Determinants driving the business evaluation of the networked digital environment experience: a theoretical model

Work in progress

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Abstract

The overall goal of this study is to offer a conceptual framework that breaks new ground and explores determinants driving the business' evaluation of benefits and constraints of the networked digital environment experience.
The study has two objectives. The first objective is to review the existing theoretical frameworks on business Information Technology adoption. Key research opportunities pertaining to business digital environment adoption and acceptance are highlighted. The second objective is to build on existing research and to provide some insights for thought for researchers examining this issue.
Key research questions that motivate our work are:

1. *What framework can be used as a theoretical basis for studying the business' evaluation of networked digital environments experience?*
2. *What facilitators and inhibitors can be identified within the theoretical framework?*
3. *What different adoption behaviors can be found across different IT business environments?*

In this paper, we (1) review business Information Technology acceptance literature, (2) develop a pilot study on a sample of twelve companies in Europe and USA (3) formulate a research model (4) discuss managerial implications and make several recommendations for future research.

Introduction

In recent years firms have witnessed the early stages of a technological transformation driven by two mutually reinforcing trends (1) digitization and (2) the networking of firms (Tapscott 1995; Varian & Shapiro 1998). Together these trends are ushering firms into the networked digital environment (NDE) (Balasubramanian, Krishnan & Sawhney 2001) which allows companies a better integration and efficient relationships and interactions with employers, customers and suppliers. In this networked digital environment some fundamental assumptions about the effects of time, space, and mass on the operating of firms are being questioned (Davis 1989; Davis & Meyer 1998). These developments translate into significant strategic, technological, and organizational challenges for firms. Firms that have embraced these digital networks – net enabled organizations (Straub and Watson 2001) can execute transactions, rapidly exchange information, and innovate through new business processes at an unprecedent pace (Weill and Vitale 2001).

Net enabled organizations employ innovative uses of digital networks to reduce barriers of time and distance, substitute information for physical processes and engage in innovation that aligns the firm to its competitive environment. The need for net-enablement (and the development of NDEs) is most visible in hypercompetitive environments but the utility of net-enablement is also applicable in non hypercompetitive environments.
The dominant business configuration for NDEs is a network, web, or hub connected via IT and/or wireless technologies (WiFi, Wlan). The recent development of web TV technologies represents a further configuration of NDE. Suppliers, customers, complementors, and alliance partners engage in "coopetition" as they collaborate via alliances and compete via coalitions (Brandenburger and Stuart 1996, Moore 1996, Singh and Mitchell, 1996, Afuah 2000)

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The study has two objectives. The first objective is to review the existing theoretical frameworks on business Information Technology adoption. Key research opportunities pertaining to business digital environment adoption and acceptance are highlighted. The second objective is to build upon prior academic research to propose specific constructs, propositions, and a research agenda for theory-driven measurement of digital net-enabled adoption.

Key research questions that motivate this study are:

RQ1. What framework can be used as a theoretical basis for studying the business' evaluation of networked digital environments experience?
RQ2. What facilitators and inhibitors can be identified within the theoretical framework?
RQ3. What different adoption behaviors can be found across different IT business environments?

In this paper, we (1) review business Information Technology acceptance literature, (2) develop a pilot study on a sample of twelve companies in Europe and USA (3) formulate a research model (4) discuss managerial implications and make several recommendations for future research.

Theoretical background

While the Networked Digital Environment is still in its infancy, a growing community of practitioners and academics has emerged to explore its implications for business and strategy (Arthur 1996; Brown & Eisenhardt 1998; Daley 1998; Peterson, Balasubramanian, Krishnan & Sawhney 2001; Balasubramanian & Bronnenberg 1997; Rayport & Sviokla 1994; Tapscott, Lowy & Ticoll 1998; Varian & Shapiro 1998; Wheeler 2002). Main benefits of virtual integration allowed by the networked digital environment are the network effects of innovation diffusion along with better relationships with customers and suppliers and efficient interactions inside the company (Weill and Vitale 2001). Wheleer (2002) propose the Net-Enabled Business Innovation Cycle (NEBIC) as an applied dynamic capabilities theory for measuring, predicting, and understanding a firm's ability to create customer value through the business use of digital networks.

Researches on structural issues related to IT adoption are increasing and they focus on knowledge flows researches (Nonaka 1994; Nissen & Levitt 2002; Kunz & Levitt) and financial flow researches (Macomber, Christensen). Behavioral issues associated with IT adoption are less represented in industry specific studies. They can be classified into two main issues: adoption process researches (Moore & Benbasat 1991, Tatum, Rogers 1995, Venkat) and industry culture researches (Hofstede, Schein & Koskela). This study lies in the intersection of two issues. The first is the technology adoption decision-making process. The second is the analysis of determinants of Information Technology (IT) acceptance and utilization among business users. Literature is reviewed and linked to the adoption of IT by companies, which forms the theoretical background of this research.

Technology adoption research has flourished in recent years (Agarwal & Prasad 1999; Davis 1989; Dishaw & Strong 1999; Gefen & Keil 1998; Igbaria, Parasuraman & Baroudi 1996; Klopping & McKinney 2004; Moon & Kim 2001; Pagani 2004; Taylor & Todd 1995; Venkatesh 2000; Venkatesh & Davis 2000). Currently the most effective tool to describe adoption is the Technology Acceptance Model (TAM) (Davis 1989; Davis, Bagozzi & Warshaw 1989), which has its theoretical grounding in Fishbein and Ajzen's (1975) theory of reasoned action (TRA). In the Information System literature on IT adoption, researchers have conducted several studies to examine the relationship between perceived ease of use, perceived usefulness, and the usage of other information technologies (Adams, Nelson & Todd 1992; Chau 1997; Davis 1997; Hendrickson & Collins 1996; Mathieson 1991; Szajna 1996). Their researches have supported the Technology Acceptance Model (TAM) proposed by Davis which posits that perceived ease of use and perceived usefulness are the two determinants that influence people's attitude toward IT usage intention and actual IT usage.

A second model of technology adoption, the Task Technology Fit (TTF) model (Goodhue & Thompson 1995), extends the TAM by considering how the task affects use. More specifically, the TTF model suggests that technology adoption depends in part on how well the new technology fits the requirements of a particular task. Dishaw and Strong (1999) found that TTF was somewhat more effective than the TAM for predicting use in work-related tasks; however, their study also concluded that a combination of TTF and the TAM into one extended model is a superior model to either the TAM or the TTF model alone (Dishaw & Strong 1999, Klopping & Mc Kinney 2004).

Although there are numerous studies in the field of adoption and diffusion of marketing-enabling technology (Brooksbank, Kirby & Kane 1992; Harrison, Mykytyn & Rienenschneider 1997; Holak & Lehman 1990; Iacovou, Benbasat, Dexter 1995; Julien & Raymond 1994; Kirby & Turner 1993; Kleijnen, Ruyter & Wetzels 2003; Labay & Kinnear 1981; Rogers 1995, Thong & Yap 1995; Van Akkeren & Harker 2003), previous works have focused mainly on the adoption of products and technology (Au & Enderwick 2000; Davis 1989; Eastlick & Lotz 1999; Verhoef & Langerak 2001). The literature, however, lacks of a focused analysis of internal factors influencing business' evaluation of the networked digital environment experience.

Only few studies describe a variety of factors related to the adoption of telecommunications (Grover, Goslar & Segars 1995) and client server technology (Chengular-Smith & Duchessi 1999).
Recent studies on reasons why small business owner/managers adopt or not adopt information technology (IT) and e-commerce technologies (Chau & Pederson 2000; Van Akkeren & Cavaye 1999) have highlighted both inhibitors and facilitators to adoption. Small business adoption is discussed as being determined by decision maker characteristics, information system (IS) characteristics, organizational characteristics, and environmental characteristics (Thong &Yap 1995).
Lack of speed is a barrier to adoption of mobile data technologies (Saunders et al. 1999). Another barrier is the perception of a lack of standardized IT environment for developing mobile data applications as impeding the growth of the mobile data market (Axby 1998; Harrison 1999). Security (Chan 2000; Riggs & Bachelor 1999), limited bandwidth, higher usage costs, increased latency, and a susceptibility to transmission noise and call dropouts are also possible barriers to adoption (Duffy 1999; Johnson 1999).

Clearly the literature on Information Technologies to date underlines the importance of highlighting the benefits of using the technologies, and the ease of use to potential users.
Telecommunication companies are making enormous investments in new wireless technologies and they are looking for killer applications to get pay offs. Several empirical studies took place in the last years to find out what possible killer applications are (Rauch 2001; Reinema 1998; Reinema &

Thielmann 2002; Ritzer 2001; Schlabach 2001; Waidenmaier 2001) but these killer applications aren't still found till today (Lehmann & Lehner 2003; Martignoni & Stimmer 2002).
There exists a need for more substantive, theory-based research, creating a more in-depth understanding of determinants driving the business evaluation of the networked digital environment experience.

Research method

The explorative survey was conducted through interviews on a sample of twelve companies (five in USA and seven in Europe)[1] having different size categories and ownership characteristics.
The methodology for this research is case study (Yin 1993; 1994; Stake 1995). The case study strategy consists of defining the study focus, framework construction, interviews, data collection, and case analysis. Case studies are frequently utilized to gain a greater depth of insight into organizations and their decision-making processes than is available with large sample surveys (Yin 1993; 1994). Case studies often have very small sample sizes (Yin 1993; 1994). The present case study sample frame was determined by narrowing the industry focus to twelve companies (five in USA and seven in Europe).

Interviews were conducted in 2003 and 2004 with the chief information officer or equivalent executive, and one or two managers in charge of telecommunications. A total of 36 interviews were collected. The specific criteria for company selection was the following: (a) a mixture of high tech versus manufacturing; (b) public versus private ownership; (c) a majority of cases to have a global presence; and (d) at least one company whose future is closely tied to broadband communication (i.e. global entertainment company).
The companies analyzed in the pilot study belong to the following eleven industries: (1) distributor of industrial products; (2) software vendor and services; (3) medical products manufacturing; (4) networking and telecom hardware; (5) entertainment; (6) media broadcasting company; (7) government and legal management company; (8) insurance company; (9) car manufacturer; (10) IT service company; (11) system technology.

To answer the research questions, the case study method is utilized to evaluate the factors in the research model. The study evaluates the relative importance of these factors in the companies' decisions. Interviews were carried out at both the IT decision-making and IT operational levels of each company. Interviews were conducted in person by the authors based on a standard set of interview questions. Each interview lasted 1-2 hours. The findings were taped as well as hand recorded by the interviewers. The results were transcribed, and the interview transcripts were sent to each interviewee, who validated the information. At the time of the interview, additional supporting documents were gathered or requested. Examples include organization charts, annual reports, product reports, planning reports, and websites containing company and product information.

Each case met the validity criteria for case studies, in particular, construct validity, internal validity, external validity, and reliability (Yin 1994). The construct validity came from multiple evidence sources, review of the case study transcripts by interviewees, and multiple sources of evidence (interviews and documents). Internal validity came from the construction of a detailed research framework, indicating the steps in analysis, ahead of time (Yin 1994). External validity is limited, since this is an exploratory study, and not replicating other studies. Reliability is based on a detailed case study protocol that documents the scheduling, interview procedures, recording, follow-ups, questions, and summary database (Yin 1994).

The research framework has proven to be robust, based on the interviews. Each question elicited values in the ranges expected by the research protocol, and the analyses were realizable.
We conducted a confirmatory factor analysis to assess the constructs emerging from the survey. We checked construct reliability, convergent validity, discriminant validity and validity of the second-order construct. We defined the conceptual model and ten research hypothesis.

[1] The five case studies in USA were developed in collaboration with University of Redlands – School of Management see: Pick, J & Roberts K (2005).

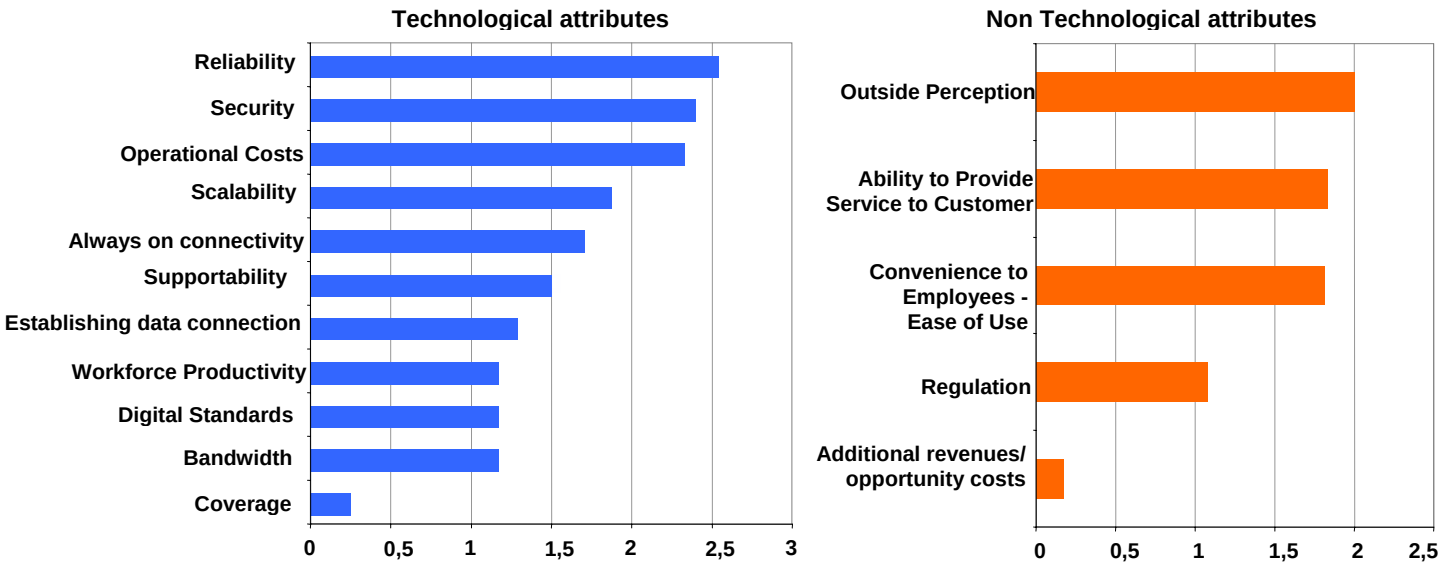
Emerging Explanatory Variables

Respondents were asked to spontaneously indicate three main important explanatory variables influencing the adoption process. In order to evaluate the relative importance of drivers and barriers we adopted at this stage the approach developed by the Nominal Group Technique for "voting". We assigned three points to the most important attribute and 2 and 1 to the second and third attributes.

It emerges two main categories of explanatory variables or attributes influencing decision to deploy a digital network (figure 1):

- Technological attributes: reliability, security, costs, scalability, establishing data connection, supportability, always on connectivity, productivity, digital standards, bandwidth, coverage.
- Non-technological attributes: outside perception, ability to provide service to customer, convenience to employees (ease of use), regulation, and additional revenues/opportunity costs.

FIGURE 1 - Average Attributes importance



The most important attributes influencing adoption are reliability, security, costs, outside perception, ability to provide service to customers. Security's prominence is consistent with other studies of IT technology (Kleijnen 2003). The security and reliability variables were not in the traditional adoption models (Davis 1989), but may have become more significant in the decade or more since those models were introduced. Reliability is a highly rated attribute because it is so intertwined with the concept of coverage and the ability to provide the service required. The attribute of reliability and cost were rated at medium to high. Reliability and convenience are consistent with the TAM factor of usefulness (Davis 1989).

Data-connectivity was not an attribute in the traditional models, which preceded widespread web use in businesses (Pick & Roberts 2005).

The ability to provide service to the customers is consistent with the TAM model (Davis, 1989) and subsequent TAM studies (Adams et al. 1992; Gefen & Straub, 2000; Lederer et al. 2000; Pagani, 2004).

The software provider company put a high emphasis on productivity, a new factor not in our theoretical model. It is consistent with the importance in TAM of usefulness (Davis, 1989).

Tables 1 and 2 show correlations among attributes. It emerges no correlations among non-technology explanatory variables and high level of correlations among technology explanatory variables.

TABLE 1 Correlations: Technology explanatory variables

		cost	reliability	bandwidth	security	scalability	connectivity to web	digital standards	technology suitability	supportability	productivity	coverage
Operational Costs	Pearson Correlation	1										
	Sig. (2-tailed)											
	N	36										
Reliability	Pearson Correlation	-,055	1									
	Sig. (2-tailed)	,865										
	N	36	36									
Bandwidth	Pearson Correlation	-,440	,170	1								
	Sig. (2-tailed)	,152	,598									
	N	36	36	36								
Security	Pearson Correlation	-,301	-,165	**,655***	1							
	Sig. (2-tailed)	,342	,609	,021								
	N	36	36	36	36							
Scalability	Pearson Correlation	-,128	-,080	**,619***	**,794****	1						
	Sig. (2-tailed)	,692	,805	,032	,002							
	N	36	36	36	36	36						
Always on connectivity	Pearson Correlation	-,292	,102	,567	**,714****	**,622***	1					
	Sig. (2-tailed)	,358	,752	,055	,009	,031						
	N	36	36	36	36	36	36					
Digital standards	Pearson Correlation	-,150	**,750****	,412	-,069	,093	,045	1				
	Sig. (2-tailed)	,643	,005	,183	,832	,773	,889					
	N	36	36	36	36	36	36	36				
Establishing data connection	Pearson Correlation	-,249	,518	,274	-,097	,015	-,050	**,756****	1			
	Sig. (2-tailed)	,436	,084	,389	,763	,962	,876	,004				
	N	36	36	36	36	36	36	36	36			
Supportability	Pearson Correlation	-,212	-,025	-,125	-,065	-,059	**-,598***	-,069	,149	1		
	Sig. (2-tailed)	,507	,938	,699	,840	,856	,040	,832	,644			
	N	36	36	36	36	36	36	36	36	36		
Workforce Productivity	Pearson Correlation	,281	-,228	-,225	-,388	-,361	-,418	-,323	-,153	,235	1	
	Sig. (2-tailed)	,377	,475	,482	,213	,250	,176	,306	,636	,462		
	N	36	36	36	36	36	36	36	36	36	36	
Coverage	Pearson Correlation	-,237	,233	-,365	**-,653***	-,344	-,418	,115	,392	,327	,196	1
	Sig. (2-tailed)	,459	,467	,244	,021	,274	,176	,722	,208	,300	,541	
	N	36	36	36	36	36	36	36	36	36	36	36

**.Correlation is significant at the 0.01 level (2-tailed).

*.Correlation is significant at the 0.05 level (2-tailed).

TABLE 2 Correlations: Non Technology explanatory variables

		ease of use	ability to provide service to customer	outside perception	regulation	opportunity costs
Employees ease of use	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	36				
ability to provide service to customer	Pearson Correlation	-,067	1			
	Sig. (2-tailed)	,837				
	N	36	36			
outside perception	Pearson Correlation	-,111	,124	1		
	Sig. (2-tailed)	,732	,701			
	N	36	36	36		
regulation	Pearson Correlation	,143	-,053	,342	1	
	Sig. (2-tailed)	,657	,870	,277		
	N	36	36	36	36	
opportunity costs/revenues	Pearson Correlation	,105	-,411	,302	,438	1
	Sig. (2-tailed)	,746	,184	,341	,154	
	N	36	36	36	36	36

Psychometric properties of the instruments

Factor Analysis was performed on the explanatory variables in order to establish their suitability for performing the multivariate analysis used. A Principal Components Analysis (PCA) was used for data reduction to examine the factor structure and help the measures conform to recommended levels of reliability. The results presented here are based on sets of variables, guided by conceptual and practical considerations: (a) the acceptance of factor loadings of approximately .50 and above – this level is considered practically significant (Hair et al. 1998), (b) most of the cross-loadings falling below .20. The internal consistency of the instruments was further tested via reliability analyses (Cronbach's alpha coefficient). High communality values were observed for all the variables indicating that the total amount of variance an original variable shares with all other variables included in the analysis is high.

Table 3 shows the summaries of the results of Principal Component Analysis factors and item loadings of ICT usage.

TABLE 3 - Principal Component Analysis

	Component					Communalities
	F1	**F2**	**F3**	**F4**	**F5**	
Cronbach's Alpha values	***.876***	***.752***	***.575***	***.245***		
Bandwidth	**,874**	7,1E-02	5,5E-03	,137	,244	,848
Security	**,795**	-,384	,243	,177	-,305	**,964**
Scalability	**,819**	-,160	,141	,247	-,144	,799
Always on connectivity	**,812**	-,266	-8,2E-02	-,332	-,178	,878
Additional revenues/opportunity costs	**,650**	,309	-,340	2,7E-03	,373	**,773**
Outside perception	**,580**	6,5E-02	,340	-,527	,124	,749
Regulation	**,676**	-182	346	299	491	**,941**
Digital standards	,362	**,812**	-,323	4,1E-02	3,8E-02	,898
Establishing data connection	,193	**,852**	,111	6,2E-02	-5,2E-02	**,783**
Reliability	,166	**,739**	-,293	-8,5E-02	-9,3E-02	,675
Coverage	-,399	**,606**	,339	-,351	,190	**,801**
Supportability	-,288	,272	**,684**	,494	-2,1E-02	**,880**
Ability to provide service to customer	-,176	,140	**,728**	-,213	-,343	**,743**
Employees ease of use	,146	,425	,102	**,707**	-,253	,777
Operational costs	-,433	-,229	-,560	**,398**	-5,8E-02	,716
Workforce Productivity	-448	-,170	,246	,169	**,718**	,831

Extraction Method: Principal Component Analysis. Five factors extracted: F1 Data connectivity; F2 Technology Suitability; F3 Customer Satisfaction; F4 Workforce Efficiency; F5 Workforce productivity.

Reliability analysis shows the following Cronbach's Alpha values: Data Connectivity (.88), Technology Suitability (.75), Customer Satisfaction (.58). These reliability test results show alpha values exceeding .60 recommended by Hair et al., (1998) as the lower limit of acceptability, ensuring that the items grouping for the respective variables are reliable under the conditions of the local survey. Only Workforce Efficiency (.25) and Workforce Productivity show low Cronbach's Alpha values. The mean of components showing internal consistency is for Data Connectivity (F1) 1.79 (high), Technology Suitability (F2) 1.31 (medium), Customer Satisfaction (F3) 1.67 (high).

The theoretical model

Building upon prior academic research which provides the theoretical framework and based on results emerging from the explorative survey we provide the underlying structure for the theoretical model of the study proposing specific constructs, relationship among those constructs, propositions and a research agenda for theory-driven measurement of digital net enabled network adoption.

The proposed conceptual model of NDE adoption for this study is shown in figure 2.

All of the companies in the case study are looking to web-based connectivity for the future, they also realize they will not reach the full benefits of such connectivity until the high bandwidth capabilities are available (Saunders et al. 1999), particularly for streaming video. As the uses of this technology become more complex and web driven in the future, regulation may become more important. In accordance with the Technology Acceptance Model (Davis, 1989) we state the following relationships among constructs and explanatory variables:

H1. Data Connectivity is positively related to interest to adopt;

H2a. Data Speed is positively related to interest to adopt;

H2b. Data Speed is positively related to data connectivity;

Respondents declare technology suitability as a factor influencing the net digital environment evaluation. This factor is influenced by geographic coverage, reliability, suitability to establish data

connection, digital standards and the search for a combination PIM/wireless capability. Therefore we hypothesize that:

H3. Technology Suitability is positively related to interest to adopt;

Workforce Productivity is consistent with the importance in Technology Adoption Model of usefulness (Davis, 1989; Davis et al. 1989). In accordance with this model we state:

H4. Workforce productivity is positively related to interest to adopt;

Customer Satisfaction and Workforce Efficiency are likely to become more important in the future as web applications become more prevalent and also more complex requiring greater user support. Their importance is related to ease of use factor, stressed in the TAM models (Davis, 1989; Davis et al. 1989). A vast body of empirical research already indicates a significant association between ease of use and behavioral intention (Agarwal & Prasad, 1999; Davis, 1989; Gefen & Straub, 2000; Venkatesh, 2000) and between ease of use and usefulness (Davis, 1989). Therefore we hypothesize that:

H5. Customer Satisfaction is positively related to interest to adopt;

H6a. Workforce Efficiency is positively related to interest to adopt;

H6b. Workforce Efficiency is positively related to Workforce Productivity;

H6c. Workforce Efficiency is positively related to Customer Satisfaction;

H7. Interest is positively related to intention to adopt.

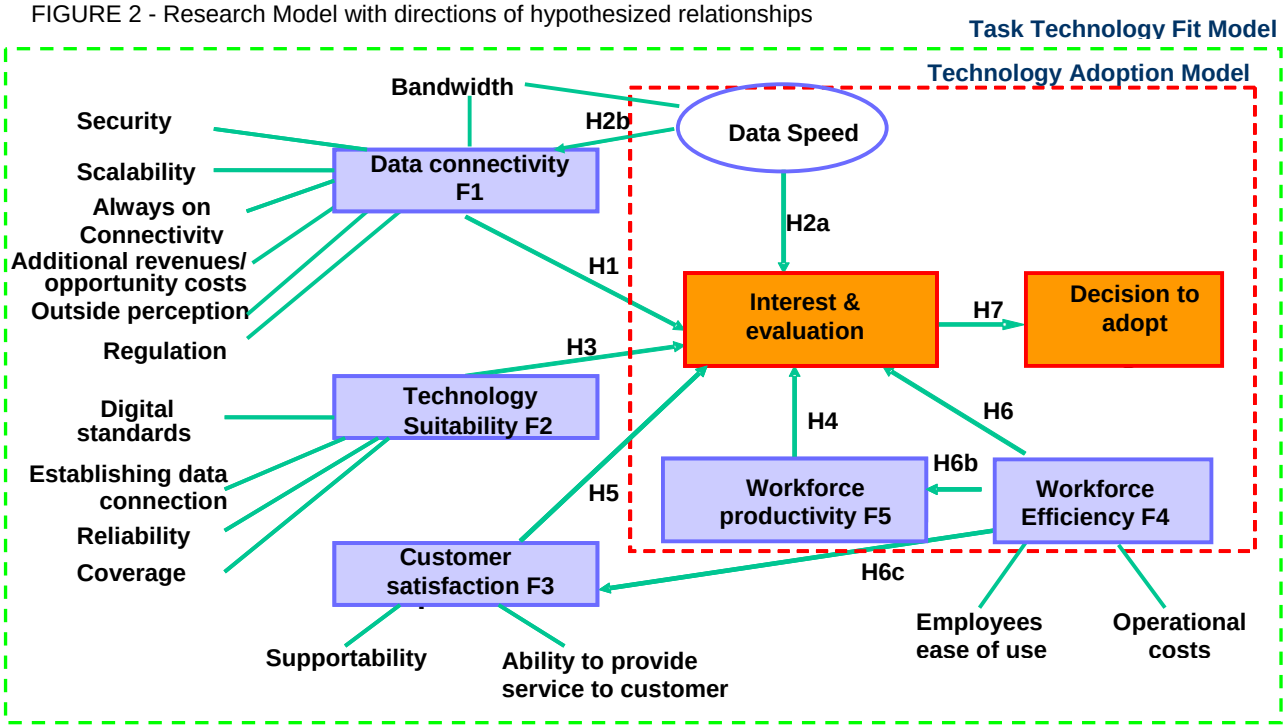
The task technology fit (TTF) model suggests that individuals not only consider beliefs about perceived usefulness and perceived ease of use, but also the extent to which the technology meets their task needs and individual abilities (Goodhue & Thompson, 1995; Klopping & McKinney, 2004). The following hypothesis are proposed:

H8. Task influences workforce productivity and attribute importance;

H9. Task influences the share of preference;

H10. The combined TTF/TAM predicts the intention to adopt.

FIGURE 2 - Research Model with directions of hypothesized relationships



Discussion

Research findings show the importance of technological and marketing determinants influencing the evaluation of networked digital environments experience. Results emerging from the explorative survey confirm that ubiquitous, low cost communication allow firms to respond in “real time” to their customers (Mc Kenna 1995) and improve customer relationships. Persistent connectivity with

customers and partners dilutes the importance of geography, vertical integration (Cairncross 1997; Rayport & Sviokla 1994) and improve interactions.
The emerging conceptual model also identifies six significant constructs which confirm the importance of better relationships with customers and suppliers and efficient interactions among the workforce.

The most important technology decision factors are security, reliability, and web connectivity.
The security and reliability factors were not in the traditional adoption models, but may have become more significant in the decade or more since those models were introduced. Reliability is a highly rated factor because it is so intertwined with the concept of coverage and the ability to provide the service required.

Outside perception and ability to provide services to customers were the most important non-technology factor. These factors are likely to become more important in the future as web and Internet applications become more prevalent and also more complex, requiring greater user support. Its importance is related to the ease of use factor, stressed in the TAM models (Davis, 1989, 1993). It is different in that it is corporate actions that can lead to ease of use.

The technology product suitability ratings were compiled by the authors' post-evaluation of all of the interviews for each company (table 4). Case 1 received a medium to high rating. The CIO of Case 1 spoke extensively about security, connectivity to the web, reliability, user interface, upgradeability. These are factors that when combined result in a medium to high rating for suitability. For Case 4, a company whose stock in trade is cutting-edge technology, product suitability, both internally and externally to its customers, is quite important. Case 8's suitability rating was high. One reason is the fact the company has created several "centers of excellence" to leverage the maximum benefit from different technologies, e.g. 802.11b. All of the companies mentioned such suitability issues as user interface, display sizes, geographic coverage, etc.

The findings showed cost to be a medium to high adoption factor. A representative explanation for this came from the CIO of Case 5 who stated that in the case of commodity items, cost could be a huge driver, although in the case of point solutions driven by a unique application, cost is not a major issue.

The mostly low ratings for regulation are due largely to firms' perceptions that network providers are responsible to consider this, rather than corporate users (table 5). The one CIO who gave a high rating for regulation is from the software firm which has a stated high social consciousness and sensitivity. That may have encouraged understanding and valuing regulation beyond just authorization to operate the devices, but delving into privacy, intellectual property, and the international sides of regulation. Cases 3 and 10 rated the regulation factor as moderate and high. Case 3 is sensitive to regulation because its products are susceptible to regulation worldwide. Case 10, the entertainment company, has very large intellectual property holdings and faces the problem of potential exposure of intellectual property laws and regulations, an exposure that may worsen with web-enabled uses. Generally, as the uses of this technology become more complex and web-driven in the future, regulation may become more prominent.

Web connectivity is a forward-looking technology factor. Since the technology is moving so rapidly (Dodd, 2002), it is essential that corporate decision makers look ahead in their adoptions; all of the case companies are doing exactly that. One example was the CIO of Case 1 who stated "We're moving all of our applications to a web-based interface." Likewise, the CIO of Case 5 regards the web "…as an emerging new way of delivering our content." The decision makers in the mid 1990s needed to think forward in assessing digital network adoption to a much wider prevalence of its use among employees and their customers, and not base decisions on the then modest adoption rates. It is no different for the decision-makers of today. Just as all of the companies in the case study are looking to web-based connectivity for the future, they also realize they will not reach the full benefits of such connectivity until the high bandwidth capabilities of 3G (third generation) are available, particularly for streaming video.

TABLE 4 Importance of technology factors

Case No: *Technology Factor*	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11	Case 12
Cost:	M	M/H	M	M	H	M	H	M	H	M	M/H	M
Reliability:	M+	H	M	H	M/H	H	M/H	H	M	H	H	L
Bandwidth:	L/M	(NA)	L today	M	None	M	None now H future	None	L/M	H	L	L
Security:	H	H -	H	H	(NA)	H	M	(NA)	H	H	H	H
Expandability/ Scalability:	L/M	M	M	M	(NA)	M	M	L	H	H	M	M
Connectivity to Web:	H	H	M	H	None now M future	L/M	None now H future	None	H	H	L Now H Future	L Now H Future
Digital Standards::**	L Today	L		M	L	L	L-M	L-M		H	L	
Technology/ Suitability**	M-H			M-H			M	H		M-H	H	
Other - Supportability			H	L		H	H	H			H	M
Other - Productivity:			H		H			M	M		H	L
Other - Coverage:								H				
Most Important:	Connect-ivity to Web/ Security	Ability to Provide Service to Cust Omer	Producti vity	(NA)	Produc-tivity	Reliabil ity	Reliability Support Ability	Coverage Service Quality	Security	Security	Security	Security

TABLE 5 Importance of non -technology factors

Case No: Non-Technology Factors	**Case 1**	**Case 2**	**Case 3**	**Case 4**	**Case 5**	**Case 6**	**Case 7**	**Case 8**	**Case 9**	**Case 10**	**Case 11**	**Case 12**
Convenience to Employees; Employees' Ease of Use	M	L+	M	L/M	L	M	H	M	M	M	M	L
Ability to Provide Service to Customer	M	H	H	H	(NA)	(NA)	M	H	(NA)	(NA)	H	H
Outside Perception	M	H	M	M	(NA)	M	None	H	H	H	M	M
Regulation	L	None	H	L	None	L	None		L/M	M/H	M	L
Other: Opportunity Cost										M		

(H) High
(M) Moderate
(L) Low

(NA) Does not know answer
(MI) Missing from interview

Other: refers to factors identified by respondents and not in the theoretical model.
** Conclusion from entire interview as specific question was not asked of interviewees.

Conclusion and next step of the research project

This study analyzes technology and non-technology factors driving the business evaluation of the networked digital environment experience. The research questions are answered as follows:
RQ1 The research model and related hypothesis are in the process to be tested on a broad empirical base with a large dataset that was not limited to a single country. This helps to strengthen the generalizability of the findings. Drawing up the data and results, our study offered several

contributions. First, we demonstrated the usefulness of a combined Technology Adoption Model (Davis 1989) and Task Technology Fit Model for identifying facilitators and inhibitors of IT adoption. This framework could be applied by researchers to study other IS adoption in different settings. Second, our empirical analysis identified six significant IT adoption predictors and revealed differing adoption behaviors across different industries. These results might be useful to serve as a basis for others to derive their research models. The study also has managerial implications as well. It shows that as e-business intensity increases, companies (in particular SMEs) have more opportunities to compete in the e-business domain.

RQ2. The most important technology factors are reliability, security. Technology factors are more important than non-technology ones.

RQ3. The decision-making process for networked digital environment adoption was unique to each company and depended on that firm's organizational structure and corporate culture. The final decision-maker varied considerably by firm and by size of project; decision-makers included a middle level board, technical director, CIOs and CEO.

The study is limited by only examining cases for twelve firms in eleven industries. Future research needs to encompass larger samples of firms, which would be more robust and enable more sophisticated methodology, such as multivariate statistics. A weakness of the present study is not including the measurement or analysis of the extent of success or failure of networked implementation. Including success measures for a large sample would provide more extensive and robust advice for corporate decision-makers. A large sample would also allow robust industry sector comparisons. The present multi-layered interview methodology could be supplemented with large-sample surveys of firms. Future studies should also try to sample advanced-use regions, such as Japan.

The increasing use of 3G wireless devices today and 4G devices in the future will cause the momentum to shift from voice-centric uses to data-centric applications and to streaming content. It will also encourage businesses to become increasingly dependent upon the web, Internet applications, and mobile devices. When looking at information technology, particularly wireless/mobile devices, from either a legal or ethical perspective (Johnson, 2001), privacy/security is the most important issue. The vulnerability of the large and rapidly growing wireless industry to this issue may cause the governments to increase regulation of the industry.

References

Adams, D.A., Nelson, R.R. and Todd, P.A. (1992), "Perceived usefulness, ease of use, and usage of information technology: a replication", *MIS Quarterly*, 16(2), 227-247.

Agarwal, R. and Prasad, J. (1999), "Are individual differences germane to the acceptance of new information technologies?", *Decision Science*, 30(2), 361-391.

Au, A.K. and Enderwick, P. (2000), "A cognitive model on attitude towards technology adoption", *Journal of Managerial Psychology*, 15(4), 266-282.

Axby, E. (1998), "Creating a market for mobile data", *Telecommunications*, 32(9), 37-39.

Brooksbank, R. , Kirby, D. and Kane, S. (1992), "IT adoption and the independent retail business: the retail news agency", *International Small Business Journal*, 10, 53-61.

Chan, T. (2000), "Cracks in the WAP", *America's Network*, 104, 26-27.

Chau, P. Y. K. (1997), "Reexamining a model for evaluating information center success using a structural equation modeling approach", *Decision Sciences*, 28(2), 309-334.

Chau, S. and Pederson, S., (2000), "The emergence of new micro businesses utilizing electronic commerce", in *Proceedings of the 11th Australian Conference of Information Systems (ACIS)*, Cable, G.G. and Vitale, M. R., eds., Brisbane, (CD ROM).

Chengular-Smith, I. and Duchessi, P. (1999), "The initiation and adoption of client-server technology in organizations", *Information & Management*, 35(2), 77-88.

Davis, F. D. (1989) "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly*, 13(3), 319-340.

Davis, F. D., Bagozzi, R. P. and Warshaw, P. R. (1989), "User acceptance of computer technology: a comparison of two theoretical models", *Management Science*, 35(8), 982-1003.

Dishaw, M. T. and Strong, D.M. (1999), “Extending the technology acceptance model with task technology fit constructs”, *Information & Management*, 36(1), 9-21.

Duffy, R. (1999), “Wireless set to take the lead”, *Telecommunications*, 33, 24-26.

Eastlick, M.A. and Lotz, S. (1999) “Profiling potential adopters and non-adopters of an interactive electronic shopping medium”, *International Journal of Retail & Distribution Management*,27(6),209-223.

Fishbein, M. and Azjen, I. (1975), *Belief, attitude, intention, and behavior*, Reading, MA: Addison-Wesley.

Goodhue, D.L. and Thompson, R.L. (1995) “Task-technology fit and individual performance”, *MIS Quarterly*, 19(2), 213-236.

Gefen, D. and Keil, M. (1998), “The impact of developer responsiveness on perceptions of usefulness and ease of use: an extension of the technology acceptance model”. *The database for Advances in Information Systems*, 29(2), 35-49.

Gefen, D. and Straub, D. (2000), “The relative importance of perceived ease of use in IS adoption: a study of e-commerce adoption”, *Journal of Association for Information Systems*, 1(8), 1-21.

Grover, V., Goslar, M. and Segars, A, (1995), “Adopters of telecommunications initiatives: A profile of progressive US corporations”, *International Journal of Information Management*, 15(1), 33-47.

Jr Hair, J. F., Anderson, R.E., Tatham, R.L. and Black, W.C. (1998), “Multivariate data analysis”. (fifth edition), New Jersey: Prentice Hall, Inc.

Harrison, D.A., Jr Mykytyn, P.P. and Rienenschneider, C.K. (1997), “Executive decisions about IT adoption in small business: theory and empirical tests”, *Information Systems Research*, 8, 171-195.

Harrison, H. (1999), “WAP: the key to mobile data”, *Telecommunications*, 33, 96-98.

Hendrickson, A. R. and Collins, M.R. (1996), “An assessment of structure and causation of IS usage”, *Data Base for Advances in Information Systems*, 27(2), 61-67.

Holak, S.L. and Lehman, D.R. (1990), “Purchase intentions and the dimensions of innovation: An exploratory model”, *Journal of Product Innovation Management* 7, 59-73.

Iacovou, C.L., Benbasat, I. and Dexter, A.A. (1995), “Electronic data interchange and small organizations: adoption and impact of technology”, *MIS Quarterly*, 19, 465-485.

Igbaria, M. , Parasuraman, S. and Baroudi, J.J. (1996) “A motivational model of microcomputer usage”. *Journal of Management Information Systems*, 13(1), 127-143.

Johnson, A.H. (1999), *WAP. Computer World*, 33, 44-69.

Julien, P. A and Raymond, L. (1994) “Factors of new technology adoption in the retail sector”, *Entrepreneurship: Theory and Practice*, 18, 79-90.

Kirby, D. and Turner, M. (1993),”IT and the small retail business”, *International Journal of Retail and Distribution Management*, 21, 20-27.

Kleijnen, M., Ruyter, K. and Wetzels, M.G.M. (2003),”Factors influencing the adoption of mobile gaming services”. in *Mobile Commerce: Technology, Theory, and Applications,* Mennecke, and Strader T., eds. Hershey, PA: Idea Group Publishing, 213-214.

Klopping, I.M. and McKinney, E. (2004), “Extending the technology acceptance model and the task - technology fit model to consumer e-commerce”, *Information Technology, Learning and Performance Journal*, 22(1), 35-47.

Labay, D.G. and Kinnear, T.C. (1981), “Exploring the consumer decision process in the adoption of solar energy systems”, *Journal of Consumer Research*, 8, 271-278.

Lederer, A. L., Maupin, D.J., Sena, M.P., Zhuang, Y. (2000), ”The technology acceptance model and the world wide web”, *Decision Support Systems*, 29(3), 269-282.

Lehmann, H. and Lehner, F. (2003), “Is there a killer application in mobile technology? A tailored research approach”, *FORWIN-Bericht*-Nr. FWN-2003-004. Bamberg et al.

Martignoni, R. and Stimmer, J. (2002), “Erfolgsfaktoren des M-Commerce aus der Sicht eines Finanzdienstleisters“, in *Handbuch Mobile Commerce*, Gora, W. and Roetger-Gerigk, S., eds., Berlin, Springer.

Mathieson, K (1991), “Predicting user intensions: comparing the technology acceptance model with theory planned behavior”, *Information Systems Research*, 2(3), 192-222.

Moon, J. W. and Kim, Y. G. (2001), “Extending the TAM for a world-wide-web context”, *Information & Management*, 38(4), 217-230.

Moore, G. C. and Benbasat, I. (1991), “Development of an instrument to measure the perceptions of adopting an information technology innovation”, *Information Systems Research*, 2(3), 192-222.

Nissen, M. and Levitt, R. (2002) “Dynamic models of knowledge-flows dynamics”, *CIFE Working paper*, 076 Stanford University USA

Nonaka, I. (1994) "A Dynamic Theory of Organizational Knowledge Creation." *Organization Science*, 5(1), 14-37

Pagani, M. (2004), “Determinants of adoption of third generation mobile multimedia services”, *Journal of Interactive Marketing*, 18(3), 46-59.

Pick, J. and Roberts, K. (2005) “Corporate adoption of mobile cell phones: business opportunities for 3G and beyond” in *Mobile and wireless systems beyond 3G: managing new business opportunities*, Pagani, M., ed., Hershey, PA: IRM Press, 24-50.

Riggs, B. and Bachelor, B. (1999), “Vendors address issue of security for wireless devices”, *Informationweek*, 765, 25-26.

Rauch, C. (2001), “Zukunft von 3G“, in *Funkschau*. Poing WEKA Fachzeitschriften-Verlag, 18-20.

Reinema, R. (1998), “Cooperative Buildings – Workspaces of the Future”, in *Proceedings of the World Multiconference on Systenics, Cybernetics and Informatics* (SCI’98), Orlando, Florida.

Reinema, R. and Thielmann, H. (2002), “Room Computer – Ubiquitous Computing in kooperative Rooms” in: *thema FORSCHUNG (Schwerpunktheft “Eingebettete Systeme”)*. TU Darmstadt,118-124.

Ritzer, W. (2001) “Mobile Data. Die Suche nach Killerapplikationen“, in *Funkschau*, Poing: WEKA Fachzeitschriften-Verlag, 46 - 48.

Rogers, E.M. (1995), *Diffusion of Innovations* (4th ed.)., New York, Free Press.

Saunders, S., Heywood, P., Dornon, A., Bruno, L. and Allen, L. (1999), “Wireless IP: ready or not, here it comes”, *Data Communications*, 28, 42-68.

Schlabach, T. (2001), “UMTS loest eine Branchenimplosion aus“ in *Computer Zeitung*, Leinfelden, Konradin Verlag, 19.

Stake, R. (1995),*The art of case study research*. Thousand Oaks, CA: SAGE Publications.

Szajna, B. (1996), “Empirical evaluation of the revised technology acceptance model”, *Management Science*, 42(1), 85-92.

Taylor, S. and Todd, P.A. (1995), “Understanding information technology usage: a test of competing models”, *Information Systems Research*, 6, 144-176.

Thong, J. and Yap, C.S. (1995), “CEO characteristics, organizational characteristics and information technology adoption in small business”, *Omega*, 23, 429-442.

Van Akkeren, J.K. and Cavaye, A.L.M. (1999), “Factors affecting entry-level Internet adoption by SMEs: an empirical study”, in *Proceedings of the Australasian Conference in Information Systems*, vol. 2, Brisbane, 1716-1728.

Van Akkeren, J. and Harker, D. (2003), “Mobile data technologies and small business adoption and diffusion: an empirical study of barriers and facilitators” in *Mobile Commerce: Technology, Theory, and Applications,* Mennecke, and Strader T., eds. Hershey, PA: Idea Group Publishing, 218-244.

Venkatesh, V. (2000), “Determinants of perceived ease of use: integrating control, intrinsic motivation, & emotion into the technology acceptance model”, *Information Systems Research*, 11(4), 342-365.

Venkatesh, V. and Davis, F.D. (2000) “A theoretical extension of the technology acceptance model: four longitudinal field studies”, *Management Science*, 46(2), 186-204.

Verhoef, P.C. and Langerak, F. (2001), “Possible determinants of consumers' adoption of electronic grocery shopping in The Netherlands”, *Journal of Retailing and Consumer Services*, 8, 275-285.

Waidenmaier, S. (2001), “Multimedia im Auto der Zukunft“, in *Funkschau*, Poing: WEKA Fachzeitschriften-Verlag, 36 - 38.

Wheeler, B.C. (2002), “NEBIC: A Dynamic Capabilities Theory for Assessing Net-Enablement”, in *Information Systems Research*, Vol. 13, 2, 125-146.

Yin, R. (1993), *Applications of Case Study Research*. Thousand Oaks, California: SAGE Publications.

Yin, R. (1994), *Case Study Research: Design and Methods. 2nd Edition*. Thousand Oaks, California: SAGE Publications.