



Journal of Applied Sciences

ISSN 1812-5654

science
alert

ANSI*net*
an open access publisher
<http://ansinet.com>

Impact of Mobile-Commerce: Benefits, Technological and Strategic Issues and Implementation

Sang Hyun Kim

College of Business Administration, Kyungpook National University,
701-702 Sankyuk-dong, Puk-ku Daegu, South Korea

Abstract: Although e-Commerce has influenced the global business environment, many firms are continuously looking for new technology, applications and infrastructures where such innovations can bring more profits and attract more customers. One innovative environment, involving mobile computing and wireless technology is related to Mobile-Commerce (m-Commerce), which has become a new area of interest for today's firms. M-Commerce is a new concept and is an innovation of the electronic market. It is creating entirely new opportunities for mobile devices and services. Until now, m-Commerce study has used to focus on issues and challenges. Recent statistics and predictions show that m-Commerce, however, may generate more strategic advantages than disadvantages for firms. Therefore, the main purpose of this study is to provide an overview of m-Commerce, the four main issues that affect the industry and implementation of this technology and its substantial benefits.

Key words: Mobile-Commerce, m-Commerce issues, benefits

INTRODUCTION

Since many businesses used to be conducted in traditional marketplaces, the new innovative market place—the Internet and e-Commerce, has provided a huge impact on the global business environment and it has changed the way of conducting business. Regarding the advantages of e-Commerce, firms keep looking for new technology and applications in order to be more competitive and successful. One new business strategy trend is the progress toward mobile computing and the wireless web (Tarasewich *et al.*, 2002). This trend is known as mobile computing or nomadic computing (Kleinrock, 1995), which provides new interest for firms in m-Commerce (Tarasewich *et al.*, 2002). M-Commerce is creating entirely new opportunities both for mobile devices and services and it provides the same capabilities, functionalities and mobility of e-Commerce.

There are various mobile devices used in m-Commerce, such as digital cameras, cellular phones, Personal Digital Assistants (PDA) and wireless laptops to name a few. Therefore, users can have unlimited access to all types of information, including music, news, sports, stock trading and financial reports. Wireless and mobile networks have been growing in terms of mobile devices, middle-ware development, standards and network implementation and user acceptance (Varshney and Vetter, 2000), so there is great interest in mobile technology. Demand for mobile devices is increasing throughout the world; there were 720 million people using mobile phones in 2000 and the number is increasing

(Cheskin, 2001). According to study conducted by Accenture, the Institute for Strategic Change (2001), mobile penetration, which is a measurement indicator, of many Asian and European countries such as Japan, South Korea, U.K and Italy, is greater than 60% in those areas whereas in the U.S., it is less than 50%. Goldman Sachs Equity Research (Raczkowski, 2002) predicted that the number of mobile phone users would exceed one billion worldwide by 2003 and that 500 million mobile devices would have Internet access by 2005. As a result, global m-Commerce revenues would grow from \$400 million in 2000 to \$22.2 billion in 2005, according to Jupiter Research (Raczkowski, 2002).

Such an increase of mobile users will have a huge impact on m-Commerce and it will bring many benefits to firms. This emerging technology has created a new marketplace, called m-Commerce and it has become a new way for many firms to conduct their businesses. This study presents a conceptual understanding of m-Commerce, its four main issues (technological and strategic issues) and their implementation and the substantial benefits of this technology. All of these aspects of m-Commerce may be considered for successfully m-Commerce practices are provided.

Definitions of m-Commerce: Since m-Commerce is a new concept, it is important to first understand the concepts that are associated with it. M-Commerce, also called wireless commerce or mobile e-Commerce does not have one particular definition (Tarasewich *et al.*, 2002). In principle, m-Commerce is any monetary business

activity conducted via mobile communication networks (Müller-Veerse, 1999). Some studies, however, define m-Commerce in different ways. For example, Tarasewich *et al.* (2002) defined m-Commerce as, all activities related to commercial transaction conducted through communications networks that interface with wireless/mobile devices. Another study defined m-Commerce as, the use of hand held wireless/mobile devices to communicate, interact and transact via high-speed connection to the Internet (Shuster, 2001). This study simplified the definition of m-Commerce as, any activity, including both monetary and non-monetary, conducted through any mobile device.

Another important concept that should be defined is mobile devices, since this is how m-Commerce is conducted. It is not easy to present a precise definition of mobile devices (Bardo and Jürgen, 2002). According to Hansmann (2001), mobile devices are defined as electronic appliances that serve communication, data processing and exchange purpose, which can be conducted by its user and which can receive, send or transmit information to other devices. Current mobile devices include mobile phones, mobile-enabled hand held computers, wireless laptops, vehicle-mounted technology and personal pagers. These devices can be interactively used with other devices and can network via wired synchronization.

Characteristics of m-Commerce: One reason that people adopt m-Commerce may be due to its unique characteristics. It has two fundamental characteristics, Mobility and Reachability (BenMoussa, 2003; Camponovo and Pigneur, 2003; Ng-Kruelle *et al.*, 2002; Turban *et al.*, 2002). Figure 1 shows the characteristics and attributes of m-Commerce.

Mobility capability of mobile devices provides users with a free of time and location. Reachability is directly related to mobility. Mobile device users can be reached instantly. These two characteristics can solve any geographic or time obstacles of a particular situation (Turban *et al.*, 2002). Other characteristics and attributes

include: ubiquity, user identity, location awareness and interactivity, security and instant connectivity (Müller-Veerse, 1999). Studies (Kenny and Marshall, 2000; Kannan *et al.*, 2001; Tarasewich and Warkentin, 2002; Vetter, 2001) have claimed that ubiquity is the most obvious advantage of m-Commerce because it can satisfy the need for real-time information and communication anywhere, regardless of a user’s location. Furthermore, size and portability (Stoica, 2003) would be important reason for potential customers to adopt mobile devices. The desire to buy mobile devices can be easily satisfied by these characteristics.

Causes, issues and implementation of m-Commerce: An early adaptor of new technology often assumes some level of risk. m-Commerce is a new innovation in the electronic market. Thus, many firms have been very skeptical of m-Commerce and many industries have not examined its potential. As a result, there is not much research regarding its’ impacts. There has been some research, however, on general aspects of m-Commerce, such as m-Commerce technology and applications (Mueller-Veerse, 1999; Varshney and Vetter, 2000a, b; Varshney *et al.*, 2000). Other research have focused on the issues and challenges of m-Commerce, including a series of propositions for marketing (Kannan *et al.*, 2001), fourth generation wireless networks (Varshney and Jain, 2001; Varshney and Vetter, 2001), a framework for m-Commerce applications (Siau, 2001) and mobile clients and communication infrastructure (Tarasewich *et al.*, 2002).

Such issues and challenges, however, are very different, depending on how developed the m-Commerce market is. For instance, m-Commerce in the US is involved in assessing the technological evolution and the potential market growth, whereas m-Commerce in Europe focuses on a socio-economic analysis of the new market evolution. Therefore, studies have found different issues and challenges between the two different m-Commerce markets. In the US m-Commerce market, Tarasewich *et al.* (2002) categorized three technological issues: mobile clients, communications infrastructure and other technology. In addition, Kennedy and Gavras (2001) outlined three challenges of m-Commerce: technical, business and security issues. Organizations should improve these issues in order to instill customers with confidence in m-Commerce. In the European m-Commerce market, Vittet-Philippe and Navarro (2000) claimed strategic challenges as being the biggest concern, which include vanishing revenue streams from sales capacity to monitoring content, increased convergence, competition, expanding core business, climbing the value chain,

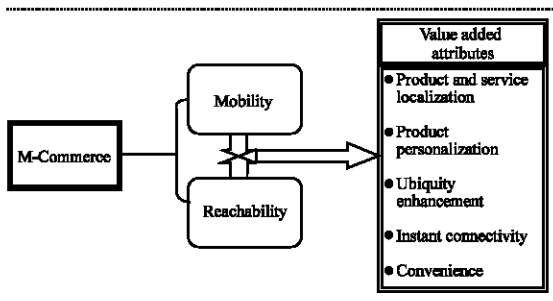


Fig. 1: Characteristics and attributes of m-Commerce

Table 1: Comparison of m-Commerce phase and issues between the US and Europe

	US		Europe
Phase	Assessing the technological evolution and potential market growth	Phase	Analyzing a socio-economic of the new market evolution New market evolution
Issues	Technical issues (mobile clients, communication infrastructure, etc.) Business issues Security issues	Issues	Strategic issues (vanishing revenue streams, value chains, business model, increasing competitions etc.) Security issues
Common issue		Security	

expanding footprint, reaching critical mass and increased concentration and competition concerns. Furthermore, Bergström (2001) found other issues, such as trust, confidence, user friendliness, business models, value chains and regulatory aspects. There are some issues which link all regions, such as security concerns (Ghosh and Swaminatha, 2001; Hamblen, 2001; Hutchinson and Warren, 2001; Jain *et al.*, 2000; Miller, 2001). Table 1 compared the phases and issues that face the US and European m-Commerce market.

Even though the focus of arising issues and challenges in the European and US markets may differ, it is obvious that all issues should be addressed in order to develop m-Commerce.

In order for m-Commerce to be successful, firms must be aware of possible problems and solutions. As mentioned earlier, m-Commerce issues need to be addressed. m-Commerce can merge the Internet and the mobile telephone, which will result in more technical and strategic issues. For example, technical studies should be conducted to solve issues, such as speed and strategic and implementation plans have to be made in order to answer m-Commerce issues in terms of marketing. Therefore, recognizing m-Commerce issues, as well as trying to solve them should be at the strategic core for many m-Commerce firms. Among these issues, Vittel-Philippe and Navarro (2000) claimed that the most important issues involved measurement, security, competition and standardization concerns. Each issue is discussed in the following.

Measurement issues: m-Commerce firms need to define new measurement indicators. In the future, m-Commerce market will be close saturation, so traditional mobile-telephone indicators, penetration and growth issues will be inappropriate. According to the International Telecommunications Union, the US had the highest absolute number of mobile phone users and the penetration was fifth in 1994. A slower growth rate in 2000, however, caused the US market penetration to fall from the top ten list; this came about due to population density (Speter and Speter, 2000). In this case, penetration and growth rate do not reflect the size of the m-Commerce market. Therefore, m-Commerce firms should define new

specific indicators, which must reflect the advanced segmentation of the market by service and its users. New indicators should be capable of measuring the growth of the market by service and its users, which will be the first hard data for firms initiating m-Commerce. In order to define new indicators, firms should first recognize their position in each sector of industry, which will give them more detailed information to decide their needs. According to Vittel-Philippe and Navarro (2000), to define such new indicators, a sector analysis of the m-Commerce impact is the first step in defining new indicators. Firms should then use their current scoreboard as a starting point to get information. With new measurement indicators, firms will be able to evaluate their exact position in the m-Commerce market and will be able to make appropriate plans for their business.

Security issues: Like many other businesses using technology, security issues are probably the greatest concern of any m-Commerce firm (Ghosh and Swaminatha, 2001; Hamblen, 2001; Hutchinson and Warren, 2001; Jain *et al.*, 2000; Miller, 2001). Even if m-Commerce is a new evolution for many businesses, such businesses can sustain substantial threats without a secure environment. Most e-Commerce businesses have security-control counter plans in the form of processes, technology and organizations that can be implemented to eliminate vulnerability and then can reduce security risks (Sawma and Probert, 2003). To some extent, m-Commerce firms require the same security controls that are used to protect company networks and web applications in the wired e-Commerce environment. These controls involve various technology, such as firewalls, anti-virus protection, user identification, authentication and secure device management. Without providing secure environments or controls, m-Commerce will have a difficult time in succeeding.

Even if security concerns are very common for any type of e-Commerce, m-Commerce firms should develop and provide additional technology for a secure environment. This is due to different technological environments. Such additional security considerations need to be implemented only in the m-Commerce environment (VHA white paper, 2001). They include:

- WAP does not provide end-to-end encryption
- Initial access code/password on wireless devices can be deactivated by the user
- Lack of standards for user and device authentication, executable content security and stored data security
- Users can be tracked, with location-based services
- Radio frequency signal jamming can lead to disruption and non-availability of wireless devices and networks
- Wireless PANs such as Bluetooth provide little security out of the box and can allow unauthorized access to the data

There are additional security issues, such as access, destruction, manipulation or copying of important data and applications by unauthorized people. m-commerce firms must tackle every potential issue. For some security issues, solutions are already available, whereas others still need to be developed. For example, IT firms, such as Baltimore Technology Corp, have developed KeyTools Wireless in order to improve the performance of applications and to bring authentication and end-to-end security. Other implementations are such that in order to secure the extension to m-Commerce channels, firms must provide cryptographic technology, strong user authentication, mobile service ISDN, wireless public key infrastructure and content filtering (Tzvetkov and Cubaleska, 2002). In addition, in order to secure credit payments in the m-Commerce, firms should provide WTLS/TLS protocols (Fourati *et al.*, 2002). m-Commerce should also continue to provide responses to all future security issues.

Competition issues: Another consideration of strategic plans would be the issue of competition. Sooner or later, the m-Commerce market will be saturated due to high competition. m-Commerce activities will influence many consumer markets as did e-Commerce (Vittet-Philippe and Navarro, 2000). With such trends, m-Commerce firms should consider both managerial and technological plans that will play a crucial role in order to be more competitive. For managerial implementation, m-Commerce firms should be able to evaluate their competitors, customers and many others inside and other factors which affect them. One recent m-Commerce value chain model developed by Barnes (2002), pointed out all necessary processes in order to analyze competitors, technology and activities that are involved in m-Commerce industry. This model consists of six core processes: content creation, content packaging, mobile portals, mobile transport, mobile services and delivery support and mobile interface and applications. These processes are in two main areas:

content and infrastructure and services (Barnes, 2002), which are used to identify and analyze competitive dynamics and their implications on strategy formulation (Sigala, 2002). M-Commerce firms must be able to understand all processes in each area in order to have a better managerial competitive advantage.

Furthermore, m-Commerce firms need to develop more advanced mobile technology and networks in order to deal with competitors. Vittet-Philippe and Navarro (2000) suggested that m-Commerce firms need to develop structured database systems on firms, which can examine their competitors and e-Commerce. With is technology, firms need to develop and sustain a continuous watch on market activities, which must include new measurement indicators specifically defined for m-Commerce and be proactive instead of reactive. Technical development must be very specific, especially for mobile area, so that firms not only measure potential risks from competitors and other threats, but that they galvanize leading positions in different markets that will ensure their success.

Standardization issues: Finally, standardization is another important issue that m-Commerce firms must consider. It is not easy to standardize new technology and/or business concept. Different hardware, infrastructures and applications among m-Commerce firms make standardization difficult, particularly in integrating data and the many rapidly-changing requirements. In defining a new standard, however, device-independent encryption, privacy and security solutions and electronic cash formats are very important issues because such standards may be able to reap a competitive advantage (Fahy *et al.*, 2002; Stallings, 1994; Vittet-Philippe and Navarro, 2000).

The main purpose of standardization for m-Commerce is to ensure interoperability (Cousins and Varshney, 2001). Interoperability plays a crucial role for many businesses not only because it saves time in communication, but also because it reduces costs of the workforce and operation management. According to Allan (2002) and Miller (2002), interoperability simplifies the exchange and re-use of information both internally and externally. With m-Commerce bring added innovation to our lives, the integration of m-Commerce technology and services would be successful.

A single company, however, cannot design m-Commerce standards because of complications in m-Commerce IT infrastructure. Furthermore, standardizing work is not just an issue for m-Commerce firms, but for the m-Commerce industry as a whole. As a result, m-Commerce firms should cooperate with other partners or consortia in order to standardize work together. For

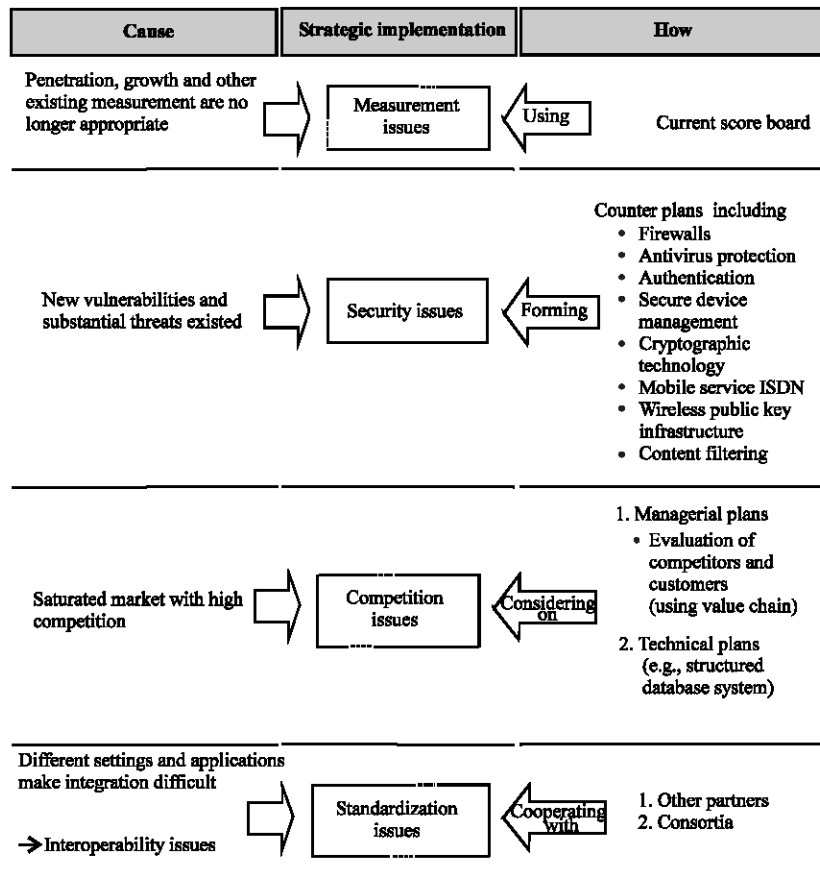


Fig. 2: Strategic implementation approaches

example, in order to standardize authentication matter, the European Commission helped launch the European Electronic Signatures Standardization Initiative (EESSI), that is the standardization for the European Directive regarding electronic signatures in m-Commerce (Vittet-Philippe and Navarro, 2000).

The four strategic factors based on issues in the m-Commerce field do not along guarantee successful m-Commerce. There are many other social, strategic and technical considerations and implementations of m-Commerce that should be examined and developed. Figure 2 summarizes the causes of the four core issues and the method which are suggested for implementation.

Benefits of m-Commerce: M-Commerce will generate many benefits as has e-Commerce. In the beginning, m-Commerce targeted individual customers rather than businesses. In other words, m-Commerce has mainly been applied to consumer-oriented areas (Barnes, 2002; Kennedy and Gavras, 20001; Lyytinen, 2001). Such a new

type of technology provides individual customers with better data exchange and communication. The current usage of m-Commerce, however, is not only for individuals, but also for organizations. There is now a fast-growing interest in expanding m-Commerce technology into the enterprise market (Jukic *et al.*, 2002; Stoica, 2003; Varshney *et al.*, 2002). Now more firms realize that urgent launching of m-Commerce initiative will be a successful strategy for them. A number of firms have launched m-Commerce, such as Alliance Sprint-Compuware, Saven Technology, Mobile Telephony and Yankee Group (Stoica, 2003). Each of them has had success m-Commerce in different ways.

Benefits of m-Commerce are reflected in two aspects; indirect and direct benefits. Regarding indirect, m-Commerce provides more competitive advantages than other firms. M-Commerce initiatives bring the rapid development and deployment of customized-wireless applications, as well as the integration of these applications with an organization's existing

communication and data infrastructure, which could create awareness in their business areas (Stoica, 2003). Strategies of a developing market for m-Commerce could enable firms to provide more in-depth comprehensive analysis for its clients. On the other hand, direct benefits are more noticeable in many industry sectors. Leung and Antypas (2001) also claimed that m-Commerce could improve the efficiency and effectiveness of business activities by distributing information to the workforce remote and by offering new ways in which to interact with customers. Furthermore, Varshney *et al.* (2002) suggested that organizations being able to utilize the power of mobile technology in order to automate and make business processes more efficient, may acquire the benefits of enhanced productivity, lowered operational cost, increased customer satisfaction and improved decision-making.

Industry sectors gain substantial benefits from m-Commerce include manufacturing, marketing and retailing. Increasing productivity with efficiency and effectiveness may be the most important assets for manufacturing firms. Mobile devices and m-Commerce are one way to increase productivity. According to Gartner Group reports (Maginnis *et al.*, 2000), manufacturing firms utilizing m-Commerce have increased worker productivity. By using mobile devices, such as cell phones, personal digital assistants (PDAs) and laptops with built-in wireless modems, employees can access the company's network and ERP systems or supply-chain integration applications even when they are away from the office. Also, employees can manage their schedules, exchange e-mail and stay in touch with mobile devices on the road. Field operation workers may use mobile devices in order to collect data. Furthermore, the invention of communication standards such as Wireless Access Protocol (WAP) and Bluetooth (Maginnis *et al.*, 2000) makes it possible for an employee on the road to quickly respond to a customer's request for information. Such

mobile functionality provides great possibilities in improving the productivity and effectiveness of a manufacturing company. Investing in effective mobile technology is likely to increase mobile workers' productivity 30% (Nadesan, 2001). Increasing productivity is the most obvious benefit from opting to use m-Commerce technology.

The retailing and marketing sectors also recognize the increased benefits from m-Commerce. According to Kannan *et al.* (2001), m-Commerce provides benefits for the marketing of goods, services and content. In the retail and marketing sectors, m-Commerce provides more opportunity for service differentiation and new routes to promote and sell products to business partners and customers. In other words, m-Commerce is the creation of a new channel for businesses. Jukic *et al.* (2002) stated five benefits that m-Commerce can provide in the marketing sector: creation of zones, place utility, personalization, promotional utility and interaction. These noticeable benefits of m-Commerce are the systematic, but rapid generation of mobile shopping areas, which are similar to real or virtual malls. With e-Commerce, marketing and retailing activities are only possible when customers have the web access. With m-Commerce, firms, however, can market their products and services to customers anytime, anywhere because of mobile devices. With mobility, individual purchasing opportunities will be maximized.

With such benefits of m-Commerce, Table 2 introduces some of firms taking advantages of m-Commerce and their success.

The success of FedEx is a well-known case and it has become the grandfather of m-Commerce in its field. Due to its wireless system, employee productivity skyrocketed and operational efficiency reached new levels. m-Commerce will become a tool for successful business in the near future and more firms will benefit from using this type of technology.

Table 2: m-Commerce success

Company	m-Commerce implementation
One-two snap	This company established the world's first mobile phone auction shopping service. It ranks 26th in the Sunday Times' European Top 100 e-League and is poised to roll out its business in the United Kingdom market
Paybox.net	Instead of giving a credit card in a transaction, customers give cell-phone number so that merchants, either in stores or online, can dial up the Paybox.net line or website, then the customer's mobile-phone number and the amount to be charged can be entered
Erico	This company developed a range of WAP-based products for the business market. Each model is integrated with the rest of the products which can provide extra functionality
Elbit Ltd.	It developed a complete solution to enable a person to operate computerized software applications in the e-Commerce and m-Commerce environments by using natural language
Employee Matters	It developed an extended of m-Commerce system to provide a fully integrated, web-based provider of employee administration outsourcing services to small and medium-sized businesses
FedEx	By using a mobile electronic dispatch system, FedEx would increase productivity, cultivate customer loyalty, create a competitive advantage and cut costs

CONCLUSIONS

M-Commerce is an interesting and a very recent addition to the way that modern business enterprises conduct business. It will become a new frontier for e-Commerce in the near future and it can bring many business opportunities because of its unique characteristics and positive impact in many business sectors. For the past several years, researchers and practitioners (Chaffey, 2003; Chan *et al.*, 2002; Goodman, 2000; Hawick and James, 2002; Tarasewich and Warkentin, 2000; Varshney, 2002a, b) have focused more on identifying the issues and challenges of m-Commerce. There is not much research, however, which concentrates on the actual benefits of m-Commerce. This study outlined the potential of m-Commerce and provided information regarding related issues.

Recently, firms have gained substantial benefits from m-Commerce in many business areas, such as manufacturing, retailing, marketing and finance. Manufacturing firms increased efficiency and effectiveness; firms reduced potential costs, operated business activities more efficiently and improved their competitive position. Furthermore, m-Commerce provides a new channel for retailing and marketing. Business activities are conducted via mobile devices, such as mobile phones and PDAs. In the finance sector, m-Commerce provides better customer service; customers may gain access to data and information anytime, anywhere. Benefits in each sector will bring a potential increase in profits for firms in the future.

With such benefits of m-Commerce, firms should consider tackling the four issues mentioned earlier: measurement, competition, security and standardization, all of which are considered major limitations of m-Commerce. These implementations deal with both technological and managerial issues of m-Commerce and are very important for ensuring long-term success. Since m-Commerce requires infrastructure, applications and H/W and S/W, the urgent implementation may focus on technical issues. M-Commerce, however, is not technology, but it is about discovering innovative ways to define value for customers, as well as to conduct business. Once m-Commerce issues and challenges have been incorporated into the policies of a company, more benefits could be expected. Therefore, in the future, research needs to focus on two aspects; the influences that determine the success of m-Commerce and the benefits themselves.

REFERENCES

- Accenture, Institute for Strategic Change, 2001. The Future of Wireless: Different than you Think, bolder than you imagine. Retrieved May 12, 2006 from http://www.accenture.com/Global/Research_and_Insights/Institute_For_High_Performance_Business.
- Allan, H., 2002. Optimizing Revenues from Mobile Messaging: Business Support Strategies for SMS, EMS and MMS. Baskerville, Chorleywood Publications.
- Bardo, F. and J. Jürgen, 2002. Evaluation of mobile applications: Software-technical and human aspects. Proceedings of the 9th European Conference on Information Technology Evaluation (ECITE), Université Dauphine, Paris, France.
- Barnes, S.J., 2002. The mobile commerce value chain: Analysis and future developments. *Intl. J. Inform. Manage.*, 22: 91-108.
- BenMoussa, C., 2003. Workers on the move: New opportunities through mobile commerce. UKAIS Conference, University of Warwick, Apr. 9-11th.
- Bergström, R., 2001. Promoting an open environment for mobile ecommerce in Europe. Mobile Commun. Conference, April, 23-26th.
- Camponovo, G. and Y. Pigneur, 2003. Business model analysis applied to mobile business. 5th International Conference on Enterprise Information Systems (ICEIS), Angers, Apr. 23-26th.
- Chaffey, D., 2003. Internet Marketing: Strategy, Implementation and Practice. 2nd Edn. England: Pearson Education Ltd.
- Chan, S.S., X. Fang, J. Brzezinski, Y. Zhou, S. Xu and J. Lam, 2002. Usability for mobile commerce across multiple form factors. *J. Electron. Comm. Res.*, 3: 189-199.
- Cheskin, 2001. The Wireless Future: A Look at Youth Unplugged. September 2001. Retrieved Dec. 8, 2005 from <http://www.ixi.com/PDF/CheskinYouthUnplugged.pdf>.
- Cousins, K. and U. Varshney, 2001. A product location framework for mobile commerce environment. Proceedings of the ACM Mobile Commerce Workshop, Rome, Italy.
- Fahy, M., J. Feller, P. Finnegan and C. Murphy, 2002. Measuring and managing intangibles in mobile commerce: The Potential of Mediation Standards. PRISM Case 9.1.1. IST project 2000-29665 'RESCUE'. European Case Clearing House (Reference No. 302-162-1).

- Fourati, A., H.K. Ayed, F. Kamoun and A. Benzekri, 2002. A SET based approach to secure the payment in mobile commerce. 27th Annual IEEE Conference on Local Computer Networks (LCN'02), Nov. 06-08, Tampa, FL.
- Ghosh, A.K. and T.M. Swaminatha, 2001. Software security and privacy risks in mobile E-Commerce. *Communications of the ACM*, 44: 51-57.
- Goodman, D., 2000. The wireless internet: promises and challenges. *Computer*, 33: 36-41.
- Hamblen, M., 2001. Privacy Concerns Mount over Wireless Location Technology. *Computerworld*. Retrieved Jan. 3, 2006 from <http://www.computerworld.com/printthis/2001/0,4814,57662,00.html>.
- Hansmann, U., 2001. *Pervasive Computing Handbook*. Springer, pp: 409.
- Hawick, K.A. and H.A. James, 2002. Middleware Issues for Mobile Business and Commerce. DHPC Technical Report DHPC-126. Proc. World Scientific and Engineering Academy and Society (WSEAS) Intl. Conf on E-Activities, Singapore.
- Hutchinson, D. and M. Warren, 2001. Security issues of m-Commerce. Proceeding for 2nd International We-B Conference 2001: Working for excellence in the e-economy, Edith Cowan University, Churchlands, Western Australia, pp: 478-485.
- Jain, A., L. Hong and S. Pankanti, 2000. Biometric identification. *Commun. ACM* 43: 91-98.
- Jukic, N., A. Sharma and B. Jukic, 2002. M-Commerce: Analysis of impact on marketing orientation. Proceedings of Information Resource Management Association (IRMA) Intl. Conference, Philadelphia, PA.
- Kannan, P.K., A. Chang and A.B. Whinston, 2001. Wireless Commerce: Marketing Issues and Possibilities, Sprague, R.H. Jr. (Ed.). Proceedings of the 34th Hawaii International Conference on System Sciences, Piscataway, New Jersey: IEEE.
- Kennedy, D. and A. Gavras, 2001. Business Briefing: Global m-Commerce. World Markets Research Center, London.
- Kenny, D. and J.F. Marshall, 2000. Contextual Marketing; the Real Business of the Internet. *Harvard Business Review*, November-December.
- Kleinrock, L., 1995. Nomadic computing: An opportunity. *Computer Communications Review*. Satellite Access Protocol. Retrieved Jan. 23, 2006 from <http://citeseer.ist.psu.edu/cache/papers/cs/159/http://zSzzSzmillemnium.cs.ucla.edu/zSLKzS zBibz SzPsz Szpaper185.pdf/kleinrock 95 nomadic .pdf>.
- Leung, K. and J. Antypas, 2001. Improving returns on m-Commerce investments. *J. Bus. Strategy*, 22: 12-13.
- Lyytinen, K., 2001. Mobile Commerce: A new frontier for E-business. 34th Annual Hawaii International Conference on System Sciences (HICSS-34), 9, Maui, Hawaii.
- Maginnis, F., R. White and C. McKenna, 2000. Customers on the move: M-Commerce demands a business object broker approach to EAI. *EAI J. Nov./Dec.*
- Miller, P., 2002. Interoperability. What is it and Why should I want it? *Ariadne*, Vol: 24.
- Miller, S.K., 2001. Facing the challenge of wireless security. *Computer*, 34: 16-18.
- Müller-Veerse, F., 1999. *Mobile Commerce Report*. Durlacher Research Ltd., London.
- Ng-Kruelle, G., P.A. Swatman, D.S. Rebne and F. Hampe, 2002. The price of convenience: Privacy and mobile commerce. *Quarterly J. Electro. Comm.*, 3: 273-285.
- Raczkowski, G., 2002. *Mobile Ecommerce: Focusing on the Future*. dash30.inc.
- Sawma, V. and R. Probert, 2003. Specializing the NIST security services model for electronic commerce systems. Federal Information Systems Security Educators' Association (FISSEA) 2003 Annual Conference, March 4-6, Silver Spring, MD.
- Shuster, T., 2001. Pocket Internet and M-Commerce: How Will It Fly? Working Paper, George Washington University, Washington, DC.
- Siau, K., E. Lim and Z. Shen, 2001. Mobile commerce: Promises, challenges and research agenda. *J. Database Manage.*, 12: 4-13.
- Sigala, M., 2002. Competitive strategies for mobile portals. Proceedings for first international conference on mobile business, 8-9 July, Athens, Greece.
- Speter, L.J. and M. Speter, 2002. Forecasting Demand through Estimation by Analogy: The Case of the Internet. 2002 ABAS International Conferences, June 22-24, Cancun, Mexico, July 6-8, San Jose, Costa Rica.
- Stallings, W., 1994. *Data and Computer Communications*. 4th Edn., NY, MacMillan Publishing.
- Stoica, M., 2003. The Impact of Mobile Commerce on Small Business and Entrepreneurship, in the Volume *New Perspectives in Entrepreneurship*. Routledge Publishing, Florence, KY.
- Tarasewich, P., R.C. Nickerson and M. Warkentin, 2002. Issues in mobile e-commerce. *Commun. Assoc. Inform. Sys.*, 8: 41-64.

- Tarasewich, P. and M. Warkentin, 2000. Issues in wireless E-Commerce. *ACM SIGecom Exchanges*, 1: 19-23.
- Tarasewich, P. and M. Warkentin, 2002. Information everywhere. *Infor. Sys. Manage.*, 19: 8-13.
- Turban, E., D. King, J. Lee, M. Warkentin and M. Chung, 2002. *Electronic Commerce A Managerial Perspective*. 2nd Edn., New Jersey, Pearson Education.
- Tzvetkov, V. and B. Cubaleska, 2002. WAP protocol security solutions for mobile commerce. *Proceedings of the 6th World Multiconference on Systemics, Informatics and Cybernetics*, Orlando, FL.
- Varshney, U., R. Vetter and R. Kalakota, 2000. Mobile commerce: A new frontier. *IEEE Comp.*, 33: 32-38.
- Varshney, U. and R. Vetter, 2000. Emerging Mobile and Wireless Networks. *Communications of the ACM*, 43: 73-81.
- Varshney, U. and R. Vetter, 2001. A Framework for the Emerging Mobile Commerce Applications. In: *Proceedings of the 34th Hawaii International Conference on System Sciences*. Sprague, R.H. Jr. (Ed.). Piscataway, New Jersey.
- Varshney, U. and R. Jain, 2001. Issues in emerging 4G wireless networks. *Computer*, 34: 94-96.
- Varshney, U., 2002. M-Commerce-issues, applications and technology. *MobiCom 2002, 8th ACM International Conference on Mobile Computing and Networking*, Sep. 23-28, Atlanta, GA.
- Varshney, U. and R. Vetter, 2002. *Mobile Commerce: Framework, Applications and Networking Support*. *Mobile Networks and Applications 7*, Kluwer Academic Publishers. In the Netherlands, pp: 185-198.
- Varshney, U., A. Mallow, R. Jain and P. Ahluwalia, 2002. Wireless in the enterprise: Requirements and possible solutions. *Proceedings of the Workshop on Wireless Strategy in the Enterprise: An International Research Perspective*, University of CA, Berkeley. October 15-16.
- Vetter, R., 2001. The wireless web. *Commun. ACM*, 44: 60-61.
- VHA, 2001. *Option for Wireless Technology and Applications in Health Care*. Retrieved April 8, 2006 from https://www.vha.com/research/public/it_whitepaper.pdf.
- Vittet-Philippe, P. and J. Navarro, 2000. *Mobile e-Business (m-Commerce)-State of Play and implications for European Enterprise Policy*. European Commission: DG Enterprise.