

SECURITY AND THE FACTORS AFFECTING THE ACCEPTANCE OF B2B DIGITAL MARKETPLACES IN EGYPT

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Abstract: Business has adopted technology to lower cost, make better decisions, and improve customer service (Chen, 2000). Companies have continued to automate their back-end planning and processes, however the automation stops at the boundaries of the company. Electronic Data Interchange (EDI) has been traditionally used as a point-to-point system to execute transactions between different companies but the need for a secure service, the limited flexibility of interchange formats, as well as the huge cost, have kept adoption of EDI to a few industries and extremely large companies. Clark and Lee (1997) believe that due to the large investment and technological complexity associated with EDI, few companies have actually benefited from it (Clark & Lee, 1997). It is worth noting that the penetration level of EDI is quite low and especially so in Egypt. Baum (1997) concluded that 90% of Fortune 500 companies used EDI while only 6% of the rest of the businesses in the United States were EDI capable. In such conditions, started different B2B marketplaces to emerge to connect the different businesses in an inexpensive and simple way. Online Markets and their enabling technologies have been available since 1995. The first online markets were mainly targeting technical goods. These early marketplaces were able to bring together buyers and sellers, and provided information about products, prices and items availability.

The basic task of a B2B marketplace is to enable firms to find desired products, suppliers, and customers or to create markets on the web (Dai and Kauffman, 2002). They also act as market-making electronic intermediaries whose value lies in reducing search costs, increasing market liquidity, offering transaction facilitation mechanisms, and procurement expertise (Bakos, 1997; Bailey and Bakos, 1997).

B2B digital markets have brought new opportunities and challenges for the industry they serve. They provide new procurement and distribution channels for the manufacturers, and at the same time pose a threat to traditional distributors serving the same industry group since they enable firms to bypass the traditional intermediaries to transact directly online (Dai and Kauffman, 2003).

In business-to-business electronic commerce, businesses use the Internet to integrate the value-added chain. IDC the leading provider of technology intelligence and industry data analysis, has predicted that e-procurement, through a combination of EDI and Internet based systems, will grow from US \$225 billion in 2002 to about 1.5 trillion by 2006 which represents a seven fold increase (Hamblen. 2002) .

In Egypt, the first B2B digital marketplace was established in 1999 as a joint venture between an international Bank and an Egyptian IT firm. The aim of this venture was to create a number of vertical marketplaces that targeted different industries. The first vertical marketplace created was a pharmaceutical one that aimed at connecting pharmaceutical buyers and sellers together. Hundreds of pharmaceutical businesses were interested in this marketplace and subscribed to it. In this paper, the author studied the different factors that influenced the businesses' decision to indulge in this new endeavor.

In this research the author is using Structure Equation Modeling (SEM), which is a second-generation multivariate technique (Bollen, 1989, Fornell, 1982) to validate the modeling describing the different factors affecting the adoption decision of B2B digital marketplaces. SEM has been rarely used in Egyptian researches, and accordingly one of the purposes of this paper is to introduce it to the research community in this country. SEM "takes a confirmatory (i.e., hypothesis-testing) approach to the multivariate analysis of structural theory bearing on some phenomenon" (Byrne, 1998). SEM is comprised of measurement model and a structural model. First, the measurement model is tested for convergent and discriminant validity. The measurement model must then be adjusted and fixed prior to examination of the structural model. The structural model is then tested for explanatory power and goodness of fit. The model is further tested for goodness of fit and modified again so that the best fitting model can be used for the final tests. In this research, SEM is chosen for the following reasons:

Contrary to the initial hypothesis, security could not be proven to have any influence on the adoption decision. On the other hand,

users' experience, relative advantage, and the low establishing cost of the system all had a positive influence on the adoption decision of B2B digital marketplaces.

Keywords: B2B, Marketplace, E-commerce, Adoption, Egypt

1 INTRODUCTION

In 1999 the first B2B digital marketplace in Egypt was established as a joint venture between an international Bank and an Egyptian IT firm. The aim of this venture was to create a number of vertical marketplaces that targeted different industries. The first vertical marketplace created was a pharmaceutical one that aimed at connecting pharmaceutical buyers and sellers together.

More than four hundred business participated in the first pharmaceutical B2B digital marketplace in Egypt, and the aim of this paper is to study the different factors that influenced the decision of the different businesses to participate in this marketplace. The author believes that by understanding these factors, future B2B digital marketplaces would have a better chance of succeeding and achieving their aims. The author will also try to verify a general belief that the perception of security is a critical factor affecting the acceptance of the digital marketplace.

After studying the literature covering Innovation adoption, Electronic Data Interchange, Electronic Commerce, and Electronic Commerce in Egypt, the author formulated a theoretical model with the aim of trying to prove that this model reflects the different factors affecting the adoption decision of B2B digital marketplaces in Egypt. A questionnaire was created and circulated among the different pharmaceutical businesses and the results were collected, analyzed using Structured Equation Modeling technique to verify the model.

It is important to study this venture and the factors affecting its adoption in order to improve the possibility of success in the future for emerging marketplaces.

Although Security is seen by many as a factor affecting the Electronic commerce, it is interesting to note that few literature is available to highlight the effect of security on the adoption decision of Electronic commerce in general and B2B in particular in Egypt.

The paper is divided into the following sections: Literature review in which previous relevant literature is studied the similarities between this study area and previous research are highlighted. The research models together with the model development strategy are then introduced. Followed by the data analysis section and a description of the techniques used in collecting and analyzing the data. The results of the data analysis as well as the final model are then introduced. Discussions of the findings and conclusions are then presented accompanied by references from relevant literature. At the end, a list of all the references used in this paper is presented.

2 LITERATURE REVIEW

2.1 Historical Background and the Role of B2B Marketplaces in Supply Chain Management

Online Markets and their enabling technologies have been available since 1995. The first online markets were mainly targeting technical goods. These early marketplaces were able to bring together buyers and sellers, and provided information about products, prices and items availability.

One of the early examples of online markets was Industry.Net which failed in 1997 and filed for bankruptcy. One of the reasons why such a venture failed might be because it was a closed market (traders had to pay to become part of the marketplace. While others blamed the underlying technology which they thought was too weak.

Marshall Industries created another example of Digital marketplaces. In this marketplace when a customer approaches the web site for a product they do not have, they source from the competition for a fee.

Companies have automated their back-end planning and processes through the implementation of enterprise resource planning (ERP) and advanced planning and scheduling (APS) systems. However the automation stops at boundaries of the company or in other words at the output of these systems. Electronic Data Interchange (EDI) has been traditionally used as a point-to-point system to execute transactions between different companies but the need for a secure service, the limited flexibility of interchange formats, as well as the huge cost, have kept adoption of EDI to a few industries and extremely large companies.

An increasing number of organizations are realizing the benefits associated with supply chain management via a marketplace. The digital marketplace is a vehicle for sharing information across the supply chain. Now an order entering the top of the chain can be used immediately to stimulate orders at each element of the chain, with the intention of just in time supply, just in time production and delivery. Production planning can take place in parallel, and storage of inventory and work in progress and minimized. Such marketplaces can also undertake collaborative planning across the supply chain, and migrate to collaborative design and sourcing. (Hughes, 2001).

2.2 Innovation Adoption: Innovation Adoption Theory (IDT)

An innovation is “an idea, practice, or object that is perceived as new by an individual or another unit of adoption” (Rogers, 1995). An innovation generates uncertainty, and uncertainty motivates an individual or another unit of adoption to seek more information about alternatives. Diffusion on the other hand is “the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 1995). One of the aims of IDT is to explain, among many things, the process of the innovation decision process, the determining factors of rate of adoption, and different categories of adopters. IDT helps predict the likelihood of adoption of an innovation and rate of such adoption.

IDT was widely researched and applied in different disciplines such as, education, communication, marketing, etc. (Rogers, 1962, 1983, 1995). A lot of the innovations studied in recent IDT research though are technology innovations. The eight main types of diffusion research, classified by Rogers (1995), were earliness of knowing about innovation, rate of adoption on different innovations in a social system, innovativeness, opinion leadership, diffusion networks, rate of adoption in different social systems, communication channel use, and consequences of innovation. Information technology researchers have used diffusion theory to study the impact of attributes of innovations and rates of adoption.

One of the major contributions of IDT is the innovation decision process, which starts with one's knowledge about the existence of the innovation and ends with the confirmation of the adoption/rejection decision.

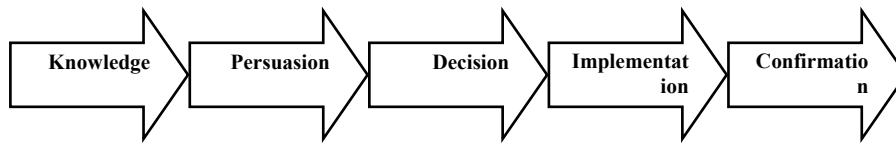


Figure 2.1. Innovation Decision Process (Source: Rogers 1995)

Rogers identifies five attributes that affect the innovation adoption decision: relative advantage; compatibility; complexity; trial-ability; and observability. Relative advantage refers to the degree to which an innovation is perceived as an improvement on the existing way of doing things. Compatibility is the extent to which an innovation is perceived as fitting in with existing values, past experiences, and the need of potential adapters. Complexity is the degree to which an innovation is perceived as difficult to understand and use. Trial-ability is the degree to which an innovation can be tested before the final adoption decision. Observability is the degree to which the results using an innovation can be observed and communicated to others.

2.3 EDI, E-commerce, and Internet-Based Inter-Organizational Information Systems

Today, many companies are exploring alternatives to improve business communications with trading partners along the supply chain. Several new alternatives are available to utilize the Internet for business communications. Virtual VAN or extranets are examples to utilize the Internet to establish B2B communications. Virtual VAN can work like a traditional VAN, but over the Internet (Prinince 1998). Either one of the trading partners or a middle party can own the virtual VAN. On the other hand, by using extranets, organizations would allow their trading partners to access their private networks and internal applications via the Internet.

On the one hand, IBIS would allow small organizations that could not afford the costs associated with establishing EDI to develop business contracts with new trading partners. On the other hand, organizations that already understand the intricacies of the EDI would realize the significant savings provided by the IBIS environment. These savings could be in the form of lower initial and operational expense, higher level of business communications, and lower costs associated with changing trading partners.

Table 2.1 shows a summary of the results of some of the researches reviewed and the different factors that were shown to influence the dependent variable in these researches. Of special importance is the work of McCartney (1997) and Pincince (1998) where security was proven to have an effect on the adoption of Internet-based Inter-organizational Information Systems.

Table 2.1 Factors affecting EDI and Electronic Commerce adoption

Factor	Dependent Variable	Author
Relative Advantage Technical Expertise Training	Adoption Decision of EDI	Mcgowan and Madey (1998)
User's Computer Experience	Adoption of Web Shopping	Ruth (2000)
Communication standards	Adoption decision of Internet-based Inter- organizational Information Systems	Dykeman (1997)
Compatibility, Information Richness, Product Offering	Acceptance of Virtual Stores	Chen (2000)
Establishing Cost, Perceived Benefits	Adoption decision of Internet-based Inter- organizational Information Systems	Soliman (2000)
Network Externality, Perceived Benefits, Costs	Adoption of E-business by SME	Pai (2000)
Security	Adoption decision of Internet-based Inter- organizational Information Systems	Pincince (1998), McCartney (1997)
Initial investment and operating expenses	Adoption decision of Internet-based Inter- organizational Information Systems	Tan and Teo (1998)
Trading partner and competitor's pressure	Adoption decision of Internet-based Inter- organizational Information Systems	Crook and Kumar (1998); Urbaczewski et al. (1998)

3 THE PROPOSED MODEL

3.1 Model Development

In order to formulate the model that describes the factors influencing the adoption decision of B2B digital marketplaces in Egypt, the following steps were taken:

- Studied the factors affecting the adoption of EDI, IBIS, and B2B Ecommerce in the available literature, and then created an initial model.
- Enhanced the initial model using literature that Studied Electronic Commerce, and Internet adoption in Egypt.
- Enhanced the model further using the findings of a number of market researches conducted by leading research and consultancy firms. This also helped to double check on the validity of the constructs used in the model. The used researches dealt mainly with B2B electronic commerce and B2B marketplaces and exchanges.

3.2 Model Description

The proposed model consists of the different factors that are believed to affect the adoption of B2B digital marketplaces in Egypt. These factors are grouped in the following categories: Technical, Environmental, Experience, Relative Advantage, Costs, and Industry Knowledge.

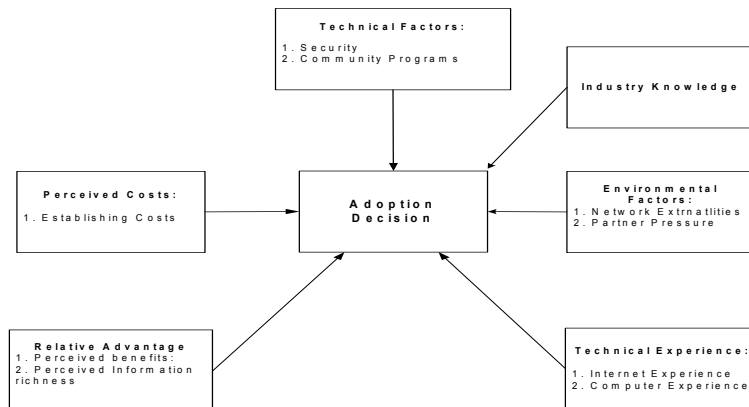


Figure 3.1 Proposed Model

4 DATA ANALYSIS

4.1 Overview of Structural Equation Modeling (SEM)

In this research Structure Equation Modeling (SEM) which is a second generation multivariate technique (Bollen, 1989, Fornell, 1982) is being used. SEM is comprised of measurement model and a structural model. First, the measurement model is tested for convergent and discriminant validity. The measurement model must then be adjusted and fixed prior to examination of the structural model. The structural model is then tested for explanatory power and goodness of fit. The model is further tested for goodness of fit and modified again so that the best fitting model can be used for the final tests.

Before assessing the significance of the overall model, the validity and reliability of the constructs is examined as well as the significance of the measures.

4.2 Data Collection

Throughout this work, the author will mainly be using Survey research. Survey is one of the most prevalent research methodology used in management information system (MIS) research (Vogel and Wetherbe 1984; Pinsonneault and Kreamer 1994). In conducting a survey, the investigator elicits opinions, attitudes, and beliefs of a sample group regarding some issue of interest. The data will be collected through questionnaires. The benefit of using surveys is that the researcher can easily cover large populations quickly at a relatively low cost (Davis and Cosenza 1993).

Data was collected from a sample of 127 businesses that showed interest and participated in the B2B digital marketplace. The data collected was discrete and Ordinal (based on 5 points Likert scale).

4.3 Item Reliability

Item reliability refers to the degree of variance explained by the construct rather than by error. This is typically measured by squared factor loading (SFL) which represent the item's ability to capture variance within the construct (Ruth, 2000). One construct in the model as well as one item were excluded because they was not able to meet the minimum SFL needed.

4.4 Construct Validity

Construct reliability is the ability of variables to tap a similar underlying construct (Ruth, 2000). This can be measured using a measure of construct reliability and a measure of Average Variance Extracted.

Composite reliability of a variable is the square of summation of factor loadings/[(square of summation of factor loadings + (summation of error variances)]. A value of .8 or higher is an indicator of strong composite reliability (Nunnally, 1978).

Average Variance extracted on the other hand is the amount of variance captured by the measurement model versus the amount due to measurement errors. It can be calculated by (summation of squared factor loadings)/[(summation of squared factor loadings) + (summation of error variances)]. Average Variance Extracted values of .5 or higher demonstrate significant variance captured by the measurement model (Fornell & Larker, 1981).

Table 4.1 shows the values of Construct reliability and AVE for all the constructs in the study.

Table 4.1 Composite Reliability and AVE of Constructs

Variable	Composite Reliability	Average Variance Extracted	Status
Partner Pressure	.88	.78	Accepted
Network Externality	.86	.75	Accepted
Establishing Cost	.85	.74	Accepted
Perceived Benefits	.88	.72	Accepted
Information Richness	.89	.63	Accepted
Computer Experience	.89	.74	Accepted
Internet Experience	.93	.82	Accepted
Security	.86	.76	Accepted

4.5 Model Fitting

The structural model is then tested for explanatory power and goodness of fit and is modified and retested until we reach best fitting model. The best model that was able to fit is the one shown in Fig 4.1.

The model yielded the following goodness-of-fit values:

$$\chi^2=6.32$$

$$\text{RMSEA}=.068$$

$$\text{AIC}=-1.68$$

$$\text{Probability}=.176$$

Based on the above results, and according to Bollen (1989), the higher the probability associated with χ^2 the closer the fit between the hypothesized model and the perfect fit. The value of the probability associated with χ^2 is the highest achieved so far and is high enough for us to assume that the model fits the data. Given the sensitivity of the Likelihood Ratio Test statistic to sample size (Byrne, 1998), it is beneficial to use other goodness-of-fit indices to ensure the fit of the model. The RMSEA value is later examined (.068), and since a value less than .08 constitutes a model fit, the model is proved to fit the data. The AIC value is < 1 which also proves the model fit.

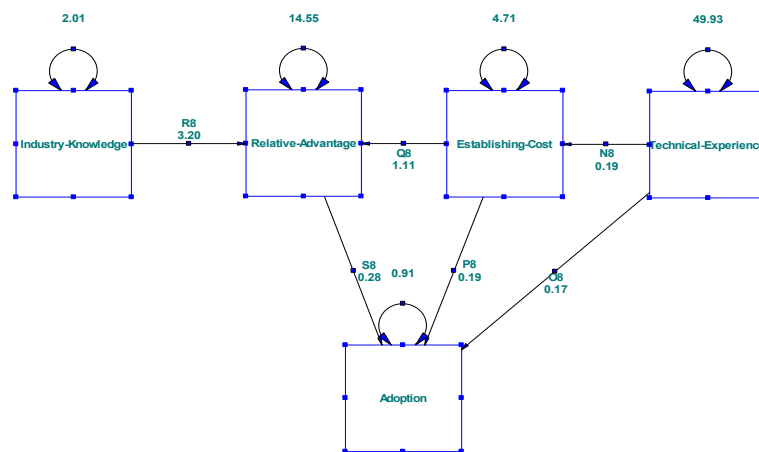


Figure 4.1 Final Model

4.6 Path Estimates

Based on the final model, the estimates of the paths calculated are provided in the following table

Table 4.6. Path Estimates

Path	Value
Low Establishing Cost → Adoption	.19
User Experience → Adoption	.17
Perceived Advantage → Adoption	.28

5 CONCLUSIONS

Although Security is generally thought to be a major concern in Electronic Commerce, in my study, the author was not able to prove that it is a factor affecting the adoption decision of B2B digital marketplaces in Egypt. Although this contradicts several previous researches (example: Pincince,1998), it still reflects the findings of Soliman (2000) who was also unable to prove that Security had any effect on the adoption decision of Internet-based Inter-organizational Information Systems either. Such a finding can still be justified by searching through the available literature. In the 1980's organizations started to have some trust in IT, and realize the critical role it can play in achieving competitive advantage as well as increasing coordination and control (Ives & Jarvenpaa, 1991). Nowadays organizations have developed high expectations of Information Technology and there is a general belief among managers that IT is capable of addressing security concerns and providing the required level of security in establishing a B2B electronic commerce environment (Soliman, 2000). McCartney (1997) believes that existing technology can already provide a reasonable level of security. Accordingly, Soliman (2000) concluded that most business managers do not perceive security as a critical factor in utilizing the Internet in B2B communications. He also believes that the security "hype" was mainly discussed within the business-to-consumer environment and not the business-to-business environment.

Perceived Benefits: was found to be a significant factor that influences the adoption decision of B2B Digital Marketplaces. This seem to be in line with previous studies in the field of innovation adoption (Rogers, 1993), Internet Based Information Systems (Soliman, 2000), and the Internet (Poon and Swatman, 1999).

Information Richness was found to be a significant factor that influences the adoption decision of B2B Digital Marketplaces. This finding is supported by the Information Richness theory (IRT) proposed by Daft and Iengle (1986) which proves that users would choose media higher in richness for tasks with higher equivocality and ambiguity.

Although Industry knowledge was not found to have direct influence on the adoption decision of B2B digital market places, it was proven to have an indirect effect through another construct which is Relative Advantage. Industry Knowledge might be seen as having a direct relationship with Compatibility which was identified by Moore and Benbasat (1991) to affect usage of innovation. The high correlation between Industry Knowledge and Relative Advantage can be explained by the fact that Egyptian businesses rely heavily on their perception of Relative Advantage gained by an innovation to adopt it.

User Technical Experience was found to be a significant factor that influences the adoption decision of B2B Digital Marketplaces. Kown and Zmud (1986) identified five factors that influence IT adoption and implementation. The first factor is the user's characteristics. The results of my finding seem to prove this theory. Chen (2000) also stated that experienced computer users are able to predict their satisfaction prior to the purchase from a virtual store based on the product attributes and past experience. Ease of Use has also been repeatedly identified as a factor affecting the usage of innovation as well as its adoption. Accordingly, the results of my findings seem to suggest that users who have a technical experience perceive B2B Digital Marketplaces as easier to use and thus readily adopted it.

Establishing cost was also found to be a significant factor that influences the adoption decision of B2B Digital Marketplaces. Bakos (1991) proved that an electronic market system can reduce costs of obtaining information from a trading partner about price and product. Scala and Mcgrath (1993) found that one of the major disadvantages of implementation EDI is that it needs high initial capital investments. Accordingly these high investments prevented many organizations, especially small ones from establishing EDI links with their trading partners. Soliman (2000) also claims that the low costs involved in establishing Internet Based Information Systems allow the organization to establish B2B communications with new suppliers, improving the efficiency of the supply chain as a whole.

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Appendix I

The Questionnaire

Please indicate your level of agreement or disagreement with the following statements

	1	2	3	4	5
The B2B Marketplace provides reduced errors/data accuracy regarding orders					
I have extensive experience with Word Processors					
The B2B Marketplace provides reduced administrative/transaction costs					
The B2B Marketplace provides better communication with trading partners					
If My trading partner is interested in joining the B2B marketplace my firm would probably follow					
I have extensive experience with Chatting Software (IRC, etc)					
My main trading partners decides on pricing, delivery, etc					
The B2B marketplace currently has a substantial number of users that I can trade with					
The B2B marketplace demonstrates in-depth knowledge of my industry					
I have extensive experience with Spreadsheets (Excel, etc)					
The B2B marketplace is expected to have a big number of users that I can trade with in the future					
Using B2B digital marketplaces would be less expensive than using traditional trading means					
Doing business with my trading partners over the B2B					

marketplace is cost effective					
I intend to use the B2B digital marketplace					
I am satisfied with the feedback I receive to the request for product/service information					
The B2B marketplace offers a vast selection of products and services					
By using the B2B marketplace, I am achieve cost savings					
The presence of community programs in the B2B marketplace affects my adoption of the system					
I have extensive experience with Electronic Mail					
I will subscribe to the B2B digital marketplace					
By using the B2B marketplace, I am able to find hard to find products and services					
I am happy with the products and services offered by the B2B marketplace					
Using the B2B marketplace is secure enough to allow business transactions to be conducted via it					
I have extensive experience with Presentation Software (Power Point, etc)					
Using the B2B marketplace subjects me to fraud problems					
I can clarify ambiguous issues about the product/service by using the B2B marketplace					
I have extensive experience with Word Processors					
I have already subscribed to the B2B digital marketplace and I intend to use it					
The B2B marketplace allows me to compare products					
I have extensive experience with Web Browsers					
I am satisfied by the Information Richness of the B2B marketplace					

1= Highly agree
 5= Highly disagree

Appendix II

The Hypothesized Model in Lisrel Notation

Nachtigall et al. (2003) argue that Structural Equation Models are often called LISREL models, meaning Linear Structural Relations. Where ‘structural relation’ refers to the relationships between latent variables. They add that such relations are usually formulated by linear regression equations, graphically expressed by so-called path diagrams using arrows. The operational research model will be drawn with Lisrel notation, which helps identify the model constructs with their indicators and paths to the adoption decision (Figure II.).

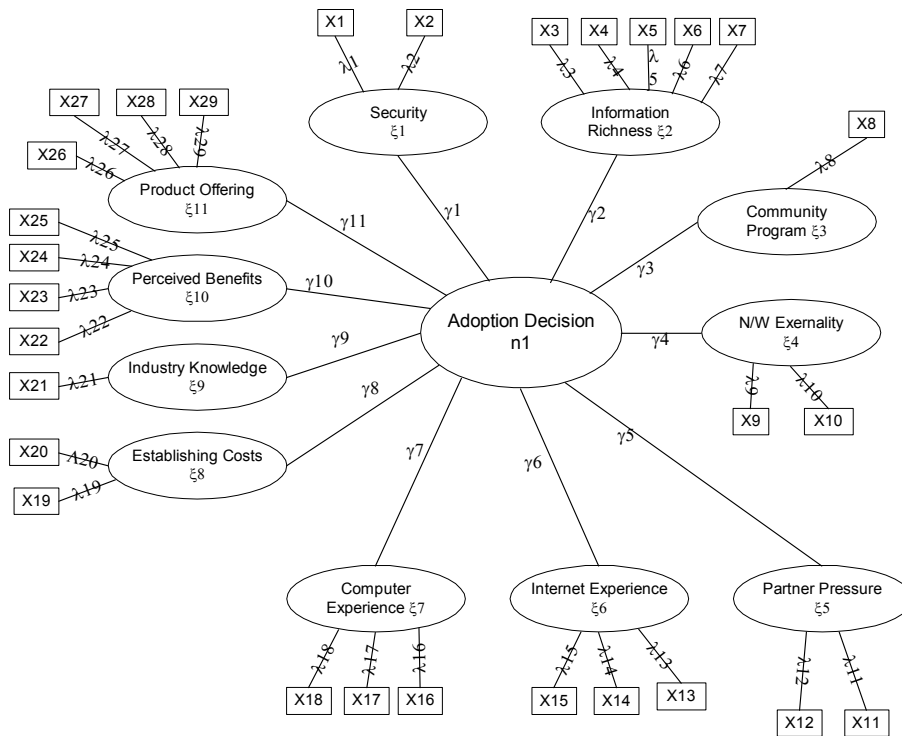


Figure II. Research model in Lisrel notation

Appendix III**Means and Standard Deviation of Indicators***Table III. Means and Standard Deviation of Indicators*

Indicator	Mean	Standard Deviation
X1	3.46	1.07
X2	2.59	1.29
X3	1.83	.73
X4	2.32	1.24
X5	1.62	.71
X6	2.2	.93
X7	1.87	1.05
X8	1.98	1.21
X9	3.07	1.38
X10	4.02	1.06
X11	1.82	1.05
X12	2.76	1.5
X13	2.06	1.4
X14	2.06	1.41
X15	1.94	1.3
X16	1.79	1.34
X17	1.8	1.28
X18	1.81	1.35
X19	2.06	1.37
X20	1.87	1.36
X21	3.16	1.41
X22	2.56	1.35
X23	3.13	1.5
X24	3.0	1.42
X25	1.14	.37
X26	1.39	.84
X27	3.55	1.38
X28	2.36	.97
X29	2.22	.93