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Research of risk factors measurement of mobile commerce based on delphi sorting method

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ABSTRACT

Mobile commerce is currently experiencing massive growth as demonstrated by its rapid spread and upgrades in data transfer speeds throughout China and worldwide. However, the development of mobile commerce is dependent on many unpredictable risk factors that have the potential to create/destroy the flourishing 3G service in China. This paper reports the results from a study using the ranking-type Delphi method to examine the responses from professionals in the mobile commerce industry to gain their insights. The top 10 risk factors, such as the decline in average revenue per user (ARPU) caused by the price war among the mobile network owners (MNOs), the lack of 3G consumption capacity and the stability of the government communications policy, were captured after three phases of the Delphi study. Finally, the risk factors are compared for Chinese and global data. It was found that the cooperation risks in the value chain and the risk factors involving 3G should be given more attention in China.

KEYWORDS

Mobile commerce; Risk identification; Delphi method; Risk factors.

INTRODUCTION

Mobile commerce (m-commerce) is currently experiencing massive growth with rapid expansion and the upgrade of telecommunication networks across the globe. The explosive growth of the Apple iPhone shows that the usage of mobile devices on IP-based networks has surprised many people[23]. The success of m-commerce is dependent on the evolution and innovation of mobile services, which are developed and financed by the mobile service providers (SPs) and mobile network operators (MNOs)[22, 29]. The Chinese mobile communications industry has enjoyed impressive growth in terms of revenue and the number of subscribers. In 2009, the number of Chinese mobile phone subscribers increased by 106 million, reaching 747 million by the end of 2009. The revenue of mobile commerce in China reached 509 billion RMB, a 13.2% increased over 2008[31].

The path to 3G telecommunications is dependent on many unpredictable factors, such as the mobile network infrastructure costs, the growing number of subscribers, the uncertainty in the market conditions and regulatory policies[15]. There are uncertainties surrounding tomorrow's significant growth opportunities that cannot be ignored, i.e., the decline in the average revenue per user (ARPU) in the 3 Group, which consists of the 3G mobile operations in Europe and Australia. In 2009, the ARPU of 3 Group decreased 15% in 2009 to €28.32. This decrease was largely due to regulatory reductions in mobile termination fees and roaming rates, price competition and an increased proportion of mobile broadband access customers[1].

Understanding the risk factors is essential for MNOs and SPs to manage risk effectively, optimize performance and increase operational efficiency. There is a strong need by MNOS and SPs for a comprehensive risk assessment for an in-depth understanding of what may cause the failure of the mobile service development. The risk factors are only mentioned in some case discussions and sensitivity analyses in academic papers, which cannot provide a comprehensive understanding of the risks. The importance of the risk factors needs to be ranked in order to focus on the most important risk factor. No paper to the best of our knowledge has provided a ranking of the risk factors for the mobile commerce industry. Thus, no systematic risk analysis can be found in the literature, ignoring a key discussion area in the industry.

We collected responses from telecommunications professionals to gain their insights. In this study, a total of 27 relevant industrial and academics experts were recruited from the mobile network operators, equipment providers, research institutions and regulatory departments. The underlying research questions that we sought to address in this study are as follows:

1. What are the most important risk factors in the development of mobile commerce in China?
2. How can we define the probability and the loss of the risk factors?
3. Based on the risk factors for global mobile commerce, what characterizes the risk factors in China?

To achieve these goals, the remainder of this paper is organized as follows. In Section 2, a literature review is conducted, categorizing the studies of mobile commerce risk factors into five dimensions. In Section 3, the details of the Delphi method are described to illustrate the investigation process. In Section 4, the sorting order, risk exposure, risk matrix, risk radar and expanded commentary are analyzed, based on the empirical results. In section 5, the mobile commerce risk factors for China and global markets are compared. In the last section, this paper concludes with a discussion of the limitations in this study and the primary implications.

LITERATURE REVIEW

The discrepancy between the ideal and actual financial returns on investments in a new mobile telecommunications network or service can be quite large, and this can cause economically viable projects not to be undertaken. Regulatory risk, technological risk and market risk need to be considered in the investment of mobile telecommunications, according to a case analysis of the European Union[13]. Also, there is a study claiming that customer dynamics, competitive dynamics and innovation dynamics may be the three key uncertainty determinants of 3G wireless communications value[23]. The initial investment cost, the average revenue per user, the growth of the subscriber base and the volatility of the markets may also be key risk factors in the investment process[15].

As more firms enter the mobile commerce market, the profitability of the sector is expected to decline. There is also the risk of over-capacity and concomitant price wars as the product become homogenized with little scope for differentiation[13]. According to a financial simulation of the future mobile network, certain variables will have considerable impact on the profitability, such as the policies for spectrum management, competitive impacts and expansion levels[7].

In recent years, 3G technology has broken through the data transfer limitations; it has increased the transmission rate and the complexity of the electronic commerce (e-commerce) interactions and, thus, has pushed the formation of the mobile commerce value chain. The business models and value chains of conventional mobile communication and the internet may not completely apply. 3G telecommunication operators may face many challenges, including the steep cost of the 3G license, the cost of the network infrastructure, the selection of the network system, profit distribution on the value chain, mobile number portability, the competition of mobile virtual network operators and the entry of other operators because the voice service market is saturated and its profits are decreasing[19].

Although the risks of desktop internet-based service will pervade m-commerce, mobile commerce presents new technological risks[12, 20]. The current predominant model of perimeter security may not scale for future mobile business applications. These applications will require appropriate application-level security mechanisms to be in place[11, 33], so there

are different security challenges for mobile commerce[27]. It is assumed that a technological design, which is in line with the legal framework, will ensure the future growth of mobile commerce[8, 24].

The risks and challenges profiled in related studies on mobile commerce risk management can be categorized into five risk dimensions. The five risk dimensions consist of regulatory risk, technological risk, market risk, cost management risk and social & cultural risk. The risk dimensions and their descriptions, along with the related studies, are listed in TABLE 1:

TABLE 1 : Related studies and risk dimensions of mobile commerce risk management

Dimensions	Description	References
Regulatory Risk	Despite some trends toward deregulation, the changing of regulatory policy remains one of the most powerful ways in which government can influence activities in the telecommunication industry.	Gruber (1999), Harmantzis and Tanguturi (2007), Bohlin (2007)
Technological Risk	The security of the network infrastructure of mobile network as well as the accelerating speed of the evolution of telecommunications technologies.	Gruber (1999), Pagani and Fine (2008), Kuo and Yu (2006)
Market Risk	The participants in the value chain of mobile commerce need to cope with the problems related to the number of subscribers, popularity of the service brand and market diffusion levels.	Gruber (1999), Harmantzis and Tanguturi (2007), Bohlin (2007), Tanguturi and Harmantzis (2006), Pagani and Fine (2008), Kuo and Yu (2006)
Cost Management Risk	The cost of mobile communications networks is mainly composed of three parts: the cost of the network infrastructure, the cost of information transmission and the information processing cost.	Harmantzis and Tanguturi (2007), Tanguturi and Harmantzis (2006), Kuo and Yu (2006)
Social & cultural risk	Social concerns about mobile commerce are commonly related to authentication and confidentiality issues as well as the loss of privacy space in daily life.	Walter, et al. (2004), Galanxhi and Nah (2006), Schwiderski-Grosche and Knospe (2002), Ghosh and Swaminatha (2001), Ng-Kruelle, et al. (2002), Cleff, (2007), Pitkanen, et al. (2003)

METHODOLOGY

Delphi method

The main purpose of this paper was to gain insights from professionals within the telecommunications industry. We utilized the Delphi method to identify and rank the mobile commerce risk factors. The Delphi method is a structured, multi-round group decision process that was developed to address research problems in which there are no rigid answers. It has been successfully used for long-term forecasts as well as for the identification of factors and indicators[14, 18]. The Delphi method provides a concise approach to return controlled feedback to the respondents after each round. The advantage of this method is due to the anonymity of the experts and the avoidance of the dominance of singular opinions as compared to other group discussion methods[14, 18].

The Delphi method has been employed both within and outside the fields of e-commerce and m-commerce. For example, it was used to produce a reliable forecast about the development of electronic business-to-business (B2B) marketplaces in Germany[16]. Addison (2003) also explored e-commerce project development risks through a Delphi survey, which included the viewpoints of developers, project managers, clients/users and academics.

Many variations of the Delphi method can be found in studies on forecasting and evaluation[17]. This study followed a modified version of the ranking-type Delphi method that was developed by Schmidt (1997) and is composed of three phases. In the design of Schmidt (1997), Kendall's coefficient of concordance (W) was chosen as the standard deviation of ranks to identify the consensus of the experts' opinions to balance feasibility and potential gain.

Composing of experts

In this study, a group of 27 experts in China were recruited to complete a list of the most important risk factors of mobile commerce. The experts came from mobile commerce-related industries and research centers, such as China Mobile (mobile network operator), China Unicom (mobile network operator), HUAWEI (mobile equipment provider), ZTE (mobile equipment provider), the Office of Information Industry in Hubei (government regulator) and mobile commerce research group from Huazhong University of Science & Technology (academics). Most of the experts were members of the Alumni Association of Huazhong University of Science and Technology. Of the 27 experts, 6 had a bachelor degree, 14 received at least one master's degree, and 7 had a doctoral degree. Most of the experts had two or more years of experience in mobile commerce-related industries and with the research center. The experience, work sector and education level of the experts is shown in TABLE 2.

TABLE 2 : The distribution of the experience, education and work sector of the experts

Characteristic of Experts	Distribution of Experts			
Experience in m-commerce	Under 2 years	2-4 years	4-6 years	More than 6 years
	3	12	8	4
Work sector in m-commerce	R&D	Market	Administration	Scholar
	4	11	2	10
Education Degree	Bachelor	Master	MBA/EMBA	Doctor
	6	8	6	7

Compared with other investigations using Delphi method, the experience of the experts may have been limited. However, relaxing this qualification was reasonable, considering that mobile commerce is an emerging industry in China that has only begun to flourish in recent years. Delbecq et al. (1975) suggests that few new ideas are generated within a homogeneous group once the size exceeds 30 well-chosen participants. Therefore, 27 experts were recruited for this investigation. The number of experts, expert experience and breadth of the sample distribution were prepared to meet the Delphi requirements.

Investigating process

The data were collected using both paper-based and email questionnaires. Each expert was asked to identify the risk factors from an overall industry perspective. The participants received both paper and email versions of the material and were encouraged to respond by either format. The data collection process took four months (December 2009 to March 2010) and involved three sequential phases of Schmidt's design. The Delphi process that we used is shown in Figure 1.

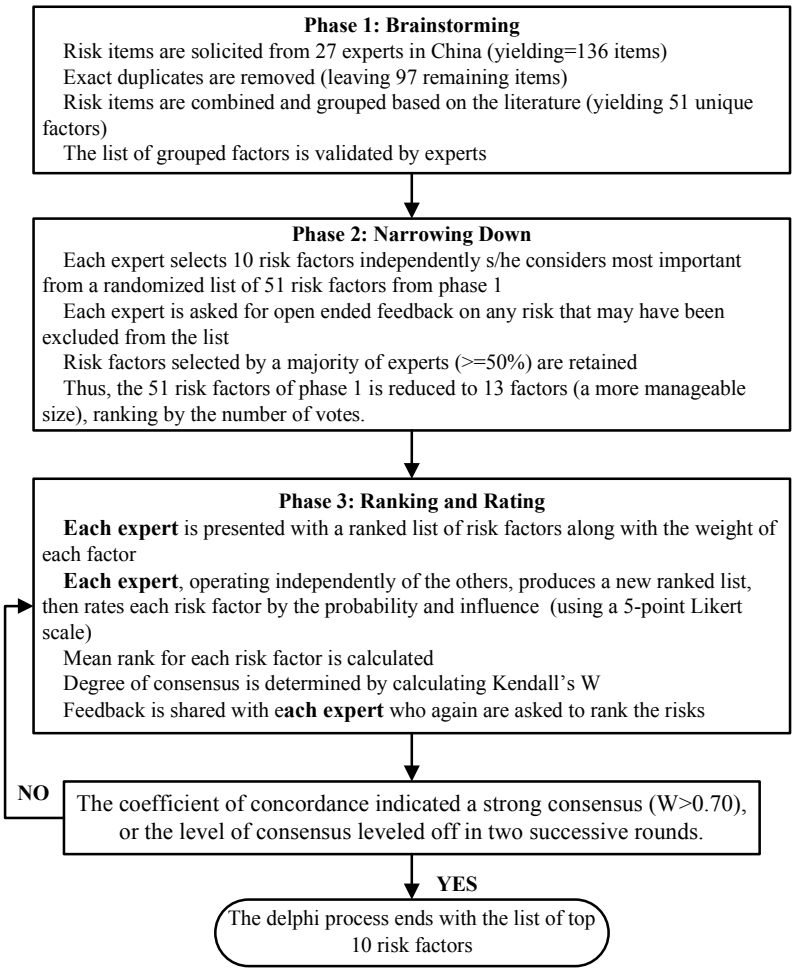

Figure 1 : The Delphi investigation process

In phase 1, a brain-storming round was conducted to produce as many items as possible. Each expert was asked to submit at least five risk factors and to provide short descriptions of each factor, which yielded 136 risk items. Next, the duplicates were removed, and a combined list of 97 unique risk factors was categorized, based on the meaning of each item.

This information was returned to the experts for corrections, additions and further validation to assure that each factor had a clear definition. This process produced a list of 51 grouped risk factors.

In phase 2, the experts were then asked to independently select the 10 most important risk factors from the grouped list of 51 risk factors derived in phase 1. The experts were also given the opportunity to provide open-ended feedback on any risks viewed as important but not included in the initial list. None of the experts created additional risks, suggesting that the initial list was viewed as a complete.

At the end of this phase, 13 risk factors were selected by a majority of the experts. In this study, 14 experts from the panel were needed to represent the majority. The ordering of the list was based on the percentage of experts who selected each factor. Research suggests that presenting randomized risk factors at this stage would not take advantage of the feedback that the group provided in narrowing the list of risk factors. The intent of forcing respondents to reconsider their viewpoints in view of the group's viewpoint would be lost if the items were randomized (Adler and Ziglio 1996;**17]**.

In phase 3, each expert was presented with an ordered list of 13 risk factors. The experts were asked to rank and rate each risk factor on a five-point Likert scale by its probability (Prob) and loss (Loss), according to the practice of Boehm (1991). Risk exposure (RE), a fundamental concept in risk management, was used in this study. Risk exposure is defined by the relationship RE = Prob * Loss and is promoted by many scholars[6]. In addition, each expert was asked to provide an open-ended explanation for the selection of the top-ranked factor.

At the end of phase 3, the mean rank and rating for each factor were computed, and the degree of consensus was determined by calculating Kendall's coefficient of concordance[25]. As suggested by Schmidt et al. (2001), the ranking rounds stopped when either the coefficient of concordance indicated a strong consensus (W > 0.70) or the level of consensus plateaued after two successive rounds.

EMPIRICAL RESULTS

The sorting order of risk factors

In this section, we present the results of our Delphi study, beginning with the full list of risk factors. As described above, the list of 51 risk factors that were identified by the experts in phase 1 was reduced to a brief list of 13 risk factors. After three rounds of investigation, the perceptions of mobile commerce risk factors reached a consistency of 0.706 (Kendall's W coefficient), which indicates that there was strong agreement among the experts and that there was no need to conduct the next round of sorting. The mean ranking order and the consistency after the three rounds of the Delphi process are shown in TABLE 3.

TABLE 3 : Ranking results for each round of the Delphi process

Risk Factors	Final Rank	Mean Rank		
		Round 1	Round 2	Round 3
The decline in the ARPU caused by the price war among the MNOs	1	2.56	2.39	1.95
The lack of 3G consumption capacity	2	4.28	4.10	2.67
The stability of the government communications policy	3	4.75	4.00	3.45
Huge investment in the construction of the 3G infrastructure	4	4.55	4.01	3.91
The harmonization of business recombination and acculturation	5	5.96	5.28	5.37
The irregular action of SP	6	5.53	5.81	6.41
The dissension over profits distribution with the equipment providers	7	6.93	6.40	6.93
Escalating trend of the user fluxion rate	8	6.95	6.93	7.26
Internet security risk	9	8.53	8.92	8.65
The concern for user privacy	10	9.38	9.84	9.81
Failing to hit the payoff rock bottom of the new mobile service	11	9.31	9.52	10.29
The compatibility of the evolutional communication equipments	12	10.79	11.47	11.93
Failing to control the operation cost effectively	13	11.48	12.32	12.37
Kendall's W		0.519	0.626	0.706

After the Delphi investigation, the mean probability (Prob) and the mean loss (Loss) of the evaluation results were calculated. The mean level of risk exposure was then calculated. The risk exposure was sorted from highest to lowest. The results show that the sorting order of the risk exposure agreed with the mean ranking results of the final round investigation for most of the risk factors with the exception of the harmonization of business recombination and acculturation, which dropped from fifth to seventh. The final sorting order according to risk exposure after round 3 is shown as TABLE 4.

TABLE 4 : The sorting order according to risk exposure

Risk Factors	Sorting of Risk Exposure	Probability	Loss	Risk Exposure
The decline in the ARPU caused by the price war among the MNOs	1	4.50	4.79	21.55
The lack of 3G consumption capacity	2	4.39	4.78	20.97
The stability of the government communications policy	3	4.50	4.43	19.93
Huge investment in the construction of the 3G infrastructure	4	4.58	4.04	18.51
The harmonization of business recombination and acculturation	7	3.94	4.37	17.20
The irregular action of SP	5	4.52	3.99	18.02
The dissension over profits distribution with the equipment providers	6	4.18	4.28	17.88
Escalating trend of the user fluxion rate	8	4.07	3.97	16.20
Internet security risk	9	4.04	3.52	14.22
The concern for user privacy	10	3.09	3.69	11.40
Failing to hit the payoff rock bottom of the new mobile service	11	2.97	3.77	11.18
The compatibility of the evolutional communication equipments	12	2.83	3.84	10.88
Failing to control the operation cost effectively	13	2.82	3.17	8.93

The risk matrix is widely praised and has been adopted as a simple but effective approach to risk management. The risk matrix can provide a clear framework for a systematic review of the rationale of risk rankings and priority settings[9]. Using the data from empirical results, a 2 × 2 risk matrix was drawn to vividly describe the attribute of the risk factors. A 2 × 2 risk matrix was constructed by labeling one axis as "probability" and the other axis as "loss". The risk factors were placed in the four quadrants according to their level of probability and loss. We chose the mean level of all of the risk factors as the boundaries between the low and high values for each axis. The northeast end of the risk matrix represented the largest risk exposure with risk factors being both high probability and high loss. The risk matrix can be used as one component in informing eventual risk management decisions. The risk matrix of the 13 risk factors is presented in Figure 2.

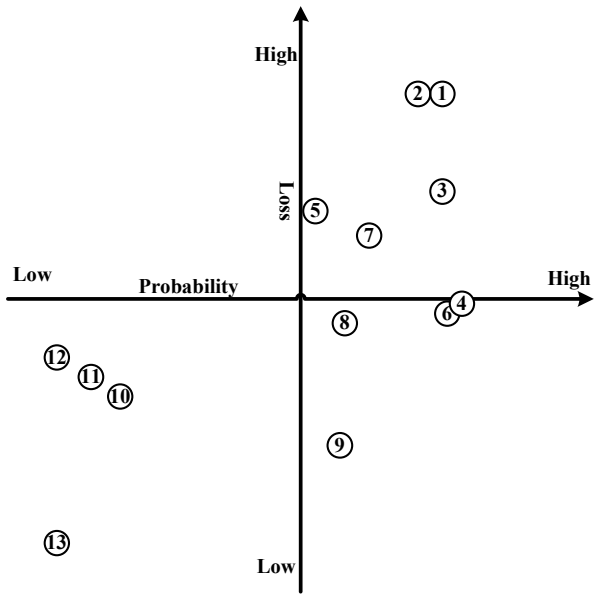

Figure 2 : A risk matrix of the mobile commerce risk factors

Each risk factor is marked as a dot with a serial number, which represents the final rank of the risk factor in round 3. As shown in Figure 2, 5 of the 13 risk factors are distributed in the first quadrant. These factors can be recognized as critical risk factors. Four risk factors are in the third quadrant, and these factors are of less importance as compared to the risk factors in the first quadrant. Four factors lie in the fourth quadrant, and these could be viewed as somewhat less possible but hazardous risk factors.

Drawing the risk radar according to SCP model

The structure-conduct-performance (SCP) paradigm was developed by the Harvard School of Thought and was popularized by its empirical work involving the identification of correlations between industry, structure and performance[4]. According to the SCP model, an industry's performance depends on the conduct of its firms, which in turn depends on the structure of the industry. The structure of the industry depends on the basic conditions[5]. Thus, the top 10 risk factors listed in TABLEs 3 and 4 could be divided into three risk dimensions: the macro-environment risk (risk of the basic conditions level), industrial risk (risk of the industry structure level) and operational risk (risk of the firm's performance level).

The dimensions of macro-environment risk are economic risk (the lack of 3G consumption capacity), political risk (the stability of the government communications policy), technological risk (internet security risk) and social & cultural risk (the concern for user privacy). The dimension of industrial risk includes competition with other MNOs (the decline in the ARPU caused by the price war among the MNOs), cooperation with SPs (the irregular action of SP) and cooperation with manufacturers (the dissension over profits distribution with the equipment providers). The operational risk dimension includes cost management risk (huge investment in the construction of the 3G infrastructure), consolidation risk (the harmonization of business recombination and acculturation) and market risk (escalating trend of the user growth rate).

To visualize the top 10 risk factors of mobile commerce, a risk radar was drawn according to the dimensions of the SCP model. Each risk factor is dotted in the risk radar according to its risk exposure. The risk factors with large risk exposures are dotted in the periphery region, and the risk factors with small risk exposures are dotted in the interior region of the risk radar. The risk radar is shown in Figure 3.

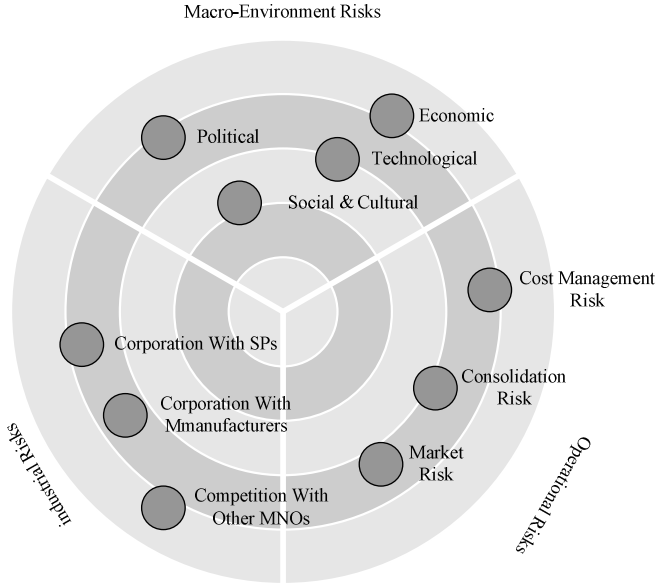

Figure 3 : The risk radar of mobile commerce

Expanded commentary of risk factors

The discussion of the top 10 risk factors of mobile commerce is listed below by quoting the participants' original descriptions, like the practice of Addison (2003). The qualitative descriptions were developed during the third stage of the Delphi process in which each expert explained the reasons they think the risk factors were important. Using the expanded commentary, we could identify the consequences of the risk factors, why these risk factors appear in China now and the details of the risk factors.

1) The decline in the ARPU caused by the price war among the MNOs

"The mobile network operator should decrease the charge of 3G service to attract more consumers; this may be the key to the success of 3G businesses." -[China Mobile]

"The charge adjustment of the 3G service is close to the threshold for 3G to take off in China, especially in some area filiales." - [China Mobile]

"The mobile service among the operators is very homogenous at present; increasing the consumer scale is the key to becoming the leader of the mobile operators, so there are many subsidies and binding policies from the mobile services for the consumers to choose." -[China Unicom]

2) The lack of 3G consumption capacity

"Similar to the development of SMS, there is still a long period until the consumers adjust to the new demand and the presence of 3G service; thus, 3G would not be popular before 2012 in the run-in period of the present time." -[China Mobile]

"Usually it takes 2-3 years to build a mature telecommunication network. The new mobile service is based on new technologies and will face obstacles, including poor communication quality that may occur when building and creating these services, which may cause problems among high-end users." -[HUAWEI]

"3G service failed to reach the operators' expected consumer scale in 2009. Most mobile phone users are still the low-end users at present; they are price sensitivity and do not have sufficient consuming ability to reach the high-value 3G service." -[China Mobile]

3) The stability of the government communications policy

"Considering the importance of the telecommunications industry to the whole national economy, the telecommunication industry is still going forward under the government administration and accommodation while seeking a certain extent of profit." -[Office of Information Industry in Hubei]

"The aftereffect of telecommunication business recombination is still being watched, and this may beget new accommodation policies if unexpected aftereffect appears. Because the governments' stimulus initiatives mainly focus on TD-CDMA because it is independent intellectual property, the predilection for China Mobile is obvious in the government regulation policies." -[China Unicom]

"The probability of sharing the network and phone number between MNOs, the roaming fee adjustment, and the market share accommodation are the uncertain factors that the mobile network operators always face these years." -[Academics]

4) Huge investment in the construction of the 3G infrastructure

"The three mobile network operators of China are falling somewhere on a stress pendulum; they are between cash burn and cash earn when pushing 3G in recent years." -[HUAWEI]

"Guaranteeing the communication quality is increasing the pressure of cost management when improving 3G infrastructure. However, consumers appear reluctant to pay a premium for high quality network access in present." -[China Mobile]

"Forecasting returns from 3G infrastructure investment is an inherently uncertain exercise; thus, the concern about the reliability of forecasts regarding returns on 3G infrastructure investment is reasonable." -[Academics]

5) The harmonization of business recombination and acculturation

"The three mobile network operators were formed by a recent revolution and restructuring launched in 2008. Time is needed for the business recombination and acculturation of the newly combined companies like China Telecom." -[China Mobile]

"The mobile network operators in China are undergoing post-merger integration and overseas expansion, but the cultural and compliance challenges after acquisition are often inevitable." -[China Unicom]

"The merger of China Unicom and China Netcom has been delayed for several months due to conflict between the management teams." -[China Unicom]

6) The irregular action of SPs

"Years of squeezing SPs to extract better terms and profits distribution have resulted in the disobedience or noncompliance of these restrictions by SPs; these restrictions contain many terms telling SPs what content cannot be transmitted and how to charge the consumers." -[China Unicom]

"If the mobile network operators cannot effectively manage and regulate the relationship with SPs, they will be at risk for damaging their reputation for the clients' compliments." -[China Mobile]

"Some illegal SPs sometimes quietly deduct fees from the clients without the notifying the users, angering the customers. This should be strictly regulated by MNO." -[China Unicom]

7) The dissension over profits distribution with equipment providers

"Usually the mobile network operators want to recover the investment in less than three years, so they fear losing the dominant pricing power among 3G network equipment suppliers such as HUAWEI or ZTE." -[ZTE]

"China Mobile is expanding their own in-house smartphone, OPhone, in order to become less reliant on the equipment manufacturers such as Apple." -[China Mobile]

"While China Mobile is launching OPhone, Apple Inc. has no choice but to agree to grant China Unicom the majority share of revenues regarding the introduction of iPhone to China." -[China Unicom]

8) Escalating trend of the user growth rate

"In the struggle to attract the clients, a fiercest competition is occurring among the three mobile network operators. The incentives of new entrants are now convincing customers to switch from one network to another." -[China Mobile]

"Chinese mobile customers often show little brand loyalty and are much more likely to switch networks in pursuit of the lowest price." -[China Unicom]

"MNO/SP need to balance two conflicting targets: retaining clients and increasing the price for 3G service. This could be recognized as a conflict of increasing their market share and improving their financial performance." -[China Unicom]

9) Internet security risk

"Without effectively regulating the industry-wide business standards for mobile commerce service or content providers, consumers would risk losing money through fraud, merchant disputes or processing mistakes." -[Academics]

"The business ethics for mobile commerce service providers or content providers is so poor that the customers are very cautious when paying for the mobile service." -[China Unicom]

"There is much illegal and disgusting information provided or transmitted by the mobile commerce service providers and content providers in their pursuit of income." -[Office of Information Industry in Hubei]

10) The concern for user privacy

"A significant number of mobile commerce customers are somewhat concerned about their security problems when using mobile payment." -[Academics]

"Many consumers have voiced concern over the privacy, which could hinder the mobile service adoption." -[Academics]

"MNO/SP should have a transparent privacy policy that accurately describes what will be done with the information a user provides." -[Office of Information Industry in Hubei]

THE COMPARISON OF RISK FACTORS BETWEEN CHINESE AND GLOBAL DATA

There are few studies that examine the possible implications of cultural differences on the mobile industry[21]. In this section, a comparison of the top ten risk factors for mobile commerce that were identified for the China and the global market is discussed. Because there are no other academic papers in this area, the global data on mobile commerce risk was provided by the Global Telecommunications Center of Ernst & Young[30], which acts as a hub to serve the fast-growing demands of the telecommunications industry. The comparison results are shown in TABLE 5.

TABLE 5 : A comparison of the mobile commerce risk factors between China and the global market

The list of mobile commerce risk factors (china)	Sorting Order (china)	Sorting Order (global)	The list of correspondence global mobile commerce risk factors
The decline in the ARPU caused by the price war among the MNOs	1		
The lack of 3G consumption capacity	2	4	Failure to generate sustainable cash flows from new business models
The stability of the government communications policy	3	2	Regulatory risks
Huge investment in the construction of the 3G infrastructure	4	3	Inaccuracy in forecasting returns from technology and infrastructure investments
		10	Inability to contain and reduce costs
The harmonization of business recombination and acculturation	5	5	Inability to manage consolidation and M&A
The irregular action of SP	6		
The dissension over profits distribution with the equipment providers	7	8	Poorly-managed strategic partnerships
Escalating trend of the user fluxion rate	8	1	Losing ownership of the client
Internet security risk	9		
The concern for user privacy	10	9	Privacy and security risks
		6	Attracting and managing talent and intellectual capital
		7	Inappropriate processes and systems to support new business strategies

As shown in TABLE 5, there are 8 risk factors in the global telecommunication industry that have similar meanings as compared with the top 10 risk factors derived from the Chinese experts in this study. They are arranged in pairs in TABLE 5. In particular, the risk factor of poorly managed strategic partnerships, which appeared in the Ernst & Young report, has two Chinese risk factors with similar meaning: the irregular action of SPs and the dissension over profits distribution with equipment providers. Furthermore, the Chinese risk factor of huge investment in 3G infrastructure construction has two

similar risk factors in the Ernst & Young report: inaccuracies in forecasting returns from technology and infrastructure investments and the inability to contain and reduce costs. We can be reasonably certain that these risks are important, regardless of the perspective.

However, there are two Chinese risk factors that are not covered in the global telecommunication risk report: the decline in ARPU caused by the price war among the MNOs, and the internet security risk. There are two risk factors in the Ernst & Young global risk report that are not covered in the list of risk factors in China: attracting and managing talent as well as Inappropriate processes and systems to support new business strategies.

When considering the meanings and rank of each risk factor, cooperation and profit distribution in the value chain (including the SP, equipment provider and MNO) is a very important risk factor in China. Also, the risk factors involving 3G are given more attention in China as compared with the Ernst & Young risk report on global mobile commerce.

The political and business environment in China could explain why the findings of this Delphi investigation differed with the Ernst & Young global survey of risk factors for mobile commerce. First, China is experiencing a restructuring in the telecom industry, and 3G is rapidly expanding during this period. China entered the 3G first year in 2009. Three mobile network operators are increasing their 3G network construction, expanding 3G services and promoting mobile broadband service for individuals, families and corporate customers[23].

Second, competition among mobile network operators is growing in order to entice more customers to switch to the 3G service. Chinese consumers have relatively little brand loyalty to MNOs – 54% would switch carriers to obtain a 3G handset. The competition in the 3G market share is lowering the profitability of MNOs[23].

Third, most countries in the Europe and America have completed the transformation of the traditional telecom companies from state-owned to private ownership, which is still occurring for the mobile commerce industry in China. In China, the government will continue to influence and supervise the mobile commerce industry by means of administrative regulations for a long period.

CONCLUSIONS AND IMPLICATIONS

This paper reports the use of the Delphi method to identify the risk perspectives of mobile commerce. The consistency of the ranking of the risk factors was achieved after three rounds of evaluation by 27 experts. These factors are as follows: 1) the decline in the ARPU caused by the price war among the MNOs; 2) the lack of 3G consumption capacity; 3) the stability of the government communications policy; 4) the huge investment in 3G infrastructure construction; 5) the harmonization of business recombination and acculturation; 6) the irregular action of SPs; 7) dissension over profit distribution with equipment provider; 8) the escalating trend of the user growth rate; 9) internet security risk; and 10) the concern for user privacy. A risk matrix was constructed by calculating the risk exposure of each risk factor. The top 10 risk factors were divided into 3 risk dimensions: macro-environment risk, industrial risk and operational risk. A risk radar was generated according to the SCP model. Finally a comparison of the top 10 risk factors in the Chinese and the global markets was conducted with the finding that cooperation risks in the value chain and the risk factors involving 3G should be given more attention in China.

There are some limitations in this study. First, as is the case with all Delphi studies, the expert panel has to be statistically representative. However, the experts in this study were mainly members of the Alumni Association of Huazhong University of Science and Technology, which likely caused some localization of the expertise. Other risk factors for mobile commerce could have been identified if other experts participated in this study.

Second, presenting randomized risk factors at the ranking and rating stage cannot force the respondents to reconsider the group's viewpoint. Therefore, a well-ranked risk list that is based on the opinion of the prior round is presented to the expert panel. However, a well-ranked risk list may be too easy to generate a consensus if the respondents are affected greatly by a group's opinion. This list could cause some unpopular but important opinions to be lost in the investigation process. Choosing a well-ranked or randomized list remains a problem to be addressed for the ranking-type Delphi method.

Implications for research

The study reported here is the first academic paper to examine the risk factors in the mobile commerce industry. This research explored the similarities and differences in the perceptions of risk between the Chinese and global markets. This study expanded the risk dimensions of mobile commerce risk management. Compared with earlier papers on mobile commerce risk management that used case studies and sensitivity analyses, the Delphi method used in this study provides a comprehensive risk overview of all aspects. In addition to the five dimensions of regulatory risk, technological risk, market risk, cost management risk and social & cultural risk, another five risk dimensions were found, including economic risk, consolidation risk, cooperation with SPs, competition with other MNOs and cooperation with manufacturers. This means that MNOs and SPs should pay attention to risks at the industrial level and other invisible aspects as well as the risks directly related to the performance and social focus. The results call for additional studies on the risk dimensions of these fields.

In this study, the experts were asked to identify the risk factors from an overall industry perspective, which is the only perspective in this investigation. The perceptions of risk factors can be different if the investigation is conducted from another perspective. An extension of our research would be to examine and compare other risk perspectives, such as different participants in the mobile commerce value chain and different mobile services. In particular, it would be interesting to examine whether the perceptions of risk factors in the mobile commerce industry will be different in other countries.

Implications for practice

3G telecommunications is rapidly growing in China. This paper presents a comprehensive risk assessment to meet the needs of Chinese MNO/SP managers, who should strike a balance between avoiding risk and seizing opportunity. Without a comprehensive understanding of the risk factors, no growth strategy will be truly sustainable and reliable. Understanding the top 10 risks highlighted in this paper will help MNOs and SPs succeed in taking their businesses forward. The stockholders of MNOs and SPs in China can make use of this risk assessment to be aware of where risks may originate and to adjust assets allocation according to their risk appetite and risk tolerance.

The revenue of telecommunications and the number of subscribers in China are growing rapidly. This growth is expected to continue in the near future. China will remain committed to the development of an open economy, and the Chinese mobile commerce industry could be of great interest for international investors. It is essential to assess the risks that may occur in regards to deciding on an investment. The comparison of the mobile commerce risks for the Chinese and global markets in this study may help to achieve a full understanding of the risk characteristics in China.

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