Research Project for E-Commerce Adoption, Acceptance, and Prototyping in Abu Dhabi

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ABSTRACT

The proliferation of Internet usage as a business environment is changing the way businesses structure their strategies and processes. The objective of this project is to specify the critical success/failure factors affecting the adoption of E-Commerce in the United Arab Emirates, particularly in the Abu-Dhabi as an example of Arabian Gulf countries. Another objective is to use the critical factors in proposing an E-Commerce prototype that suits that part of the World. Currently, the critical factors are being identified and assessed using the Technology Acceptance Model (TAM). The first phase of this project involves surveying the factors that affect the adoption and acceptance of E-Commerce, and administer questionnaires to identify the critical factors. Based on these factors, two models will be developed, one to address the E-Commerce adoption by businesses, and the second to address the E-Commerce acceptance by customers. Structural Equation Modelling (SEM) provides the theoretical foundation of the first phase. In the second phase, the critical factors are used to design and implement a Web-based E-Commerce model that will facilitate several activities such as; search for a product, making purchasing decision, and gathering pattern. The model will incorporate third-party authentication services to monitor vendors, and consumers.

BACKGROUND AND LITERATURE SURVEY

E-Commerce can be defined as the process of sharing business information, maintaining business relationships, and conducting business transactions by means of telecommunications networks. E-Commerce is evolving rapidly, moving well towards the creation of electronic markets. Clearly, E-Commerce has substantial advantages over traditional face-to-face and paper-based commerce. It gives the customers more choices and customized options by tying orders, design and production time more closely to product delivery. It decreases the time and cost of each search and discovery for customers as well as for those vendors that are trying to find customers. Moreover, with minimal capital outlay, equipment, space, and staff, it expands the marketplace from local and regional markets to national and global markets (Electronic Commerce, 1997). The generally acknowledged benefits of using E-Commerce include improved business opportunities, better record keeping, fewer mistakes, reduced processing delays, less reliance on human interpretation of data, more competition and lower prices, reduced order time, elimination of document losses, and better decision-making (Electronic Commerce (EC) and Electronic Data Interchange (EDI), 1997).

Organizations throughout the world experience difficulty in information technology transfer. This problem is even more acute in developing countries, such as the emerging economies in the Arab world (Goodman, 1991; Knight, 1993; Antonelli, 1994). Although developing countries are eager to adopt new technologies, the process of adoption has been slow and the current utilization of IT is far below that achieved in industrialized countries. While finances were not a problem for the affluent countries of the GCC region, they have historically used far less than their available computing capacity (Attiyyah, 1989; Ibrahim, 1985; Yavas, Mushtaq, & Quraesh, 1992). With some notable exceptions, sporadic implementation and use are endemic throughout the Arab world (Cunningham & Srayrah, 1994).

Anthropological studies suggest that much of the technology designed and produced in developed countries is ethnocentric, that is, culturally-biased in favour of their own social and cultural systems. Consequently, developing countries encounter cultural and social obstacles when attempting to transfer technology, created abroad, into practice at home (Yavas et al., 1992). A recent study, which used the Arab society as its setting, states that the Arab society has the most complex cultural and social system in the world (Straub, Loch, & Hill, 2001; Straub, Keil, & Brenner, 1997). The study tested the cultural influence model in the Arab region. Both quantitative and qualitative methods were used to validate and test the model. Furthermore, data analysis was based primarily on an Arabic-English questionnaire. In this study, primarily findings indicate that specific cultural components of Arab culture have an influence on how IT is viewed and the extent to which it might be utilized. Culture does not necessarily need to be viewed as a barrier that obstructs IT transfer. However, the study suggests that using specific cultural components will encourage the IT transfer process.

Research into IT adoption and use has been motivated by the desire to predict the factors which lead to IT adoption and acceptance (Thompson R. & Rose, 1994). Over the years, the area of IT adoption and acceptance has received a great deal of attention and includes a wealth of research (our database contains 400 papers).

Rose and Straub (Straub et al., 2001; Rose & Straub, 1998) stated that during the 80s, organizations throughout the Western developed countries started to use computer technologies. The new wave of attention was initiated by the increasing diffusion of networking technologies, such as the Internet, and the decreasing importance of geographical distances has given the chance for E-Commerce technologies to diffuse. Yet, while research in this area has been extensive, it has taken place almost exclusively in developed economies. This research addressed the transfer of Information technology to the Arab World, which is needed to specify the determinants of adopting and accepting E-Commerce IT related technologies in the gulf countries.

In recent years, there has been an overwhelming amount of research attention in incorporating data mining tools and other techniques of Artificial Intelligence in developing E-Commerce models. These models could encourage the growth of E-Commerce and meet the end-user satisfaction by eliminating several critical failure factors (Hongium, 2000). Hongium investigated several techniques in building an intelligent system that can manage, and search web documents stored in an information provider's web server. Techniques that were investigated include clustering of web documents, pre-fetching and caching and customized linkage of web documents. The major issues in this research include establishing measurements and heuristics on user access patterns

and developing techniques to discover and maintain such discovered patterns. The results then were expanded in the direction of using the discovered user access patterns to manage web documents so that information subscribers can access information of interest more efficiently. In another study (Ke, 2000) has proposed a framework for designing web pages of directories/catalogue of products. In the first stage he proposed an algorithm that is based on the natural categorization of products/services and frequency of accessing product. In the second stage he implemented this algorithm and tested its performance. He also looked into how the traditional data mining tools can be used for web information sources, and what extension is needed. In other words, he addressed the issue of enlarging the application domain of data mining technologies to those generated by electronic marketplace and commerce. In some cases, existing data mining tools have been used. In other cases data have to be pre-processed first.

In another study, Joshi at the University of Maryland, Baltimore County, and Krishnapuram at the Colorado School of Mines developed in their collaborative project a scalable robust techniques for web personalization and mining (Joshi & Krishnapuram, 2000). These techniques were used to create a software tool for Web personalization and mining. Personalization has two components: (1) tailoring the content delivered to the user from a Web site; and (2) exploring the available Web pages and categorizing them. Their approach consisted of developing new practical clustering algorithms by combining fuzzy methods and robust statistics to model an unknown number of overlapping sets in the presence of outliers. Since numerical features cannot represent many Web objects such as URLs, IP addresses, Web pages, and snippets, new techniques to handle such Web objects, as well as to categorize them by using suitable similarity measures between such objects, were being explored. A software tool for Web personalization and mining was created and validated. The results of their project is expected to generate new theoretical results and efficient algorithms for simultaneously estimating the prototypes/profiles of an unknown number of overlapping categories from noisy data sets, as well as a Web personalization and mining tool that will be made available on the Web. Thus their work is expected to have a significant impact on the way documents are searched for and delivered. It will directly influence the usefulness and spread of the WWW, and will also contribute to the digital library technology.

Dr. Radaideh worked on several projects (Sproule & Archer, 2000; Radaidah, 2001c; Sproule & Archer, 2000; Radaidah, 2001b; Radaidah, 2001a; Radaidah, 2001d) that involved indexing data, building searchable collections, building knowledge trees based on custom information categorizations and taxonomies, building components that integrate web-servers, web application servers, database servers, enterprise indexing and search servers, etc. Dr. Radaideh identified the indexing speed, search speed, database access time, and application web server speed as the critical factors in all E-Commerce systems that he worked on. By redesigning the searchable collections of BarPoint.com web site of Florida, and by revising the jsp pages that integrated BroadVision with Verity K2 toolkit, Dr. Radaideh managed to introduce substantial search performance improvement to that website. For most of his projects, Dr. Radaideh followed his own process for auditing the customer requirements, architecting, designing, testing, and evaluating his web-based solutions. His process always started with meeting senior executives at the customer site for the purpose of identifying any critical managerial, social, and/or financial issues that must be accounted for in the projected design. The second step would be to meet with the customer's key technical staff in order to understand the customer's technical issues and then define their requirements. The third step would be to work out a formal proposal that defines (i) the platform, (ii) the software tools such as the web-server, web-application server, database system, indexing tools, search engine, etc. Once the proposal is reviewed and approved by both parties (the architect, and the customer), a statement of work (contract) would be prepared and signed for by both parties. Then the project would be resourced and then executed and at the same time the project manager of the project would monitor the project execution progress. Testing and evaluating the project would be the one of the last steps.

E-Commerce adoption and acceptance in the GCC has not been evaluated before. While several studies do suggest that information technology adoption and acceptance models tested in developed countries may be applicable to less developed countries, such as UAE, no hard evidence presently exists. Without empirical verification, therefore, it is unclear whether IT adoption and acceptance models to be validated in UAE.

We believe that business relations are intensifying and becoming more complex, not only within the United Arab Emirates, but also across its national borders. The way business is done is increasingly shaped by the use of computer technology, especially in developed countries. The lack of similar developments in the UAE could widen the existing cultural gaps.

The research study proposed for this project aimed to encourage the growth of adopting, and using the E-Commerce in Abu Dhabi region. This project will be executed mainly in two phases; during the first phase, the researchers will assess the current E-Commerce situation in Abu Dhabi region. This assessment will be based on identifying and analysing the Critical Failure Factors (CFFs) and Critical Success Factors (CSFs) that affect using, adopting, and utilizing E-Commerce. During the second phase, the researchers will propose possible strategies that overcome the CFFs identified in the first phase. This phase will be devoted to the design and implementation of a Web-based model that can eliminate several critical failure factors. The model will facilitate several activities, such as; search for a product, making purchasing decision, gathering pattern, etc.

RESEARCH PROJECT OBJECTIVES

Table 1 shows he main objectives of this research project are presented in Table 1 next.

RESEARCH SCOPE AND FRAMEWORK SUMMARY

The main goals of this research work are to identify the critical factors that affect the adoption of E-Commerce and suggest strategies to mitigate the critical failure factors (CFFs) and induce the critical success factors (CSFs). This study assumes that critical failure factors can be identified from the many obstacle factors that prevent businesses from adopting and customers from accepting E-Commerce. Therefore, the critical factors will be identified from failure and success factors extracted from an extensive literature survey and from two models that will be designed and developed for this purpose. The first model addresses the adoption of E-Commerce by businesses and the second model addresses the acceptance of E-Commerce by customers. The proposed framework for this research has three stages; an input stage, a process stage, and an output stage- as shown in Figure 1.

In the input stage, factors affecting E-Commerce growth are surveyed, categorised and analysed. The process stage has three sub stages. In the first sub stage, an exploratory factor analysis is performed using questionnaires data. A commonly used software tool, LISREL 8.5, will be used to perform the analysis and primary factor identification. In the second sub stage, using the first sub stage results, a confirmatory factor analysis is carried out. In the third sub stage, the critical success and failure factors are identified using the confirmatory factor analysis results. A structural equation model - based technique is implemented to establish how these critical factors affect E-Commerce performance variables, such variables as; satisfaction with E-Commerce, and adopting/accepting E-Commerce.

Table 1. Research Objectives

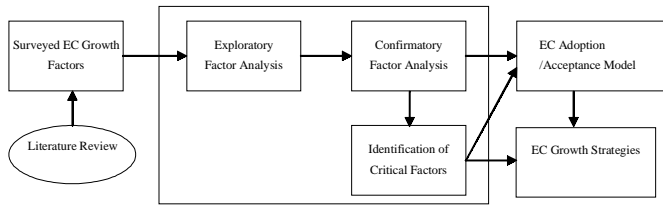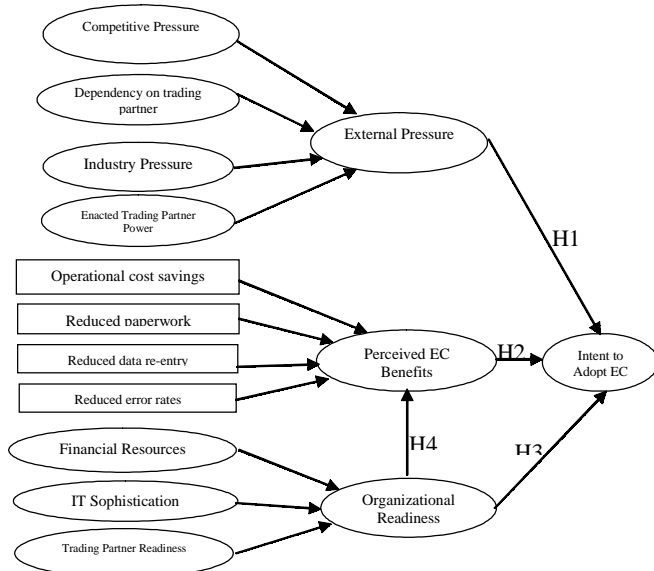|	Objective	Tools and Measures
1	Identify the factors that affect the adoption of E-Commerce by business.	• Questionnaire instrument. • ECADM, figure 2.
2	Identify the factors that affect the acceptance and use of E-Commerce by customers.	• Questionnaire instrument. • ECACM, figure 4.
3	Present an assessment for the current situation of the E-Commerce in Abu Dhabi region.	• Statistical information from ADCC.
4	Explore the opportunities and challenges that affect the adoption and use of E-Commerce.	• Validating ECADM & ECACM.
5	Identify the future trends for adopting the B2B and B2C on the region's counties.	• Expanding ECADM & ECACM.
6	Identify which E-Commerce strategies would lead to successful electronic markets.	• List of verified and validated strategies.
7	Proposing a well-defined E-Commerce model.	• E-Commerce prototype.

Figure 1. Research Model

Figure 2. E-Commerce Adoption Model (ECADM)

Table 2. E-Commerce Adoption Constructs

Construct/Factor	Definition	Antecedents
Intent to Adopt EC	Business intention of adopting E-Commerce	External Pressure to adopt External pressure Organizational readiness
External Pressure	The influences arising from sources within competitive environment	Competitive pressure Dependency on trading partner Industry pressure Enacted trading partner power
Perceived EC Benefits	The anticipated advantages that EC can provide the organization	Operational cost savings Reduced paperwork Reduced data re-entry Reduced error rates
Organizational Readiness	Measures whether a firm has sufficient IT infrastructure	Financial resources IT sophistication Trading partner readiness
Competitive Pressure	The ability EC to maintain or increase competitiveness within the industry	*To be Constructed*
Dependency on Trading Partner	The potential power of the trading partner to encourage EC adoption.	*To be Constructed*
Industry Pressure	The efforts of industry associations to promulgate EC standards and encourage adoption.	*To be Constructed*
Enacted Trading Partner Power	The strength of the influence strategy used to exercise the potential power	*To be Constructed*
Financial Resources	Sufficient funds to adopt EC	*To be Constructed*
IT Sophistication	The level of technological expertise within an organization & the assessment of the management understanding of EC adoption.	*To be Constructed*
Trading Partner Readiness	Contains the measures of the willingness and ability of potential partners to adopt EC.	*To be Constructed*

The four fundamental hypotheses required for the ECADM to test are:

H1 *Higher perceived benefits will lead to greater intent to adopt E-Commerce*
H2 *Higher external pressure to adopt E-Commerce will lead to greater intent to adopt E-Commerce*
H3 *Higher organizational readiness will lead to greater intent to adopt E-Commerce*
H4 *Organizational readiness will have a positive effect on perceived benefits.*
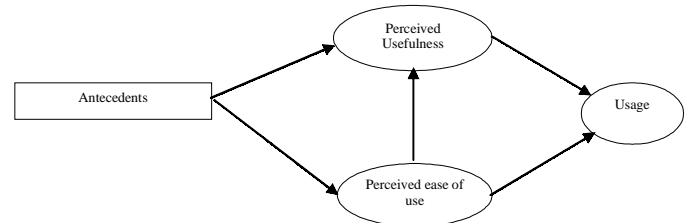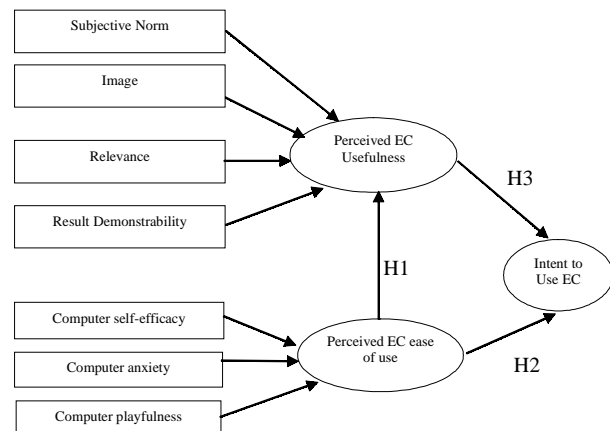
Figure 3. Technology Acceptance Model (TAM)

Figure 4. E-Commerce Acceptance Model (ECACM)

In the output stage, an EC adoption model (ECADM) and EC acceptance model (ECACM) are to be developed based on Davis' Technology Acceptance Model (TAM) (Venkatesh & Davis, 2000; Davis, 1986; Davis & Venkatesh, 1996; Davis, 1989; Davis & Venkatesh, 1995; Davis, 1993) and the strategies to encourage the growth of E-Commerce will be formulated on the basis of the ECADM results.

An examination of prior research on the adoption of information technology reveals several models. A number of these models have been used to identify the significant predictors of adopting and/or accepting new technologies. In this phase, an E-Commerce adoption model (ECADM) is developed. To construct the ECADM, several factors are to be identified and organized. The goal is to identify the factors that are influential in adopting E-Commerce technologies. By testing all these factors together in one model, their relative contributions to E-Commerce adoption are to be investigated. The proposed model is shown in Figure 2.

In the proposed ECADM, The intent to adopt E-Commerce is predicted by three factors: perceived EC benefits, external pressure to adopt EC, and organizational readiness. The organizational readiness affects the perceived EC benefits. The constructs' external pressure, perceived EC benefits, and organizational readiness have a number of antThe four fundamental hypotheses required for the ECADM to test are

An extension of the original Technology Acceptance Model (TAM) is to be used to develop the EC Acceptance Model (ECACM). TAM, as developed by (Davis, 1986), is shown in Figure 3. The antecedents are to be constructed and identified. Figure 4 shows the first draft of the ECACM. The criticality of the antecedents is to be determined by a questionnaire instrument.

The second phase of this work involves suggesting possible strategies that overcome the key factors identified in the first phase by using a technological model. This phase will be devoted to design and implementation of a Web-based model for performing web mining on

E-Commerce information, in particular within Abu Dhabi area that could help in eliminating several critical failure factors. The module will facilitate several activities, such as; search for a product, making purchasing decision, and gathering pattern. The suggested model must incorporate third-party authentication services to monitor vendors, and consumers.

This stage will also involve investigating and studying several issues, as follows;

Table 3. E-Commerce Acceptance Constructs.

Construct/Factor	Definition	Antecedents
Intent to use EC	Customer intention to use E-Commerce	Perceived EC Usefulness Perceived EC Ease of Use
Perceived EC Usefulness	The degree of which a person believes that using E-Commerce would enhance his/her life.	Subjective norm Image Relevance Result demonstrability
Perceived EC Ease of Use	The degree with which a person believes that E-Commerce would be free of effort	Computer self-efficacy Computer playfulness Computer anxiety
Subjective Norm	Person's perception that most people who are important to him/her think that he/she should or should not use E-Commerce	
Image	The degree to which use of E-Commerce is perceived to enhance one's status in one's social system.	
Relevance	Individual's perception regarding the degree to which the E-Commerce is applicable to him/her.	
Result Demonstrability	Tangibility of the results of using the E-Commerce	
Computer Self-efficacy	One's belief about his/her ability to perform a specific task/job using a computer.	
Computer Anxiety	The individual's apprehension, or even fear, when he/she is faced with the possibility of using computers.	
Computer Playfulness	The degree of cognitive spontaneity in computer interactions	

The three fundamental hypotheses required for the ECACM to test are:

H1 Perceived EC ease of use will have positive effect on the perceived EC usefulness
H2 Perceived EC ease of use will have positive effect on the customer intent to use E-Commerce
H3 Perceived EC usefulness will have positive effect on the customer intent to use E-Commerce

- Study how the traditional data-mining tools can be used for web information sources. Also, study some methods for coping with some problems that may arise from using data-mining tools.
- Study algorithms and techniques involved in data mining, in particular, for web information, such as; clustering, information filtering, customising, etc.
- Study intelligent agents involve in data mining on web information.

CONCLUSIONS

The execution of this research project has been just recently started. The authors anticipate the completion of the first phase to be within the next few months. Then, the second phase will be started.

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