The State of VoIP Adoption in Contemporary Organizations

Catherine Murphy Bakes, Kholekile L. Gwebu and David X. Zhu

Dept of Mgt. and Info. Systems, College of Business Admin., Kent State University, Kent, OH 44242, USA,

cbakes@bsa3.kent.edu, {kgwebu, xuzhu@kent.edu}

INTRODUCTION

To the best of our knowledge, this is the first study to discuss the factors influencing VoIP adoption, among different organization types at different organizational levels. Our intention is to gain a meaningful and accurate understanding of the factors that influence the adoption of VoIP and the reasons behind its rapid adoption in certain orgainzations. To accomplish this, a *case study* research approach is employed. Such an approach is ideal when a holistic, in-depth investigation is required [10]. Additionally, case study research gives researchers the opportunity to engage in theory building in areas in which there is little or no prior theory and research [2].

All three organizations which we contrast in this study have a lot to offer in terms of insights into the factors which affect the adoption of VoIP technology. Through a series of interviews with various parties, ranging from top executives who make budget and purchasing decisions to technicians who test and install the equipment, we were able to compile this study which allows for a holistic understanding of factors influencing the adoption of VoIP in different types of organizations.

The remainder of the paper is presented as follows. After this introduction is a review of the existing literature on VoIP. Thereafter we outline the methodology employed in the study followed by a detailed description and analysis of the three cases. Finally we draw meaningful conclusions and lay the groundwork for future research in this area.

LITERATURE

Most of the scholarly articles on VoIP have focused on studying either the technical aspects of the technology or regulatory surrounding the use of VoIP technology. A search of Business Source Premier (BSP), a scholarly and practitioner research database covering various business disciplines, using the terms "VoIP", "Voice over IP" and "IP telephony" and restricting the results to only scholarly articles, resulted in 23 distinct articles. When the same set of query terms was used without the restriction to scholarly articles 1539 articles were retrieved. This is an indication that there is a great deal of discussion in practitioner circles surrounding the technology, yet academia appears to be lagging behind. Similarly, a search of the Electronic Journal Center (EJC), an electronic database containing more than 5,700 academic journals across a wide range of disciplines yielded 91 distinct articles on VoIP. This number is higher than that found in the BSP, however most articles retrieved were very technical in nature, with the vast majority focusing on VoIP performance and security issues.

We scanned through the articles in EJC and did not find any scholarly pieces that both dealt with VoIP adoption and also appeared in BSP. We did the same for the results from BSP and found one article that discusses, to a limited degree, issues related to VoIP adoption. We then classified the articles in BSP into the three distinct groups shown in Table 1. This was done to gain a more holistic understanding of the current issues under discussion in VoIP literature and to see whether these could help us address our research question: What are the factors that affect VoIP adoption?

Nineteen of the twenty-three articles were technical in nature. These technical articles were either about VoIP performance issues (QoS) or security. Although VoIP has been in existence for over 10 years, it is only in recent years that the QoS it delivers has become comparable to that of the traditional telephone. Different methods have been adopted to evaluate VoIP QoS with the two most common methods being simulation and experimentation.

THEORETICAL FRAMEWORK

To better understand VoIP adoption, we turned to work by Grover and Goslar [13] in which the authors attempt to identify "factors that enable the initiation, adoption and implementation of a set of 15 distinct telecommunication technologies." These factors are categorized into 3 distinct groups, namely, environmental factors, organizational factors and IS factors.

Environmental Factors

The environment has been defined in the past by some authors as any outside system that influences behaviors and properties of an organization [7]. Others view the environment as a collection of social and physical factors essential for success but outside the boundary of an organization [9] [32]. The common elements in both definitions are that the environment includes factors which may be beyond the boundary of an organization's control yet influence the organization in some meaningful way. Over the years scholars have realized that environmental factors influence organizational innovation [13] [7] [32]. Grover and Goslar [13] found that "greater environmental uncertainty makes it necessary for organizations to evaluate more technologies as well as to adopt and implement them, in order to cope with greater information processing and flow requirements associated with such environments." Damanpour et al [7] used the environmental context in their conceptual framework to demonstrate how organizational structures and environmental factors may influence the adoption of innovation. They focus on environmental dynamism which they describe as having two components, environmental stability and environmental predictability. Subsequently, the two components are further developed into four combinations of environmental conditions: stable and predictable; stable and unpredictable; unstable and predictable; and unstable and unpredictable. These are shown in Figure 1.

Organizational Factors

The Grover and Goslar [13] technology adoption model considers the three organizational characteristics that are commonly discussed in innovation adoption theory, namely, size, centralization and formalization. It has been demonstrated empirically that these factors may influence adoption of innovations in organizations. For instance organization size has been found to be positively correlated to the degree of initiation, adoption and implementation of innovations [12] [16]. This is because larger firms have the financial resources available to initiate, adopt and implement new technologies and they have the ability to absorb more risk and are therefore more open to experiment with new

Table 1. Classification of VoIP Literature

Technical	Regulatory	Adoption/other
• Ram, DaSilva, and Varadarajan [28]	• Kuntin and Blosser [17]	• Varshney, Snow, McGivern, and
• Conway and Zhu [5]	• Kuntin and Blosser [18]	Howard [37]
• Das, Lee, Basu, and Sen [8]	• Kuntin and Blosser [19]	
• Smith, Kabal, Blostein, and Rabipour [35]		
• Ranganathan and Kilmartin [29]		
• Rangel, Edwards, Tzerefos, and Schunke [30]		
• Stathopoulos and Venieris [36]		
• Hunter [18]		
• Lin, Cheng, Cheng, and Agrawal [23]		
• Sammateu et al [34]		
• Parez-Costa and Hartenstein [26]		
• Houck and Meempat [14]		
• Chapron and Chatras [3]		
• Chiang and Douglas [4]		
• Rao and Lin [31]		
• Liao and Liu [22]		
• Pazos and Kotelba [27]		
• Goodman and Atlantic [11]		
• Rizzetto and Catania [33]		

Figure 2. Potential Factors that may Influence the Adoption of VoIP

technologies [32]. Centralization is concerned with whether decision making is centralized or distributed [6]. Decentralization is more likely to lead to the initiation, adoption and implementation of an innovation. A meta-analysis by Damanpour [6] confirms that centralization is negatively related to both administrative and technical innovations. It may be argued that, as decision making becomes less centralized, bureaucracy is reduced which subsequently leads to easier decision making processes for initiation, adoption and implementation. Formalization concludes the set of organizational variables considered by Grover and Goslar [13]. Formalization refers to the degree of rule observation and job codification in an organization [20]. Damanpour [6] found a statistically insignificant relationship between the formalization of both administrative and technical innovations. Grover and Goslar [13] confirmed this in their study when they found that the "greater formalization in organizations does not lead to differences in the use of telecommunication technologies."
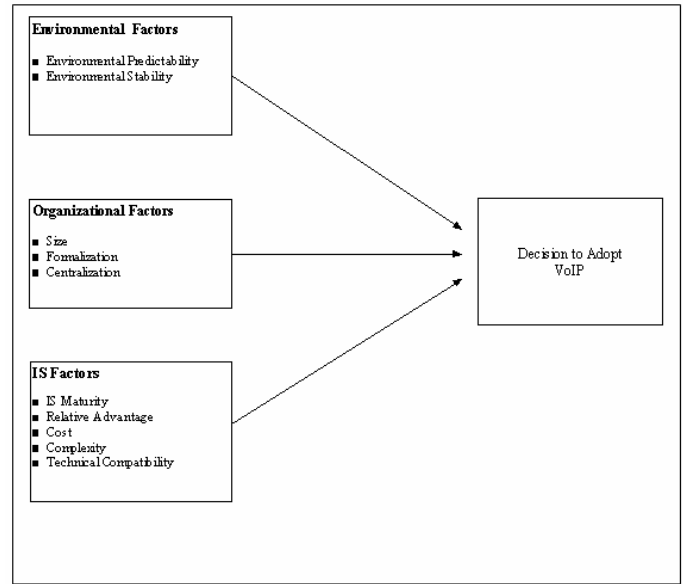
IS Factors
Organizational IS maturity has been said to play a crucial role in the initiation, adoption and implementation of technology [2]. Various items have been studied in an attempt to gauge an organization's level of IS maturity. Some of the most crucial factors include the level of IT knowledge top management possesses, the level of involvement in IS planning by top management, and the extent to which IS performance criteria are based on organizational goals rather than on cost [13] . Collectively these items constitute an organization's level of IS maturity. The more of these factors an organization possesses the higher the level of its IS maturity and the greater the likelihood of IS initiation, adoption and implementation. If top management is very knowledgeable about IT, they are more likely to "try out", adopt and implement new technologies compared to managers that are deficient in IT knowledge. Managers who actively participate in IS planning are more likely to be aware of emerging technologies than those who refrain from getting involved. Therefore, organizations with top managers who are actively involved in IS planning are more likely to adopt and implement a new IS than other organizations. Organizations whose performance criteria are based on organizational goals rather than cost are thought

to be more mature and are thus more likely to initiate, adopt and implement new technologies.

Other important IS factors which could influence the decision to adopt a technology include the product's perceived complexity and the technical compatibility of the product. The technology acceptance model suggests that perceived ease of use and perceived usefulness determine the *acceptance* of a *technology [38]*. If a technology is too complex users may not readily accept it. Typically organizations conduct pilot studies to determine the level of complexity and technical compatibility of various technologies they intend to adopt. If it is found that there are complexity or technical compatibility issues which may subsequently be difficult to resolve adoption of the technology may be abandoned.

Figure 2 summarizes the theoretical framework we adopted based on existing literature to investigate factors which may influence the adoption of VoIP.

Case Study Methodology
The case study methodology has been used extensively in IS organizational research to explore and explain various complex phenomena which do not readily lend themselves to study through other research techniques such as surveys, controlled experiments, or archival analysis [1][39]. Technology adoption may be viewed as a complex phenomenon, because it involves a series of complex decisions being made at various levels within an organization over whether or not to use an item which is dynamic in nature. In addition to the complexities associated with the technology itself, other external environmental factors need to be considered, making adoption even more complicated. Many adoption studies in the past have utilized survey research in an attempt to understand the forces behind the adoption of a technological innovation [6], but these studies have been unable to fully capture and explain this phenomenon. Such studies however do shed valuable light on some of the elements which may influence adoption [13] and we use these elements as the starting point of our study with the goal being to determine whether or not additional elements not captured though survey research exist, thus creating a holistic model for the adoption of our technology or interest.

Figure 1. Combinations of Environmental Conditions

Data Collection

A series of semi-structured interviews and a collection of documentary materials and archival records were used as the primary data sources of the study [24] [25]. Individuals from three organizations were interviewed with positions ranging from CTO's (the senior decision maker) to technical staff that is responsible for, among other things, testing, installing and maintaining the technology.

Interviews

When conducting interviews Lee [21] recommends that "the researchers should enter with a high degree of conceptual clarity as to the interrelationships among the study's purpose, the research question, and the analytical method." To this end, after conceptualizing the theoretical framework for VoIP adoption, interview questions were crafted, all geared toward identifying factors which influence the adoption of VoIP. Each of the three interviewers independently constructed questions around the various variables identified in the literature. The interviewers then met to deliberate and decide which questions to include and exclude in the interview schedule and finally agreed on a set of 31 questions.

Interview Analysis

Analysis of the interview data was conducted through a process of "meaning categorization" [21]. This process involves categorizing the most important themes from the data collected in the interviews and then articulating them in a clear concise manner.

First each researcher read through their entire set of interview transcripts and filled in omitted data with the aid of the audio recordings. Lee [21] argues that it is important to first read through the entire transcript before analyzing each interview one at a time because it helps the interviewers develop a sense of the entire data set. Thereafter, each interview conversation was analyzed in detail, with each researcher, individually, identifying elements that contributed to the understanding of factors which affect the adoption of VoIP and documenting this in the form of complete sentences, sentence fragments or portions of paragraphs. The interviewers then met to compare notes and check whether the factors each of them had identified were similar. Once there was inter-rater agreement on all the factors, they were classified into one of six categories, namely, Environmental Factors, Organizational Factors, Technical/IS Factors, Financial Factors, and Regulatory Factors. Once consensus had been reached on the classifications each of the researchers took the agreed upon classification scheme and attempted to make it as concise as possible, i.e., the challenge posed was to come up with short concise descriptive words or phrases under each category.

Documentation and Archival Records

Our documentation compilation efforts revolved around collecting and analyzing any paper or electronic records related to VoIP, organizational structure, business operating environment, IT investments and the current telephone infrastructure. Documentation and archival records were examined from newspaper clippings and articles appearing in the mass media and organizational records collected from the interviewees, corporate websites and third party sources.

Documentation and Archival Records Analysis

A similar procedure to that used in the interview analysis phase was employed in the documentation and archival records analysis. First all the collected documents were distributed to each of the researchers. Each researcher summarized each of the documents then classified them into one of the six categories. Thereafter the researchers met to compare classification schemes. When consensus had been reached on the classifications each of the researchers took the agreed upon classification scheme and derived short concise descriptive words or phrases under each category.

Convergence of Evidence

Once we had collected and summarized the multiple sources of evidence, i.e., documents, archival records and semi-structured interviews, we proceeded to triangulate the evidence so as to obtain a holistic understanding of the factors that may influence the adoption of VoIP in contemporary organizations.

Findings

The major finding of this paper is that although VoIP has been in existence for many years it remains a niche market technology. Organizations will only adopt it in "greenfield locations" or other niche areas where traditional telephone technologies are difficult or expensive to install. Additionally, although VoIP quality has dramatically improved over the years, it is unlikely to hit the mainstream until a complementary killer application emerges. In all cases the individuals interviewed felt that the integration of wireless technology would be the killer app that would take VoIP technology into the mainstream telephony market.

Prior studies on technology adoption allowed us to identify three categories of factors which had the potential to influence the adoption of VoIP, namely, organizational factors, environmental factors, and IS factors. These factors subsequently served as an initial model for our investigation of VoIP adoption. Based on these categories we were able to frame questions for the respondents and ultimately draw out additional factors and categories which had not been addressed in previous studies. Two of the organizations studied are fortune 500 companies operating in a highly competitive environment where technology is a key element to survival and success. Thus they endeavor to ensure that their technological infrastructure and tools are current. To this end they tend to quickly pilot emerging technologies which are likely to reduce costs

Table 2. Factors Influencing VoIP Adoption

	Environmental	Organizational	Technical	Financial	Regulatory
Org A	- Highly competitive - Unstable, unpredictable - Deregulation, globalization, technological change - VoIP at implementation stage	- Specialization high - Large size: over 25,000 employees - 2003 sales: $11 billion - Annual sales growth about 28%	- Waiting for "killer app" - Expecting new emerging technologies - Relying on vendors' support	- Expanding - Technological investments 5 years or less - Vigorous RFP, negotiation, and cost benefit analysis process	- E911 won't be an issue because VoIP will be implemented within the organization
Org B	- Highly competitive - Unstable, unpredictable - Deregulation, globalization, technological change - VoIP at implementation stage	- Specialization high - Large size: over 29,000 employees - 2003 sales: $32 billion - Annual sales growth about 8%	- Waiting for "killer app" - Staff have skills and knowledge - Relying on vendors' support	- Growing - Careful with spending - Always does RFP and cost benefit analysis	- Is not concerned with E911 regulation - Keeping close watch - Expecting help from Vendors
Org C	- Not for profit - Stable, predictable - Affected by Internet, technological change - VoIP at experimental stage	- Specialization not as high as the other two - Large size: top 30 in the US; over 35,000 enrolled students; 5,600 employees; 8 campus network - Highly bureaucratic	- Waiting for "killer app" - Can not roll out campus-wide currently - VoIP on Wireless LANs is expected - User education an issue, i.e., the students and faculty - Power issues	- State budget cuts have depleted funding - Very tight budgets and careful spending - Some IT investment 10 years plus	- Liability concerns due to E911 regulation - Taxing VoIP may affect future implementation

Note: Enhanced 911 (E911) rules seek to improve the effectiveness and reliability of wireless 911 services by providing 911 dispatchers with additional information on wireless 911 calls. E911 requires carriers, upon appropriate request by a local Public Safety Answering Point (PSAP), to report the telephone number of a wireless 911 caller and the location of the antenna that received the call. Phase II requires wireless carriers to provide far more precise location information, within 50 to 100 meters in most cases. In 2002 it began a rulemaking to consider whether to expand the 911 rules to other communications services. Source: www.FCC.gov

and thus make them more competitive and ensure their survival. The academic institution studied prides itself on being one of the more technologically savvy schools in the nation. Like the commercial enterprises studied it frequently pilots new technologies, however the nature and level of competition in the commercial and non commercial arenas are different and this has resulted in a slightly slower and less formalized adoption process for VoIP.

Regulation of VoIP seems unlikely to hinder its adoption. All parties interviewed were highly cognizant of issues surrounding E911, taxes and current and likely state and federal regulations concerning the technology. Most parties were optimistic that E911 and power issues were technological issues that could be resolved, while the regulators were unlikely to tamper with the Internet and its related technologies and, even if they did, the impact on VoIP would be minimal.

Business drivers both in the commercial and non-commercial environments are essential for a technology to be adopted. Most voice contracts that organizations sign tend to be for long time periods ranging from 5 to 10 years. Thus, in order for VoIP to be fully adopted, they must (1) drastically reduce the current cost of providing voice services and (2) be able to give the same, if not better, service than existing technology. We found that, although VoIP may reduce overall business costs in the very long run, the technology has not yet matured to a level where it provides significantly better service than existing technology.

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH
Like all studies, this work had some limitations which future researchers may wish to address in order to better understand factors which influence VoIP adoption. First, we were only able to study 3 organizations' VoIP adoption initiatives in great detail. Ideally researchers could study a larger number of organizations, however, their ability to burrow deeply into the subject matter would be constrained by logistics, time and the number of knowledgeable interviewers and interviewees available. Also researchers would have to locate and study organizations currently adopting or who have recently adopted VoIP technology in order to have a thorough understanding of issues surrounding its adoption.

A second limitation of the study was that we only studied large fortune 500 companies in highly competitive environments. It would be interesting to know whether our findings would apply to smaller companies. Additionally, although we also studied an educational institution, it was in the early stages of VoIP adoption. It would be interesting to know whether these findings at this one particular academic institution are generalizable to other such institutions.

While VoIP is poised to enter the mainstream telephony market adoption has been slow. We have identified some critical factors which have stimulated and impeded VoIP adoption for two distinct organization types. Although the study had a few limitations, the findings are interesting, important and warrant further investigation by future researchers in order to fully understand the phenomena surrounding VoIP adoption in organization types other than the ones investigated here.

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