Mobile Devices into Information Systems: risks, facilitating factors and benefits

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Abstract - This article intends to contribute to a better understanding of the mobile devices roles in information systems and its contribution to communications processes as a systemic competitive weapon. The main objective of this research has been to explore the evaluation of risks, facilitating factors, and benefits of mobile devices in small medium sized enterprises (SME). The results indicate that many SME are encountering significant benefits from the use of wireless technologies as other sectors of the economy, however they recognize that risks should be taken into account. Further empirical work will be required in order to appreciate executive's opinions, managerial implications, and to evaluate their statistical meaning. The major factors are discussed and directions for future research are suggested.

Index Terms - Mobile devices, risks, facilitating factors, benefits.

1. INTRODUCTION

In the respective architecture, information systems include connections with different methods of communication, namely the use of mobile devices, which have recently become ubiquitous and offer easy connections to the different components of information systems. The use of wireless networks and mobile devices is growing. From the 1990s onwards, methods of doing business have had a great shift with the emergence of the electronic commerce (e-commerce). Advanced and mature wireless and mobile technologies facilitate organizations relationships conducted from a wired network to a wireless network. Users can simply use some mobile handheld devices such as Personal Digital Assistants (PDA) and mobile phones to conduct various e-commerce activities. The market for mobile technologies has seen significant growth in the past few years [1], [2].

The safe and efficient use of mobile devices can contribute to the competitive advantages of organizations. To be able to achieve the benefits offered by information systems, organizations have to overcome many risks, specially the issue of information security. Organizations may strengthen their credibility by increasing security levels and reducing the possibility of malicious intrusions and unauthorized access to their private data and information systems. Risks are also embodied in security and web site concerns, new types of payments, cost of technology; and related issues of technological innovation [3], [4]. Lastly, overcoming the risks and achieving the benefits of mobile devices is only possible through identifying essential success factors.

Many mobile devices allow a connection to the Internet and thus, users can have access to organizational information systems and perform data transfers. For some companies this connection provides benefits because some of their employees can work in virtual situations. However, it is also negative because it allows an intruder has access to information systems. Generally, mobile devices have a lot of information, including data needed to access domains and servers. Thus, an intruder can eavesdrop on the communication between a device and the information system of an enterprise, if he penetrates the mobile device while it is connected to the internet.

Due their benefits in what concerns data flow, it is needed to face factors (facilitating factors) that may facilitate the presence of mobile devices into information systems. The major facilitating factors of mobile devices include general habits, more personalized communication with customers, and functional and user-friendly web site [5], [6]. However, these devices present serious risks. To be successful and benefit from mobile devices, organizations must recognize and then overcome the risks and challenges. When an employee uses the mobile device outside a secure information environment, for example, when there is a connection to the internet, the possibility of intrusions in the information system and unauthorized access to data increases. There are several ways of making calls and transferring data using mobile devices. It is essential that users be convinced that whenever a connection is established, there is an increased vulnerability and this poses a risk to information systems of their organizations. Other researchers highlight the problem of the misuse of communication systems and the need for appropriate legal controls to ensure information security and integrity [7].

In the transition from the industrial to the information age, mobile devices offer considerable benefits for new players who are ready for proactive action [8]. The use of electronic billing systems provides personalized service to customers leading to increased satisfaction and loyalty [9]. Nevertheless, organizations have to demonstrate perfect rationality regarding their valuation of risks and benefits regarding mobile devices disclosure.

The paper is organized as follows. In the next section, a brief literature review of the related problems is provided. In section 3, the methods of research used in the study are described. In section 4, the results of this research are discussed. Finally, further steps and some conclusions are presented in the last section.

2. Information Systems and Wireless Technology

2.1 Mobile Devices in Business and Social Life

Currently companies have a high level of connectivity between sales teams, back-office, managers, suppliers and customers. Direct communication with several markets and business partners can be accomplished in several ways using native or Web-based applications, which enables personalized and faster processes.

The new developments in mobile technology offer the prospect of improved access to information wherever the user may be. This includes not only the provision of higher data transfer rates to support access to multimedia information (especially by upcoming technologies such as Universal Mobile Telecommunications System - UMTS) but also new developments such as the introduction of location awareness [10]. There are various techniques that are currently being tried out by network providers with different degrees of accuracy associated with them. The simplest of these depends on the cell id of the nearest transmitter and systems based on this approach are already operational. However, the accuracy of such systems is dependent on cell size, which can be quite large. More sophisticated techniques provide increasing accuracy but rely on specialized hardware and changes to the mobile devices.

When companies started using mobile wireless communications devices, the difference between internal and external world information systems has become less defined. Currently, the vast majority of people and companies can communicate over the internet and transfer data. Furthermore, access to private, sensitive or critical information became simpler, requiring a more careful attention to security policies and protection mechanisms, namely the monitoring of network traffic.

Although computer security is in constant development and there are some advances successfully, companies do not have definitive and fully secure solutions in order to protect their information systems from cyber criminals. Some companies can minimize risk aided by hardware implementation that specifically monitors the potential dangers that Internet traffic might bring [11], and intrusion prevention / detection systems in order to avoid attacks on information systems [12]. Some companies that are developing safety software are already providing advanced safety software for mobile devices [13] and firewalls, which monitor Internet traffic on the mobile device and the information system [14]. There is software that helps companies to prepare their own safety guidelines in what concerns the use of mobile devices [15]. Employees usually have passwords to wireless networks [16]. Some corporations implemented their own rules for maintaining information security in the process of acquiring the ISO 27001 certificate [17], [18].

Mobile devices may be present in four communication channels, where they present their benefits but also reveal its risks. About these four channels it is convenient to remember the following:

- Instant Messenger (IM): results from the simplification of Internet Relay Chat, and allows two or more people have a conversation in real time, sharing text messages. The use of this channel contributes to various social relations [19], [20], [21]. In personal and professional life, there are many reasons to explain the high frequency of this communication channel [20];
- Short Message Service (SMS) or text messages. This channel started being used in 1992. SMS messages are characterized by their speed, ease and reduced price [22]. Moreover, is more private than using e-mail [23], and enables social and professional networking relationships;
- Mobile phone calls: there are millions of mobile devices users [24]. Some research into the reasons for the use of mobile phones has been held and it is already known that they are essential for social, professional and even for some parental control [25]. For the vast majority of people, the mobile phone is an essential tool in almost every facet of their lives [26];
- Email: This form of communication is now widely used in business communications and its rapidity facilitates the processes between business partners. Investigations on e-mail show that contacts between people are more open and uninhibited, allowing wider circles of communication [27] and enable the development of relationships [28].

2.2 Risks of Information Security

The business world has understood very quickly that mobile devices are a useful tool for companies, suppliers and customers. For this reason, the wireless communications industry strives to find ways to mitigate the risks associated with their use [29].

The loss and / or theft of mobile devices is a clear security threat to personal safety and to accumulated data [30], since mobile devices are widely used in business.

There is some complexity in the types of risks associated with mobile devices. For this reason and to achieve a better risk management, it is necessary for security professionals to fully understand the various concepts, including the following:

- Lost or stolen devices – Surely, companies that are concerned with security policies of information systems should consider this loss as a serious threat. Often these devices contain confidential data relating to business affairs and contacts with customers and therefore cannot suffer possible intrusions or unauthorized access. Naturally, the higher number of mobile devices is proportional to the increase in risk;
- Mobile malware – The possibility of applications that allow access to data and other information system resources increases the likelihood of this risk. In the field of computer security, companies can create ways to limit access to applications and

prevent intrusions. However, malware authors are always developing new techniques of infecting devices;

- Advanced Threats – In order to prepare their reactions to incidents and disasters caused by cyber adversaries when performing network attacks, companies need contingency plans drawn up in detail. In what concerns protection mechanisms, organizations implement intrusion detection systems (IDS) and other tools to detect suspicious activities. However, and with regard to the traffic on mobile devices, it is very difficult to track the possible problems of these threats;
- Software Vulnerabilities – The evolution of technologies in relation to operating systems can be faster than the creation of new protection mechanisms. Due to jailbreak and rooting, mobile devices can become vulnerable to outside attacks. Sometimes, some users fail to realize that their mobile devices are jail broken;
- End-user Behavior – This means that users may not have the necessary care regarding how they use their mobile devices. It is necessary to consider that the cloud-based storage for organization data has a significant risk. In addition, users can inadvertently download an application that contains crime ware, enabling access or theft of confidential data. Since companies do not have full control over the behavior of their employees, allowing the use of their personal mobile devices can also mean a risk to consider;
- Compliance and Legal Issues – Risk management in business and user privacy can be affected by the introduction of personal and professional information in a single device. Enterprises must understand the risks they take when they use the practice of BYOD (By Your Own Device) because the existing law prevents companies retain mobile devices if an employee turns off the organization.

2.3 Facilitating Factors for Adoption

These are factors in the environment that users perceive as making an act easy to do, including providing technical and computer assistance [31]. Internal organizational training and technical support are significantly associated with adoption behaviors among clinicians, nurses in particular [32], [33] and also physicians [34]. In addition, technical issues such as poor connectivity were perceived as barriers of adoption, and health professionals believe that supported technical improvement would improve their adoption intention and/or actual use. Furthermore, Hsiao *et al* also showed that external suppliers' support is a significant predictor of attitude. Hence, the external environment (outside of the users' organization) also constitutes a significant adoption factor, specifically through external business competition [32], [33], and trends of use of the technology (i.e. smartphones, PDAs, etc.) in the market [33]. The internal organizational needs were also associated with adoption [32]. One study, however, found that the hypotheses for technical support and training effects on the perceived usefulness and perceived ease of use were not supported [35].

Facilitating conditions become important in technology adoption, can influence user's attitudes and behavioral intention, and includes variables such as system service, quality, and cost [36]. Some research shows that in education [37] and in organizations, the use of mobile devices is supported by a range of factors, including:

- Portability – these devices are small in physical size;
- Connectivity – These devices allow various forms of connections due to its communication technologies that are built-in or add-on (infra-red port, bluetooth, WLAN, mobile phone);
- Functionality – there are a varied number of functions that they can perform (address book, calendar, to-do list, memo pad, e-mail client, Web / WAP browser, flash and audio player);
- Capacity – they present an internal memory with essential applications already installed and it would be possible to install other applications;
- Ease of use – these devices present an user-friendly interface;
- Low additional costing – they can work with freeware applications and trial versions of shareware.

2.4 Benefits of Mobile Devices

Mobile technology offers many benefits, even in the professional field, for example, allowing an employee to work for his/hers company at home or while traveling. Moreover, the evolution of cloud computing is positive for the use of mobile devices because supports more flexible working practices by offering possibilities for communication and other services over the internet.

Mobile technology solutions may include mobile infrastructure, access to website and/or application development, marketing solutions, communication solutions, software management solutions, and many other positive procedures.

Mobile technology has created a new dimension of computer technology as a support of marketing processes. Potential customers can now have business ads on mobile phones through a wide variety of mobile marketing technologies, including: SMS (text), mobile websites, mobile apps, and other techniques. The integration of mobile devices such as laptops, tablets, PDAs and smartphones, along with its various applications and software, facilitates collaboration between workers and firms so that they can communicate clients and suppliers. The development of mobile technology enables customers to have an interactive and more direct role in the performance of companies.

Mobile Accessibility - In the field of business and organizations relationships, accessibility is one of the major benefits of using mobile devices. Businesses may continue even when managers and other employees are not present in the office. Thus, communication is at the center of operations and management decisions, which may create

competitive advantages and ensure continuous support of information systems for performance of companies.

Mobile Internet - The possibility of a permanent internet access has a high value for enterprise management. Laptops are not always available. The use of mobile phones with internet access allows that there is a constant connection between the company's employees and its customers. This possibility highlights huge advantages, especially when those employees are not in their normal working hours, but need to receive or provide important information to close a deal. Moreover, it allows quick access to the internet to confirm events, analyze data and obtain other necessary information.

Organization / Structure - The level of organization and structure is another important advantage that mobile phones can offer in the business world. Entrepreneurs, managers and representatives can have all of their valuable contacts' information, including names, phone numbers, electronic and physical addresses in only one small device. Mobile phones also offer programs that allow users to organize and plan their day in order to successfully maintain productivity levels and achieve predefined objectives.

3. RESEARCH

The purpose of this research was to explore the potential of mobile devices as a tool to increase the strategic value of information systems. More specifically to identify:

- The risks of mobile devices;
- The facilitating factors of mobile devices; and
- The benefits of mobile devices offered to the strategic use of information systems.

This study examines the evaluation of risks, facilitating factors, and benefits of mobile devices and their importance in the field of information systems in SME. A sample of 276 SME, through managers (top and middle level) was sent a mailing. This sample was selected from SME located in two towns: Lisbon and Setubal. This questionnaire was designed in order to understand: 1) how subjects evaluate the importance of mobile devices variables; 2) how they perceive their own positions facing the use of mobile devices and finally 3) the connection between their management roles and mobile devices.

According to a previous exploratory study involving eighteen managers, a set of variables were grouped by risks, facilitating factors and benefits. Tables 1, 2 and 3 show the ten key variables in each group.

TABLE 1
Risks

Device loss or theft
Loss of data
Lack of privacy
Unauthorized access to confidential data
Greater number of threats in the network
Deliberate software attacks
End-user Behavior
Internet risks (worms, spoofing, spam, denial of service, etc.)
Mobile Malware
Security flaws in software

TABLE 2
Facilitating factors

More personalized customer service
Portability
Connectivity
Internal organizational training
Technical support
External environment
Internal organizational needs
Functionality
Ease of use
Low additional costing

TABLE 3
Benefits

Faster access to critical information for better decision making
Competitive advantage
Interactivity with colleagues and hierarchy
Increased employee productivity and lower cost
Interactive order processing
More time for customer value-added work
Make better use of the ERP solution
Reduced operation costs
Checking stock levels via the office network
Ability to monitor project's progress

3.1 Research Method

According to this initial appreciation, respondents were asked to evaluate the use of mobile devices in what concerned these variables. For each of those elements, respondents indicated how much they valued them and the answers were scored on a Likert scale, ranging from 0 indicating "no impact" to 5 indicating the "greatest impact". The resulting data were statistically discussed. One hundred eighty eight (127) usable responses (86 middle managers and 41 top managers) were received, yielding a response rate of 46 percent.

The compiled data from the study were analyzed using SPSS, the tests conducted were:

- Sign tests: performed to establish if there was a significant difference between the anticipated and

identified risks, facilitating factors, and benefits of mobile devices in the various participating organizations;

- Rank order: a comparison of rank orders was used to establish the differences in importance of encountered risks, identified risks and achieved benefits;
- Kruskal-Wallis test: was performed to determine the differences between risks, facilitating factors and benefits of mobile devices in top and middle managers;
- Correlation analysis: was conducted to establish whether the relationships between the risks, facilitating factors and benefits existed.

4. DATA FINDINGS AND DISCUSSION

After the initial semi-structured conversations with eighteen managers, 276 questionnaires were sent and 127 usable responses were received providing an overall response rate of 46%.

4.1 Rank Order and Sign Test Results

The results of the Sign Test and Rank Order for risks of mobile devices in the SME are presented in Table 4.

TABLE 4
Top 10 risks of mobile devices

Rank	Risks	Median	Sign T. / Signif.
1	Device loss or theft	3.50	.633
2	Loss of data	3.00	.578
3	Lack of privacy	3.00	.252
4	Unauthorized access to confidential data	3.00	1.000
5	Greater number of threats in the network	3.00	.247
6	Deliberate software attacks	3.00	.221
7	End-user Behavior	3.00	.633
8	Internet risks (worms, spoofing, spam, denial of service, etc.)	3.00	1.000
9	Mobile Malware	3.00	.678
10	Security flaws in software	2.00	.227

Table 4 suggests that the most frequent risks encountered in SME are "Device loss or theft", "Loss of data", followed by "Lack of privacy", "Unauthorized access to confidential data", "Greater number of threats in the network", "Deliberate software attacks", etc. The results of the Sign Test and Rank Order for facilitating factors of mobile devices in the SME are presented in Table 5.

TABLE 5
Top 10 facilitating factors of mobile devices

Rank	Facilitating factors	Median	Sign T. / Signif.
1	More personalized customer service	5.00	1.000
2	Portability	4.00	.119
3	Connectivity	4.00	1.000
4	Internal organizational training	4.00	.119
5	Technical support	4.00	.448
6	External environment	4.00	.503
7	Internal organizational needs	4.00	.633
8	Functionality	4.00	1.000
9	Ease of use	4.00	1.000
10	Low additional costing	4.00	1.000

Table 5 indicates that the most commonly identified facilitating factors in the industry include "More personalized customer service", "Portability", "Connectivity", "Internal organizational training", "Technical support", "External environment", "Internal organizational needs", etc. The results of the Sign Test and Rank Order for benefits of mobile devices in the SME are presented in Table 6.

TABLE 6
Top 10 benefits of mobile devices

Rank	Benefits	Median	Sign T. / Signif.
1	Faster access to critical information for better decision making	3.00	.498
2	Competitive advantage	3.00	.061
3	Interactivity with colleagues and hierarchy	3.00	.125
4	Increased employee productivity and lower cost	3.00	.372
5	Interactive order processing	3.00	.183
6	More time for customer value-added work	3.00	.031
7	Make better use of the ERP solution	3.00	1.000
8	Reduced operation costs	3.00	.372
9	Checking stock levels via the office network	3.00	1.000
10	Ability to monitor project's progress	3.00	.018

Table 6 indicates that among the most achieved benefits in the industry are "Faster access to critical information for better decision making", "Competitive advantage", and "Interactivity with colleagues and hierarchy", "Increased employee productivity and lower cost", "Interactive order processing", etc. To identify the differences between the evaluations of top managers and middle managers, the rank orders were computed. Tables 7, 8, and 9 presents rank orders for top 10 risks, facilitating factors and benefits in both groups (top and middle managers).

TABLE 7

Rank Order of top 10 Risks (Top and Middle Managers)

Rank	Top	Middle
1	Device loss or theft	Device loss or theft
2	Loss of data	Deliberate software attacks
3	Lack of privacy	End-user Behavior
4	Unauthorized access to confidential data	Unauthorized access to confidential data
5	Greater number of threats in the network	Internet risks (worms, spoofing, spam, denial of service, etc.)
6	Deliberate software attacks	Mobile Malware
7	End-user Behavior	Lack of privacy
8	Internet risks (worms, spoofing, spam, denial of service, etc.)	Greater number of threats in the network
9	Mobile Malware	Loss of data
10	Security flaws in software	Security flaws in software

TABLE 8

Rank Order of top 10 Facilitating Factors (Top and Middle Managers)

Rank	Top	Middle
1	More personalized customer service	Portability
2	Portability	More personalized customer service
3	Connectivity	Functionality
4	Internal organizational training	Internal organizational needs
5	Technical support	Connectivity
6	External environment	Functionality
7	Internal organizational needs	Internal organizational training
8	Functionality	Low additional costing
9	Ease of use	Technical support
10	Low additional costing	Ease of use

TABLE 9

Rank Order of top 10 Benefits (Top and Middle Managers)

Rank	Top	Middle
1	Faster access to critical information for better decision making	Competitive advantage
2	Competitive advantage	Interactivity with colleagues and hierarchy
3	Interactivity with colleagues and hierarchy	Faster access to critical information for better decision making
4	Increased employee productivity and lower cost	Increased employee productivity and lower cost
5	Interactive order processing	More time for customer value-added work
6	More time for customer value-added work	Make better use of the ERP solution
7	Make better use of the ERP solution	Reduced operation costs
8	Reduced operation costs	Ability to monitor project's progress
9	Checking stock levels via the office network	Checking stock levels via the office network
10	Ability to monitor project's progress	Interactive order processing

4.2 Kruskal Wallis Test

To establish whether the differences for the risks, facilitating factors, and benefits in top managers in comparison with the opinions of middle managers were statistically significant, the Kruskal-Wallis test was performed. Coinciding with the results of semi-structured interviews with managers (top and middle) in eighteen companies prior to this study in 276 SME, most participants were at the same stage of using mobile devices and, therefore, very similar opinions were obtained.

4.3 Correlation Analysis

Since these variables are considered as important to give a sight over the adoption of mobile devices, it would be adequate to evaluate the correlation among them. The correlation analysis indicated that a number of factors were correlated as well as statistically significant. In Tables 10 and 11 only statistically significant and logical correlations are presented.

TABLE 10
Correlation between risks and facilitating factors

Risks	Facilitating factors	Sig.
Device loss or theft	Portability	.012
Lack of privacy	Connectivity	.015
Loss of data	More personalized customer service	.037
Greater number of threats in the network	Functionality	.033
Deliberate software attacks	Internal organizational needs	.043
Unauthorized access to confidential data	Technical support	.034
Mobile malware	Internal organizational training	.039

TABLE 11
Correlation between facilitating factors and benefits

Facilitating factors	Benefits	Sig.
More personalized customer service	Faster access to critical information for better decision making	.033
Portability	Competitive advantage	.018
Functionality	Increased employee productivity and lower cost	.031
Internal organizational needs	Interactivity with colleagues and hierarchy	.029
Ease of use	Competitive advantage	.049
Internal organizational training	Reduced operations costs	.018
Connectivity	Faster access to critical information for better decision making	.026
Technical support	More time for customer value-added work	.049
External environment	Make better use of the ERP solution	.029

4.4 Discussion

This paper argues that organizations involved in mobile devices have to be aware of challenges, facilitating factors and benefits in order to be successful in mobile devices nowadays. The main findings from this research include:

- The major risks of mobile devices encountered in this sample in SME field are: device loss or theft, loss of data followed by lack of privacy, unauthorized access to confidential data, greater number of threats in the network, deliberate software attacks, and others as can be seen in table 1.
- The major facilitating factors of mobile devices identified in the sample are: more personalized customer service, portability and connectivity of mobile devices, internal organizational training, technical support, external environment, internal organizational needs, functionality of mobile devices, and others (Table 2).
- The major benefits of mobile devices achieved in this sample in SME field are: faster access to critical information for better decision making, competitive advantage, interactivity with colleagues and hierarchy, increased employee productivity and lower cost, interactive order processing, more time for customer value-added work, the possibility of making better use of the ERP solution, reduced operation costs, the possibility of checking stock levels via the office network and ability to monitor project's progress (Table 3).
- Many organizations appeared to be using their Web sites and mobile devices as to communicate with present customers and some of them try to reach potential customers. The strategic power of mobile technology has to be highly correlated with SME competitiveness. The rapid pace of adoption and advancement of mobile devices creates opportunities for innovative services and better relationships.
- From an academic perspective, this study represents an approach to examine the use of mobile devices in SME activities and appreciate managers' assessment about the way how mobile devices can support a number of activities and should faced as components of information systems architecture.

5. CONCLUSIONS

This study provides insights to how SME managers evaluate the use of mobile devices as components of their information systems and identify risks, facilitating factors and benefits of mobile devices. It facilitates also a better understanding of making-decision process in what concerns the possibility to exploit its benefits while keeping the need to protect the information assets and the effectiveness of their countermeasures.

The findings from this research can be used as a guide in successful adoption and implementation of mobile devices in companies that are starting to engage in this new way of conducting businesses. Although this research addresses SME, the nature of mobile devices is such that it is global and should be applicable to organizations over a much wider scope. Consequently, the results reported here represent an important step forward in unraveling the complicated communication network where wireless technology is present.

Limitations: These results should be interpreted in light of some limitations. First, the sample size is limiting the generalization of findings. Moreover, it does not permit the comparison between SME from different industries. A second limitation arises because it was not possible to differentiate the users of mobile devices and its relationship with external and internal organizational information systems. A research strategy that may overcome this

limitation is to conduct further studies in which these variables and their relationships may be considered and also the extent to which managers can focus on the value and security of mobile devices in the context of competitive decisions and daily business processes.

Directions for future research: it should attempt also to incorporate improved differences between internal and external information sources relating them with a better utilization of mobile devices. Because the measures used in this study represent general opinions and attitudes, researchers have to be cautious about interpreting these results as indicative of causal relationships between dependent and independent variables. Finally, future research on managers' attitudes facing the linkages between strategic management and wireless technology may have to examine carefully the evolution of the use of mobile devices as a common effort to support adequately strategic communication with markets and business partners.

References

[1] S. Kumar and J. Stokkeland, "Evolution of GPS technology and its subsequent use in commercial markets", *International Journal of Mobile Communications*, 1 (1/2), pp. 180–193, 2003

[2] H. Vogt, F.C. Gartner, H. Pagnia, "Supporting fair exchange in mobile environments", *Mobile Networks and Applications*, vol. 8, no. 2, pp. 127– 136, 2003

[3] T.B. Warrington, N.J. Abgrab, and H.M. Caldwell, "Building Trust to Develop Competitive Advantage in E-business Relationships", *Competitiveness Review*, vol. 10, no. 2, pp. 160 – 168, 2000

[4] J. Nouwens and H. Bouwman, "Living Apart Together In Electronic Commerce: The Use Of Information And Communication Technology To Create Network Organizations", *Journal of Computer-Mediated Communication*, vol. 1, no. 3, 1995, doi:10.1111/j.1083-6101.1995.tb00169.x

[5] B. Mahadevan, "Business Model for Internet-based E-commerce: An Anatomy", *California Management Review*, Berkeley; Summer; vol. 42, no. 4, pp. 55-69, 2000

[6] L. Segil, "Fast Alliances are the Key to Dot.com Success", *The Journal of Quality and Participation*, vol. 23, no. 4, pp. 40 – 42, 2000

[7] J. Ayoade and T. Kosuge "Breakthrough in privacy concerns and lawful access conflicts", *Telematics and Informatics*, vol. 19, no. 4, pp. 273-289, 2002

[8] P. Roel, "Embarking Electronic Commerce", *Chief Executive*, no. 130, pp. 61-68, 1997

[9] S. Kim, "Firm characteristics influencing the extent of electronic billing adoption: an empirical study in the US telecommunication industry", *Telematics and Informatics*, vol. 19, pp. 201-223, 2002

[10] A. Leonhardi and U. Kubach, "An Architecture for a Universal, Distributed Location Service", *Proceedings of the European Wireless '99 Conference*, Munich, pp. 351-355, 1999

[11] M.E. Whitman and H.J. Mattord, *Management of information and security* (2nd ed.). Boston: Course Technology Cengage Learning, 2008

[12] K. Scarfone and P. Mell, *Guide to intrusion detection and prevention system (IDPS)*, NIST Special Publication, February 2007, pp. 800-94, 2007

[13] D. Schechtman, *IPad security from En Pointe and McAfee's mobile security practice*. En Pointe Technologies, 2011, available at http://www.enpointe.com/blog/ipad-security-en-pointe-and-mcafees-mobile-security-practice

[14] S. Endait, *Mobile security - the time is now*, 2010, available at http://www.authorstream.com/Presentation/snehaendait-477029-mobile-security

[15] P. Mottishaw, *Policy management will be critical to mobile operators as data traffic grows*. Analysys Mason, 2010, available at http://www.analysysmason.com/About-Us/News/Newsletter/Policy-management-hasbecome-an-urgent-issue-for-mobile-operators-as-a-result-of-the-rapid-growthin-mobile-data-traffic-increasing-availability-of-flat-rate-data-plans-and-newregulations-in-Europe

[16] W. Arbaugh, "Wireless security is different", *Computer*, vol. 36, no. 8, pp. 99-101, 2003

[17] A. Calder, *Implementing information security based on ISO 27001/ISO 17799: A management guide*. Hogeweg: Van Haren Publishing, 2006

[18] I. Bernik and K. Prislan, "Information security in risk management systems: Slovenian perspective", *Varstvoslovje*, vol. 13, no. 2, pp. 208-222, 2011

[19] D. Schiano, C.P. Chen, E. Isaacs, J. Ginsberg, U. Gretarsdottir, and M. Huddleston, "Teen Use of Messaging Media", *Proceedings of Conference on Human Factors in Computing Systems, CHI '02*, Minneapolis, USA, pp 594 -595, 2002

[20] L. Leung, "College Student Motives for Chatting on ICQ", *New Media and Society*. vol. 3, no. 4, pp 483-500, 2001

[21] A. Lenhart, L. Rainie, and O. Lewis, *Teenage Life Online: The Rise of the Instant-Messenger Generation and the Internet's Impact on Friendships and Family Relationships*. Pew Internet and American Life Project. Washington, USA, 2001

[22] R.E. Grinter and M.A. Eldridge, "y do tngrs luv 2 txt msg?" *Proceedings of the European Conference on Computer-Supported Cooperative Work*, Bonn, Germany, pp 219-238, 2001

[23] B. Clarke, and C. Strong, *Kids Net Wave 5*. London, UK: NOP Research Ltd., 2000

[24] O. Gibney, K. Swain, and G. Hooper, *Global Mobile Forecasts to 2010*, 3rd Edition. Baskerville Telecoms. Colchester, United Kingdom, 2002

[25] R. Ling and P. Helmersen, "It Must be Necessary, it Has to Cover a Need: The Adoption of Mobile Telephony Among Pre-Adolescents and Adolescents", *Telenor Report FoU R 9/2000*, Telenor. Fornebu, Norway, 2000

[26] M. Hulme and S. Peters, "Me My Phone and I: The Role of the Mobile Phone", *CHI '02 Workshop on Mobile Communications*. Seattle, USA, 2002

[27] N. Ducheneaut, "The Social Impacts of Electronic Mail in Organizations: A Case Study of Electronic Power Games Using Communication Genres", *Information Communication and Society*, vol. 5, no. 2, pp 153-188, 2002

[28] T. Finholt, L. Sproul, and S. Kiesler, "Communication and performance in ad-hoc task groups", in J. Galegher, R. Kraut and C. Egido (Eds.) *Intellectual Teamwork*, pp. 295 -325.:Lawrence Erlbaum Press, Hillsdale, NJ, USA, 1990, ISBN:0-8058-0534-6

[29] C. Tessier, "Moving targets: Maximizing the rewards and minimizing the risks of mobile devices", *Journal of AHIMA / American Health Information Management Association*, vol. 81, no. 4, pp. 38-40, 2010

[30] Z. Tu and Y. Yuan, "Understanding User's Behaviors in Coping with Security Threat of Mobile Devices Loss and Theft", *Proceedings of 45th Hawaii International Conference on System Science (HICSS)*, pp. 1393-1402, 2012

[31] V. Venkatesh, M.G. Morris, G.B. Davis, and F.D. Davis, "User acceptance of information technology: Toward a unified view", *MIS Quarterly*, vol. *27*, no. 3, pp. 425-478, 2003

[32] S.J. Hsiao, Y.C. Li, Y.L. Chen, and H.C. Ko, "Critical factors for the adoption of mobile nursing information systems in Taiwan: The nursing department administrators' perspective", *Journal of Medical Systems*, vol. 33, no. 5, pp. 369-377, 2009

[33] G.J. Putzer and Y. Park, "The effects of innovation factors on smart phone adoption among nurses in community hospitals", *Perspectives in Health Information Management /AHIMA, American Health Information Management Association, 7*, 1b, 2010

[34] G.J. Putzer and Y. Park, "Are Physicians Likely to Adopt Emerging Mobile Technologies? Attitudes and Innovation Factors Affecting Smartphone Use in the Southeastern United States", *Perspectives in Health Information Management /AHIMA, American Health Information Management Association, 9*, 1b, 2012

[35] J. Wu, S. Wang, and L. Lin, "Mobile computing acceptance factors in the healthcare industry: A structural equation model", *International Journal of Medical Informatics*, vol. 76, no. 1, pp. 66-77, 2007

[36] J.V. Biljon and P. Kotzé, "Modeling the Factors that Influence Mobile Phone Adoption", *Proceedings of the 2007 Annual Research Conference of the South African Institute of Computer Scientists and Information Technologists on IT research in developing countries*, pp. 152-161, 2007

[37] J. Csete, Y.H. Wong, and D. Vogel, "Mobile devices in and out of the classroom", in L. Cantoni & C. McLoughlin (Eds.), *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2004*, Chesapeake, VA: AACE, pp. 4729-4736, 2004