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## **Factors Affecting Electronic Data Interchange Implementation The Case of Jordanian Commercial Banks**

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### **ABSTRACT**

This study aimed to develop and test a model which describes the factors affecting the EDI implementation in Jordanian commercial banks. These factors are: perceived benefits, top management support, technical infrastructure, external pressure, and organizational characteristics. Data were collected using a questionnaire consisted of 23 “likert” type items from a convenience sample of 227 respondents, data were analyzed using AMOS 16.0, to determine the interactions between the various factors. The results support the direct effect of perceived benefits, top management support, and external pressure on EDI implementation. Findings also indicated that there are no direct effects of technical infrastructure and organizational characteristics on EDI implementation. The study has suggested some recommendations, and also some directions for future research were proposed.

**Keywords:** Electronic Data Interchange, Jordanian Banks.

### **1. INTRODUCTION**

Implementation of Information and Communication Technology (ICT) in banking sector is growing rapidly (Afrouz, 2007). In Jordan as a developing country, there is a high interest in using Information Technology (IT) on different businesses especially in banking sector. The adoption of Information and Communication Technology (ICT), and more precisely the Electronic Data Interchange (EDI) Implementation in this sector has become an obligation rather than a choice. The new trend of using electronic innovations on banking industry appeared to spread on 1980s by advertising the banking services on internet (Al-Harhi, 2004). Today’s banking sector is dynamic and constantly changing. Information and its swift communication, and Electronic Data Interchange (EDI) systems are vital to competitive vigor of data transferring between banks. Today, more than ever before, the success and high performance of organizations, particularly the commercial banks, are dependent upon rapid access to accurate, and up-to-date information especially data and information exchange between the employees in the same bank or between the banks’ employees. This study is concerned with the Electronic Data Interchange (EDI) applied in commercial

banks in Jordan, since there are important factors affecting the implementation of the EDI system. The objective of this study is to investigate some selected factors affecting the EDI Implementation in Jordanian commercial banks that had already adopted EDI system.

#### **1.1 Problem Statement**

Information and Communication Technology (ICT) is becoming an important factor in the future development of financial services industry, especially banking sector (Goldmann, 2008). Banks and other financial institutions in Jordan are one of the largest investors in the fields of Information and Communication Technology (ICT) and more precisely the Electronic Data Interchange (EDI) implementation. However, the cost of investment in Information and Communication Technologies is relatively high. Hence, the Jordanian Commercial Banks should be sure that there is a good impact of these costly investments on bank Performance, the major problem that the study tries to explore can be expressed in the following question: What are the factors that affect the Implementation of Electronic Data Interchange (EDI) by Jordanian commercial banks?

#### **1.2 Importance of the Study**

The importance of this study stems from the following:

1. The size of service sector and its contribution to most

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of world's economies is in rapid increase. In regard to Jordan where the economy is considered as a service economy in the first place; the percentage of service sector contribution to the working force is about 72% (Siam, 2006).

2. Recently, Jordanian banks have spent millions of dinars on new electronic channels, and also have invested in expanding and improving the IT systems.
3. The banking industry is highly competitive. Thus, changing needs and new technologies are brought together to revolutionize the way in which banking business is conducted. Modern banking business is characterized by ever-increasing global competition, and ever-increasing customer expectations. So, Banks have used EDI to enhance and attract a large number of customers through services quality.
4. This study focuses on relatively unexplored phenomenon in Jordan. Unfortunately, a few studies have been conducted in Jordan regarding this subject. Therefore, the current study represents a starting point for other researchers to study the EDI implementation in Jordan.
5. The result of this study would be useful for academicians; they might gain insights and suggestions for future research.

### **1.3 Objectives of the Study**

The aim of this study is to investigate some factors that influence EDI implementation. The researchers try to accomplish this aim through the following objectives:

1. Providing an overview of EDI implementation in Jordanian commercial banks.
2. Investigating the various factors affecting the EDI implementation in the Jordanian commercial banks.
3. Providing some recommendations to decision makers relating to the best approaches to support the implementation of EDI in Jordan.

## **2. THEORETICAL FRAMEWORK**

### **2.1 EDI Definition**

EDI can be defined as the electronic, computer-to-computer exchange of business information in a structured format between business trading partners or between various units within an organization (Ferguson, Hill, and Hansen, 1990).

The idea behind EDI is very simple. Most companies are using computers for keeping records and for

correspondence. The information is entered to the computer then printed out and either stored or sent to business partners using mail or fax. EDI enables these companies to transfer this information directly from their computer to other computers.

## **2.2 EDI in Jordanian Banking Sector**

### **2.2.1 Electronic Funds Transfer (EFT)**

Electronic funds transfer (EFT) is the banking equivalent of EDI. Banks and other financial institutions transfer electronic checks and related payment information to each other, crediting and debiting customer accounts. EFT transactions are generally exchanged between banks through some form of network or funds transfer system. The most commonly used network is the Automated Clearing House (ACH) Network. As business demands increase and technology improves, several bank-to-bank EFT formats have been developed for the ACH network. The main difference between the formats is the amount of payment information that can be attached to the payment order (HTML1).

### **2.2.2 Clearing of Cheques**

As of Thursday, July 5, 2007, Jordan became one of the leading word countries that implement a comprehensive system for electronic cleaning of cheques. To execute this major project, all licensed banks and their branches were equipped with the necessary computers, scanners, and communication lines and data base systems. Moreover, the necessary technical cadres were trained to handle the system (HTML1).

### **2.2.3 ATM Service**

Even in some industries where information system (IS) has proved truly strategic, it is still beginning to see the emergence of cooperative development replacing competition in IS innovation, at least for those products and services that appear destined to become commodities; for these products and services, the benefits of cooperation may exceed the potential benefits from competition. The emergence of regional and national ATM networks in retail banking throughout the world is a clear example of this phenomenon (Clemons and Knez, 1988).

## **2.3 Literature Review**

Iacovou, Benbasat, and Dexter (1995) identified

three major factors responsible for EDI adoption. They are organizational readiness operationalized as financial and technological resources of the firm; external pressures divided into competitive pressure and imposition by trading partners; and perceived benefits of the technology. By investigating seven case studies of small businesses, Iacovou et al. (1995) concluded that a large number of small organizations tend to lack the needed high organizational readiness and perceived benefits that are required for integrated high impact systems and that a major reason for small companies to adopt EDI is the external pressure by trading partners.

Elbaz (1998) modified Iacovou et al. (1995) model by introducing the awareness variable. He also changed the organizational readiness variable to financial strength and technology used. So, Elbaz (1998) model consists of five factors namely perceived benefit, external pressure, financial strength, technology used and awareness. The third and fifth variables are the subset of organizational readiness category in Iacovou et al. (1995) model. The fifth factor had been introduced in this study to measure the roles of users' awareness on EDI adoption. His study was conducted using questionnaires that were sent to 1000 businesses in different industries in Quebec. A size of 149 companies was used to test the revised model. According to Elbaz (1998), the lack of EDI knowledge could be an obstacle for EDI adoption and thus, awareness and understanding of new technology is a prerequisite to the adoption process. This study found EDI adoption had significant positive relationships with awareness, financial strength, external pressure and technology used. Thus, Elbaz (1998) suggested the inclusion of awareness factor in Iacovou et al. (1995) EDI adoption model.

Kuan and Chau (2001) conducted a study in Hong Kong to understand factors distinguishing EDI adopters from non adopters. They proposed a perception-based small business EDI adoption model. They tested this model with a survey of 575 small firms. The main results can be summarized as follows: perceived direct benefits were distinguishing adopter from non adopter firms, while perceived indirect benefits were not a distinguishing factor. Perceived financial cost and perceived technical competence was more obstacles for non adopter firm than adopter ones. Finally adopters perceived a higher government pressure and a lower industry pressure than non adopters.

Another study by Ngrai and Gunasekaran (2004)

used an empirical research to study the application of EDI in Hong Kong. Through a survey of Hong Kong companies, questions were asked about perceived barriers to implementation of EDI, perceived benefits achievable through EDI, and critical success factors for the adoption of EDI. The main objective of this study was to develop a framework for enhancing the application and implementation of IT with a view to improved organizational competitiveness.

Chwelos, Benbasat, and Dexter (2000) posited three factors as determinants of the adoption of electronic data interchange (EDI): readiness, perceived benefits, and external pressure. To construct the model, they identified and organized the factors that were found to be influential in earlier EDI researches. By testing all these factors together in one model, they are able to investigate their relative contributions to EDI adoption decisions. Senior purchasing managers, chosen for their experience with EDI and proximity to the EDI adoption decision, were surveyed and their responses analyzed using structural equation modeling. All three determinants were found to be significant predictors of intent to adopt EDI, with external pressure and readiness being considerably more important than perceived benefits. They stated that the constructs in this model can be categorized into three levels: technological, organizational, and inter-organizational. They assumed that these categories of influence will continue to be determinants of the adoption of other emerging forms of inter-organizational systems (IOS).

Kim and Lee (2007) identified the determinant factors which affect implementation of EDI systems by Korean companies. Decentralization, EDI standards, technical compatibility, technical support by EDI vendors, education and training, and participation of trading partners positively affect the extent of EDI usage. Formalization, technical compatibility, user involvement and participation of trading partners affect EDI integration with internal applications. Top management support and the participation of trading partners promote the extent of EDI operations. This study provides evidence of the effect of important determinant factors such as participation of trading partners and technical compatibility replicating previous EDI studies conducted in the US and Europe. For policy makers and EDI developers, this study provided insights as to appropriate measures and incentives system designed to encourage EDI and B2B implementation.

Seyal and Rahim (2006) investigated the 84 small and medium enterprises in Brunei by using a survey approach to find out the key factors that are determinants to EDI adoption. Based upon the existing model, the study uses seven factors grouped into three categories, namely organizational (IT Knowledge, top management support), external (government support, trading partner influence) and economic factors (perceived direct benefits, perceived indirect benefits, perceived cost). The findings indicate that hypotheses related to perceived direct benefits and perceived cost are supported. However, the study not finds support for perceived indirect benefits. All other factors such as: IT Knowledge, government support, top management support and trading partner influence remain insignificant.

Seyal, Abd Rahman and Mohammad (2006) investigated fifty small and medium enterprises by using a survey approach to find out the key factors that are determinants to EDI adoption. Based upon the existing model, the study used six factors grouped into three categories, namely organizational, environmental and technological aspects. The findings indicated that factors such as perceived benefits government support and management support were significant determinants of EDI adoption. The remaining factors like organizational culture, motivation to use EDI and task variety remain insignificant. Apart from the governance implications few studies have tried to evaluate the direct benefits of technology usage.

Arunachalam (2004) examined alternative organizational forms for EDI processing within organizations and evaluated them on several task performance indices including independence, saturation, and satisfaction, and also related them to EDI effectiveness as a function of information technology (IT) intensity and length of EDI use. Results from an extensive, two-phase survey of EDI users indicated that organizational form for EDI processing influenced task performance indices such that the more decentralized structures (i.e. star and circle structures) exhibited higher independence and lower saturation than the more centralized structures (i.e. wheel, kite, and chain structures). More decentralized forms also exhibited higher satisfaction with EDI than the more centralized forms on no routine EDI tasks. EDI task performance indices were also correlated with EDI effectiveness, such that higher independence, lower saturation, and

higher satisfaction were associated with higher EDI effectiveness. IT intensity and length of EDI use also positively moderated the effects of decentralization on EDI effectiveness.

Ramamurthy, Premkumar and Crum (1999) examined the influence of organizational and inter-organizational variables on the extent of diffusion attained by the adopters of inter-organization systems within the specific context of EDI and examined whether more extensive diffusion is really useful in furthering organizational outcomes. The research model investigated in this study includes a set of seven (three inter-organizational and four organizational) antecedent variables that are expected to influence EDI diffusion. Diffusion is a two-dimensional measure represented by external and internal integration. The model also posits a relation between the extent diffusion and two organizational-level outcomes. The five major areas of research that provide the necessary theoretical foundations for this study and the rationale for selecting the above variables are political economy within marketing, organizational theory, innovation, use of information technology for competitive advantage (ITCA), and IS implementation. A discussion of key research in these areas in general and those specific to EDI is provided fewer than three broad categories: inter-organizational factors, organizational factors, and diffusion organizational outcome domains. Two senior executives (the chief executive officer and a senior manager responsible for the IS function or EDI) from 83 firms in the motor carrier industry participated in a field survey. The results from a structural equation model (SEM), developed using LISREL, provide quite a strong support for the hypothesized relations. All four organizational variables and two of the three inter-organizational variables (customer support and competitive pressure) influence EDI diffusion. The results also indicate that external integration dimension of diffusion enables adopter firms to achieve improved operational and market-oriented performance, whereas internal integration contributes only to operational performance.

#### **2.4 Study Model and Hypotheses Development**

This study is based on Iacovou et al.'s study (1995) where seven cases of EDI adoption were investigated. Iacovou et al. (1995) identified three major variables affecting the adoption of EDI: perceived benefits, external pressure and organizational readiness. The

current study introduces the top management support and organizational characteristics in addition to the three variables in Iacovou et al. (1995) model. In this study, organizational readiness variable will substitute for

technical infrastructure. According to many studies reviewed by the researchers there are many important factors that have an impact on EDI implementation. A summary of these factors is given below:

**Table 1. Summary of EDI Implementation Factors in the Current Study**

<b>Factor in the current study</b>	<b>Source</b>
Perceived Benefits	Chwelos et al, 2000; Elbaz, 1998; Iacovou et al., 1995; Kuan and Chau, 2001; Seyal et al., 2006; and Ramamurthy et al., 1999
Top Management Support	Kim and Lee, 2007; Ngrai and Gunasekaran, 2004; Seyal and Rahim, 2006; Seyal et al., 2006; and Ramamurthy et al., 1999
Technical Infrastructure	Elbaz, 1998; Kim and Lee, 2007; Kuan and Chau, 2001; and Ngrai and Gunasekaran, 2004
External Pressure	Chwelos et al., 2000; Elbaz, 1998; Iacovou et al., 1995, Seyal and Rahim, 2006; and Ramamurthy et al., 1999
Organizational Characteristics	Kim and Lee, 2007; and Kuan and Chau, 2001

Perceived Benefits refer to the anticipated advantages that EDI can provide the organization. Benefits are both direct and indirect in nature. Direct benefits include operational cost savings and other internal efficiencies arising from. For example, reduced paperwork, reduced data re-entry, and reduced error rates. Likewise, indirect benefits are those opportunities that emerge from the use of EDI, such as improved customer service and the potential for process reengineering (Chwellos et al, 2000). An organization will only choose to adopt an innovation if it perceives that doing so will provide significantly greater benefits than existing technologies and processes (Rogers, 1983). Perceived Benefits to Bank are the extent to which banks perceive that there are benefits to be derived from participating in an electronic network (Al-Bakri, 2007). This lead to the following hypothesis:

*H1: Perceived Benefits have a positive direct effect on EDI Implementation.*

One of the most frequently mentioned factors in the literature for successful adoption and implementation of integration solutions is top management support (Ngai and Gunasekaran 2004), it refers to positive attitude towards microcomputers, Top Management endorsements of efforts of the staff to provide training information, and consulting on data access, system development, and operations (DeLone and McLean, 1992). Top Management Support has been recognized as one of the most important elements necessary for successful implementation of EDI (Angeles and Nath, 2001; Emmelhainz, 1988; Scala and McGrath, 1993).

Since Top Management's primary responsibility is to provide sufficient financial support and adequate resources for building a successful EDI system, the support of management ensure that the EDI project has a high priority within an organization and that it receives the required resources and attention. Lack of financial support and adequate resources will inevitably lead to failure. Apart from this primary support, psychological or behavioral support is also important in making the development run smoothly, especially if there is a significant resistance from the staff involved (Ngrai and Gunasekaran, 2004). Based on this, the following hypothesis is developed:

*H2: Top Management Support has a positive direct effect on EDI Implementation.*

Implementing EDI requires a higher level adoption of computer applications and infrastructures to leverage intra-and interbank transactions via systems integration. So, when a bank adopts EDI, it is estimated that the integration of new electronic channels within the bank requires the presence of telecommunication, multimedia and network infrastructure, electronic platforms, an interconnection, advanced programming languages (Toufaily and Daghfous, 2006). This lead to the following hypothesis:

*H3: Technical Infrastructure has a positive direct effect on EDI Implementation.*

External Pressure encapsulates the influences arising from several sources within the competitive environment surrounding the organization: competitive pressure, relating to the ability of EDI to maintain or increase

competitiveness within the industry; industry pressure, relating to the efforts of industry associations or lobby groups to promulgate EDI standards and encourage adoption; and two measures of trading partner influence. Dependency on trading partner captures the potential power of a trading partner to “encourage” EDI implementation (Provan, 1980). External Pressure on EDI implementation between banks is assessed by incorporating four items: competition, dependency on other banks already using EDI, the industry, and the government (Anandarajan et al, 2002; Grandon and Pearson, 2004). This lead to the following hypothesis:

*H4: External Pressure has a positive direct effect on EDI Implementation.*

The organizational characteristics are a critical factor in the reaction to innovation (Skhiri, 2000). Such as, organization size, financial resources. The size and financial resources factors are one possible explanation for the greater rate of EDI implementation among very large firms, as organization size has consistently been recognized as a driver of organizational innovation (Damanpour, 1991). Langley and Truax (1994) also emphasize that the possession of funds is a key factor when companies introduce technology. This study demonstrates that the implementation of EDI, with its high costs, requires serious financial justification, not only to cover the costs of introducing the new technology, but also for learning about the new management model, technology support, application of new procedures, and training existing staff members. Thus, organizations which have greater financial resources and which have easier access to capital are

more likely to introduce new electronic communication systems. Based on this, the following hypothesis is developed:

*H5: Organizational Characteristics have a positive direct effect on EDI Implementation.*

To examine the points previously discussed and address the issues raised, figure (1) represents the hypotheses that have been developed for testing based on the theoretical framework and previous studies.

### 3. THE RESEARCH DESIGN

The validation of the conceptual framework is based on quantitative method of data collection, using a survey administered to Jordanian commercial banks branches managers. The choice of the Jordanian context is firstly explained by the importance of the banking sector in this developing country and secondly, by the rapid evolution of the implementation of new technologies by these banks.

#### 3.1 Population

One of the important research design decisions pertains to sampling. Sampling design relates to both the methods used to select the sample from the population, and the size of the sample necessary to generalize the findings from the sample data to the total population. The population includes all the Jordanian commercial banks’ branches in Jordan (451 branches). The researchers chose commercial banks because they are heavily involved with data interchange activities because of their business nature.

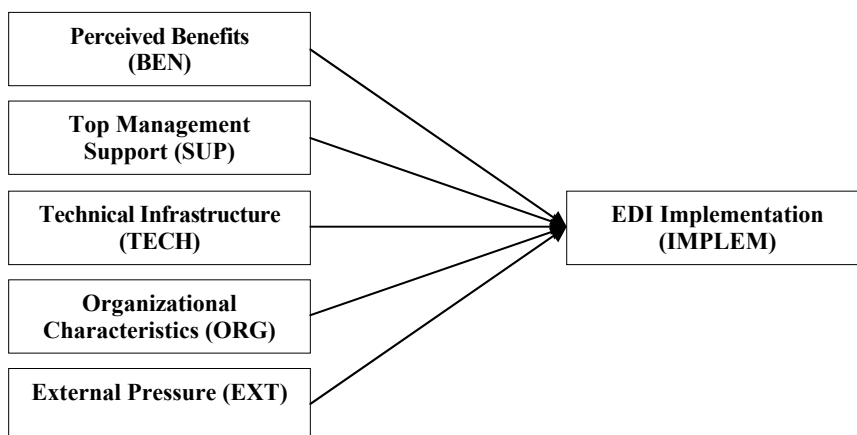


Figure 1. Study Model

#### 3.2 Sample Selection

Using the 29<sup>th</sup> annual report of Association of Banks

in Jordan (2007), the researchers chose the six largest banks in Jordan (Arab Bank, Housing Bank Housing,

Bank for Trade and Finance, Jordanian Ahli Bank, Cairo Amman Bank, Bank of Jordan and Jordan Kuwaiti Bank) working in Amman, Irbid, and Karak (276 branches), which represents 61% of the population. Because of this high rate, it is estimated that there was no representativeness problem. The researchers targeted top managers, assistant, managers, co-assistants and experts of commercial banks branches in Jordan chosen

for their experience. Co-assistants are those people who have high responsibility after managers in a certain department in a bank. In this study, experts are those people who have experience and works sometime as managers' arm in implementing their decision but they have lower position than managers have and higher than other typical experts (Table 2).

**Table 2. Selected Sample**

<b>Bank's Name</b>	<b>Amman</b>	<b>Irbid</b>	<b>Karak</b>	<b>total</b>
Arab Bank	49	5	1	55
Jordanian Ahli bank	32	3	1	36
Cairo Amman Bank	29	7	2	38
Bank of Jordan	28	6	1	35
The Housing Bank for Trade&Finance	50	15	9	74
Jordan Kuwaiti Bank	29	3	0	32
<b>Total = 270</b>	<b>217</b>	<b>39</b>	<b>14</b>	<b>270</b>

Source: 29<sup>th</sup> annual report 2007, Association of Banks in Jordan.

The researchers first distribute a survey questionnaire to each of the 276 sampled branches by hand, together with a cover letter that explained the purpose of this study. The researchers followed up, personally, the questionnaires with sample's members. A total of 230 questionnaires were collected. Three questionnaires removed due to incomplete information. Thus, the researchers had 227 usable responses resulting in an 84.07 % response rate, which was comparable to other studies of a similar nature.

### 3.3 Data Collection Method and Instrument

In the first phase of data collection, the researchers use secondary data for building up the research model and questionnaire. In the second phase of the data collection, primary data is applied to the research investigation, since the researchers is carried out a self-completion questionnaire survey with closed questions.

#### 3.3.1 Questionnaire Structure and Format

The survey is consisted 32 questions. The

questionnaire was pre-tested, modified, and used to capture data in a cross-sectional survey of EDI implementation in Jordanian commercial banks. The questionnaire was originally prepared in English, and it was later translated into Arabic (the native language of respondents). The translated version of the questionnaire was shown to some specialists for arbitration to assure the face validity and the accuracy of translation. The design of the questionnaire was based on the research issues discussed below. There were four parts to the questionnaire:

1. Profiles of the bank and respondent,
2. Respondent opinion about EDI implementation in his bank, it had items measured on a five-point scale ranging as follow: (1=very low, 0 -20%, 2=low, >20 -40%, 3=medium, >40 -60%, 4=high, >60 -80%, 5=very high, <80-100%) (Lai et al., 2007).
3. Critical factors affecting the EDI implementation, it had items measured on a five-point Likert scale ranging as follow: (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree).

**Table 3. Operational Definitions**

<b>Variables</b>	<b>Operational definition</b>	<b>Sources</b>	<b>Items</b>
EDI implementation	The current stage of electronic data interchange measured by deferent dimensions such as volume, diversity, and breadth.	Massetti and Zmud. 1996; Lai et al., 2007	1-6
Perceived benefits	Improving the job performance and productivity, and enhancing job effectiveness.	Chwelos et al. 2000; Iacovou et al.,1995; Elbaz, 1998; and Al-Bakri, A. 2007.	7-10



Variables	Operational definition	Sources	Items
Top management support	Top management' positive attitude towards EDI implementation.	Kim and Lee, 2007; Ngrai, E., and Gunasekaran, A.2004; and Anandarajan et al., 2002.	11-15
Technical Infrastructure	Existing of technology infrastructure, and technical resources to implement EDI.	Kim and Lee. 2007; Ngrai and Gunasekaran. 2004; and Kuan and Chau. 2001.	16-17
External pressure	The impact of competition, customers, industry, and central bank pressure on EDI implementation.	Kim and Lee, 2007; Elbaz. 1998 Iacovou et al., 1995.	18-21
Organizational characteristics	The importance of the bank size and bank financial resources on EDI implementation.	Damanpour, 1991; Langley and Truax, 1994.	22-23

### 3.4 EDI Implementation Scale

It has been shown that it is of vital importance that organizations know its current position with respect to its EDI implementation stage. However, being able to monitor developments can provide crucial information for a continual emergent strategic approach. Massetti and Zmud (1996) have developed an approach to EDI measurement that has the dimensions of volume, diversity, breadth and depth.

- 1) Volume: the extent to which a firm's co-document exchange are handled through EDI connections (characterized by file to file connections).
- 2) Diversity: the extent to which different types of a firms business documents are handled through EDI connections (characterized by application to application connections).
- 3) Breadth: the extent to which a firm has developed EDI connections with each of its trading partners (characterized by coupled work environments).
- 4) Depth: the extent to which a firm's business processes are intertwined with those of its trading partners through EDI connections (characterized by penetration of coupled work environments).

Increasing depth needs financial and managerial commitment and not all companies are willing to cooperate. Some researchers argue that the financial risks resulting from greater depth in relationships between banks. For this reason the researchers depends on three dimensions of volume, diversity, breadth to EDI measurement.

### 3.5 Analyses Tools

Data collected is analyzed using SPSS version 16.0 for purposes of descriptive statistics and exploratory factor analysis, while Partial Least Square (PLS), using AMOS

16.0, is utilized to determine the interactions between the various constructs of structured equation model (SEM). Inter-item consistency reliability is conducted for the consistency of the respondents' answers to the items in a measure in this research questionnaire.

In order to investigate the direct effects of perceived benefits, top management support, technical infrastructure, external pressure and organizational characteristics on EDI implementation, the collected data were analyzed using the structural equation modeling method.

Structural equation modeling has been used by previous researchers for decomposing effects into direct and indirect (causal) effects and for eliminating non-causal effects (Reger et al., 1992). By identifying indirect effects, path analysis makes available results, which are not calculated using ordinary regression analysis. This provides a more holistic view of the relationships, rather than examining each pairing in isolation.

Structural equation modeling is a large-sample method. A sample size below 200 may be insufficient for SEM. As a general rule, those samples are considered large that contain more than 200 sample units (Fan and wang, 1998). Hair, Anderson, Tatham and Black (1995) considered a number of 200 to be ideal. In determining the simple for this survey this criteria was met. The sample size of this thesis is 227, which is considered appropriate for the sample size of this thesis is 227, which is considered appropriate for using SEM.

AMOS (Analysis of Moment Structure) is a program designed for estimating structural equation models. There are two ways to set up AMOS models. AMOS can read files in a number of formats, including SPSS, Excel, and D-Base, but NOT Stata. The AMOS version 16.0, a

method to analyze the Linear Structural Relationship Model, was used to examine the suggested model.

### 3.6 Instrument Validation and Reliability

#### 3.6.1 Validity

Validity is a characteristic of measurement concerned that a test measures what the researcher actually wishes to measure; that differences found with a measurement tool reflect true differences among respondents drawn from a population (Cooper and Schendler, 2001). One type of validity is content validity which is the degree to which a research instrument provides adequate coverage of the topic under study (Cooper and Schendler, 2001). Face validity and content validity refers to the subjective agreement among professionals that a scale logically appears to reflect accurately what it purports to measure (Zikmund, 2000).

In order to ascertain the model's predictive validity, the strength of the independent variable upon the dependent variables, and the strength or significance of the paths between the variables, or constructs, was assessed. The strength of the impact was assessed by means of the explained variance in the dependent variable and should be above 0.1 (Chan, 1992), and the paths should be significant (Goo, Kishore and Rao, 2004).

#### 3.6.2 Reliability

Reliability is a term that refers to the consistency of results produced by a scale if repeated measurements are

made (Malhotra, 2002). In the case of this study, reliability of the survey scale was measured using the Cronbach's alpha ( $\alpha$ ) in the SPSS software. Cronbach alpha measures the consistency based on the extent to which a participant who answers a question in a way will respond to other questions in the same manner (Malhotra, 2002). Moreover, the higher the value of ( $\alpha$ ) is, the greater the reliability (Sekaran, 2004). Table 4 shows the results of reliability testing of measurement scales used for measuring exogenous and endogenous variables of the defined structural model. The alpha values for all dimensions vary from 0.763 to 0.906, which are considered acceptable (Hair et al., 1995).

The AMOS program (Analysis of Moment Structure) version 16.0, a method to analyze the Linear Structural Relationship Model, was used to examine the suggested model. The fundamental point in analyzing structural models is the extent to which the hypothesized model "fits" or adequately describes the sample data (Byrne, 2001). A model fit can be evaluated by examining several model-fit indices. Six common model-fit measures were used to assess the model's overall goodness-of-fit Table 5. Comparison of all fit indices with their corresponding recommended values, as shown in Table 5, provided evidence of a good model fit. The values of analyzed indices indicate that the level of fit of defined model to data is satisfactory and that the defined model is acceptable for further analysis.

**Table 4. Model Reliability (Cronbach's Alpha for the Measurement Scales)**

Variable	No. of Items	Alpha
EDI Implementation (IMPLEM)	6	0.886
Perceived Benefits (BEN)	4	0.863
Top Management support (SUP)	5	0.906
Technical Infrastructure (TECH)	2	0.812
External Pressure (EXT)	4	0.763
Organizational Characteristics (ORG)	2	0.855

**Table 5. Recommended fit indices**

Fit Indices	Recommended value*	Indices Value
$\chi^2/df$	$\leq 3.00$	2.30
Goodness of fit (GFI)	$\geq 0.90$	0.981
Adjusted goodness of fit (AGFI)	$\geq 0.80$	0.865
Normed fit index (NFI)	$\geq 09.0$	0.996
Comparative fit index (CFI)	$\geq 0.90$	0.997
Root mean square residual (RMSR)	$\leq 0.10$	0.061

Source: Luarn and Lin (2005).

4.1 Sample Characteristics

according to demographic variables.

Table (6) shows the characteristics of sample

**Table 6. Sample Characteristics**

Measure		Frequency	Percent
Gender	Male	163	71.8
	Female	64	28.2
Age	Less than 30	9	4.02
	30-39	82	36.21
	40-49	117	51.72
	50-59	19	8.05
Educational level	High school	4	1.7
	B.A	171	75.3
	Master	52	23.0
	P.H.D	0	0.00
Bank	Arab	43	19.0
	Ahli	31	13.8
	Cairo	33	14.4
	Jordan	30	13.2
	Housing	46	20.1
	Kuwait	44	19.5
Area	Amman	141	62.1
	Irbid	61	27.0
	karak	25	10.9

The largest number of respondents comes from Amman banks branches (62.1%). The largest category (75.3%) of educational level is Bachelor degree. The age of the participants ranged from less than 30 and above, with a largest percentage (51.72%) in 40-49 category, furthermore, about (71.8%) of respondents are male, whereas (28.2%) of respondents are female.

Because of the assumption that factor analysis and structural equation modeling both require variables to be normality distributed, it was necessary to check the distribution of variables to be used in the analysis (Hair et al., 1995; Tabachnick and Fidell, 2001; Kline, 2005). To test the normality of distributions of individual variables, kurtosis index and skewness index were computed for each variable. The resulting indices are shown in Table 7.

4.2. Hypotheses Testing and Results

**Table 7. Assessment of normality**

Variable	skew	kurtosis
Perceived Benefits (BEN)	.308	-.152
Top Management Support (SUP)	1.047	1.663
Technical Infrastructure (TECH)	.713	.103
External Pressure (EXT)	.647	.416
Organizational Characteristics (ORG)	.759	.275
EDI Implementation (IMPLEM)	-.052	-.872

From the results, it can infer that both indices are within acceptability limits (absolute values lower than 10 for kurtosis index, and absolute values lower than 3 for skewness index), and that collected data demonstrate

an acceptable level of normality (Kline, 2005).

After the measurement model has been assessed, the researchers examined the estimated coefficients of the causal relationships between constructs, which would

validate the hypothesized effects.

The test of the structural model included estimating the path coefficients, which are interpreted as standardized beta weights in a regression analysis, and R<sup>2</sup>, which is used to assess the proportion of variance in the endogenous constructs (dependent variables) which can be accounted for by the antecedents. The path coefficient of an exogenous variable (dependent variable) represents the direct effect of that variable on the endogenous variable.

Using AMOS, the researchers tested the hypotheses and determine the path coefficients based on the model. Figure (2) illustrates the coefficients of determination (R<sup>2</sup>) for each dependent construct, the estimated coefficients and their significance on the structural model. All of the path estimates are statistically significant, except for those running from Technical Infrastructure (TECH) to EDI implementation (IMPLEM), and from Organizational Characteristics (ORG) to EDI implementation (IMPLEM).

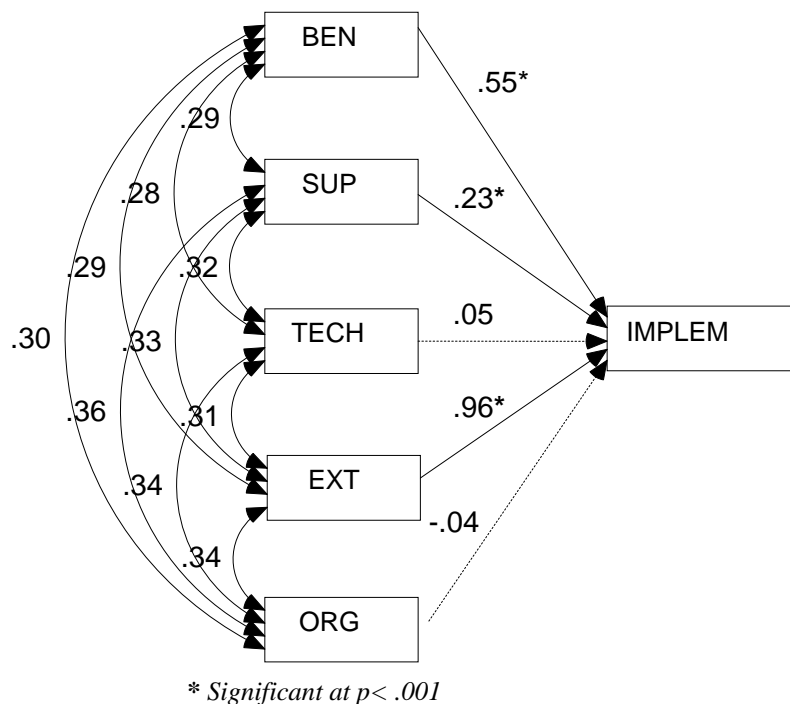


Figure 2. Structural Model

4.3. Interpretation of the Findings

As indicated in Table 8 and figure 2, BEN-Perceived Benefits ( $\beta = 0.545$ ;  $t = 10.405$ ;  $\alpha = 0.000$ ), SUP-Top management Support ( $\beta = 0.229$ ;  $t = 3.805$ ;  $\alpha = 0.000$ ) and EXT-External Pressure ( $\beta = 0.958$ ;  $t = 13.728$ ;  $\alpha = 0.000$ ) have a positive direct effect on EDI implementation (IMPLEM). While TECH-Technical

Infrastructure ( $\beta = 0.049$ ;  $t = 0.815$ ;  $\alpha = 0.415$ ) and ORG-Organizational Characteristics ( $\beta = -0.043$ ;  $t = -0.660$ ;  $\alpha = 0.509$ ) have no direct effect on EDI implementation (IMPLEM). Therefore, the researchers accept hypotheses H1, H2, and H4, but doesn't accept hypothesis H3 and H5.

Table 8. Structural Model Results

Path	Coefficients ( $\beta$ )	S.E.	T-values	P-Value	result
H1: BEN -> IMPLEM	0.545	0.052	10.405*	0.000	Supported
H2: SUP -> IMPLEM	0.229	0.060	3.805*	0.000	Supported
H3: TECH -> IMPLEM	0.049	0.060	0.815	0.415	Rejected
H4: EXT -> IMPLEM	0.958	0.070	13.728*	0.000	Supported
H5: ORG -> IMPLEM	-0.043	0.064	-0.660	0.509	Rejected

\* Significant at  $p < .001$ , based on  $t (227)$ , two-tailed test;  $t (.001, 227) = 3.29$ .

**Table 9. Summary of the Results of Hypotheses Testing**

Hypothesis	Accepted /Rejected
H1: Perceived Benefits have a positive direct effect on EDI Implementation.	Accepted
H2: Top Management Support has a positive direct effect on EDI Implementation.	Accepted
H3: Technical Infrastructure has a positive direct effect on EDI Implementation.	Rejected
H4: External Pressure has a positive direct effect on EDI Implementation.	Accepted
H5: Organizational Characteristics have a positive direct effect on EDI Implementation.	Rejected

**5. FINDINGS AND RECOMMENDATIONS**

**5.1 Discussion of the Findings**

In this study, some findings, especially which related to Perceived Benefits, Top management Support, and External Pressure are similar to those found in studies conducted in different developed countries or different geographical regions.

This is one of the first studies to examine these factors in Jordanian commercial banks. This study analysis showed that Technical Infrastructure and Organizational Characteristics are not major factors preventing Jordanian commercial banks from implementing EDI system.

In light of the study objectives and the test of the research hypothesis in chapter four the researchers has reached the following:

**5.1.1 Perceived Benefits**

It was found that perceived benefits have a positive direct effect on EDI Implementation. This finding is similar with what Chwelos et al. (2000); Kuan and Chau. (2001); Iacovou et al. (1995) and Seyal et al. (2006) have found, which have indicated that the perceived benefits are one of the key reasons why banks and other organizations implement EDI system because perceived benefits were the most influential determinants of the technology usage.

This study has concluded that compatibility of the management of banks and other organizations considered the perceived benefits as an important prerequisite to decide on EDI implementation. If the benefits are not viable they might not decide on this technology. The organizations may pay more attention to the viable benefits. Perceived benefits can act as motivators to encourage the EDI implementation because direct benefits are more viable and are easier to

measure (Seyal et al. 2006). So, this study supports the prior studies that perceived benefits were the most influential determinants of the technology usage and especially EDI implementation.

**5.1.2 Top Management Support**

It was found that Top management support has a positive direct effect on EDI Implementation. This finding is similar with what Kim and Lee (2007); Ngrai and Gunasekaran (2004) and Seyal et al. (2006) have found. This is because the support from top management can be effective and influential in introducing new technology.

Many studies (e.g. Premkumar and Roberts 1999; Grover, Teng, Segars and Fiedler, 1998) have found that top management support to be critical for creating a supportive climate for the adoption and implementation of new technologies. In a study of large innovative organizations, Quinn (1986) reports that innovation would emerge continuously because top management would appreciate innovation and contributes actively to keep up the value system and atmosphere of the organization in a manner that supports innovation adoption and implementation. Jeyaraj, Rottman, and Lacity (2006) found that top management support to be one of the best predictors of organizational adoption of IS innovations.

Top management support goes beyond general approval for technology acquisition and includes a strong commitment to support the technology at all levels of the organization (Lederer and Sethi, 1992). Research indicates that securing top management support is a good predictor of the level of success of a new information technology (Ives and Olson, 1984). The role of top management support in the success of a Management Information System (MIS) project is not only intuitive but also axiomatic. The same is true for

EDI project implementation, where the implementation efforts must be protected by top echelon mandate and nurturing. A common complaint in many firms' EDI department is the lack of top management support for EDI programs (Angeles and Nath, 2001).

According to Angeles and Nath (2001), top management support can play a crucial role in the following area:

1. Persuading and supporting business process reengineering;
2. Commitment to the goals of EDI network; and
3. Adopting innovative technologies (Parsa and Popa, 2003).

Inter-Organizational Information System (IOIS) research has emphasized that a key success factor for EDI is management support (Crook, and Kumar, 1998) and consistently found a significant relationship between top management support and the decision to implement EDI.

In many ways, non-technical issues of an EDI initiative such as organizational issues can be more daunting and expensive than the technical issues of EDI implementation. The "human" costs associated with education, training, and implementation management constitute a significant part of EDI implementation costs. Consequently, in order to successfully implement EDI system, it is necessary to develop a strategy that will manage the nontechnical, organizational issues involved in the process (McLure and Moynihan, 1995).

Top management can stimulate change by communicating and reinforcing values through an articulated vision for the organization (Thong 1999). In banks, the decision-maker is very likely to be in the top management team and his support is vital for the implementation to take place.

### 5.1.3 Technical Infrastructure

It was found that Technical infrastructure has no effect on EDI Implementation. This finding contradicts with what previous studies have found that (Ngrai and Gunasekaran. 2004), because higher bank Technical infrastructure is not necessarily associated with the decision to EDI implementation.

### 5.1.4 External Pressure

It was found that External Pressure has a positive direct effect on EDI Implementation. According to this result and also as in the case of Iacovou et al., (1995)

external pressure was the most important factor contributing to intent EDI implementation. Many previous studies agree with this result (Chwelos et al., 2000; Elbaz, 1998; Iacovou et al., 1995, Seyal and Rahim, 2006; and Ramamurthy et al., 1999).

Customer Pressure emerged as one of the significant factor affecting of EDI Implementation, demonstrating that the EDI Implementation was more likely to be higher when respondents perceived the pressure exerted from their customers to be high. Since most organizations are highly dependent on their customers, they may be very willing to Implement EDI in order to maintain business with them (Iacovou et al., 1995).

This study extends previous findings of the significance of pressure from trading partners in EDI. Chwelos et al. (2000) considered the trading partner as influencing external pressure and readiness while external pressure was considered to be influenced by the dependency on trading partner and enacted trading partner power.

Pressure from competition represents the third factor, which is consistent with previous EDI literature. These studies have shown that innovation diffusion is accelerated by the competitive pressure in the environment. Competitive pressure can affect the implementation of EDI (Banerjee, and Golhar, 1994).

Jordanian central Bank is conducting several projects to provide e-services such as the electronic clearing system; the Bank participates also in the other projects which include the exchange of data by electronic means such as the Information System of Trade and Investment, and the Financial and governmental Information Management System.

### 5.1.5 Organizational Characteristics

Organizational Characteristics was found to have no direct effect on EDI implementation. This result is in contrast with various other studies on EDI Implementation. This might be due to the fact that the Organizational Characteristics of Jordanian commercial banks might have other characteristics that were not included in this study and contributed to the EDI implementation decision indirectly.

### 5.2 Limitations

Several limitations were faced during the conducting of this research such as:

1. Unavailability of enough information or statistics

concerning information technology in the banking sector in Jordan and some information could not be revealed for security reasons.

2. Lack of studies that searched directly into the impact of EDI on marketing performance.
3. Another limitation was the lack of knowledge of some managers had about the EDI implementation in banks which made the contact with these foundations difficult to some extent.

### 5.3 Recommendations

Depending on the results of this study, this study can suggest some recommendations to the decision makers in Jordanian Commercial banks, these recommendations may include:

1. A more careful attention should be paid by the top management to EDI investments to enable the positive impact of EDI implementation.
2. A clear strategic plan and information technology plan is needed, as alignment between strategic objectives and IT is a major reason behind EDI investments success.
3. Many bank's experts and managers believed that there must be several infrastructural readiness before implementing EDI; consequently, top managers should try to solve the mentioned impediment so that they can implement EDI easier than before.
4. The search for excellence for all types and sizes of banks is their main objective. The winner is the one who predicts changes in the appropriate manner and responds quickly and effectively to them. This can only be achieved through a mixed of policies, procedures, techniques and IT tools. EDI is a

powerful tool that enables banks in achieving their strategic priorities.

5. Banks and other organizations may find it valuable to utilize electronic data interchange, as a coordination mechanism, to facilitate information flows and manage task dependency amongst business processes. Study findings could be useful for those implementing to understand that their efforts may not deliver their expected performance. Managers should not just emphasize developing electronic linkages. In the implementation process, they need to listen to the voice of customers and create customer value.

### 5.4 Future Researches

The researchers make the following recommendations for other researchers.

1. The study can be repeated not only with banks managers, but also with the goal of getting to know consumer perceptions, interests and opinions about the impact of electronic data interchange implementation on his satisfaction and loyalty.
2. Another future possibility is to conduct the same study in another industry or country and to compare the results to deduce the common factors as well as the factors that cause differences in EDI implementation from country to the next.
3. Future research could also focus on other factors that may affect EDI implementation and the effect of EDI on productivity and profitability.
4. The study can be repeated as comparison study identifies gaps between local and foreign banks in Jordan concerning EDI implementation.

## Questionnaire

### PART 1: General information

- Gender:  Male  Female
- Age:  Less than 30 years  30-39  40-49  50-59  More than 60
- Educational background:  High School Bachelor  Degree Master  Degree Ph. D
- Bank's name:  Arab Bank  Jordanian Ahli bank  Cairo Amman Bank  Bank of Jordan  The Housing Bank for Trade&Finance  Jordan Kuwaiti Bank
- Bank's location:  Amman  Irbid  Karak

**Part two:** EDI implementation.

The number of banks and other institutions (central bank, customers, companies) that we receive data electronically from:

**Part three** factors affecting on EDI implementation

### Perceived benefits

EDI implementation provides the opportunities to enhance the functional performance.

EDI implementation enables me from increasing my productivity on the job.

EDI implementation enhances the level of accomplishment of required work.

EDI implementation increases my ability to achieve the objectives.

#### **Top management support**

Management realizes the benefits achieved through EDI implementation.

Management encourages employees to use modern electronic means to perform their jobs.

Management provides employees with necessary resources that enable them to apply EDI.

Management provides the equipment and electronic devices that are needed for this process.

Management provides employees with all forms of EDI.

#### **Technical infrastructure**

EDI implementation consistent with existing technological infrastructure of the bank.

The bank possesses the technical means for EDI implementation.

#### **External pressures**

The competition is an essential factor in our decision to implement EDI.

Customers are an essential factor in our decision to implement EDI.

The banking sector imposes the implementing of EDI.

The mechanism of work with the central bank imposes the implementing of EDI.

#### **Organizational Characteristics**

EDI is applied regardless of the bank size.

The bank possesses sufficient financial resources to implement EDI.

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