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Hypercube Innovation: An Analysis of Web-based commerce, M-commerce, and U-commerce

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Abstract

The E-commerce innovating applications have moved from Web-based commerce, M-commerce to U-commerce. This study systematically examines these innovative changes based on the dimensions of core technological component and business model, then analyze their impact on the stakeholders of E-commerce: e-businesses, customers, and complementary providers. The results indicate that M-commerce innovation is a modular, architectural to customers and businesses, but radical to complementary providers. The U-commerce innovation is a radical, architectural to complementary providers, modular to customers, but radical to businesses. The findings not only provide greater insight for the E-commerce stakeholders to understand each type of commerce but also help them adapt from one type of commerce to another.

Keywords

Innovation, electronic commerce, mobile commerce, ubiquitous commerce

1. Introduction

Rapid developments in information technology and telecommunication are substantially changing the landscape of organizational computing. In the past decade, the electronic commerce via Internet (Web-based commerce) has hit the business world and will continually be important. Today, the world of business is witnessing profound changes under the influence of wireless technology. The opportunity of mobile commerce (M-commerce) is then opening up. The total global electronic commerce (E-commerce) revenue is estimated to be \$6.9 trillions by 2004 (Forrester Research 2000), of which more than 200 billions will be derived from M-commerce. Market researchers also predict that by the end of year 2005, there will be almost 500 millions users of wireless devices, generating more than \$200 billions in revenues (Kannan et al., 2001).

Predictably, to go with the progress of telecommunication technology, the continuous growth of wireless bandwidth and connectivity will drive the E-commerce to the new frontier of

ubiquitous commerce (U-commerce) during the next 5 to 10 years (Lyytinen & Yoo 2002a). These innovative E-commerce applications will have a significant impact on the businesses and raise many novel issues of change management. Understanding the nature of innovation is a crucial first step in managing change associated with the innovation (Henderson & Clark 1990). Therefore, the primary purpose of this paper is to explore what are the major changes among the E-commerce applications and the impacts of these applications on capabilities and the assets of their stakeholders.

The remainder of the paper is organized as follows. In Section 2, a hypercube model of E-commerce innovation was developed as a framework to classify the E-commerce innovating applications and their impacts. Section 3 compares the major differences among Web-based commerce, M-commerce, and U-commerce based on the hypercube model. Finally, in Section 5, the innovation effects to stakeholders' capabilities and assets are analyzed.

2. Hypercube Model of E-commerce Innovation

An innovation, such as a system or a product, can be seen as a historic and irreversible change in the way of "doing thing" and "creative destruction" (Schumpeter 1947). The subject of change can be described in terms of its core components and system architecture (Afuah & Bahram 1995). Components are distinct portion of the product that embodies the core design concept and performs a well-defined function. A system's architecture is the way in which the components are integrated and linked together into a coherent whole. The possible change of an innovation can be classified into four types: radical, incremental, architectural, and modular, based on the intensity that it overturns the existing components and architecture (Henderson & Clark 1990).

In this paper, we present a hypercube model of E-commerce innovation based on the above four types of innovation to examine the major changes and impacts of Web-based commerce, M-commerce, and U-commerce. Figure 1 shows the hypercube model that includes three dimensions: core components, business models and stakeholders. For Web-based commerce, M-commerce, and U-commerce, we examine their differences and changes based on the dimensions of core components and business models, then their impacts on the three critical stakeholders are examined, i.e., e-businesses, customers, and complementary providers. The major complementary providers include: service providers, content providers, application providers, backbone operators, and device/network equipment manufacturers (Barnes 2002).

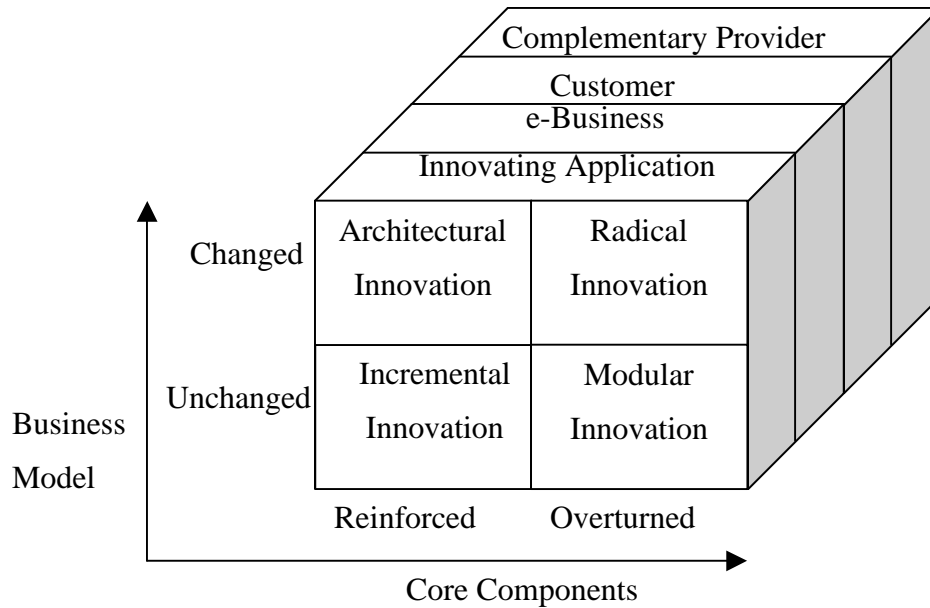


Figure 1. The hypercube model of E-commerce innovation

An E-commerce system can be visualized as a hierarchical structure comprised of three meta-level, such as: (1) Infrastructure: hardware, software, and telecommunications infrastructure, (2) Services: enabling services and secure messaging, and (3) Products and structures: e-marketplaces and e-hierarchies (Zwass 1996). The three core components of E-commerce value chain are: infrastructure, service and content (Schlueter & Shaw 1997, Barnes 2002) and the business model is a coherent framework that takes technological components as input and converts them through markets into economic output (Chesbrough & Rosenbloom 2002). The above three core components and business model are described as follows.

- Technological infrastructure consisting of network infrastructure, application development, and devices (Rayport & Sviokia 1994, Zhang & Yuan 2002, Barnes 2002)
- Content consisting of content creation, content packaging, and content distributing (Rayport & Sviokia 1994, Schlueter & Shaw 1997, Barnes 2002).
- Service consisting of nature and facility in supporting consumer’s decision process (Engel et al., 1995, O’Keef & Mceachern 1998, Barnes 2002).
- Business model consisting of value proposition, market segment, value chain, cost structure, profit potential, value network and competitive strategy (Afuah & Tucci 2003, Chesbrough & Rosenbloom 2002)

3. Comparison of Web-based commerce, M-commerce and U-commerce

3.1 Differences in the Core Components

3.1.1 Technological Infrastructure

Table 1 summarizes the major differences of Web-based commerce, M-commerce and U-commerce in technological infrastructure. The technologies of Web-based commerce are embodied in the Internet infrastructure, which based on the standardized TCP/IP protocol and global wired networking. The characteristics of Internet include: client-server architecture, easy and inexpensive public access, reliance on an open and packet switching protocol, data-oriented transmission, and consequent organic growth combined with reliability and bandwidth.

The World Wide Web (WWW) has served the Web-based commerce as a medium for distribution of passive hyper linked multimedia information (Zwass 1996). Additionally, Internet provides interoperable and adaptive connection service, which constructs a platform for the independent and standardized distributed computing environment, so the legacy systems and databases are easy to integrate with Internet via middleware (Zhang & Yuan 2002). In addition, the Internet applications mainly rely on the personal computers, which have the features of desktop computing, powerful processor, large memory, big screen, and full input model. Thus, the Web-based commerce inherits these salient technology features.

In contrast with Internet, the natures of mobile transmission are wireless, connection-based, voice-oriented, device-dependent, geographic locating, limited bandwidth, regional coverage and unreliable (Varshney & Vetter 2001, Samaras 2002). However, they own the unique functionalities mobility, portability, ever-present and location-aware, that reduce the constraints of location for the conventional client terminals (Kannan et al. 2001).

In past years, although multifarious mobile technologies have been announced, including satellites, Global System for Mobile Communication (GSM), General Packet Radio Service (GPRS), Code Division Multiple Access (CDMA), wireless LANs (IEEE 802.11), and Bluetooth, and so forth, but they are incompatible standards and supported by various network operators. Due to the lack of interoperability standards, the mobile computing is restricted by dominant networks and specific devices and thus its application development and system integration are more complex than that of the Internet. In terms of terminal devices, various handheld devices have emerged, which have different abilities and functionalities. Such devices can be characterized as either communication-centric or computing-centric (Varshney & Vetter 2001).

	Web-based commerce	M-commerce	U-commerce
Network infrastructure	<ol style="list-style-type: none"> 1. Wired networking 2. Connectionless-based 3. Data-oriented network 4. Package switching technique 5. Global connection 6. Internet channel 7. Unlimited bandwidth 8. TCP/IP 	<ol style="list-style-type: none"> 1. Wireless networking 2. Connection-based 3. Voice-based network 4. Local and regional connection 5. Mobile phone network channel 6. Limited bandwidth by spectrum 7. GSM, GPRS, PCS, CDMA etc. 	<ol style="list-style-type: none"> 1. Ubiquitous networking 2. Connection-based 3. Data-oriented network 4. Universal connection 5. Multicast channel 6. Broadband network 7. Non-available protocols
Application development	<ol style="list-style-type: none"> 1. Desktop computing 2. Open system 3. Device-independent 4. General programming tools 5. Easy to integrate with other system 	<ol style="list-style-type: none"> 1. Mobile computing 2. Embedded system 3. Device-dependent 4. Specific development tools 5. Difficult to integrate with other system 	<ol style="list-style-type: none"> 1. Mobile computing and Pervasive computing 2. Embedded system 3. Cross-platform 4. Specific development tools 5. Seamlessly integrate with other system
Devices	<ol style="list-style-type: none"> 1. Computing-centric 2. Stationary location 3. Passive 4. Dominated by PCs 5. Powerful CPU, Large memory, Big screen 6. Full input model 7. Position may not be identified 8. User interface: Keyboard, Mouse, Graphics Display, Icons 	<ol style="list-style-type: none"> 1. Communication-centric and computing-centric 2. Mobile location 3. Passive 4. Dominated by handheld devices (e.g. mobile phones and PDAs) 5. Limited input model 6. Limited CPU, Small memory, Small screen, Slow bearers 7. Positioning and user identity capability 8. User interface: Handwriting, Speech recognition, Speech synthesis, Multi-modal and etc. 	<ol style="list-style-type: none"> 1. Communication-centric and computing-centric 2. Ubiquitous location 3. Pro-active 4. (e.g. sensors and effectors) 5. Combination of handheld devices and remove control devices (e.g. sensors and effectors) 6. Multiple input model 7. Geo-positioning and Remember capability 8. User interface: Position sensing, Eye tracking, Stereo audio, Video, 3D virtual reality and etc.

Table1. Differences in technological infrastructure dimension

In the ubiquitous computing environment, every computer-embedded device is seamlessly connected to each other in a broadband channel (Weiser 1993). Such a technology originates from integration mobility and pervasive computing functionality (Lyyfinen & Yoo 2002a). It integrates wired and wireless, multimedia-based computing, and telecommunication and representation services into a channel. The features of ubiquitous network are technologically heterogeneous, geographically dispersed, context-sensing, architecturally flexible, and without centralized control mechanism (Banavar & Bernstein 2002). Thus, the network infrastructure should be a standard platform to ensure full interoperability, multicast, stability, reliability, and persistence. Any ubiquitous computing device, while moving with us, can build incrementally dynamic models of its various environments and configure its proactive service accordingly (Lyyfinen & Yoo 2002b). In practice, a terminal device is mainly equipped with mobility and embedded processors, new user interface, and a variety of sensors

and effectors (Anatole 2002, Siewiorek 2002). The trend of ubiquitous technology will be more embedded and integrated with mobility and other electronic devices (Gershman 2002).

3.1.2 Content

Content is the information, transactions, or other products that are delivered over the network. Regarding to the content management, three important activities: creation, packaging and distributing should be discussed (Schlueter & Shaw 1997, Barnes 2002). In the Web-based environment, most of the content are hypermedia and the creation of such content mainly follows the hypertext transport protocol (HTTP). Accordingly, it can be easily edited, combined and customized by some standard description languages such as hypertext markup language (HTML), extensible markup language (XML), or Java. In general, the hypermedia content is packaged and displayed in the web sites and the distribution of content utilizes the pull-oriented navigation and client-server accessing model via WWW.

The content is mainly message-based in mobile environment, but the differences in the core concepts of content creation and delivery are not significant between Web-based commerce and M-commerce (Barnes 2002). However, the mobile devices raises some special requirements in the content creation, which includes interactivity, representation, customization, time-dependence, and thin-format. Among these requirements, transiting the Internet-facilitated content into the mobile consumption or migrating from the Internet-based environment into the wireless environment is a major challenge.

Recently, several Internet standards have been developed that attempt to enable wireless devices to access the Web-based content. Such techniques include Wireless Markup Language (WML), compact HTML (cHTML), and Extensible Style Sheet Language (XSL) (Varshney & Vetter 2001; Barnes 2002). However, such a content presentation can be seen as a compactly web page, which is termed as "business card" (vCard) in WML. Typically, the overall contents are split into cards and navigation in M-commerce environment (Pahlavan & Krishnamurthy 2002).

The nature of content in the ubiquitous environment is more information-intensive than in the mobile or Internet-based environment. The content includes both transaction-related and need-based information about the context users involved in, which consists of various attributes such as physical location, physiological state, personal profile, behavioral patterns, and so on (Siewiorek 2002). Since the heterogeneous information will be seamlessly distributed via heterogeneous mediums and devices, a new content design method will be required. Table 2 summarizes the major differences of Web-based commerce, M-commerce, and U-commerce based on the content dimension.

	Web-based commerce	M-commerce	U-commerce
Content creation	<ol style="list-style-type: none"> 1. Hypermedia (text, audio, graphics, video) 2. Transaction information 3. Information-rich 	<ol style="list-style-type: none"> 1. Voice and Text 2. Message-based 3. Transaction information and location information 4. Less Information-intensive 	<ol style="list-style-type: none"> 1. Cross-media 2. Need-based 3. Transaction information and context information 4. Information-intensive
Content packaging	<ol style="list-style-type: none"> 1. Hypertext (e.g HTML, XML) 2. Hyperlink navigation model 	<ol style="list-style-type: none"> 1. Card (e.g. WML, SMS, cHTML) 2. Inter-card navigation mode 	N/A
Content distributing	<ol style="list-style-type: none"> 1. Web-based client-server distribute model 2. Pull oriented 3. Global distribution 	<ol style="list-style-type: none"> 1. Mobile distribution model 2. Push oriented 3. Regional distribution 	<ol style="list-style-type: none"> 1. Ubiquitous distribution model 2. Push oriented and Pull oriented 3. Universal distribution

Table 2. Differences in content dimension

3.1.3 Service

The service is the supports of transaction to customers. Essentially, in Web-based commerce, the nature of service is “transaction aware”, which focuses on surmising what activity customers are performing as a given time. M-commerce is a “location aware” service, which focuses on pinning point where the customers are. Additionally, the service of U-commerce is “context aware.” It focuses on actively sensing of what different customer’s roles involving through time and location specificity (Kannan et al. 2001, Anckar & D’Incau 2002). Table 3 summarizes the major differences of Web-based commerce, M-commerce, and U-commerce based on the service dimension.

Web-based services are a stack of emerging standards (Frank 2002). Most of the consumer’s decision activities can be afforded by well-designed web sites. In pre-purchase stage, web sites construct a worldwide market-space where the customers can recognize their needs without geographic and timing limitation. Besides, the search engines, customized services and intelligent agents enable the customers to easily gather commercial information. In the purchase stage, Web-based commerce provides sophisticated and safely electronic transaction facilities and payment mechanisms such as Secure Sockets Layers (SSL) or Secure Electronic Transaction (SET). In terms of delivery services, since the web-based applications can be easily integrated with backend enterprise information systems, so the applications can efficiently support the logistic operations. Moreover, the e-mail and virtual community can also improve the real-time pro-purchase services.

	Web-based commerce	M-commerce	U-commerce
Nature	<ol style="list-style-type: none"> 1. Web-based service 2. Transaction-aware 3. Passive service 4. Pull-oriented 5. Mass customization 	<ol style="list-style-type: none"> 1. Mobile service 2. Location-aware 3. Proactive service 4. Push-oriented 5. Personalization 	<ol style="list-style-type: none"> 1. Ubiquitous service 2. Context-aware 3. Proactive service 4. Push-oriented and Pull – oriented 5. High personalization
Need recognition	<ol style="list-style-type: none"> 1. Worldwide range of product and services offered 2. Overcome geographic and time limitation 3. Advertising on Web sites and Web sites navigation 	<ol style="list-style-type: none"> 1. Regional range of product and services offered 2. Location-specific services 3. Message-based advertising 	<ol style="list-style-type: none"> 1. Specific range of services offered 2. Location-specific and Temporal-critical services 3. Multi-channel
Information search	<ol style="list-style-type: none"> 1. Universal searching 2. Virtual navigation search 3. Searching rich product information 4. Overcome geographic and time limitation 5. URL on physical material 	<ol style="list-style-type: none"> 1. Location-specific searching 2. Virtual navigation search 3. Searching abstract product information 4. Time-critical 5. Short Message Service (SMS) or Multimedia Message Service (MMS), Discussion 	<ol style="list-style-type: none"> 1. Context-specific searching 2. Virtual and Physical navigation search 3. Searching full product information 4. Spatial-critical and Temporal-critical 5. Multi-discipline
Evaluation	<ol style="list-style-type: none"> 1. Sophisticated transactions discussions in newsgroups 2. Navigation cross web sites or Intelligent agents 	<ol style="list-style-type: none"> 1. Less sophisticated interaction applications 2. Short Message Service (SMS) or Multimedia Message Service (MMS) 3. Cell Broadcast (CB) 	Multidiscipline evaluation
Purchase	<ol style="list-style-type: none"> 1. Digital payment 2. Third party payment systems 3. Standards SET,SSL 	<ol style="list-style-type: none"> 1. Digital payment, Bill 2. Build-in carrier payment system 3. Standards Wireless Transport Layer Security (WTLS), Wireless Public Key Infrastructure (PKI) 	<ol style="list-style-type: none"> 1. Multidiscipline digital payment and traditional payment 2. Build-in carrier payment system or physical stores 3. Standards Open Platform, Visa's XML invoice, Travel and Entertainment (T&E)
Pro-purchase	<ol style="list-style-type: none"> 1. Easy connection to backend system 2. Services deliver to fixed location 3. Irregular feedback 4. Virtual community and E-mail 	<ol style="list-style-type: none"> 1. Limited connection to backend system 2. Services deliver to a moving person 3. Instantaneous feedback 4. Voice, SMS, MMS and E-mail, Interactive chart 	<ol style="list-style-type: none"> 1. Seamlessly connection to backend system 2. Services deliver to a moving person 3. Ubiquitous feedback 4. Multicasting facilities

Table 3. Differences in services dimension

In M-commerce, the mobility and location-aware services can proactively push relevant messages to consumers with greater success rate than the Web-based commerce anywhere and anytime (Kannan et al. 2001). Especially, a firm can obtain instantaneous feedback from their customers via wireless network. In practice, the popular services include Wireless Application Protocol (WAP), Short Message Service (SMS), Multimedia Message Service (MMS), and Information Mode (iMODE). Such applications mainly transit from the current

Web-based to Mobile environments. However, in security mechanism for payment services, the differences between Web-based commerce and M-commerce are insignificant (Anckar & D'Incau 2002).

In contrast with M-commerce, U-commerce is built upon fundamental concepts of content-awareness services, which includes spatial and temporal awareness (Siewiorek 2002). Accordingly, they not only concern the location of a user, but also concern the time or the frequency of public and private events. It seems advantageous to dynamically configure and migrate to meet the customers' dynamic needs and to modify the interaction with its customer (Varshney & Vetter 2001). Additionally, the services provide highly personalized services to allow the customers to dedicate their attentions to the context with minimize distractions in the stages of need recognition and information search. In sum, the ubiquitous services will provide more choices, more convenience, more personal and more adaptive to the customers.

3.2 Differences in the Business Model

A business model can be considered as a linkage among the E-commerce core components. In Internet market-space, hyper-competition is intense and a monopoly or even a duopoly assumption should be moot (Balasubramanian 1998). Web-based commerce enables customers to efficiently compare with the other marketing webs. It creates a nearly perfect competitive market. The impact has been the widespread instances of price competition. In practice, the business applications of Web-based commerce can be classified into Business-to-Commerce (B2C), Business-to-Business (B2B), Customer-to-Business (C2B), and Customer-to-Customer (B2C).

In contrast, the value propositions for M-commerce are regional wireless coverage, location-specific, and mobility. Additionally, M-commerce is convenient for dynamic promotion, cross-category promotion and pricing. A firm could track customers' movements across aisles when they shop and collect the customer's transaction information that combining of profile data stored in SIM card of handheld device. In general, the current M-commerce includes B2B, B2C, and Business-to-Employee (B2E) and the B2C dominates the applications (Kannan et al. 2001).

The U-commerce integrates virtual market-space and physical marketplace into a universal market via multi-channel (Fano & Gershmann 2002). A ubiquitous market implicates that a business should develop unusual marketing strategies to segment customers effectively for wireless and wired channels, respectively. Typically, the physical retail environment will be increasingly characterized by dynamic pricing models with the increasing usage of U-commerce (Kannan et al. 2001). Another significantly distinctive characteristic is that the paradoxical consequence of U-commerce is simultaneously very personal and extremely universal (Lyytinen & Yoo 2002a). To induce the customers' spontaneous needs, the ubiquitous marketing will be increasingly characterized by dynamic promotion, pricing and marketing techniques. Given such characteristics, the U-commerce has significant impact on the conventional E-commerce business models. It require fundamental advance in marketing and operation (Banavar & Bernstein 2002, Fano & Gershman 2002).

The market segments are quite different in various E-commerce markets. In Web-based commerce, the majority of consumers are highly educated PCs users with Internet connection. In contrast, most M-commerce consumers are mobile phone adopters. Currently, such users are mainly modern young people or business mobile workers. Majority of them are functionally illiterate and technologically unsophisticated (Feldman 2000, Zang & Tuan

2002). Thus, the users' willingness of using M-commerce services is various in different age groups. The youngest users form the primary group for most mobile services (Anckar & D'Incau 2002). In U-commerce, the size of the potential customer base will be more than M-commerce and Web-based commerce. Paradoxically, the customers will be more heterogeneous, but they are usually observable in physical marketplace. The phenomenon implies a profound effect on the customer segments. Table 4 summarizes the results.

	Web-based commerce	M-Commerce	U-Commerce
Value proposition	<ol style="list-style-type: none"> 1. Global markets 2. Virtual market-space (virtual stakeholders, virtual product, virtual process) 3. B2B, B2C, C2B, C2C 	<ol style="list-style-type: none"> 1. Regional markets 2. Virtual market-space 3. B2B, B2C, B2E 	<ol style="list-style-type: none"> 1. Ubiquitous markets 2. Cyberspace 3. Integration of virtual market-space and physical marketplace
Market segment	<ol style="list-style-type: none"> 1. PCs users with Internet connection 2. Most of users are highly educated 3. Wide consider set 	<ol style="list-style-type: none"> 1. Mobile device users 2. Business mobile workers and young, less educated people 3. Smaller consider set 	<ol style="list-style-type: none"> 1. Heterogeneous users 2. Unlimited demographics 3. Wider consider set
Cost structure	<ol style="list-style-type: none"> 1. Low technology cost 2. Low application development cost 3. Low communication charge 4. High content creation cost 5. Low content delivery cost 6. High service cost for physical cost, low service cost for information goods. 7. Low business entry cost 	<ol style="list-style-type: none"> 1. High technology cost 2. High application development cost 3. High communication charge 4. Low content creation cost 5. High content delivery cost 6. High service cost for physical cost, high service cost for information goods. 7. High business entry cost 	<ol style="list-style-type: none"> 1. High technology cost 2. High application development cost 3. Low communication charge 4. High content creation cost 5. Low content delivery cost 6. Low service cost for physical cost, high service cost for information goods. 7. High business entry cost
Profit potential	<ol style="list-style-type: none"> 1. Reduction of construction cost, search cost, promotion cost, service cost and transaction cost 2. Advertising revenue is a major profit source 3. Low communication charge 4. Limited service charge 5. High content charge 6. Global market opportunity 	<ol style="list-style-type: none"> 1. Improve mobility of transaction 2. Mobile value-added service revenue is a major profit source 3. High communication charge 4. Low content charge 5. High service charge 6. Location based market opportunity 	<ol style="list-style-type: none"> 1. Improve convenience of transaction 2. Value-added service and sales revenue is a major profit source 3. Low communication charge 4. High content charge 5. High content charge 6. Ubiquitous market opportunity

Table 4. Difference in business models

4. The Hypercube: M-commerce and U-commerce

4.1 Hypercube Model for M-commerce

As mentioned in Section 3, the mobile technology has made the Web-based commerce into fundamental change in network infrastructure, content format, and devices etc. Unexpectedly, the results also showed that the current M-commerce services are likely to be the same as they have been for Web-based commerce. Additionally, we also found that there is no significant difference in business models between M-commerce and Web-based commerce, besides the market segments. This can be the reason that the current mobile technology is not mature enough. Regarding to the innovating applications, the current M-commerce can be considered as modular innovation since majority of core components had overturned and only the business model had not change.

M-commerce is per se not included in the traditional E-commerce. It should be as a new aspect of consumerism. An e-business will need to reconfigure the current business models with the unique features of M-commerce (Nohria & Leestma 2001). Therefore, the evidences manifest that M-commerce is an architecture innovation for the incumbent e-businesses. Generally, to the consumers, M-commerce is an architectural innovation since the terminal devices, networking fees, cost structure and value propositions are different from the Web-based commerce. M-commerce is radical innovation to the existing complementary providers such as service providers, content providers, network operators and equipment providers. Thus, they may redesign their product by incorporating suitable technologies and continue to support the innovation of technologies and standards. Additionally, the design of service and content need to be characterized by a greater degree of customization, compactness and location-awareness, such changes will destroy the existing design knowledge of the complementary providers.

In sum, the current M-commerce innovating application is a modular in contrast to Web-based commerce, architectural to customers and businesses, but radical to complementary providers. The finding implies that the M-commerce is primarily as a supplement rather than a substitute to the Web-based commerce, it supports the findings of Anckar & D’Incau (2002). Figure 2 shows the zone map that represents the range of possible impact of M-commerce innovating application on the businesses, customers, and complementary providers. The zone map is a simplified two-dimensional version of the hypercube. A measure of how radical the innovation is: incremental=1, modular=2, architectural=3, and radical=4.

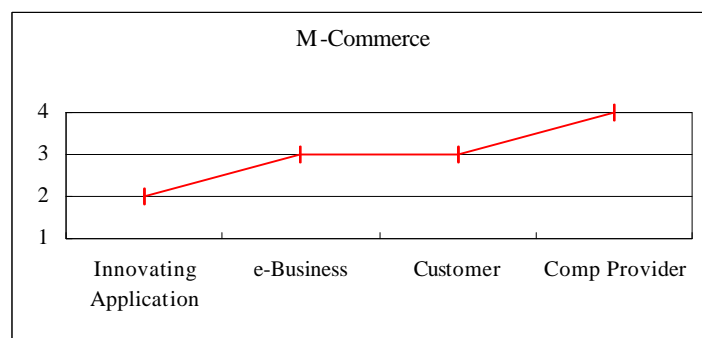


Figure 2. The zone map for M-commerce

4.2 Hypercube Model for U-commerce

Comparing with the current M-commerce, U-commerce is a radical change especially in the capabilities of ubiquitous networking, pervasive computing, input/output modalities, and context-aware service (Siewiorek 2002). Moreover, U-commerce will affect many aspects of how business model is and how it is constructed. It is a fundamental change for the incumbent e-business in business operation and customer relationship management (Fano & Gershman 2002). In addition to improving a product or refining a distribution channel, they also need to leverage superior customers’ insights to develop powerful branded solutions with value outside their traditional markets (Schapp & Cornelius 2002). In U-commerce, a physical point of presence wherever products and services are used will become a competitive necessity (Fano & German 2002). Additionally, they will have to forge alliances with telecommunications, network carriers, retails, entertainment businesses and the brick-and-mortar stores that will appear to the customer groups they have targeted (Noheria & Leestma 2001). Building the new collaboration and the associated business models will be a great challenge for incumbent e-businesses (Kannan et al. 2001).

For the customers, U-commerce will be a modular innovation because the U-commerce can be considered as an integration of “traditional” E-commerce applications. However, ubiquitous computing will change the way people use computing devices. For the complementary providers, due to the multiple industries involved in U-commerce scenarios, strategic collaboration and partnerships have become increasingly important. The coordination between multiple stakeholders is necessary to address the challenges such as standards, interoperability, and security (Schapp & Cornelius 2002). Thus, the complementary providers not only have to enforce their knowledge in ubiquitous computing, but also have to rebuild the collaborative relationship with the new partners to retain their competitive advantages. The U-commerce innovation is architectural for the complementary providers. The zone map is shown in Figure 3.

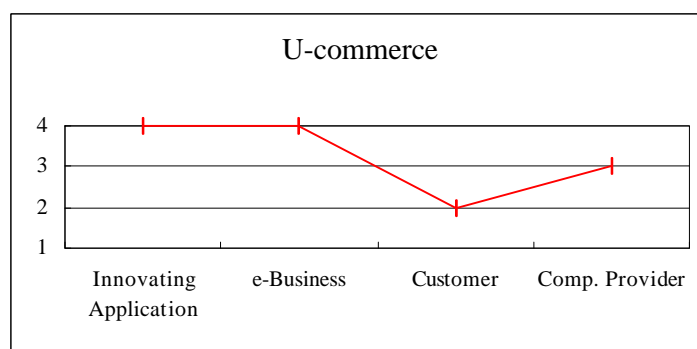


Figure 3. The zone map for U-commerce

5. Conclusions and Implications

The findings manifest that the M-commerce differs substantially from Web-based commerce in some components yet both share common business model forms, but the U-commerce is a

radical change. The impact of the M-commerce is stronger on complementary providers than on the businesses and customers. In contrast, the impact of the U-commerce on the businesses is stronger than on the customers and complementary providers. The pronounced diversities have important implications for the E-commerce innovation adopters.

M-commerce and U-commerce should not be simplistically regarded as an extension of Web-based commerce. An e-business should take a much broader view of the new technology, markets and customers in the novel world. Firstly, it is important to rethink what are their special market niches with the unique features of new applications and then develop effectively value-added services to attract the potential customers. Attempting to duplicate the business models from traditional E-commerce is impractical. The customers with successful experience of using previous E-commerce application will be more willing to embrace the next innovation, therefore reducing the customers' switching cost and resistance and then developing an effective transitional solutions to enable early adopters to migrate to the new technologic environments are the critical issues for e-businesses and complementary providers.

M-commerce and U-commerce are still not mature enough, especially to the U-commerce. This brings many challenges to the M-commerce and U-commerce adoption. Predictably, the standardization, interoperability, and security are all crucial issues. In addition, how to integrate content, software and hardware design and how to configure an effective business model to implement the M-commerce and U-commerce are worth to pursue.

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