

M-COMMERCE SUCCESS MODEL

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Abstract: Mobile Commerce or M-Commerce is a next generation of E-Commerce. It's a new trend and is expected to drive the future development of E-Commerce. M-Commerce is a unique business opportunity and having its own unique characteristics and functions. Thus, M-Commerce can be generally defined as a process of conducting commercial transactions via "mobile" telecommunication networks using mobile devices. There are several technologies that are associated with the emerging of M-Commerce such as network and service communication technologies. Both technologies have gone through many evolution phases in order to fit with M-Commerce requirements. In this paper, we discuss issues in M-Commerce technologies, associated models and propose a model for M-Commerce called M-Commerce Success Model.

Keywords: M-Commerce, E-Commerce, Success Model

INTRODUCTION

M-Commerce is a new technology and seems to be a new opportunity in the business world. It combines the two most explosive technologies, World Wide Web and wireless communication. The explosion of M-Commerce is derived from the tremendous improvements on the mobile devices such as WAP-enables devices as well as the Personal Digital Assistants (PDA). In general, the mobile technologies behind the M-Commerce can be grouped into network and service communication technologies. There are many definitions of the term M-Commerce [2] has been proposed. Durlacher in [2] defines M-Commerce as "any transaction with a monetary value conducted via a mobile telecommunications network". This definition gives a very clear-cut distinction between M-Commerce applications and other mobile applications. According to Sadeh [14], M-Commerce is different from E-Commerce in terms of technologies, services, and business models approach. Both technologies still refer to the process of exchanging the products and services that is relatively associated with a monetary value. In summary, M-Commerce can be viewed as an additional channel for E-Commerce. However, this does not mean that the approaches to develop E-Commerce applications can be directly applied to M-Commerce application. Thus, the client-server model for E-Commerce application is not suitable for a mobile environment.

In 1992 [3], DeLone and McLean have proposed the IS Success Model (ISSM) that incorporates several individual dimensions of success. It was the first study that tried to impose some orders on IS researchers' choices of success measures. To suit with M-Commerce environments, Mola and Licker [3] has reviewed ISSM and propose an E-Commerce Success Model (E-CSM). In E-CSM, the missing link in ISSM called customer E-Commerce satisfaction is included. This paper starts with an overview of M-Commerce technologies that are based on the mobile evolutions. Then, we will briefly explain the associated models for M-Commerce. The last sections on this paper will discuss M-Commerce Success Model (M-CSM).

MATERIALS AND METHODS

This study has been carried out based on the associated technology to implement M-Commerce solutions. Basically, M-Commerce technology can be divided into Network Communication Technologies and Service Communication Technologies.

Network Communication Technologies can be classified as Analog Network (1st Generation – 1G), Digital Network (2nd Generation – 2G), GPRS Network (2.5G), and Broadband Network (3rd Generation – 3G) and Bluetooth.

- (a) *Analog network*: Advanced Mobile Phone Systems (AMPS) emerged in US in 1982 and is considered as the first mobile phone systems. This system is based on an analog standard and also known as International Standard IS-88. AMPS is capable to allocate frequency ranges within the 800 and 900 Megahertz (MHz) spectrum to cellular telephone. Each service provider can use half of the 824-849 MHz range for receiving signals and half of the 869-894 MHz range for transmitting signals to the cellular phones.
- (b) *Digital network (2nd Generation – 2G)*: There are four types of systems available in 2G technologies – TDMA & CDPD, GSM, PDC/PDC-P and CDMAone. TDMA (Time Division Multiple Access) is a technology for delivering digital wireless service [5] using time division multiplexing technology. Eventually, it has been upgraded to cellular digital packet data (CDPD) in order to support the packet-switched data service. Global System for Mobile Communications (GSM) was first introduced in Europe in the mid-1980s, capable to support roaming across the entire continent. The range of its data rates is between 9.6 and 14.4kbps. PDC (Personal Digital Cellular) relies on a variation of time division multiplexing technology and has been upgraded into a packet-switched overlay solution called PDC-P. NTTDoCoMo has launched i-Mode service based on this network standard. The range of data rates for this standard is between 9.6 and 28.8 kbps. CDMAone (Code Division Multiple Access) standard is derived from the code division multiplexing technology and IS-41 standard. CDMAone relies on frequency band of 1.25 Mhz.
- (c) *Intermediate evolved 2G (2.5G)*: Due to some limitations, GSM has been upgraded into High-Speed Circuit-Switched Data (HSCSD) or much better technology known as General Packet Radio Services (GPRS). GPRS successfully introduces “always-on” functionality, more efficient capacity utilization, more flexible billing options and faster data rate [14]. It is capable to supports peak data rates up to 100kbps and variety of QoS profiles. CDMAone had been upgraded to CDMA2000 1X due to the problems of its data rates. CDMA2000 1X can support peak rates of around 300 kbps and operates at 1.25-Mhz bands.
- (d) *Broadband network (3rd Generation – 3G)*: EDGE (Enhanced Data Rates for Global Evolution) derived from GSM/GPRS or TDMA network technologies. EDGE is capable to supports peak data rates up to 384 kbps and variety of QoS profiles [14]. WCDMA / UMTS relies on the same core data network as GPRS and EDGE. It is capable to support peak data rates up to 2Mbps and a number of QoS profiles. The next migration for CDMA2000 1X is CDMA2000 1X EV (EV stands for evolution). Even though CDMA2000 1X EV can support peak data rates up to 2.4 Mbps, WCDMA technology receives more acceptance than CDMA2000 technology.
- (e) *Bluetooth (802.15 WPAN Standard)*: Bluetooth wireless technology enables users to exchange information between a wide variety of computing and communications systems without connecting to wires. Instead of its own features, Bluetooth replicates from several existing wireless standards such as Motorola's Piano, IrDA, IEEE 802.11, and Digital Enhanced Cordless Telecommunications (DECT). Bluetooth also inherits the use of the 2.4GHz ISM band, Frequency Hopping Spread Spectrum (FHSS), authentication, privacy, power management, and LAN capabilities provided by the IEEE 802.11 specification [4]. The Bluetooth Special Interest Group (SIG) has been established to provide a good support in terms of interoperability and compatibility for this new technology.

The other M-Commerce technology, Service Communication Technologies are typically categorized into Short Message Services (SMS), Enhanced Messaging Service (EMS), Multimedia Messaging Service (MMS), Wireless Application Protocol (WAP) [1] and i-Mode.

- (a) *Shot Message Services (SMS)*: SMS was first initiated by ETSI (European Telecommunication Standard Institute) and currently has been accomplished by 3GPP (Third Generation Partnership Project). This matured service allows the exchange of short text messages (up to 160 characters) between subscribers. Due to the widely acceptances by subscribers, SMS has been ported by other network technologies such as GPRS and CDMA. There are two types of basic services available

with SMS: SMS point-to-point [7] and the Cell Broadcast Services. The most basic features in SMS are message submission and delivery.

- (b) *Enhanced Message Services (EMS)*: EMS [15] is an extension or supersedes of SMS capabilities. Two sets of EMS features have been defined by 3GPP technical specifications. The basic EMS feature was defined in 3GPP-23.040 releases 99, and the extended EMS defined in 3GPP-23.040 releases 5. EMS allows subscribers to exchange long text and richer message that may contains such as pictures (with a maximum of 255 x 255 pixels), melodies, animations and various objects. Extended EMS has been developed to support extended objects, compression of objects, integrated Object Distribution Indicator (ODI), a new set of objects, coloring formatting for text, hyperlink, and capability profile.
- (c) *Multimedia Messaging Services (MMS)*: MMS [8], developed by 3GPP, is able to support 2G, 2.5G and 3G networks. It allows the exchange of multimedia messages between subscribers. The main objectives of MMS are to support the demands of multimedia communication and also to break interoperability barriers between mobile communication and the Internet. MMS enables to compose and receive messages (plain text / multimedia formats), support group sending and management reports (delivery / read-reply) and allows immediate or differed retrieval of messages.
- (d) *Wireless Application Protocols (WAP)*: Wireless Application Protocols (WAP) is one of the famous protocols over the Internet communication technology. WAP is a standard developed by the WAP Forum, a group founded by Nokia, Ericsson, Phone.com (formerly Unwired Planet), and Motorola. The WAP Forum's purpose is to promote the growth of the WAP protocol through an open standard available to all [12]. Generally, this protocol relies on famous Internet standard (HTML, XML, and TCP/IP) and consists of WML Language Specification, WMLScript Specification and Wireless Telephony Application Interface (WTAI) Specification. Mobile devices than can support WAP are called WAP-enabled devices.
- (e) *i-Mode*: i-Mode is a packet-based service for mobile phones offered by Japan's leader in wireless technology, NTT DoCoMo. It combines three technologies – a smart phone, a new transmission protocol and a new markup language [5]. A smart phone enables user to browse the Internet with the touch of a button. i-Mode relies on CDMA transmission protocols with transmission speed at 9.6 kbps. For content presentation, it used Compact HTML (cHTML) [14], a subtext of HTML. Currently, i-Mode has been shifted into XHTML Basic, a new presentation standard adopted by WAP 2.0.

As mentioned in the beginning of this paper, there are two models used in producing M-CSM i.e. ISSM and E-CSM. ISSM [3] becomes a measurement standard to evaluate the success of implementing Information System. Figure 1 shows the ISSM.

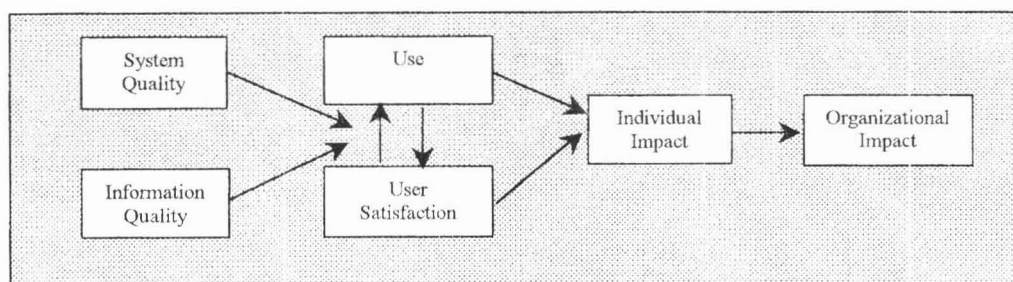


Figure 1: Information System Success Model (ISSM)

The dimensions involved in ISSM are System Quality, Information Quality, User Satisfaction, System Usage (Use), Individual Impact and Organization Impact.

- System Quality is a measure of the information processing system that evaluates the contributions of the ISs to the organization.
- Information Quality is focused on the quality of the information that system produces, primarily in the form of report.
- User Satisfaction is recipient response after using the IS output. It is the most widely used measure of IS success.
- The use of an IS is the recipient consumption of the output of the IS. This can be in terms of the use of IS reports or operations research models
- Individual impact is the effect of information on the recipient's behavior. This impact is closely related to the performance, but is also an indicator of better understanding in decision process, improved decision-making activity, etc.
- The organization impact is the information that can give a significant effect to the organization's performance.

Mola and Licker [13] have produced an E-CSM based on the ISSM. This extended model is more comprehensive and enables us to apply the E-Commerce theories. Besides that, this new model systematically structures the various success criteria. Figure 2 shows the result of E-Commerce Success Model (E-CSM).

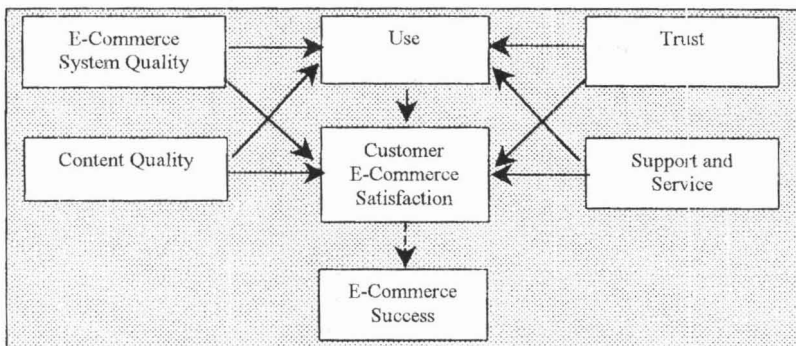


Figure 2: E-Commerce Success Model (E-CSM)

- The E-Commerce System Quality is a measure of the contribution of E-Commerce to the organization in terms of the value added; increase profit margins, efficiency, effectiveness, ect.
- The Content Quality focuses on the quality of the information that is related to the services or products being offered. All the information must be conducive and helpful for customers to make a decision.
- Use is largely voluntary and optional to the E-Commerce users, whether to use the system or ignore to buy.
- In E-Commerce, trust is an important factor. Organization needs to convince their customers that all the products and services offered are reliable.
- Support and Services factors are used to capture the transactional and also provide a good channel for customers to raise their problems related to this E-Commerce process.

RESULTS AND DISCUSSIONS

Based on the M-Commerce technologies and associated models that have been discussed above, it has provided us the good foundations to derive the M-Commerce Success Model (M-CSM). Generally, M-CSM is derived from E-CSM. Mola and Licker [13] have successfully developed the E-CSM based on the ISSM. After studying the E-CSM, some customization is needed to suit the M-Commerce

environments. We have comprehensively identified the important elements involved to measure and endeavor the M-Commerce Success Model. They are as follows:

(a) *Mobile Application Infrastructure [6]*: Mobile Application infrastructure can be categorized into four:

- Application Gateway / Platform Provider: These provide user management services, communication services and e-commerce services.
- Mobile Application Service Providers (MASPs): MASPs provide a data center and infrastructure hosting services
- Mobile Internet Service Providers (MISPs): MISPs provide connectivity to link the devices to the Internet.
- Mobile Application Enablers: These provide data and transaction security services

Thus, mobile application infrastructure measure the readiness of inter-related providers to offer the significant services or facilities to M-Commerce participants.

(b) *M-Commerce Trust & Security*: Trust and security need to be addressed to ensure M-Commerce is a success. The risk of fraud must be eliminated or maintained at least at a very minimum. Typically, both business and individual consumers in M-Commerce are looking for reliability, trustworthy, genuine and non-eavesdropping. Thus, in order to create a trust and secured transactions, M-Commerce environments need to apply the standard security characteristics such as confidentiality (cryptography), authentication (digital certificates), integrity (digital signatures), and non-repudiation (digital signatures and certificates) [11]. For any WAP-enabled devices, WAP 2.0 introduces security features as follows:

- WTLS (Wireless Transport Layer Security) provides services to protect data, including data integrity, privacy, authentication, and denial-of-service protection.
- TLS (Transport Layer Security) permits interoperability for secure transactions. These include cipher suites, certificate formats, signing algorithms, and the use of session resurne.
- WIM (Wireless Identity Modules) provides the functions that store and process information needed for user identification and authentication.
- WAP-PKI enables the use and management of public-key cryptography and certificates.

The security provided by WAP 2.0 secured it is transaction equal to what can be achieved in current wired environments. Without trust and security, it is difficult to encourage and convince the customers to enjoy the services offered by M-Commerce.

(c) *M-Commerce Services & Applications*: Generally, the main services that are offered by M-Commerce include Mail, Information, Entertainment, Transaction, Database and Internet Website [14]. These services are derived from the most comprehensive and successful of mobile Internet service today – NTTDoCoMo's i-Mode Portal. In terms of applications, the important characteristics and features that must be considered are [10]:

- Ubiquity: Mobile users must be able to receive information and perform transactions in real-time, regardless of location. M-Commerce can be present in any location or several places simultaneously.
- Personalization: The huge amount of information, services and applications presented on the Internet is of great importance, but users of mobile devices require different services and applications that should be personalized according to their preferences.
- Flexibility: Mobile users should be able to engage in activities such as, receiving information, and conducting transactions with ease.
- Localization: Mobile users should be able to access local information and services. This can be achieved by having service providers know the location of mobile users in order to promote their products and services directly to their customers in a local environment.

The services and applications offered by M-Commerce are definitely unique and have its own strengths. As a result, it will contribute into customer's satisfaction as well as a success for M-Commerce.

- (d) *M-Commerce Quality*: Joseph M.Juran [9] has defined quality as “fit for use” and “conformance to specifications”. The elements of quality in M-Commerce can be divided into two parts: Content Quality and Service Quality. Both explanations are derived from the quality as defined by Juran.
- *Quality of Services (Qos)*
QoS defines as characteristics of services delivery that impact most critically user’s perception of the service. The three characteristics of QoS are availability of the service, quality of information, and consistent delivery.
 - *Content Quality*
The general characteristics of Content Quality in M-Commerce are complying with user perception, localization, timing, ubiquity and convenience. In the context of mobile devices, the additional features should be closely tied-up including carry precise synthesis, immediateness, easiness interpretation, and easiness for processing in the right situation.
- By ensuring that the QoS and content quality are satisfying customer requirements, it will help organization to be more competitive and obtain value added advantages against competitors.
- (e) *M-Commerce Technologies & Standardization*: As mentioned in the earlier discussion, M-Commerce technologies can be divided into network and service communication technologies. The uses of both technologies to support data transmission are basic pre-requisites for M-Commerce success. Based on the M-Commerce evolutions, a variety of devices and technologies has emerged, which created a challenge for a uniform standard. For this reason, standardization in any platforms is very crucial. Currently, the standard development organizations (SDOs) provide a good framework for its development in M-Commerce [1]. The prime objectives are to develop and maintained widely accepted standards and also to ensure interoperability of mobile communication networks around the world. Generally, the actors involved here include network operators, manufacturers and third party organizations such as content provider, equipment testers and regulatory authorities.
- (f) *Use, Customer M-Commerce Satisfaction and M-Commerce Success*: These elements remain unchanged in the M-CSM. The only changes are the term of “E-Commerce” has been replaced by “M-Commerce”. In terms of tasks or functionalities, both transactions are carrying the same meanings.

Based on the issues discussed above, a model called M-CSM, shown in Figure 3 is proposed provides a framework or necessary elements that must be considered. M-CSM provides a framework or necessary elements that must be considered to endeavor successful implementation of M-Commerce.

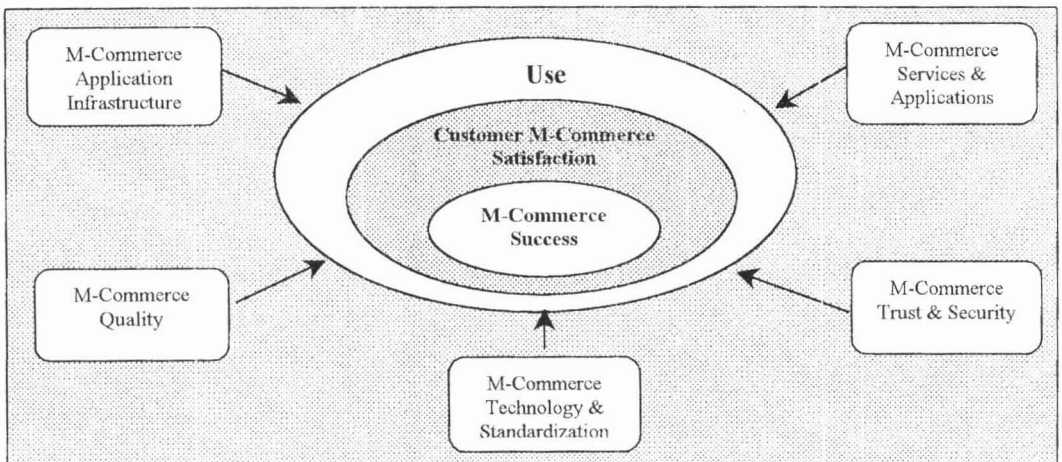


Figure 3: M-Commerce Success Model (M-CSM)

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