Foundations of SMS Commerce Success: Lessons from SMS Messaging and Co-opetition

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Abstract

As a convenient and low-cost mobile communication technology, Short Messaging Service (SMS) is experiencing very rapid growth. It is reported that 700 million mobile phone users worldwide sent 20 to 30 billion SMS messages every month in 2001. At the same time, SMS commerce applications have emerged to provide mobile users consumer-oriented services. The huge SMS messaging customer base serves as the potential SMS commerce customer base [1]. However, the bloom in messaging business does not automatically lead to the success of general SMS commerce applications. In this paper, we analyzed SMS developments in three different countries to derive three success indicators for SMS messaging and relate them to the success of SMS commerce. Based on the proposed SMS application framework, we postulate four additional hypothesized success factors that could uniquely contribute to the success of SMS commerce. Our findings provide practical implications for promoting SMS commerce applications successfully.

1 Introduction

The mobile commerce (M-commerce) can be differentiated by two different underlying technology platforms: **wireless Web-based technologies**, such as Wireless Application Protocol (WAP), i-mode, or General Packet Radio Service (GPRS), and **text-based technology** or Short Messaging Service (SMS) [1]. SMS is known to have a simple user interface, unlike the WAP's rich Web-like interface.

Recently, the growing influence of SMS has attracted significant attention. As a convenient and low-cost mobile communication technology, SMS is experiencing very rapid growth. In 2001, 700 million mobile phone users worldwide sent an average of 20 billion SMS messages every month [2]. Indeed, the volume of SMS messages sent in December 2001 was 30 billion worldwide and it is expected to grow to 100 billion by the end of 2002. In Europe, Norway leads the region with an average of 47 messages sent per month per user in 2001 while Philippines leads the Asia-Pacific region with 336 SMS messages [3]. Figure 1 shows the growth of volumes of messages sent per year in a few countries and in West Europe [4].

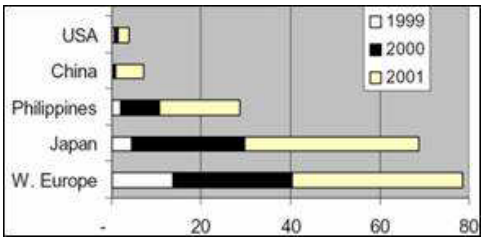

Figure 1. Billon SMS messages sent per year by country/region

The worldwide increasing growth of SMS messaging services has spurred the developments of SMS commerce applications. Emerging SMS commerce applications mainly cover consumer-orientated business, such as alerting, ticket booking and retailing. Given that the huge SMS messaging customer base could potentially serve as the potential SMS-commerce customer base [1], many commerce providers have begun to show interest in SMS commerce applications. For example, in a survey of 200 European direct marketers [5], 21% of respondents use SMS marketing at least occasionally, and 12% have at least attempted to. 5% of respondents plan to use SMS regularly in 2003, and devote 7% of their budgets to SMS commerce applications. On average, marketers using SMS could achieve a remarkable response rate of 11% at a reasonably low campaign cost of 24,000 Euro. Hence, SMS offers great economical value to marketers.

Notwithstanding its potential benefits, SMS commerce has yet to take off. A Google search using the keyword "SMS Application" yields a very limited number of reported cases of successful implementation of SMS com-

[1] In Japan, SMS is also called *short mail*.

Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS'03)
0-7695-1874-5/03 $17.00 © 2002 IEEE

merce applications, both from the research and the industry arena[2]. Searching the academic literature through ScienceDirect also returns few related articles. Specifically, recent HICSS papers on mobile commerce focus on the general issues such as system architecture and framework, marketing and the customer adoption of mobile commerce [6, 7, 8, 9]. Furthermore, we cannot find any report or figure published on the volume of SMS commerce transactions. Given the limited literature on SMS commerce and that SMS commerce is still in its infancy stage, it is imperative that we understand and examine the success indicators that could potentially determine the success of emerging SMS commerce applications.

The key objective of this paper is to derive the hypothesized success factors of SMS commerce. First we have motivated the research problem by showing the huge success of SMS messaging and the emergence of SMS commerce applications. Specifically, we analyzed SMS developments in three different countries and derived three success indicators that are common for both SMS messaging and SMS commerce. Since SMS commerce is more complex than messaging business, we further discussed these complexities and proposed four hypothesized success factors for SMS commerce using the SMS commerce application framework (Figure 3) and the co-opetition theory [10]. Our findings provide practical implications for promoting SMS commerce applications successfully.

The paper is structured as follows: in the next section, we review the SMS messaging basics and the characteristics of SMS commerce applications. In section 3, we describe and analyze the SMS developments in three countries and identify the success indicators for SMS messaging. In section 4, we propose hypothesized success factors for SMS commerce. Section 5 concludes the paper.

2 Characteristics of SMS messaging and commerce applications

2.1 SMS messaging basics

SMS, the shortcut for Short Messaging Service, is a technology that allows data to be sent and received via mobile phones. This can be alphanumeric and more recently graphical. A sent SMS message is stored at an SMS Center (SMSC) until the receiver's phone receives it. The receiver can identify the sender by his/her telephone number that is included in the message itself. SMS supports several input mechanisms that allow interconnection with different message sources and destinations including voice-mail systems, Web-based messaging and E-mail integration. We illustrate the basic architecture of SMS network in Figure 2. SMS service operators are normally mobile network operators.

[2]From the Google search results, we examined the top 200 links, decided whether the related articles are about SMS commerce. This was done at March 2002 over three weeks.

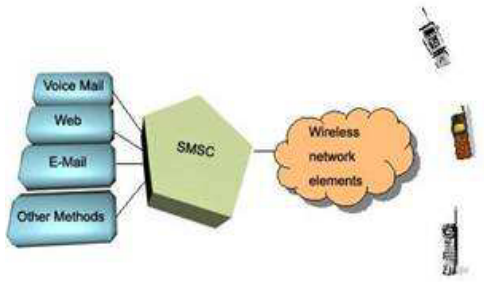

Figure 2. Illustration of a SMS network

2.2 Characteristics of SMS messaging and commerce applications

SMS messaging has the following characteristics: 1) low cost; 2) convenience of "anytime and anywhere"; 3) "personal" characteristic; 4) support for "location-awareness". SMS commerce applications also inherit those characteristics since they are operated over messaging services. In the following subsections, we explore those characteristics and study their marketing implications to SMS commerce.

2.2.1 Low cost

The cost of sending SMS messages is lower than other data-oriented mobile services such as WAP. Mobile service incurs two kinds of cost: the one-time cost of purchasing a mobile device; and the ongoing cost of using the services. Nowadays, almost all mobile phones are SMS enabled but WAP phones are still relatively expensive. The cost of sending a SMS message is low and relatively much cheaper than accessing Internet via WAP. The cost of sending a message is 0.02 Euro in Philippines, 0.04 Euro in Japan and 0.11 Euro in Western Europe [4]. Affordability greatly enhances the suitability and potential of applying SMS to the commerce arena.

2.2.2 The convenience of "anytime and anywhere"

SMS messaging has two special characteristics: "anytime" and "anywhere" availability. A switched-on mobile device is able to receive or send a message at "anytime" regardless of whether a voice or data call is in progress. Messages sent to a switched-off phone are guaranteed to deliver when the handset is on again. Because SMS messages are

tied to a personal mobile device, they inherit the benefits of "anywhere" availability. Hence, SMS could be used in the following context:

- *Information alerting services.* SMS can be used to deliver an extensive variety of information to SMS users, including weather reports; flight, train and bus information; news headline; lottery results, etc. Existing applications include news alerts over SMS and discount coupons over SMS offered by the Straits Times newspaper in Singapore, and examination result notification via SMS by Australia's Monash university.

- *Marketing campaigns.* SMS supports instant and on-site feedback collection from customers over SMS. Customers can complete a survey or provide feedbacks right after the completion of transactions and on their move. Compared to the choice of filling in the paper-forms on the spot and the choice of mailing back surveys, the SMS approach shortens the duration of feedback collections and saves respondents' time.

- *Real-time auctions.* SMS allows buyers to learn the instant updates on bids and offer bids at their move.

2.2.3 The "personal" characteristic

SMS messaging is obviously "personal" as it is invariably tied to a mobile phone. A mobile phone is a personal device, always handy and available. An active mobile phone has a globally unique number (identified by its country and region code) and carries the identity of its user. This leads to the following implications:

SMS can be used for identification purposes in information inquiries and reservation services. Mobile users can send SMS messages to enquire particular information, such as a flight schedule or to book movie tickets.

In the retail arena, SMS can be effectively used to provide remote points of sale services. For example, consumers can purchase a can of coke through the widely deployed automatic vending machines enabled with a "Dial-a-Coke" feature. Consumers pay by sending SMS messages and are billed through their regular mobile phone bills. Since mobile phones are personal devices, SMS makes identification and authentication much easier for payment purposes. The use of mobile phones as a substitute or supplement to cash or credit cards in wireless commerce is also discussed by Kannan et al. [6].

2.2.4 The "location awareness" characteristic

With the Global Positioning System (GPS), the location of a GPS-enabled mobile phone can be determined. SMS thus can be sent/received depending on the location of mobile users. One application is in the selective advertising business for promotional purpose. For example, restaurant operators can entice customers by sending them advertisements and promotional information messages when they are in the vicinity of restaurants.

3 Success indicators for SMS messaging

To determine the possible success factors of emerging SMS commerce, we first need to understand the contributing factors to the existing success of SMS messaging. Toward this end, we performed an extensive content analysis[3] of the extant literature on SMS messaging in several countries. We have analyzed 45 papers from journals and conference proceedings; 200 articles and reports found on the Internet. Owing to the space constraint, we would only describe the key factors contributing or inhibiting the success of SMS messaging in three countries, namely Japan, Finland and the U.S. We chose country as the unit of analysis because of two reasons: 1) SMS messaging is a domestic service and competitions among wireless network operators are normally local to a country; 2) cost measurement and public policies are consistent in a country. These three countries are also chosen because:

- SMS messaging in Finland and Japan have been acknowledged as extremely successful. Finland has an average of 51 messages sent per month per mobile user, among its 3.4 millions of mobile phone users by May 2000 [11]. In Japan, NTT DoCoMo has 30 million i-mode subscribers who sent an average of 119 messages per month per mobile user in 2001 [4].

- SMS messaging in the U.S have been perceived as relatively unsuccessful, and thus offers a useful contrasting case. Only 12% of the estimated 120 million mobile phone users in the U.S. have sent text messages [12]. As at May 2000, the monthly volume of messages sent is mere 0.15 messages per mobile user [4].

- These three countries are wireless technology leaders in the world, and they represent the three continents of Europe, Asia and North America.

From the content analyses, we found three consistent success indicators for SMS messaging:

- ***Cost-effective and interoperable wireless infrastructure,***

[3] Content analysis is a research tool used to quantify and analyze the presence, meanings and relationships of words and concepts within the text, then make inferences about the messages within the text. Two of the authors identified and coded the success indicators based on this methodology and the inter-rater reliability between the two authors was sufficiently high. These results are not presented due to space constraints.

- ***High penetration of mobile phones, and***
- ***Relatively low cost of SMS messaging service.***

These success indicators are discussed in detail in the next three subsections.

3.1 Cost-effective and interoperable wireless infrastructure

3.1.1 Japan

Infrastructure is the basic guarantee of SMS operations. There are three main mobile operators in Japan – NTT DoCoMo's i-Mode[4], KDDI's EZWeb[5] and J-Phone's J-Sky[6]. We focused on NTT DoCoMo's i-Mode only in our analyses because it enjoys the widest market share close to 55 percent in Japan [13]. NTT's DoCoMo started i-mode service in February 1999 and has now grown to a staggering 30 million subscribers by the end of 2001 [4].

The remarkable success of i-mode is related to the type of wireless infrastructure adopted in Japan. With heavy government support, Japan implemented the first nationwide "packet-switched" infrastructure in the world, as opposed to the "circuit switched" networks in the U.S. and Europe [14]. Because of this "packet-switched" network, NTT's DoCoMo charges are based on the volume of data transmitted, not based on the amount of time spent connected. This cost effective infrastructure permits and promotes the high usage of SMS in Japan.

3.1.2 Finland

Finland has benefited from its long-standing GSM mobile phone infrastructure. All wireless network operators use one GSM standard and have roaming agreements with each other [14]. The interoperability increases the number of available message destinations and boosts the use of SMS in Finland.

Similar to Japan, Finland has very concentrated urban populations. Thus a relatively small investment in infrastructures in key locations can capture a large number of users and provide greater economies of scale. Additionally, geography also plays an important role in the comprehensive coverage of Finland's telecommunication infrastructure [14]. The long and narrow geography of Finland allows the backbone network to be built along the north-to-south "backbone" line of the country. And local links connected to the backbone network are relatively cheap because the west-to-east span of the country is narrow. This avoids excessive construction of towers and transmitters for wireless communications. Consequently, the comprehensive wireless infrastructure in Finland is relatively cost-effective both in terms of operations and maintenance.

3.1.3 The United States (U.S.)

In the U.S., the wireless market has long been characterized by a confusing array of carriers, incompatible standards, and tight competition across a patchwork of service areas. There exist more than 350 mobile communication service companies in the United States. U.S carriers operate 2G and 2.5G networks based on the TDMA, CDMA, GSM, PCS, AMPS, and iDEN protocols [15]. The disparate nature of these technologies makes most of these networks *not* interoperable. For example, AT&T phone users are unable to send SMS messages to Sprint PCS phones. These infrastructure problems have resulted in a low level of SMS usage in the U.S.

Wireless services in the U.S. grew on a regional basis across its huge land mass rather than on an integrated basis [16]. This is reflected in the fragmented, localized approach to licensing early mobile phone providers. Since local network operators are concentrated on the areas that generated high traffic volumes, expensive high-speed wired links and wireless infrastructure are available only in specific regions [14]. This situation has prevented the building of a national infrastructure. Problems such as roaming charges, quality and availability often arise when a subscriber moves out of the reach of his or her subscribed service.

As a result, most U.S. mobile phone users view SMS as a limited convenience and rely far more on toll-free phones and PC connections to the Internet for communication purposes. Surveys show that only 12% of the estimated 120 million mobile phone users in the U.S. have sent text messages [12]. Consequently, network operators are less inclined toward enhancing SMS services. For example, AT&T Wireless, the first company to offer SMS in the U.S., started to offer two-way messaging services only from October 2000 [12] much further behind network operators in other countries. On one hand, the slow offering of advanced SMS services results in a slow increase in new subscribers. On the other hand, SMS operators have incentive to provide advanced services only when there is a critical mass of new subscribers. This scenario perpetuates a vicious cycle where users have no incentive to subscribe to new SMS services and network operators have no incentive to provide advanced SMS services for a lack of a critical mass of users.

In short, the proliferation of SMS usage and its interoperability in Japan and Finland is greatly attributed to the existence of a wireless industry standard and cost-effective network infrastructure. In contrast, the problems of fragmented infrastructure and interoperability in the U.S. have led to extremely low usage of SMS messaging. Hence, we

[4] i-mode: http://www.nttdocomo.com/top.html
[5] EZWeb: http://www.tu-ka.co.jp/common/ezweb/index.html
[6] J-Sky: http://www.j-phone.com/h-e/products/service/index.html

propose:

Proposition 1a: All other things being equal, countries with an effective network infrastructure are more likely to experience higher success of SMS messaging usage than countries that do not.

Proposition 1b: All other things being equal, countries with an interoperable network infrastructure are more likely to experience higher success of SMS messaging usage than countries that do not.

3.2 High penetration of mobile phones

The rapid growth of SMS is dependent on the penetration of mobile phone since it is the main conduit by which SMS messages are sent and received. All three countries have a high penetration rate for mobile phones. In the U.S., there are 134 million mobile users out of the 280 million populations [11]. In Finland there are 3.4 million mobile users out of the 5.2 million populations, and close to 100 percent of the adults are mobile enabled [11, 14]. In Japan, there are 67 million mobile users out of the 126 million populations in January 2002 [17]. The penetration rate is still increasing. For example, Japan saw a 0.6 percent growth in mobile phone subscribes month-on-month in January 2002 [17].

The high penetration of mobile phones could potentially be converted into a large SMS messaging customer base. Since SMS messaging is for communication, more mobile phones indicate more potential messaging destinations and this leads to more messages sent per user.

Interestingly, we also found that the unique Japanese culture and demographic environment plays an important contributing role in the penetration of mobile phones in Japan [15].

- Japan is a large and homogeneous (single-language) market with a dense population (126 million people). Cities in Japan have heavy population, complex city plans, and communicating bottlenecks, which makes the high penetration of mobile phones.

- Many Japanese are not comfortable with computer keyboards because their language is ideographic, not alphabetic. Thus the touch-pad of mobile phones is a better alternative than computer keyboards for electronic communication.

- Cute-favor culture is one of the main characteristics of Japanese youth who are targeted by Japan's mobile network operators. Japanese youth consider mobile phones as a type of fashion accessory and thus they prefer mobile phone more than PC as their communication tool. Moreover, they regard these devices as entertainment instead of just a communication method.

A driving force behind the penetration of mobile phones is the mobile phone technology producer. Finland has Nokia, the number one mobile phone manufacturer and the most powerful technology and marketing player in the wireless world. It plays an important role in making mobile phones popular in Finland, and in the rest of the world. This results in the low mobile service cost comparing with fixed voice phone services, and hence a higher penetration rate. Hence, we propose:

Proposition 2: All other things being equal, countries with a higher penetration rate in mobile phones are more likely to experience higher success of SMS messaging usage than other countries that do not.

3.3 Relatively low cost of SMS messaging service

Cost is an important factor on the usage of SMS services. The cost is compared to other electronic communication alternatives in the same country.

In **Japan**, the cost of mobile services is much lower compared to that of the wired Internet. The national phone monopoly NTT accounts for 90 percent of the Japanese wired Internet services and thus extracts a greater monopoly rent by pricing the service at a very high price [15]. However, NTT's DoCoMo prices data-oriented wireless services at a much lower rate compared to data-oriented wired services. SMS is thus considered as a lower cost, convenient, and easy-to-use alternative than chatting tools on the wired Internet. Consequently, the usage of SMS messaging is relatively high in Japan.

Similarly, SMS messaging service is proliferating in **Finland** partly because of low pricing. Many Finnish use SMS as low-cost mobile email solutions and send SMS messages more often than the wired Internet emails and instant messaging.

Unlike Japan and Finland, the charge for the wired Internet in **the United States (U.S.)** is relatively low compared to that of the wireless services. In the U.S., wired Internet technologies were developed at a much earlier stage and is very well established in terms of its reach and functionalities compared to other countries. Hence, most people prefer using Internet emails and instant messaging tools rather than wireless services for communications and exchanging information.

From the above discussion, we propose:

Proposition 3: All other things being equal, countries with an average lower cost for using mobile phones are more likely to experience higher success of SMS messaging usage than other countries that do not.

3.4 Summary of content analysis

Table 1 summarizes the contributing and inhibiting factors for successful SMS messaging derived from our content analysis of literature on SMS messaging usage in Japan, Finland, and the U.S.

4 Hypothesized success factors for SMS commerce applications

Since SMS commerce applications are built on top of messaging services, the success indicators proposed in section 3 may also lead to the success of SMS commerce. In section 4.1 we study their impacts and confirm that they are hypothesized determinants. Moreover, given that SMS commerce is more complex than messaging services, there may be other factors that account for its success. The complexity stems mainly from 1) the multiple parties that are involved in a SMS commerce application, and their interrelationships, 2) the mobile users' awareness of SMS commerce, 3) the government's policies on electronic and mobile commerce, and 4) the security concern about wireless payment mechanisms. We study these complexities and propose four additional hypothesized success factors from section 4.2 to section 4.5.

4.1 Inherited hypothesized success factors from SMS messaging

- *Infrastructure*. Compared to SMS messaging services, SMS commerce applications are more sensitive to infrastructure problems such as network congestion, slowness and instability. Imagine how frustrated a user would be if she were to wait unsuccessfully or for a long time for her ticket booking confirmation message. Under this situation, users would not have the patience to retry again since they have other alternatives such as phone calls or the Internet. Furthermore, the great demand for standard infrastructure and interoperability is shown by the fact that consumers do not ask which strategy has the better technology, but rather which one will be the most universally used and contain the most add-on services [1, 15]. As more transactions are performed over SMS, the demand for secure and private transmission of messages would increase. To meet this demand effectively entails efficient and effective infrastructure support. Hence we propose:

  Hypothesis 1: The success of SMS commerce is positively related to the effective, secure and interoperable infrastructure.

- *Penetration of mobile phones*. While the high number of mobile users may create business opportunities for SMS commerce, not every one needs to transact via SMS. For example, the success of SMS-based movie ticket booking applications is more dependent on the mobile phone penetration among movie lovers than among other interest groups. Thus we define *special interest group* as a group of mobile phone users who have a common interest in a certain type of mobile commerce applications. Hence we propose:

  Hypothesis 2: The success of SMS commerce applications that cater to some specific interest group is positively related to the high penetration of mobile phones in a specific interest group.

- *Cost of SMS messaging services*. The low cost of SMS messages stimulates the use of SMS for communication. In SMS commerce, the service charge is either embedded in the cost of SMS messages or charged separately. Thus we define "pure SMS message cost" to be the cost of sending SMS excluding the embedded service charge. Obviously, low "pure SMS messages cost" is vital to the viability of SMS applications, because SMS is simply a low-cost alternative to other alternatives for providing wireless electronic commerce. Aarnio et al pointed that prices must be decreased to "overcome the critical mass threshold" for general mobile services [7] . Hence we propose:

  Hypothesis 3: The success of SMS commerce is positively related to the low "pure SMS message cost".

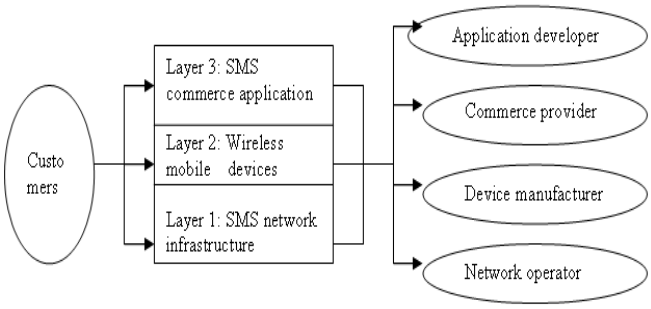

Figure 3. The SMS commerce application framework

4.2 Co-opetition and cooperation

To provide an understanding of the different parties involved in SMS commerce, we propose a framework for SMS commerce applications as shown in Figure 3.

The framework can be read from left to right as:

- Customers are interacting with parties at three layers. To perform a SMS commerce transaction, a customer

Success Indicators	*Countries*		
	Japan	*Finland*	*US*
Infrastructure	Nation-wide packet-switched infrastructure	The common GSM infrastructure with roaming agreements among carriers.	Different infrastructures causing interoperable problems; and highly fragmented in regions, lack of roaming support.
Mobile phone penetration	High	High	High
Cost (relative)	Low	Low	No difference from other electronic communication alternatives.

Table 1. Success indicators for SMS messaging services among three countries

has to choose a network operator (at layer 1), purchase a SMS-enabled mobile device (at layer 2), and select a SMS commerce provider to receive services via SMS (at layer 3).

- The application developers are transparent to customers but they have to produce and maintain applications for SMS commerce providers.

Based on this framework, we first discuss the co-opetition among competitors, and then the cooperation among non-competing parties.

4.2.1 Co-opetition among competitors

The existence of competitions among involving parties at the same level is common and understandable. Competition for enlarging market share exists among network operators, mobile device manufacturers, SMS commerce providers, and application developers.

Competition tends to improve the quality of product and services, stimulate technology advancements and lower the costs. However, this does not preclude cooperation among competitive parties. Cooperation among competitors in the SMS commerce arena is necessary to set industry standards and ensure interoperability in order to enlarge the customer base, and foster growth in not only the market share but also in services. This cooperation is especially necessary and important when SMS commerce is still in its infancy stage. Brandenburger coined the term co-opetition to describe competing businesses cooperating to create and enlarge a market instead of competing to divide it [10]. We discuss the importance of co-opetition layer by layer in the following paragraphs.

At layer 1, for example, the SMS customer base in the U.S. is fragmented by different technologies (TDMA, CDMA, GSM, PCS, AMPS, and iDEN protocols) and by different regions. The lack of cooperation among U.S. network operators gives rise to inter-network roaming and across-region roaming problems. The growth in the fragmented market and the overall market is stymied as a result. Unlike the situation in U.S., all European network operators employed the same GSM infrastructure and have inter-network roaming agreements to service their customers effectively. Such a strategy has resulted in explosive SMS messaging growth.

At layer 2, the current dispute between Nokia and its competitors on the standard of next generation of SMS underlies our emphasis on co-opetition. Nokia, which has 31% of the European market, announced its MMS (Multimedia Message Service) technology to be installed on Nokia mobile phones as the new standard to support multimedia messages such as icons and ringtones. However, its competitors including Alcatel, Ericsson, Motorola, and Siemens announced a different and incompatible technology standard called Enhanced Message Service (EMS) [1]. Both parties suggested that the other side has followed a wrong path, and their dispute is a great concern to market analysts and network operators [18, 19]. This dispute could fundamentally change Europe's messaging environment, making it more complicated for users who want to send wireless messages to each other and for SMS commerce providers to send messages to their customers, who may use different brands of mobile phones.

At layer 3, we foresee that SMS commerce providers would have to cooperate. SMS commerce providers may have to set industry standards for application vocabulary to facilitate users to send SMS messages easily. Imagine how confused a user would be, if for the same type of applications, she has to remember a different set of vocabulary for each commerce provider. This lack of standardization presents an overwhelming barrier to attracting customers. Hence, it is conceivable that SMS commerce providers would have to work out an industry standard SMS message vocabulary to remove the barrier. Hence we propose:

Hypothesis 4.1: The success of SMS commerce is positively related to co-opetition among competitors.

4.2.2 Cooperation among non-competing parties

Parties from different layers in the framework are not competitors to each other and have potentials to cooperate. The target of cooperation is to together grow the customer market and share the profits.

It was reported that in order to widen the customer base, SMS network operators collaborated with companies in different industries including banks, supermarkets, pharmacies, retailers, health and fitness clubs and airlines [2]. SMS is used to advise customers on their credit card limit, to inform them about special offers and sales, to invite them to participate in a new program, or to update them on frequent flyer miles status.

The cooperation approach is also proven immensely successful as seen from DoCoMo's profit sharing business model with its fifty-one thousands official and unofficial content providers over i-mode platform.

Consequently, we propose the value net of SMS commerce as shown in Figure 4 for describing the coordination and cooperation relationship among the four players. The benefits of coordination and cooperation can be read from this value net as:

- When network operators work with device manufacturers to provide users function-rich mobile phones, customers will be attracted to subscribe to the service package and the penetration will be increased.
- When network operators collaborate with commerce providers, customers will be attracted to subscribe to SMS applications.
- Increased customer base and increased usage of services imply increased profit for network operators, commerce providers and device manufacturers. It will attract more participants to join in the competition and the cost of products and services will drop.
- More commerce providers should lead to more SMS application research and development, resulting in application technology advancement. Moreover, more application developments should lead to lower development costs and in turn reduce the cost of services.

Hence we propose:

Hypothesis 4.2: The success of SMS commerce is positively related to coordination and cooperation among non-competitive parties.

4.3 Customers' mindset change on the "limits of possible"

SMS messaging has been seen as a huge success. Most people intuitively link SMS to messaging or wireless email.

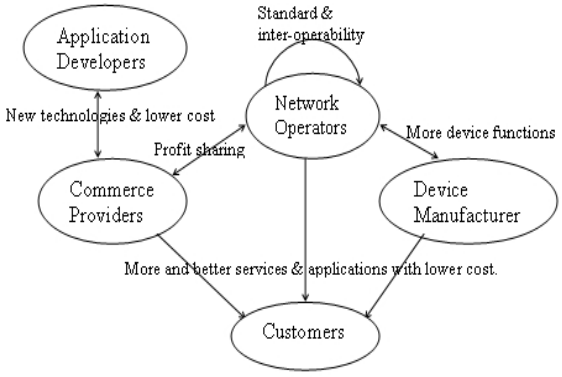

Figure 4. Value Net for SMS commerce

However, the potential of SMS has not been fully explored in commerce applications. This may be related to the customers' understanding of "limits of possible" on what SMS can do.

The concept of "limits of possible" is provided by Fernand Braudel, the historian who showed the very concept of how the economic, social, and technological shifts that we label as "progress" come from people challenging the "limits of possible" in the structures of everyday life [20]. We borrow this concept to illustrate the existence of "limits of possible" in the customers' mindset, and the need to change this mindset.

Take SMS based booking services for example. They have gained great success in Finland but this success may not happen in other places. Customers may think that the booking services can be obtained by other ways, such as by phone calls or Internet. They stay with what they have in mind; and pre-define the "limits of possible" on SMS as:

- SMS can only do messaging. Usage of SMS beyond chatting is not possible.
- A phone call is a better alternative than sending SMS in terms of efficiency.

With an increasing awareness of the usage of SMS-based applications, the first "limits of possible" to be challenged should be the freedom of when, where, and how customers enjoy those services.

The second "limit of possible" for SMS can be explained as follows: customers think that speaking to an operator is faster than sending SMS. However, they ignore the fact that phone calls often get into waiting mode due to the limited number of available lines or available operators. Sending SMS is not affected by this limitation because the reservation is handled by computer software and the system can take 6,000 SMS requests at a time, thus shortening the waiting time.

This analysis demonstrates that the customers' "limits of possible" mindset on SMS is a critical barrier to the growth of SMS commerce. Knowledge in SMS "can-dos" should be broadcast to the mass public and in particular to existing and potential mobile phone users. For example, those users should also be trained on the skills of fast inputting of messages (some mobile phone products already have offered smart typing functions). By doing so, SMS messaging customers can be upgraded to well-equipped SMS commerce application customers.

Customers' adoption of mobile commerce has been extensively studied in the literature. Pedersen et al. modeled the end-user adoption using a mobile commerce value chain where users are at the demand side and technologists are at the supply side [9]. Khalifa and Cheng studied the importance of customer's exposure to mobile technologies in the adoption of mobile technologies [8]. Changing customers' mindset can be seen as a type of technology exposure based on breaking the conventional thinking of how to satisfy customers' demands. Hence we propose:

Hypothesis 5: The success of SMS commerce is positively related to changing the customers' mindset on the "limits of possible".

4.4 Government support

Government support is critical to the growth of SMS commerce, especially at its start-up stage. In the past, the Clinton's government had waived the tax on the profits made from Internet-based commerce. This policy has been seen as a critical stimulus for Internet commerce. Furthermore, the government's efforts in pushing interoperable network infrastructures in Finland and Japan also show the importance of government involvement. Apparently, government support is a hypothesized success factor for SMS commerce.

In fact, some countries have already started pushing SMS commerce. For example, the Singapore government removes the withholding tax for purchasing wireless software overseas from 2002 [21]. This means that Singapore-based wireless companies need not pay "withholding tax" for software bundled with hardware (e.g. gateway, SMSC on servers). Singapore government is also developing leading edge talent and openly supports the mass adoption of a wireless lifestyle in Singapore. Hence we propose:

Hypothesis 6: The success of SMS commerce is positively related to government's support.

4.5 Guaranteed Security in SMS commerce

Performing transactions using SMS demands high security. On top of a secure infrastructure (as discussed in section 4.1), the security of M-commerce payment has received much attention. For example, Kwon et al. proposed several enhancements to improve the security of WAP to make the communication protocol layer more secure for transaction processing [22]. Tang addresses the security problem of a lost or stolen mobile device, and the loss of a secret personal identification number (PIN) to unauthorized users [23]. The paper proposed a third-party software component called "agents" to store part of the PIN and proposed the related protocols to allow the PIN verification process to involve both the mobile device and the agent. More generally, a common platform for secure mobile payment was proposed to define various infrastructures [24]. We believe security will play a vital role in the adoption of SMS commerce: Unless security is guaranteed in transactions via SMS, users will simply use SMS as messaging tool rather than a payment alternative. Hence we propose:

Hypothesis 7: The success of SMS commerce is positively related to the secure platform and payment mechanisms.

5 Conclusion

In this paper, we have derived hypothesized success factors for emerging SMS commerce. Understanding these factors would allow governments to formulate the right policies to promote SMS commerce, and to make investments in the necessary infrastructure development. Similarly, merchants could gauge how likely their SMS applications would be successful, make an informed decision of whether to invest in SMS applications, and to construct intervention strategies to overcome some of these barriers to SMS success.

Beyond general implications for government and merchants, these success factors have specific practical implications for a few industries including wireless network operators, mobile device makers and various SMS commerce providers. To facilitate the success of SMS commerce, the following should be achieved:

- Players in various industries should cooperate with their competitors especially in making industry standards in order to grow the market.
- Players from different industries should cooperate together to grow the market and share the market.
- Network operators should remain the pure cost of SMS message at a low level.
- Commerce providers intending to or doing business over SMS should pay attention to the specific mobile user groups whose interest may relate to the business.
- All industry players should try to broadcast the knowledge on SMS "can-dos" to the customers and change the customers' mindset of "limits of possible" on SMS.

- Industry players should seek government's support of promoting SMS commerce.

Our paper could be further extended in a number of ways. First, a multi-country survey could be conducted among the SMS users to test the hypotheses mentioned in section 4. An industry-level case study can also be performed to validate the hypothesized success factors highlighted in this paper. By examining the relationship between the customers and players in the real world, we would get a much clearer picture of the development of SMS commerce and draw important lessons for ensuring successful SMS commerce implementation. China, Hong Kong, Japan, and Singapore present interesting platforms for our future research given the proliferation of SMS messaging and commerce in these countries and regions. Last but not less important, we will explore the impact of the emerging Multimedia Messaging Service (MMS) technology [19] on the mobile commerce applications.

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* Due to the space limit, some Web references are not given with full URL which can be requested from the authors.