprecision in the data, computing the value of obtaining additional information, and presentation of results.

These methods have been under continuous scrutiny by psychologists working in the domain of behavioral decision theory and have proven to cope reasonably well with the dangers related to human judgmental biases.

The first two approaches are suited for slightly different applications. The customized model generation approach is an attempt to automate the most laborious part of decision making, structuring a problem, so far done with significant assistance from trained decision analysts. A session with the program that assists the decision maker in building an influence diagram is laborious. This makes the customized model generation approach particularly suitable for decision problems that are infrequent and serious enough to be treated individually. Because in the static domain model approach an existing domain model needs to be customized by the case data only, the decision-making cycle is rather short. This makes it particularly suitable for those decisions that are highly repetitive and need to be made under time constraints.

A practical system can combine the three approaches. A static domain model can be slightly customized for a case that needs individual treatment. Once completed, a customized model can be blended into the large static model. Learning systems can support both the static and the customized model approach. On the other hand, the learning process can be greatly enhanced by prior knowledge from domain experts or by a prior model.

In many business and engineering problems, interactions among model variables can be described by equations which, when solved simultaneously, can be used to predict the effect of decisions on the system, and hence support decision making.

One special type of simultaneous equation model is known as the structural equation model (SEM), which has been a popular method of representing systems in econometrics. An equation is structural if it describes unique, independent causal mechanism acting in the system. Structural equations are based on expert knowledge of the system combined with theoretical considerations. Structural equations allow for a natural, modular description of a system each equation represents its individual component, a separable and independent mechanism acting in the system yet, the main advantage of having a structural model is, as explicated by Simon [1953], that it includes causal information and aids predictions of the effects of external interventions. In addition, the causal structure of a structural equation model can be represented graphically, which allows for combining them with decision-analytic graphical models in practical systems.

Structural equation models offer significant advantages for policy making. Often a decision maker confronted with a complex system needs to decide not only the values of policy variables but also which variables should be manipulated. A change in the set of policy variables has a profound impact on the structure of the problem and on how their values will propagate through the system. The user determines which variables are policy variables and which are determined within the model. A change in the SEMs or the set of policy variables can be reflected by a rapid restructuring of the model and predictions involving this new structure.

Kumar [34] Identifies Sub-specialties for Decision Support Systems based on organizational perspectives:

1. Decision support system design

DSS design is the process of identifying the key decisions through decision analysis, specifying requirements of each DSS component to support key decisions identified through decision analysis. DSS are designed and implemented to support

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organizational as well as individual decision making. Without a detailed understanding of decision-making behaviour in organizations, 'decision support is close to meaningless as a concept. Organizational scientists classify organizational decision making in terms of several schools of thought: (1) the rational model which focuses on the selection of the most efficient alternatives, with the assumption of a rational, completely informed single decision maker; (2) the organizational process model which stresses the compartmentalization of the various units in any organization; (3) the satisficing model which reflects 'bounded rationality' to find an acceptable, good enough solution; and (4) other models.

2. Decision support system Implementation

Use of some computer-based information systems such as TPS and MIS are, in most cases, mandatory. But decision support systems are voluntary systems. In regard to voluntary systems, DSS implementation research has been important for ascertaining the influence of success factors of DSS implementations. DSS implementation researchers are investigating the relationship between user-related factors and implementation success. User factors include cognitive style (the characteristic ways individuals process and utilize information to solve problems), personality (the cognitive structures maintained by individuals to facilitate adjustment to events and situations), demographics (age, sex and education), and user-situation variables (training, experiences and user involvement) [2]. Future implementation research should be directed toward the development of causal models of user-related implementation factors. Furthermore, it is suggested that DSS researchers shift the research focus from user-related factors to the contextual variables. An important assumption on which the DSS implementation research is based is that DSS are voluntary systems. A recent survey of DSS suggests that an increasing number of DSS have become a strategic tool for organizational survival [20].

Thus, these systems are no longer voluntary ones. Future DSS implementation research must take this changing nature of DSS from voluntary systems to mandatory survival tools. Consequently, individual differences, cognitive styles, personality, demographics, and user-situational variables may become less critical success factors. Shifting the focus of implementation research from user-related factors to task-related, organizational, and external environmental factors may be necessary to reflect the changing decision environment in which organization must survive and prosper [20].

3. Decision support system Evaluation:

Evaluation of DSS is concerned with analyzing costs and benefits of DSS before and after DSS development and implementation. The unique nature of DSS evaluation is that although some DSS provide substantial cost saving and profit increases, measurements of benefits of DSS have been problematic as quantification of the positive impacts of improved decision process is difficult. Therefore, DSS evaluation research deals with the following methodologies: decision outputs, changes in the decision process, changes in managers' concepts of the decision situation, procedural changes, cost/benefit analysis, service measures and managers' assessment of the system's value[30].

Decision making in the dynamic and rapidly evolving world is a major challenge. Decision making essentially involves the generation of a set of criteria and the choice of the most appropriate criteria for execution by answering the following important questions: what decisions must be made, who will make them, how and what resources will be allocated, and how will the situation will be measured and revisited in the dynamic environment in which the system will be operating. Also, in large organizations such as a multinational business group, it is imperative to decide what principles, style and guidelines for decision-making are

appropriate for the organization. It is essential to decide what structure will govern the process of decision making. Structured methods utilizing the theoretical and practical advances made in the fields of mathematics, operations research, cybernetics, artificial intelligence, etc, have become an important aid to decision making in all sectors. The theoretical underpinnings of such decision aids is the principle of optimization, which tries to maximize or minimize certain combinations of conflicting variables representing the matrix of interest for the decision maker under constraints imposed by the real life situation. The empirical, common sense or subjective decision making of the past graduated to the field of operations research based on the principle of optimization and has resulted in enhanced decision aids at all levels of an organization. Strategic, operational and tactical agility in quickly responding with maximum concentration of effort is the absolute requirement. However, at the strategic levels these techniques have not been able to make a greater impact. The problems in which stakes are extremely high, human perceptions and judgments are involved and whose solutions have long term repercussions, fall in the strategic level decision-making category. At this level problems are ill defined and are usually in terms that are uncertain, fuzzy and confusing. However, the existing problem-solving techniques based on sound mathematical principles require systematic and well-formed problems. To solve such problems with limited amounts of time and resources needs the balancing of many variables. This research will focus on applying the Analytic Hierarchy Process (AHP) for such strategic level decision-making problems. The Analytic Hierarchy Process (AHP) is a systematic approach developed in late 1970s to structure the experience, intuition, and heuristics-based decision making into a well-defined methodology on the basis of sound mathematical principles. The AHP is suited to quantitatively arrive at the decision in the strategic domain. It provides a formalized approach for creating solutions to decision-making problems, where the

economic justification of time invested in the decision-making process is reflected in the better quality solutions of the complex decision-making problems.

2.4 The Analytic Hierarchy Process – Background

The AHP is based on the experience gained by its developer,T.L. Saaty,while directing research projects in the US Arms Control and Disarmament Agency. It was developed as a reaction to the finding that there is a miserable lack of common, easily understood and easy-to-implement methodology to enable the taking of complex decisions. Since then, the simplicity and power of the AHP has led to its widespread use across multiple domains in every part of the world. The AHP has found use in business, government, social studies, R&D, defense and other domains involving decisions in which choice, prioritization or forecasting is needed. Owing to its simplicity and ease of use, the AHP has found ready acceptance by busy managers and decision-makers. It helps structure the decision-maker's thoughts and can help in organizing the problem in a manner that is simple to follow and analyze. Broad areas in which the AHP has been applied include alternative selection, resource allocation, forecasting, business process re-engineering, quality function deployment, balanced scorecard, benchmarking, public policy decisions, healthcare, and many more. Basically the AHP helps in structuring the complexity, measurement and synthesis of rankings. These features make it suitable for a wide variety of applications. The AHP has proved a theoretically sound and market-tested and accepted methodology. Its almost universal adoption as a new paradigm for decision-making coupled with its ease of implementation and understanding constitute its success. More than that, it has proved to be a methodology capable of producing results that agree with perceptions and expectations.

Theoretically the AHP is based on four axioms given by Saaty; these are:

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Axiom 1: The decision-maker can provide paired comparisons aij of two alternatives i and j corresponding to a criterion/sub-criterion on a ratio scale which is reciprocal.

Axiom 2: The decision-maker never judges one alternative to be infinitely better than another corresponding to a criterion, i.e. aij.

Axiom 3: The decision problem can be formulated as a hierarchy.

Axiom 4: All criteria/sub-criteria which have some impact on the given problem, are represented in the hierarchy in one go.

The AHP is analytic – mathematical and logical reasoning for arriving at the decision is the strength of the AHP. It helps in analyzing the decision problem on a logical footing and assists in converting decision-makers' intuition and gut feelings into numbers which can be openly questioned by others and can also be explained to others. The AHP structures the problem as a hierarchy – Hierarchic decomposition comes naturally to human beings. Reducing the complex problem into sub-problems to be tackled one at a time is the fundamental way that human decision-makers have worked.

The AHP defines a process for decision-making – Formal processes for decision-making are the need of the hour. Decisions, especially collective ones, need to evolve. A process is required that will incorporate the decision-maker's inputs, revisions and learning's and communicate them to others so as to reach a collective decision. The AHP has been created to formalize the process and place it on a scientific footing. The AHP helps in aiding the natural decision-making process [41].

CHAPTER 3

STUDY MODEL AND METHODOLOGY

In this chapter the researcher will present briefly the study design, then introduce the subjects, after that the instrument designs, the data collection, and at last the data analysis procedure.

3.1 STUDY DESIGN AND THE PROPOSED MODEL

Descriptive research involves collecting data in order to test hypotheses or to answer questions concerning the current status of the subject (s) of a study.

Typical descriptive studies are concerned with the assessment of attitudes, opinions, demographic information, conditions, and procedures. The research design chosen for the study is survey research and Programable Decision Support System. A survey is an attempt to collect data from members of a population in order to determine the current status of that population with respect to one or more variables. Survey research at its best can provide very valuable data. It represents

considerable more than asking questions and reporting answers; it involves careful design and execution of each of the components of the research process.

The researcher will design adapt survey instrument and Programable Decision Support System that could be administered to selected subjects.

The purpose of the survey instrument was to collect data about the respondents about Critical Success Factors for E-banking Adoption in Jordan, depending on a model that built by he researcher as shown follow:

The adoption of E-banking by a financial institution, as like any other innovation, isn't an easy process. Rather it depends on many factors: strategic, operational and technical factors.

The proposed model presented in Figure 3.1 summarizes the variables tht are retained and that will be used as the fundamental base in the development of our empirical study.

```
┌─────────────────────────────┐
│   Critical Success Factors  │
└─────────────────────────────┘
               │
               ▼
┌─────────────────────────────┐
│      Strategic Factors      │
├─────────────────────────────┤
│ ▪ Availability of  resoures │
│ ▪ Support from top management│
│ ▪ Organizational flexibility│
│ ▪ Re-engineering processes to web│
└─────────────────────────────┘

┌─────────────────────────────┐          ┌──────────────────────────┐
│     Operational Factors     │ ───────▶ │   E-banking adoption and │
├─────────────────────────────┤          │ implementation decision  │
│ ▪ Rapid delivery and Fast responsive│   └──────────────────────────┘
│   of services               │
│ ▪ 24-h availability of services│
│ ▪ Richness of website contents│
└─────────────────────────────┘

┌─────────────────────────────┐
│      Technical Factors      │
├─────────────────────────────┤
│ ▪ Systems and channels Integration│
│ ▪ Systems security          │
│ ▪ Technology infrastructure │
└─────────────────────────────┘
```

Figure 3.1: The conceptual model of CSFs and its impact on the adoption of e-banking (**The proposed model**).

The study will be carried out in two phases as following:

▶ First phase

The researcher will design a survey instrument that could be administered to selected subjects. The purpose of the survey instrument was to collect data about the CSFs which effect the e-banking adoption and implementation decision.

Data from the returned responses will collected for the analysis and conclusions of the study questions. The researcher will use the statistical package for the social sciences (SPSS) to analyze the data. Finally, the researcher will use the suitable statistical methods that consist of:

      1. Arithmetic mean and standard deviation.

      2. Sample regression analysis

The collected data of this phase will be used in the second phase as a database for DSS which the researcher will build.

▶ Second phase

In this phase; the output from the first phase will be used as an input to develop a weighting DSS and use it to help banks managers in making a successful e-banking adoption and implementation decision.

The CSFs as a result of the first phase will be the criteria that will shape the e-banking adoption decisions, however, banks have to determine their relative importance (i.e. weights) so that they can better identify which factors are strong and which factors are weak. The relative weights for each CSFs can be calculated using the Analytic Hierarchy Process (AHP). The AHP can compute the weights of CSFs based on two stepwise questions: First, questions are asked for comparing (pair-wise) the major CSFs (strategic, operational, and technical). Subsequently, questions are asked to compare (pair-wise) the sub-factors under each major factor. The AHP converts the pair-wise comparisons into the weights.

The AHP constructs a set of pair-wise comparisons as a square matrix A as Follows:

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ . & . & & . \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix}$$

Where aij is a relative value with respect to factor j of i; aij = 1/aji and aij = 1 if i=j ; and the computing of the (A) matrix produce a weights matrix called (w^T), then multiply the (A) by (w^T). To verify the level of logical inconsistency of matrix A; the consistency index (CI) is calculated by finding the summation of the entry in the (A w^T) devided by the summation of the entry in the (w^T), then the CI divided by the average random index from the empirical data. If the value of CI/RI is less

than 0.1, it is typically considered acceptable; larger values require the decision-maker to reduce the inconsistencies by revising judgments.

WEIGHTING DECISION SUPPORT SYSTEM:

In this research, we are going to develop the weighting decision support system (hereafter, WDSS) in order to retrieve the weights of a given number of neighbors nearest to a certain bank (so called proximate banks). This retrieval can help determine the weights of the CSFs for a particular corporate e-banking strategy; i.e. the weights of proximate banks can be useful as a reference. For this determination, WDSS employs 3- dimensional axes: strategic, operational, and technical. The WDSS enables us to identify which banks are the most similar to a particular one in terms of strategy, operational, and technical.

The WDSS can allow users to distinguish between successful and unsuccessful firms not only by providing the weights of the CSFs measures, but also by generating the perceived performance. Figure 3.2 depicts the architecture of the WDSS. The system provides multiple screens such as the search I/O (Input/Output) and the user interface. The search I/O screens allow users to enter a search condition and get the result. The user interface screens enable users to register their own application onto the database as a new case.
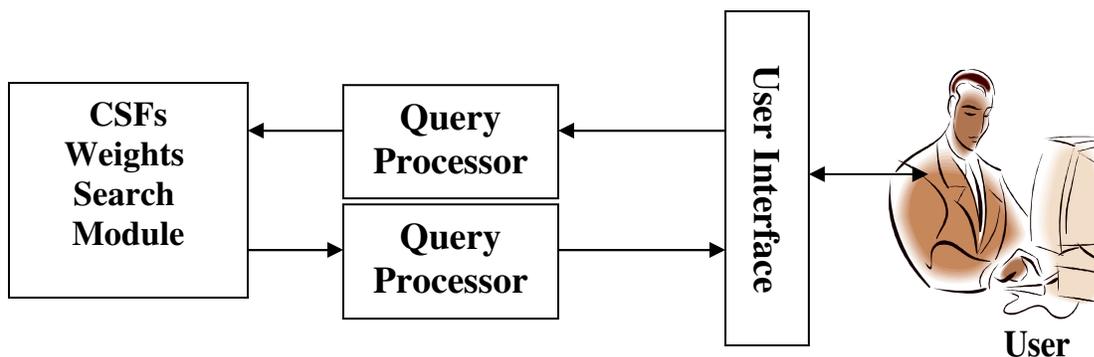
Figure 3.2: WDSS architecture

3.2 Subjects

To increase credibility in this study, it is important the sample will be chosen is representative of the population that the researcher will investigate. The societies of the study were the whole of Commercial Banks in Jordan that registered in Amman Stock Exchange Market. The samples of the study were the Top Management Levels (Decision maker, manager).

3.3 Instrument Design

There are numerous approaches to the task of gathering data needed in the examination of a problem. A common distinction is made between two different types of data, namely primary data, which consists of information collected through direct examination; and secondary data, which includes earlier examinations, existing statistics, literature, and articles. In this study, both primary and secondary data will be used.

3.4 Data Collection

In this study, both primary and secondary data will be used. Data for the model was collected via questionnaires. As will as the researcher will take the pointview the Decision Makers about the three factores (Strategic; Operacional; Technical) using AHP Technique.

3.5 Data Analysis Procedures

Data from the returned responses will collected for the analysis and conclusions of the study questions. The researchers will use the Statistical

Package for the Social Sciences (SPSS) computer program to analyze the data. Finally, the researcher s will use the suitable Statistical methods that consist of:

1. Arithmetic mean and standard deviation.

2. Sample regression analysis

CHAPTER 4

DATA ANALYSIS AND RESULTS

In this chapter the data, which have been collected through the survey, is presented and analyzed statistically. The **First section** analysis involves descriptive statistics and analytical statistics that related with hypothesis. **The Second section** the resecher used the AHP technique to putting up weights to factors then compare them to optimal results from first section, by using aprogrammable decision support system using VB.net.

4.1 Study Data Presentation

The value of which can be calculated by summing the scores of all of the 36 items.

There is one dependent variable: E-banking adoption and implementation decision and one independent variable consist of three factors: Strategic Factors;

Operational Factors and Technical Factors. Table lists the summary descriptive statistics of the variables.

Table (4.1)

Mean and Standerd deviation for Critical Succes factors (Startegic Factors)

No.	Items	Mean	Standerd deviation
	Availability of resources		
1	Availability of human resources is critical in all types of process in bank	3.63	1.18
2	Availability of financial resources is critical in all types of process in bank	3.79	0.98
	General Mean and Standerd deviation for Availability of resources	3.71	1.04
	Support from top management		
3	Top Management provides financial support for IT department	3.72	1.07
4	Top Management provides Moral (nonfinancial) support for IT department	3.67	0.99
	General Mean and Standerd deviation for Support from top management	3.70	0.94
	Organizational flexibility		
5	Multidisciplinary teams of heterogeneous backgrounds are used to facilitate bank process	3.70	0.95
6	The Bank Structure is Flat and Includes specific positions specialized in bank process	3.46	1.03
	General Mean and Standerd deviation for Organizational flexibility	3.57	0.90
	Re-engineering processes to web		
7	The Internet Banking web-site provides easy linkage to other e-commerce, business or information web sites.	3.81	0.91
8	The bank website enables to enjoy other free services (e.g. e-mail, stock quotation, news) offered in the Internet Banking web site	3.62	1.00
	General Mean and Standerd deviation for Re-engineering processes to web	3.72	0.85
	General Mean and Standerd deviation for Strategic factors	3.67	0.76

From table (4.1) we observe that the high mean was to item"**The Internet Banking web-site provides easy linkage to other e-commerce, business or information web sites**" with Average (3.81) and Standerd deviation (0.91). While the lowest mean was to item "**The Bank Structure is Flat and Includes specific positions specialized in bank process"** With Average (3.46) and Standerd deviation (1.03).

Table (4.2)

Mean and Standerd deviation for Critical Succes factors (Operational Factors)

No.	Items	Mean	Standerd deviation
fast responsive of services			
9	The bank adopts new technology that are not available for the competitors to provide a competitive advantage for the bank	**3.59**	**1.01**
10	Using electronic Banking gives bank more professional status	**3.82**	**0.96**
General Mean and Standerd deviation for fast responsive of services		**3.71**	**0.87**
24 h of Services			
11	The bank service is available 24 Hours a day.	**3.61**	**1.08**
12	The bank have a call centre that is also open 24 h a day, every day of the year	**3.69**	**1.14**
General Mean and Standerd deviation for 24 h of Services		**3.65**	**1.01**
Richness of site content			
13	All information that the customer needs is available.	**3.66**	**1.00**
14	Ease of getting all the information that customer needs.	**3.71**	**0.98**
General Mean and Standerd deviation for Richness of site content		**3.68**	**0.99**
General Mean and Standerd deviation for Operational factors		**3.68**	**0.95**

From table (4.2) we observe that the high mean was to item"**Using electronic Banking gives bank more professional status**" with Average (3.82) and Standerd deviation (0.96). While the lowest mean was to item "**The bank adopts new technology that are not available for the competitors to provide a competitive advantage for the bank"** With Average (3. 59) and Standerd deviation (1.01).

Table (4.3)

Mean and Standerd deviation for Critical Succes factors (Technical Factors)

No.	Items	Mean	Standerd deviation
Systems and channels Integration			
15	The Bank uses a middleware layer for integration of different systems and channels that enabled them to add new systems quickly as the interface had to be implemented just once to the middleware rather than to the whole range of different systems	**3.34**	**0.88**
16	The bank have multiple channels that enable customers to check account balances or transfer money between accounts	**3.73**	**1.08**
General Mean and Standerd deviation for Systems and channels		**3.54**	**0.85**

	Integration		
	Systems security		
17	The Bank have systems security to control all process at all levels	**3.85**	**0.93**
18	The bank uses secure layer technology which encrypts all of the information, from a customer logging in or filling in an application form to storage and feedback to the customers	**3.62**	**0.94**
	General Mean and Standerd deviation for Systems security	**3.74**	**0.86**
	Technology infrastructure		
19	Using Technology Infrastructure enables and Supports Business Intelligence	**3.74**	**0.94**
20	Using Technology Infrastructure enables Design and Development of new banking services	**3.82**	**0.88**
	General Mean and Standerd deviation for Technology infrastructure	**3.78**	**0.82**
	General Mean and Standerd deviation for Technical Factors	**3.68**	**0.73**

From table (4.3) we observe that the high mean was to item"**The Bank have systems security to control all process at all levels**" with Average (3.85) and Standerd deviation (0.93). While the lowest mean was to item "**The Bank uses a middleware layer for integration of different systems and channels that enabled them to add new systems quickly as the interface had to be implemented just once to the middleware rather than to the whole range of different systems"** With Average (3.34) and Standerd deviation (0.88).

Table (4.4)

Mean and Standerd deviation for E-banking adoption

No.	Items	Mean	Standerd Deviation
1	I am interested to hear about new technological developments	**3.67**	**1.11**
2	I am often asked for my advice on new technology products	**3.65**	**0.88**
3	I generally see my self as a risk taker rather than being conservative on decisions I make	**3.10**	**1.07**
4	I would only consider using credit card if someone personally recommended it to me	**3.77**	**3.88**
5	There is a greater risk of error in paying electronically than paying by cash	**3.25**	**1.11**
6	I feel it's too easy to use electronic payment method than paying by Cash	**3.75**	**1.03**
7	When I use electronic paying I feel it is as safe as paying by Cash	**3.59**	**1.03**

8	When purchasing new technology products I trust my own instincts more than advice from others	3.69	1.09
9	I would find it easy to remember the password of credit card	3.83	0.98
10	I prefer paying for credit card issuance fees and its commissions rather than having to carry cash	3.76	0.99
11	Using the electronic paying for me is the same as paying by cash	3.31	1.12
12	I am often asked for my advice on financial matters	3.66	1.02
13	I am reluctant to buy new technology products unless they have been tried and tested by others first	3.65	1.04
14	Technological developments have enhanced our lives	3.89	0.93
15	It would be easy to try credit card before committing oneself	3.75	0.96
16	Always, I have seen others using credit card	3.64	0.95
General Mean and Standerd deviation for E-banking adoption		3.62	0.69

From table (4.4) we observe that the high mean was to item"**Technological developments have enhanced our lives**" with Average (3.89) and Standerd deviation (0.93). While the lowest mean was to item "**I generally see my self as a risk taker rather than being conservative on decisions I make"** With Average (3.10) and Standerd deviation (1.07).

4.2 Hypotheses Tests

HO-1: Strategic factor has no significant effect on e-banking adoption decision in Jordanian banks.

To answer this hypotheses Sample Regreesion test used table (7) Clarification results.

Table (4.5)

Sample Regreesion to test effect Strategic factor on e-banking adoption

R	R Square	F Calculate	β Treatment	β Constant	Sig*
0.653	0.427	90.128	0.590	1.454	0.000

From the table (4.5) we observe that there are significant Effect to Strategic factor in e-banking adoption was (**0.653**) in level (**0.05** ≥ α) and R^2 was (**0.427**). This mean (**0.427**) of e-banking adoption respective explain by Strategic factor. As β Constant was (**1.454**) these mean increase one unit in Strategic factor will be increase e-banking adoption value (**1.454**). Assuring significant Effect **F Calculate** was (**90.128**) and it's significant in level (**0.05** ≥ α), and that Assuring unvalid **HO-1**. Unaccepted null hypotheses and accepted alternative hypotheses:

> **Strategic factor has significant effect on e-banking adoption decision in Jordanian banks**

HO-2: Operational factor has no significant effect on e-banking adoption decision in Jordanian banks.

To answer this hypotheses Sample Regreesion test used table (4.6) Clarification results.

Table (4.6)

Sample Regreesion to test effect Operational factor on e-banking adoption

R	R Square	F Calculate	β Treatment	β Constant	Sig*
0.595	0.353	66.160	0.487	1.828	0.000

From the table (4.6) we observe that there are significant Effect to Operational factor in e-banking adoption was (**0.595**) in level (**0.05** ≥ α) and R^2 was (**0.353**). This mean (**0.353**) of e-banking adoption respective explain by Operational factor. As β Constant was (**1.828**) these mean increase one unit in Operational factor will be increase e-banking adoption value (**1.828**). Assuring significant Effect **F Calculate**

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was (**66.160**) and it's significant in level (**0.05** ≥ α), and that Assuring unvalid **HO-2**. Unaccepted null hypotheses and accepted alternative hypotheses:

> **Operational factor has significant effect on e-banking adoption decision in Jordanian banks**

HO-3: Technical factor has no significant effect on e-banking adoption decision in Jordanian banks.

To answer this hypotheses Sample Regreesion test used table (4.7) Clarification results.

Table (4.7)

Sample Regreesion to test effect Technical factor on e-banking adoption

R	R Square	F Calculate	Β Treatment	β Constant	Sig*
0.582	0.338	61.908	0.548	1.602	0.000

From the table (4.7) we observe that there are significant Effect to Technical factor in e-banking adoption was (**0.582**) in level (**0.05** ≥ α) and R^2 was (**0.338**). This mean (**0.338**) of e-banking adoption respective explain by Technical factor. As β Constant was (**1.602**) these mean increase one unit in Technical factor will be increase e-banking adoption value (**1.602**). Assuring significant Effect **F Calculate**

was (**61.908**) and it's significant in level (**0.05** $\geq \alpha$), and that Assuring unvalid **HO-3** Unaccepted null hypotheses and accepted alternative hypotheses:

> **Technical factor has significant effect on e-banking adoption decision in Jordanian banks**

Each average in the critical success factor section considers as a weight, and these weights will be an optimal weight entered to the DSS. The decision maker will compare the results he got from applying AHP technique with the optimal results to see the weakness and strength factor in his decision.

4.3 Programable Decision Support System

In this phase, the decision maker will follow two steps. The first step is an explination a bout AHP technique to have a full inderstanding a bout the used techniqu, second step the decision maker will apply the concept of technique to fill the programmable decision support system to make a strategic decision a bout the critical success factors for e-banking adoption and compare the result he got with the optimal result which the researcher obtain from the statistical analysis, to know what is the strength and weakness factors(Strategic factor, operational factor, and technical factor).

AHP mathematically process (first step)

In the first step in AHP is to decide the relative importance of the objectives by comparing the each pair of objectives and ranking them depending on matrix called (pair-wise comparison matrix) The AHP constructs a set of pair-wise comparisons as a square matrix A as shown in figure 1:

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ . & . & & . \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix}$$

The entry in row i and column j of A (call it aij) indicates how much more important objective i is than objective j. ''Importance'' is to be measured on an integer-valued 1-9 scale, which each number having the interpretation shown in Table 1. For all i, it is necessary that aij=1, if i=j. if aij = k, then for consistency, it is necessary that aij = 1/k. Thus, if $a_{13} = 3$, then $a_{31} = 1/3$.

Value of aii	Interpretation
1	Objective i and j are of equal importance.
3	Objective i is weakly more important than j.
5	Objective i is strongly more importance than j.
7	Objective i is very strongly more important than j.
9	Objective i is absolutely more important than j.
2,4,6,8	Intermediate values.

Table 4.8: Interpretation of entries in a pair-wise comparison matrix

In the array above in table 4.8, the decision maker put the value for each criterion for factors: strategic, technical and operational factors, and represent them in array as below:

Strategic factors:

Strategic Factors	resources	top management	flexibility	Re-engineering
Resources	a_{11}	a_{12}	a_{13}	a_{14}
Top management	a_{21}	a_{22}	a_{23}	a_{24}
Flexibility	a_{31}	a_{32}	a_{33}	a_{34}
Re-engineering	a_{41}	a_{42}	a_{43}	a_{44}
SUM	$a_{11}+a_{21}+$ $a_{31}+a_{41}$	$a_{12}+a_{22}+a_{32}$ $+a_{42}$	$a_{13}+a_{23}+a_{33}$ $+a_{43}$	$a_{41}+a_{24}+a_{34}$ $+a_{44}$

Table 4.9: The calculation of decision maker input for strategic factors.

Operational factors:

Operational Factors	Rapid delivery	24-h availability of services	Richness of website contents
Rapad delivery	a_{11}	a_{12}	A_{13}
24-h availability of services	a_{21}	a_{22}	A_{23}
Richness of website contents	a_{31}	a_{32}	A_{33}
SUM	$a_{11}+a_{21+}a_{31}$	$a_{12}+a_{22+}a_{32}$	$a_{13}\,a_{23}+a_{33}$

Table 4.10: The calculation of decision maker input for operational factors.

Technical factors:

Technical Factors	Systems and channels Integration	Systems security	Technology infrastructure
Systems and channels Integration	a_{11}	a_{12}	a_{13}
Systems security	a_{21}	a_{22}	a_{23}
Technology infrastructure	a_{31}	a_{32}	a_{33}

SUM	$a_{11}+a_{21}+a_{31}$	$a_{12}+a_{22}+a_{32}$	$a_{13}+a_{23}+a_{33}$

Table 4.11: The calculation of decision maker input for technical factors.

and the decision maker will fill the matrix with the appropriate values of aij with following the rules in filling the pair-wise depending on the scale in table 1, and after that the decision maker should find the summation of each column because it will be used in next step.

After that, in the second step the AHP is going to make some simple calculation to determine overall weights that the decision maker assigning to each objective: this weight will be between 0 and 1, and the total weights will add up to 1, these weights will multiply by 5 to make the weights up to 5 to fit the weights from statistical analysis. The decision maker doing that by taking each entry and dividing by the sum of the column it appear in for each factor, and after that the decision maker calculate the average for each row and the result represent the weight for each criteria as the follow:

Strategic factors:

Strategic Factors	Resources	top management	flexibility	Re-engineering	Average (weight)
Resources	A_{11}/SUM	a_{12}/SUM	a_{13}/SUM	a_{14}/SUM	(Resource+ top + flex + Re-eng)/4
Top management	A_{21}/SUM	a_{22}/SUM	a_{23}/SUM	a_{24}/SUM	(Resource+ top + flex + Re-eng)/4
Flexibility	A_{31}/SUM	a_{32}/SUM	a_{33}/SUM	a_{34}/SUM	(Resource+ top + flex + Re-eng)/4
Re-engineering	A_{41}/SUM	a_{42}/SUM	a_{43}/SUM	a_{44}/SUM	(Resource+ top + flex + Re-eng)/4

Table 4.12: The wieghts of decision maker input for strategic factors.

Operational factors:

Operational Factors	Rapid delivery	24-h availability of services	Richness of website contents	Average (weight)
Rapad delivery	a_{11} /SUM	a_{12} / SUM	a_{13} / SUM	(rapid+avilability+richness)/3
24-h availability	a_{21} /SUM	a_{22} / SUM	a_{23} / SUM	(rapid+avilability+richness)/3

of services				
Richness of website contents	a_{31} / SUM	a_{32} / SUM	a_{33} / SUM	(rapid+avilability+richness)/3

Table 4.13: The wieghts of decision maker input for operational factors.

Technical factors:

Technical Factors	Systems and channels Integration	Systems security	Technology infrastructure	Averages (weights)
Systems and channels Integration	a_{11} / SUM	a_{12} / SUM	a_{13} / SUM	(Integration+security+tech-infras)/3
Systems security	a_{21}/ SUM	a_{22} / SUM	a_{23} / SUM	(Integration+security+tech-infras)/3
Technology infrastructure	a_{31} / SUM	a_{32} / SUM	a_{33} / SUM	(Integration+security+tech-infras)/3

Table 4.14: The wieghts of decision maker input for technical factors.

After these steps that help the decision makers to find the weights for each criteria, the decision maker should checking the consistency of the comparison's, by following the following four-steps procedure (for now on, w denotes our estimate of the decision maker's weights.).

First step:

Compute the multiple of matrix A which filling in by decision makers depending on the integer-valued 1-9 scale with the matrix of weights which is an unknown n-dimensional column vector denoted by wT.

Compute Aw^T

$$\begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ a_{31} & a_{32} & \cdots & a_{3n} \end{bmatrix} \begin{bmatrix} (a11+a12+a13)/3 \\ (a21+a22+a23)/3 \\ (a31+a32+a33)/3 \end{bmatrix}$$

$Aw^T =$

Second step:

Compute $1/n \sum i_{th}$ entry in Aw^T / i_{th} entry in w^T.

$1/n *(Aw^T)$

Third step:

Compute the **consistency index** (**CI**) as follows:

CI = (step 2 result) - n **/** n-1

Fourth step:

Compare **CI** to **Random Index (RI)** for the appropriate value of **n** shown in table 11

Table 4.15: Values of the Random Index (RI)

n	RI
2	0
3	.58
4	.90
5	1.12
6	1.24
7	1.32
8	1.41

| 9 | 1.45 |
| 10 | 1.51 |

The decision maker will choose the **RI** value depending on the appropriate value of n from the table. After that he will divide the **CI** on **RI**: **CI/ RI**. If **CI/RI < 0.10**, the degree of consistency is satisfactory, but if **CI/RI > 0.10**, serious inconsistency may exist, so the decision maker must re-enter the values a gain

Programmable decision support system (second step)

In this step the decision maker for the bank will compute the weights for the critical success factors for the bank, then the program will compare that weights with our optimal weights that will be shown in a detailed report which appear the strength and weakness points, so the decisión maker will take appropriate startegic decision. This program just to make the decision process more easier and saving time.

Here the details a bout the program:

Introductory home page:

In this page the researcher talk a bout the rogram briefly to give the decision maker an idea a bout the program.

Optimal weights page:

This page, show the optimal weihts that got from the statistical análisis, to give the decision maker an idea a bout the optimal weights.

Bank page:

In this page; the decision maker can:

1. This page shows a list of banks that exist in the database.

2. Add a new bank to compute the weights and compare it with the optimal weights.

3. the page show a list of banks that have values and can show the details of the banks (weights), the comparison of weights by showing a report, and editing the values of the bank if it need.

4. the page enable the decision maker to search a bout any existing bank.

Add new bank page:

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This page, allow us to add a new bank with computing the weights, and appear the CI/RI to make a decision to save the bank details or net dependin on the CI/RI result.

Detils page:

This page, showing the bank weights which we select and enable the decision maker to re-compute the weights.

Selecting/ Copmare page:

This page shows the strength and weakness points in the weights, to give the decision maker an idea a bout his decision.

Site map page:

This page shows the heirerchy of the pages in the site.

Chapter Five

Conclusions and future work

In this Chapter; the researcher will mention the conclusions of this work and mention an idea for a future work.

5.1 Conclusions

▶ **Strategic factor has significant effect on e-banking adoption decision in Jordanian banks.**

▶ **Operational factor has significant effect on e-banking adoption decision in Jordanian banks.**

▶ **Technical factor has significant effect on e-banking adoption decision in Jordanian banks.**

5.2 Recommendation

▶ **From results the researcher recommends the banks to adopt critical success factors in e-banking adoption decisions despite of the varying results in statistical analysis that shows the strategic factor most important than the other factor which could be used in defferent.**

▶ **The researcher recommends to the banks to use the decision support system in their e-banking adaption decision which uses the AHP techinqe and saving time and effort in taking decision.**

5.3 Future Works

- **The ability tp aplly this thesis in other fields likie insurance, etc..**
- **This study can provide a mathematical approach AHP technique, which can be used in other study like Qualty insurance.**

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Appendix

Section one: Critical Success Factors

Item Number	The Item	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
Strategic Factors						
1	Availability of human resources is critical in all types of process in bank	Availability of resources				
2	Availability of financial resources is critical in all types of process in bank					
3	Top Management provides financial support for IT department	Support from top management				
4	Top Management provides Moral (nonfinancial) support for IT department					
5	Multidisciplinary teams of heterogeneous backgrounds are used to facilitate bank process	Organizational flexibility				
6	The Bank Structure is Flat and Includes specific positions specialized in bank process					
7	The Internet Banking web-site provides easy linkage to other e-commerce, business or information web sites.	Re-engineering process to web				
8	The bank website enables to enjoy other free services (e.g. e-mail, stock quotation, news) offered in the Internet Banking web site					
Operational Factors						
9	The bank adopts new technology that are not available for the competitors to provide a competitive advantage for the bank	Rapid delivery and Fast responsive of services				
10	Using electronic Banking gives bank more professional status					
11	The bank service is available 24 Hours a day.	h of services-24				
12	The bank have a call centre that is also open 24 h a day, every day of the year					
13	All information that the customer needs is available	Richness of website content				
14	Ease of getting all the information that customer needs.					
Technical Factors						
15	The Bank uses a middleware layer for integration of different systems and channels that enabled them to add new systems quickly as the interface had to be implemented just once to the middleware rather than to the whole range of different systems	Systems and channels Integration				
16	The bank have multiple channels that enable customers to check account balances or transfer money between accounts					
17	The Bank have systems security to control all process at all levels	Systems security				
18	The bank uses secure layer technology which encrypts all of the information, from a customer logging in or filling in an application form to storage and feedback to the customers					
19	Using Technology Infrastructure enables and	Technology infrastructure				

	Supports Business Intelligence	
20	Using Technology Infrastructure enables Design and Development of new banking services	

Section Two: E-banking adoption and implementation decision

Item Number	The Item	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
1	I am interested to hear about new technological developments					
2	I am often asked for my advice on new technology products					
3	I generally see my self as a risk taker rather than being conservative on decisions I make					
4	I would only consider using credit card if someone personally recommended it to me					
5	There is a greater risk of error in paying electronically than paying by cash					
6	I feel it's too easy to use electronic payment method than paying by Cash					
7	When I use electronic paying I feel it is as safe as paying by Cash					
8	When purchasing new technology products I trust my own instincts more than advice from others					
9	I would find it easy to remember the password of credit card					
10	I prefer paying for credit card issuance fees and its commissions rather than having to carry cash					
11	Using the electronic paying for me is the same as paying by cash					
12	I am often asked for my advice on financial matters					
13	I am reluctant to buy new technology products unless they have been tried and tested by others first					
14	Technological developments have enhanced our lives					

15	It would be easy to try credit card before committing oneself					
16	Always, I have seen others using credit card					