A Review for Mobile Commerce Research and Service

Shan DU

Xi'an International University

493116176@qq.com

Abstract. There is no doubt that the use of wireless andmobile networks and devices is growing. From the1990s onwards, we have been witnessing a great shift in methods of doing business with the emergence of the electronic commerce (e-commerce). Academics, businesses, and even individuals have been focusing on this new way of conducting business online. Advanced and mature wireless and mobile technologies facilitate e-commerce conducted from a wired network to a wireless network. Mobile commerce (m-commerce) can be viewed as a subset of e-commerce and refers to bany transaction with monetary value that is conducted via a mobile network .When users conduct e-commerce such as e-banking or purchase products, they do not need to use a personal computer system. Indeed, they can simply use some mobile handheld devices such as Personal Digital Assistants (PDA) and mobile phones to conduct various e-commerce activities. In the past, these mobile devices or technologies were regarded as a kind of luxury for individuals. However, this situation has changed. The market for mobile technologies has seen significant growth in the past few years. This is creating a new opportunity for the growth of m-commerce. According to a study conducted by Datamonitor, global m-commerc revenues will amount to $131.7 billion by 2017.

Research Methodology

Considering the nature of the research on m-commerce, it would be difficult to group the literature under any specific disciplines. Further evidence of this can be seen from the fact that m-commerce articles are scattered across various journals in disciplines such as business, management, marketing, engineering, information technology (IT), and infor-mation systems (IS). Consequently, various online journal databases were selected and searched to provide a comprehensive bibliography on m-commerce literature. The literature search was based on the descriptor, mobile commerce or m-commerce[1]. The search was also limited to peer reviewed journal articles. More than 340 articles were found in the initial search of the literature.The full text of each article was reviewed to eliminate those articles that were not actually related to m-commerce. The search yielded 168 m-commerce articles from 84 journals. Each of the 168 articles was carefully reviewed. he Technology Acceptance Model (TAM) suggests that ceived usefulness and perceived ease-of-use are the two important factors that determine adoption of any technology (Davis 1989). Many enablers fall under these categories of factors. First, networking is a key enabler. Networking increases perceived usefulness. Both the Millennials and the Road Warriors value mobile devices as these help them stay in touch with other people. Whereas the Millennials prefer to use the mobile primarily for social networking, that is, to keep in close contact with their friends and family members, the Road Warriors use the mobile primarily for professional networking, that is, being in touch with their business colleagues.

Classification of M-commerce Literature

The paper depicts a graphical classification framework for m-commerce articles. The framework is developed based on Varshney and Vetter proposed a four-level integrated framework for m-com-merce: m-commerce applications, wireless user infrastructure, mobile middleware, and wireless net-work infrastructure[2]. M-commerce applications require the support of technology

from the foundation of wireless user infrastructure, mobile middleware, and wireless network infrastructure. In addition, corresponding theory and research activities are essential to provide guidance for the development of m-commerce. The classification framework recognizes that m-commerce articles consist of five levels and each of them is discussed as follows:

M-commerce theory and research: This is the lowest level of the framework. The articles included here describe the development of m-commerce applications and guidelines, behavioural issues such as consumer behaviour, the acceptance of technology, and the diffusion of m-commerce applications and services. M-commerce economics,strategy, and business models; and legal and ethical issues such as privacy, regulations, and the legal environment when using m-commerce are included[3]. Articles dealing with a general introduction to m-commerce, foundational concepts of m-commerce, and so forth were grouped under the heading m-commerce overview, context, and usage Q.

Wireless network infrastructure: This is one of the pillar technologies of m-commerce that supports the development of m-commerce applications.Wireless network infrastructure plays an important role in m-commerce as this is the core part of m-commerce technology. It provides wireless networks and network standards such as the Global System for Mobile Communication (GSM), Blue-tooth, the wireless local area network (WLAN), radio frequency identification (RFID).

Mobile middleware: Mobile middleware refers to the software layer between the wireless networks and the operating systems of the mobile devices to connect the m-commerce applications [4]. Five research issues were identified for mobile middleware based on. While the connection time and data exchange for mobile devices are expensive, various agent technologies can be used to support different m-commerce activities such as making payments and locating merchants.b Agent technologies Q can be found in publications about using software agents or mobile agents to support m-commerce activities, for example, carrying out negotiations and searching for products. bDatabase management covers articles on mobile database management. In a mobile environment, the query processing, database location, and data recovery capabilities of a mobile database system may not use the traditional method to access information[5].

Wireless user infrastructure: Wireless user infrastructure consists of two parts, software and hardware. Software refers to the operating systems and their interfaces while hardware means the mobile devices to communicate with the m-commerce applications, such as PDAs and mobile phones. In this classified framework, two issues relating to wireless user infrastructure were identified in this category[6]. b Mobile interfaces consists of publications that discuss interface designs or issue relating to the mobile applications or devices. A well-designed and usable interface is relatively difficult to achieve in a mobile environment because the mobile applications normally execute on a small and portable mobile hand-held device. Corresponding guidelines for designing suitable mobile interfaces are necessary.

Mobile commerce applications and cases: m-cmerce covers a wide range of applications. Varshney and Vetter identified several importantclasses of m-commerce applications including mobile financial applications, mobile advertising, mobile inventory management, locating and shopping for products, proactive service management, wireless re-engineering, mobile auctions or reverse auctions, mobile entertainment services and games, mobile offices, mobile distance education,and wireless data centres[7]. They gave a detailed explanation of each application. The classification framework proposed in this study is based on observations of the reviewed articles. We have identified six different m-commerce applications as addressed by Varshney and Vetter. In addition, we have included cases about m-commerce in individual companies, industries, or countries in this category[8].

Given the very different nature of communication over the current generation of mobile devicesas compared to standard PC use, developing and integrating an application interface for the user is critical. Even in the future, the very nature of mobility will mean a new line of thought is needed for developing mobile solutions that get to the heart of the user's needs rather than technological constraints. Some of the important players in this value-adding space include

technology platform vendors, application developers and mobile device vendors.Technology platform vendors provide the operating systems (OS) and micro-browsers formobile devices. Micro-browsers perform the same function as those of the Web, such as Netscape and Internet Explorer, but have been designed explicitly for the mobile environment. They have reduced functionality tailored to the present mobile devices. Phone.com's UP browser dominates the WAP market, and they have support from all but two major phone manufacturers; Ericsson and Nokia have developed their own micro-browsers. On the i Mode platform, Compact Net Front is the most popular micro-browser, used in 75% of devices.The OS market, typically for PDAs, is dominated by Microsoft, Symbian and 3Com.Microsoft's Windows Compact Edition (CE) is a cut-down version of the standard Windows OS created especially for palmtops and PDAs. It has gained support from some major PC manufacturers (such as HP and Compaq), but has also been criticised for its shortcomings in memory requirements, reliability, synchronisation and user-friendliness. Symbian (a consortium comprising Motorola, Ericsson, Nokia, Psion and Matsushita), which developed the popular EPOC32 OS for Psion PDAs, is now collaborating with 3Com, owner of the popular Palm OS and top-selling range of Palm Pilot PDAs. The result of this powerful collaboration could set the standard for mobile OS (Varshney, 2000). In terms of mobile application development, the trends are following those of the mobile OS market. Typically, applications are being built largely for the offline palmtop/PDA environment using Windows CE, Symbian's EPOC32 and 3Com's Palm OS (Durlacher Research, 1999). Connectivity is being improved by the development of applications on these platforms, but this is somewhat overshadowed by developments in the more lucrative smartphone market via i Mode, WAP and SMS. Whereas i Mode uses a variant of HTML for service provision, and more recently Java has become used (e.g. in i Appli), WAP adopts WML as the format for displaying Web pages over the WAP phone (based on XML, a meta-language used to describe the content and format of data). In most cases, HTML content needs to be rewritten for WML. Another language for the mobile environment, this time aimed at voice recognition, Voice XML, is under development.In the smartphone market, as in the PDA market, the brand and model are the most important part of the purchase decision; the service provider or network provider is less important. One of the reasons for this is the importance of 'image' and 'personality' to young customers Fas associated with specific mobile phones. In the mobile interface and applications component of the value chain, this places a lot of power in the hands of smartphone producers, who also decide which technologies are incorporated into the end products. These producers must continue to innovate and support leading edge technologies and services in their new products if m-commerce is to prosper. Recentinnovations emerging in the market have included 3G phones, devices combining the capability of a mobile phone and PDA.

In addition to the customer-related issues, retailers faceveral organizational challenges in managing mobile marketing. These challenges primarily relate to organizational culture and the lack of mobile lifestyle within organizations.With regard to organizational culture, a key question is: how should retailers create and foster a culture where mobile marketing plays an important role in the firm's marketing strategy as well as corporate strategy? What competencies do retailers need to develop to fully leverage the potential offered by mobile marketing? How can retailers create a consumer focused organization that responds to consumers' mobile life style changes and needs?Creating a sound organizational culture can enable retailers to leverage mobile marketing opportunities in a timely fashion. According to Jon Stine, Manager, Director of Internet BusinessSolutions at Cisco, a retailer who takes full advantage of the mobile medium could see increases of as much as 19% net margin in 3 years. And yet, according to him, only 2% of retailers in the United States have websites that are enabled specifically for mobile devices.

Another important challenge in mobile marketing is improving the acquisition and enhancing the retention of customers. Retailers need to better understand social networking in the mobile context to attract and retain customers even as multichannel retailing is continually being redefined. To boost customer retention, retailers can work with the shopper to let the shopper create and update shopping lists, plan shopping within a budget, and send text messages of promotional offers in the store for items that the shopper has bought before or in which she has an interest. Retailers can

customize these services and offers to each shopper. One possible solution to such a prisoner's dilemma is for a retailer to offer coupons on items not offered by the competingretailer. This strategy will likely result in the consumer visiting different stores and cherry picking the items based on mobile coupons from these stores. Retailer mobile marketing has a temporal dimension as well.Retailers could communicate instant offers to mobile consumers who are in the vicinity of their bricks-and-mortar stores with a time expiration deadline to induce immediate shopping. The success of such an offer depends on whether consumers need the item on which the offer is made, whether the offer is attractive, and whether the cost savings are worth the time for the consumers.

Although there seems to be widespread agreement thatm-commerce is the use of mobile (handheld) devices to communicate and conduct transactions through public and private networks, no formal conceptualization of m-commerce currently exists. Conceptual agreement is necessary to promote a shared understanding of m-commerce, one that encourages clarity of communication and conver gence in thinking. As Peterson and Balasubramanian(2002) recently opined, unless a concept such as m-commerce possesses a common meaning, its economic, financial, behavioral, and other boundaries will be blurred. Such blurring will impede theorizing and research on m-commerce issues and applications.

There are differences in mobile usage across geographic areas and across cultures as well. In some parts of the world such as parts of Africa, the basic applications are used, whereas in some parts of Asia and Europe, mobile use is much more sophisticated and advanced than in the U.S.In both the Hotelling (1929) model and in other models that focus on consumer location and retail draw (e.g., Huff 1964), the location of the consumer has historically beentreated as a static input. The static location (i.e., the con-sumer's home) remains of interest in a mobile world, especially in the context of directed shopping expeditions that originate at the home or for consumers who simply do not use mobile technologies. However, of additional interest now is what is termed the probability cloud of consumer location. One way to conceptualize the probability cloud is to consider the consumer's likelihood of being at a particular location at a particular time. The location of a specific consumer at a specific time is of particular interest because it allows a "mobile price" to be communicated within a space-time context where it is most likely to be effective.

Conclusions and Future Research Directions

M-commerce has attracted the attention of bothpractitioners and academics. We believe that m-commerce is becoming increasingly pervasive. Although this review does not claim to be exhaustive, it does provide a reasonable amount of insight into the state of the art in m-commerce research[9]. We have examined other review articles on m-commerce,but none has presented a comprehensive review and analysis of m-commerce. The results presented in this paper have several important implications:

There is no doubt that m-commerce research will burgeon in the future. Academics have many avenues for conducting research on m-commerce. It is not surprising that a large portion of the reviewed articles in this study were related to m-commerce theory and research, especially the study of bm-commerce behavioural issues, m-commerce economics, strategy, and business models ,and bm-commerce overview, context, and usage because m-commerce is becoming a mature business discipline. We understand that different factors are important at different stages in the development of m-commerce technology[10]. In the early stage, technology/infrastructure dominates.We expect more research to be conducted on user experiences and marketing at the mature stages. While we develop new m-commerce applications,the capabilities of the user infrastructure need to be considered[11]. Mobile devices are becoming smaller and smaller, but with faster processing times and larger storage capacity. Corresponding mobile interfaces also need to be modified in order to suit the requirements of new business models. Although we did not find many articles on wireless network infrastructure, this may not represent the actual situation. We believe that a certain number of articles on this subject have been published in the field of network engineering. Because the search descriptor was limited to m-commerce, some articles on such subjects as the wireless network architecture and network requirements may not have been searched, as no explicit mention

of m-commerce may have been made in these articles. Currently, it seems that the most popular m-commerce application is that supporting financial activities. Mobile banking and payments are issues that have been widely discussed by researchers[12].However, it is surprising not to see many articles on other m-commerce applications. Varshney and Vetteridentified and classified 12 m-commerce applications, but we have only identified articles on six different m-commerce applications in our review. Among the applications, m-commerce entertainment services and games have a great deal of potential and will dominate global m-commerce revenues in the future. Additional research is required in other related areas such as mobile education, mobile supply chain management, and so forth. There has not been much research on the relationship between culture and m-commerce. Cultura differences on adopting m-commerce could be an interesting area for investigation. For example, it would be of interest to examine the possible implications of cultural differences that stimulate the adoption of new mobile services based on new technologies that bring value to mobile users and create new business opportunities for the mobile industry.

Mobile marketing, which involves two- or multi-waycommunication and promotion of an offer between a firm and its customers using a mobile medium, device, or technology, is growing in importance in the retailing environment. It has the potential to change the paradigm of retailing from one based on consumers entering the retailing environment to retailers entering the consumer's environment through anytime, any- where mobile devices. We proposed a conceptual framework that comprises three key entities, the mobile, the consumer, and the retailer. The framework addressed a range of related issues such as mobile consumer activities, mobile consumer segments, mobile adoption enablers and inhibitors, key mobile properties, key retailer mobile marketing practices and competition. We also addressed successful retailer mobile marketing strategies, identified the customer-related and organizational challenges on this topic and outlined future research scenarios and avenues related to these issues.

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