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An analysis of the barriers to the proliferation of M-commerce in Qatar: A relationship modeling approach

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A relationship modeling approach

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Abstract

Purpose – The purpose of this paper is to identify and develop a hierarchical model for the barriers affecting the growth of mobile commerce (M-commerce). Based on the model developed, the authors' objective is to identify those variables that are of strategic nature and are the root cause of the issue.

Design/methodology/approach – Variables considered as barriers are identified, and utilizing the interpretive structural model approach, a relationship model is developed. Further, the impact matrix cross-reference multiplication applied to a classification approach is used to analyze the effect and dependence among these factors.

Findings – The research in the area of M-commerce in the Arab world and related to the strategic aspect is limited in the extant literature. The present study tries to fill this gap by investigating the variables that inhibit the growth of M-commerce in Qatar. The research shows that there exists a group of barriers having a high driving power and low dependence requiring maximum attention and of strategic importance, while another group consists of those variables that have high dependence and are the resultant actions.

Practical implications – There is a growing concern that although the numbers of mobile subscribers are increasing at a very fast pace in Qatar, actual M-commerce activities in the country remain low. The findings of this study can be used to understand the differences between the independent and dependent variables and their mutual relationships. The study would also help the policy makers to develop suitable strategies to facilitate growth of M-commerce in the country.

Originality/value – This research was the first attempt to investigate the relationships among the variables inhibiting the growth of M-commerce in a fast-growing economy in a Gulf Cooperation Council (GCC) region. Given that there is limited research on M-commerce in the GCC context, the study can be viewed as an investigation that provides a good understanding of the variables and their interrelationships affecting M-commerce proliferation.

Keywords Qatar, M-commerce, Interpretive structural model

Paper type Research paper

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1. Introduction

The fast proliferation of mobile devices coupled with continually enhanced capabilities has facilitated the growth of mobile commerce (henceforth M-commerce). Today M-commerce technology is recognized as the one that is changing the way business is conducted (Faqih and Jaradat, 2015). Viewed as an extension of e-commerce by some researchers (Ngai and Gunasekaran, 2007 and Wei *et al.*, 2009), M-commerce can be understood as the group of Web-based applications and services that help the public to carry transactions using the mobile phones/devices (Sadeh, 2002). But researchers like Feng *et al.* (2006) and Chong (2013) consider M-commerce as a phenomenon which has its own business models not available in the e-commerce platform. Thus M-commerce can be defined as:

> […] any transaction involving the transfer of ownership or rights to use goods and services, which is initiated and/or completed by using mobile access to computer-mediated networks with the help of an electronic device (Tiwari and Buse, 2007).

M-commerce can also be understood as a gateway for companies, customers, suppliers, partners and other market players to perform their day-to-day business in a convenient and customized way using the mobile phone technology (Keen and Macintosh, 2001). It can be perceived as a common platform for all the participants to perform the transactions in a flexible way or as a concept that allows the set of tasks like transfer of funds, payments, trading, exchanging, etc. using apps like mobile banking, which in turn facilitates time minimization and remote access (Liu *et al.*, 2009). M-commerce offers myriads of opportunities in a developing economy like Qatar. The number of mobile subscribers in Qatar breached the 3 million mark in 2013, with the country counting a total population of 1.9 million people. The two mobile operators in Qatar, Ooredoo and Vodafone, have experienced a double-digit growth. Regarding the sales of smartphones in Qatar, the country is considered among the leading Mideast countries with the highest per cent of smartphones users. Around 75 per cent of mobile phone users own smartphones, and most of them between the ages of 18 and 35. The sales of smartphones have increased in the past six months, and Qatar recorded the largest year-on-year handset shipments growth, by 32 per cent.

Researchers have utilized technology acceptance model (TAM) or a modified TAM to understand M-commerce in various settings (Chong, 2013). But a stream of researchers like Venkatesh *et al.* (2012) and Barki (2007) contend that TAM has its limitations in explaining many issues related to M-commerce. According to Liu *et al.* (2009), TAM has an inability to describe the behavioral aspect of a customer in various situations. Similarly, Straub *et al.* (1997) reveal that application of TAM does not reap much in the study conducted in Japan.

Ho *et al.* (2008) observed that though M-commerce looks like electronic commerce on the Internet platform and possesses many similarities, M-commerce did not gain the same prominence on par with e-commerce over the years. Because of the dearth of information required to process the tasks successfully, many people still stick to computer-based apps than mobile-based apps (Sarker and Wells, 2003).

Research on M-commerce suggests that the adoption of M-commerce in developing countries is dependent on a different set of variables as compared to the developed nations (Crabbe *et al.*, 2009; Yaseen and Zayed, 2010). Majority of the existing research has mainly focused on the technological aspects of M-commerce (Ahluwalia and Varshney, 2007), and

there are few studies that provide directions on issues like applications and strategies of M-commerce. Also, there is a growing concern that although the numbers of mobile subscribers are increasing, actual M-commerce activities in many developing countries remain low. This means that mobile consumers are only using their mobile phones to surf the Internet and listen to music, and the widespread usage of M-commerce, where consumers conduct transactions for goods or services using their mobile phone, remains low (Chong *et al.*, 2011). This is true for Qatar, even with a fast pace of smartphone adoption, only 10.2 per cent of online spending is done using smartphones.

2. Barriers inhibiting M-commerce adoption

There is a paucity of research investigating the adoption of M-commerce in particular, and in the Arab world, which appears to be lagging behind in the adoption of M-commerce due to different reasons and variety of barriers (Faqih and Jaradat, 2015). This is even true for Qatar, which is experiencing a huge surge in the mobile subscribers' base, but the transactions using a mobile device still remain low. This leads to the hypothesis that there exist few barriers that inhibit the growth of M-commerce in Qatar. The present study would try to understand these variables by developing a hierarchy-based model based on the interrelationships among the variables considered as barriers. To achieve the major objective, first, a comprehensive literature review is conducted and experts' opinion is sought to develop a list of barriers. Based on the comprehensive literature review and experts' opinion, 15 variables were identified as barriers to the proliferation of M-commerce in Qatar. These barriers are discussed in the following paragraphs.

2.1 Customer's anxiety about technology

It is very important to discuss this factor in the context of adopting any new technology, regardless of the gadget. Referring to Bandura's (1986) Social Cognitive Theory, Huang and Liaw (2005) mentioned that the apprehension to use new technology can be understood as anxiety, and this factor is found to have an inverse relationship with practicing any new methodology, in particular, mobile trading. The successful acceptance of any new environment or technology mostly depends on the individual's beliefs and confidence. The level of confidence a person possesses influences his response toward any system (Venkatesh and Davis, 1996). Compeau *et al.* (1999) illustrates that when a person encounters a new domain or system, where he lacks the required skill set, the individual gets anxious. Alda's-Manzano *et al.* (2008) drafted that lack of innovation discourages the individuals from accepting new features and new application. So, addressing the root cause of the problem can aid in dispersing the M-commerce market. It is also supported by many studies that the outcome of the thought process of the customer can reduce the anxiety and improve their level of acceptance (Lu and Su, 2009). To understand such a thought process, intuition-based analysis would be of much help, instead of empirical investigations. Because, empirical investigations cannot reveal the requirements of the customer, and hence, it becomes an impediment to embrace M-commerce and, therefore, it cannot be resolved successfully (Vittet-Philippe and Navarro, 2000).

2.2 High operation cost

Carlsson and Walden (2002) opined that high cost of Internet service coupled with other installation costs creates a big setback in using M-commerce. The cost factor involved in the process of providing the mobile banking or trading facility not only affects the

customer but also the service provider. If and only if the services, in particular Web-based services, are maintained and enhanced from time to time, with high operational costs, can customers rely on the vendor or company (Liu *et al.*, 2009; Anckar *et al.*, 2003). This is a risk for the vendor. From the study on benefit–cost perspective about the mobile banking system, Shen *et al.* (2010) disclose that the customer always considers the tradeoff between cost and benefit and accordingly takes a decision; therefore, the need of the hour is to conduct meticulous analysis of market and customer requirements for diminishing the operational cost (Mahatanankoon *et al.*, 2005).

2.3 High initial cost

Liu *et al.* (2009) conclude from their study that, in general, the middle-income group population being high, expressed the most bothering view that having the mobiles that are compatible with online banking service needs high initial costs. This has to be considered as a prerequisite by the service providers, while expecting response from the customer group and aim at cost reduction. It is augmented by Feng *et al.* (2006) that according to customer's view, the major apprehension for adopting M-commerce is high initial investment on the technology or related gadgets. A Brazil-based study on the online respondents done by Cruz *et al.* (2010) conceived that along with the cost to customer, cost of Internet installations is acting as a setback in the mobile-banking scenario. Based on an analysis done in Finland, Anckar *et al.* (2003) concluded that one of the reasons for public rejection of M-commerce is the high initial investment (Feng *et al.*, 2006).

2.4 Low-performance of mobile services

The efficiency of the electronic gadget attracts and encourages the users. A good example is the case of the mobile phone. Customer response will be more toward the devices which support all applications in a perfect manner. Mahatanankoon *et al.* (2007) augment based on the survey that the reason for the lower response of M-commerce is the inefficiency of the electronic device. The low screen resolution of mobiles discourages the users and causes ambiguity in understanding the information displayed during the process of performing the trading operations (Venkatesh *et al.*, 2003). The low processing capacity and improper input/output mechanisms restrain consumers from using the M-commerce facility (Lee and Benbasat, 2003).

2.5 Device inefficiency (small screen/poor user interface)

Carlsson and Walden (2002) opined that high cost of Internet service coupled with low screen resolution of mobiles discourages the users, because this causes ambiguity in understanding the information displayed during the process of performing the trading operations. As the major non-accruing aspects for spread of usability of M-commerce include lack of user-friendly interfaces for e-business, less effective usage of applications and other services, the manufacturers should address these issues for expanding the M-commerce market (Vrechopoulos *et al.*, 2002). Apart from the above, few other factors like inadequate capacity of the mobile devices and hence slow Internet speed are considered as crucial impediments for online commerce usage (Furnell and Karweni, 1999).

2.6 Slow connection and/or data transfer

Carlsson and Walden (2002) in a study revealed that the relatively slow pace of Internet speed and the restricted size of the mobile screen form the core road blocks for M-commerce growth. Though an exponential growth is observed in mobile device

technology (Dholakia *et al.*, 2003) their limited capacity to perform data transfer coupled with slow internet connectivity and time-consuming Internet speed are perceived as major barriers.

2.7 Poor coverage of networks

The work done by Anckar *et al.* (2003) reveals that the factor network coverage and speed are found to have an inverse relationship. That is, if poor network facility prevails, the confidentiality of the customer's data will be at stake. The better the network accessibility and user-friendliness of mobile devices, the better would be the utilization of M-commerce. Ketkar *et al.* (2000) in their study in India about the mobile banking influences mention a list of barriers to M-commerce usage. It is discussed that the adoption of mobile payments and usage of payment systems have failed to capture the majority of masses because of the vendor's and merchant's network systems. Even from the perspective of the customer, the decision to use the mobile payment service portal is mainly dependent on their respective network efficacy (Mallat, 2007).

2.8 Privacy intrusion

In the wired e-commerce *modus operandi*, data security and privacy are considered critical factors (Furnell and Karweni, 1999). Many scholars highlighted that there is a dearth of privacy for the customers accessing the Web-based information, and hence, it forms a pivotal bottleneck for the growth of Internet trading, especially through mobile devices (Feng *et al.*, 2006). Zhang *et al.* (2002) from a study to elucidate the driving forces for M-commerce success mention that privacy is crucial for location-based services. Therefore, customers use mobile phones to access the information about the facilities in their corresponding locality using location-based services like information, and in such cases, privacy was identified as a prime factor by the customer.

2.9 Lack of security

The concerns of the end-user revolve around the security regarding money and personal information being sent across to another domain/portal. These issues crop up due to the lack of a user-friendly approach while performing the transactions (Compeau and Higgins, 1995). Shen *et al.* (2010) through the cost–benefit framework felt that despite the great advantage M-commerce is providing, consumers are more concerned about the security of the data and transaction. Data security, personalization, transmission rate and user-friendliness are identified as crucial factors for the use of mobile services (Buellingen and Woerter, 2004). Various studies highlighted the main concerns about the security of data (Langendoerfer, 2002). In the wired e-commerce *modus operandi*, data security and privacy are considered as critical (Furnell and Karweni, 1999). Apart from the routine security services, provision of additional checks while accessing e-mails and data transferring options over the Internet are a must to increase the customer's response (Mahatanankoon *et al.*, 2005). It is also added that to alleviate the *angst* of performing transactions over the mobile from the perspective of security and privacy, customization strategies are to be adopted.

2.10 Lack of trust/reliability

For acceptance of any service by the customer, trust or reliability about the service provider is the antecedent. This intensity is more in the situations where money is involved. The reliability fostered among the customer group influences the thought

process of the customer regarding the ease and usefulness of the facility (Liu *et al.*, 2009). In their study, Anckar *et al.* (2003) listed out various stumbling blocks for the spread of M-commerce, which are technology, industry standardization, safety and trust (Gillick and Vanderhoof, 2000; Li, 2002; Langendoerfer, 2002), disbelief about the product and value as per the customer (Zeithaml, 1988; McDougall and Levesque, 2000). For reaping more benefits from M-commerce, banking organizations also should take the initiative to encourage the customers by organizing open seminars and workshops in the vicinity of the public (Lu and Su, 2009; Balaji *et al.*, 2013). This lead can groom the people's trust toward the services of the service providers and can create a sense of concern for them.

2.11 Perceived risks

Authors accorded that the consumer behavior is largely influenced by the perceived risks (Park *et al.*, 2004). Feng *et al.* (2006) mention that, in the view of customers, the factors that bring cost to customers and, therefore, lead to apprehensions for adopting M-commerce include lack of customization and incompatibility with the cultural and sentimental aspects. It is perceived by Shen *et al.* (2010) that the risk involved in using mobile phones for monetary transactions is of great concern, as it consists of security issues and the privacy of user is at stake. Luo *et al.* (2010) list out different types of risks involved in the process of mobile banking for all the stake holders, namely, performance, financial, time, psychological, social, privacy, physical and overall risks. Yu (2012), referring to the work of Laukkanen *et al.* (2007), grouped the inhibitors of the mobile banking technology into five heads, namely, handling, worth, threat, practices and image barriers. The study done by Cruz *et al.* (2010) considering the online respondents in Brazil reported that the perceived risk by the user posed as a problem in using mobile trading. An augmentation to this version is done by Yu (2012). Carlsson and Carlsson (2005) conclude from the study done in Austria and Finland that paucity of mobile apps with user-friendliness is the reason for insufficient penetration of M-commerce in the market.

2.12 Lack of computer and new technology skill

It is widely felt by researchers that people with erstwhile knowledge of computers and the related technologies tend to be comfortable with the operation of Internet-based services and so in the case of mobile banking (Karjaluoto *et al.*, 2002). As per Daniel (1999), one of the barring features for the customers to accept Internet banking is not having the required computer skill set. This has multiple impacts on the behavioral, technical and knowledge aspects of the customer. Hirschman (1980) states that having previous expertise with the mobile artifact assortment (software or hardware) makes them accept the new features of mobile technology and hence mobile trading. Harma and Dubey (2009), based on their study on 1,540 individuals regarding the non-usage of mobile banking, found that people with higher age and lower education, people who are farmers and village entrepreneurs and people retired from their services lack the technical skill and so are not keen on using the advanced facilities of mobile banking like M-commerce.

2.13 Incompatibility with existing technology

Another important aspect which discourages the customer from using the M-commerce facility is given by Pavlou (2002). It is mentioned in the work that the more new and advanced technologies arise, greater would be the uncertainty in the success of the service catered to the customer. The reason behind this is the compatibility of the new technology with the existing system (mobile or technology). By and large, the merchant

group constitutes the most vital part in the customer group of M-commerce adopters. Mallat and Tuunainen (2005) infer from their work that the mobile trading system is in its infancy and, therefore, customers are facing trouble while performing monetary transactions through mobile phones. The key factor identified is the compatibility issue of the new and old, be it the gadget or technology.

2.14 Low awareness of M-commerce and its benefits

Luo *et al.* (2010), from their research on multidimensional risk and multi-faceted trust, articulate that to a major chunk of customers, awareness levels about the comfort and ease of mobile banking technology are very low. Unlike the trust component, not having awareness makes the customer refrain from the usage of new inventions of technology. Harma and Dubey (2009) also support this by saying that because of the transparency in operations and methodology, the much prevailing awareness problem can be addressed. As the process of accepting M-commerce (mobile banking or mobile shopping or mobile ticketing) depends on the customer attitudes and perceptions, it is the duty of the service providers to pacify the criticality and bring this facility close to the multitude as per their requirements (Joubert and Belle, 2009). Also, educating the customers through efficient modes and delivering handouts for better understanding of operations involved in optimum performance of mobile trading has been identified as the need of the hour.

2.15 Complexity of technology

In addition, the factors like illiteracy of the applications that are mushrooming day-by-day (Liou, 2008), discrepancies between the mobile Internet and conventional Internet and others (Strong and Old, 2000; Anckar *et al.*, 2003) can prevent the people from using the online payment system through mobile devices. A study done on US consumers produced results that the consumers are not very keen on using the mobile banking facility because of the complexity involved in the process, which is in contrast to the situation prevailing in Asian countries (Venkatesh *et al.*, 2003). The technology itself is perceived as a barrier by the researchers because lack of synchronization between network connectivity and the capacity of mobile phones can lead to a big problem for the M-commerce adopters, rather non-adopters (Anckar *et al.*, 2003). In addition to the above, certain supportive decisions on investments, feasibility and viability of the business model adapted to design and develop mobiles and networks and the relevant services which cater to the concerns and queries of mobile customers are considered in depth to enhance the M-commerce. By considering all the above facts, it is deemed to be a necessity to improvise the technology on a user-friendly perspective to enable the customers to accept M-commerce. Otherwise, banks focusing on infrastructural development alone would be mopping the floor, keeping the tap open. Table I presents the list of barriers for M-commerce as discussed above, with supporting references in literature.

3. Research methodology and objectives

Based on extensive literature review and experts' opinion, 15 barriers to M-commerce were identified, as listed in Table I. For developing a structural relationship among these barriers and to find the prominent barriers that hinder the spread of M-commerce reachability among mobile device users, the interpretive structural model (ISM) is used.

Serial no.	Barriers of M-commerce	Supported by
1	High operating cost	Anckar *et al.* (2003); Wei *et al.* (2009); Feng *et al.* (2006); Carlsson and Walden (2002); Mallat and Tuunainen (2005); Mattila (2003); Suoranta *et al.* (2005); Harma and Dubey (2009); Yu (2012); Ketkar *et al.* (2012)
2	High initial cost	Anckar *et al.* (2003); Wei *et al.* (2009); Feng *et al.* (2006); Wu and Wang (2005); Yu (2012)
3	Low performance of mobile services	Lee *et al.* (2003); Laukkanen and Cruz (2008)
4	Device inefficiency (small screen/resolution/poor user interface)	Anckar *et al.* (2003); Mahatanankoon and Vila-Ruiz (2007); Lee and Benbasat (2003); Venkatesh *et al.* (2003); Feng *et al.* (2006); Carlsson and Walden (2002)
5	Slow connection and/or data transfer	Anckar *et al.* (2003); Wen and Mahatanankoon (2004); Carlsson and Walden (2002); Mahatanankoon *et al.* (2005); Mattila (2003); Suoranta *et al.* (2005)
6	Poor coverage of networks	Anckar *et al.* (2003); Wen and Mahatanankoon (2004); Lee and Benbasat (2003); Laukkanen and Cruz (2008); Ketkar *et al.* (2012); Ho *et al.* (2008)
7	Privacy invasion	Anckar *et al.* (2003); Feng *et al.* (2006); Carlsson and Walden (2002); Wu and Wang (2005); Laukkanen and Cruz (2008)
8	Lack of security	Shen *et al.* (2010); Harma and Dubey (2009); Liou (2008); Ketkar *et al.* (2012)
9	Lack of trust/reliability	Feng *et al.* (2006); Carlsson and Walden (2002); Mahatanankoon *et al.* (2005); Lee *et al.* (2003); Laforet and Li (2005); Mattila (2003); Wu and Wang (2005); Shen *et al.* (2010); Ketkar *et al.* (2012); Ho *et al.* (2008); Luo *et al.* (2010)
10	Perceived risks	Lee *et al.* (2003); Koenig-Lewis *et al.* (2010); Laforet and Li (2005); Mattila (2003); Suoranta *et al.* (2005); Im and Ha (2013); Harma and Dubey (2009); Laukkanen and Cruz (2008); Liou (2008); Khraim *et al.* (2011); Luo *et al.* (2010)
11	Lack of computer and new technology skill	Laforet and Li (2005); Mattila (2003); Harma and Dubey (2009);Liou (2008)
12	Complexity of technology	Carlsson and Walden (2002); Mallat and Tuunainen (2005); Mahatanankoon *et al.* (2005); Mattila (2003); Suoranta *et al.* (2005); Laukkanen and Cruz (2008); Khraim *et al.* (2011); Ketkar *et al.* (2012)
13	Incompatibility with existing business	Mallat and Tuunainen (2005); Laukkanen and Cruz (2008)
14	Unawareness of M-commerce and its benefits	Laforet and Li (2005); Wu and Wang (2005); Harma and Dubey (2009); Teo *et al.* (2005); Mahatanankoon and Vila-Ruiz (2007)
15	Customer's anxiety about technology	Lu and Su (2009); Balaji *et al.* (2013); Shen *et al.* (2010); Harma and Dubey (2009)

Table I.
Barriers for mobile commerce

3.1 ISM methodology

The ISM approach is a technique widely used to identify and summarize contextual relationships among various elements of the system (Ahuja *et al.*, 2009; Singh, 2011). Introduced by Warfield (1974), ISM is a qualitative and interpretive method which

derives possible solutions for complex problems through discussions based on the structural mapping of complex interconnections of elements (Pfohl *et al.*, 2011; Watson, 1978). ISM allows as interactive learning practice as well as transforms unclear, poorly articulated models into visible, well-defined models for wide applications (Talib *et al.*, 2011a; Sage, 1977; Singh, 2011). Moreover, it is referred as a group learning process but can also be used individually (Govindan *et al.*, 2012; Diabat *et al.*, 2013, Al-Zaabi *et al.*, 2013). ISM further allows researchers, decision makers and managers to gain in-depth understanding of the relationships among prominent issues. Sagheer *et al.* (2009) applied the ISM methodology on food standards in India. Faisal and Al-Esmael (2014) utilized this approach to effectively model the enablers of organizational commitment in Qatar, while Wang *et al.* (2008) applied the ISM and the impact matrix cross-reference multiplication applied to a classification (MICMAC) approach to identify and classify barriers affecting energy conservation in China. Talib *et al.* (2011b) found interaction between barriers of total quality management (TQM) in the service sector to improve customer satisfaction in Indian service companies. Debata *et al.* (2013) developed a model for medical tourism in India using an integrated ISM and fuzzy-MICMAC (FMICMAC) approach. While, Khurana *et al.* (2010) adopted the ISM and FMICMAC to identify and classify the important criteria for information-sharing enablers for building trust in the Indian manufacturing industry. Azevedo *et al.* (2013) studied the ISM approach in the automotive industry and developed a relationship model. Matawale *et al.* (2013) developed the ISM that revealed the interrelationship among various drivers for individual lean, agile and legale manufacturing system. Singh and Khamba (2011) identified various barriers that affect the utilization level of advanced manufacturing technologies. They adopted the ISM approach to develop the structural relationship among different barriers for achieving manufacturing success.

Furthermore, Nagar *et al.* (2013) proposed the ISM for the next-generation manufacturing systems to mitigate their negative impacts. A relatively different study by Saleeshya *et al.* (2012) presented a case study on the spinning industry of South India in which various enablers and determinants of agility were identified and developed a multilevel model to improve the agility of the supply chain using the analytic hierarchy process and ISM methodologies. Chandramowli *et al.* (2011) analyze the barriers to development in landfill communities using ISM in the USA. A study by Wakchaure and Jha (2011) developed the ISM approach to formulate a hierarchical structure of the phenomenon of bridge failure showing the interrelationship of the causative factors. A study by Ansari *et al.* (2013) used a structural model of the barriers to implement solar power installations in India. Finally, Yadav and Sushil (2014) developed a total interpretive structural model of strategic factors related to performance management for Indian telecom service providers.

The methodology also has some limitations. The major drawback of ISM is the biasness of the expert chosen to judge the various factors. The relation among the factors always depends on the knowledge of the expert and his familiarity with the organization and its products and processes (Kannan and Haq, 2006). The outcome of this bias will affect the final ISM. Similarly, ISM does not show the strength of the relationships between factors. However, there are many approaches that can be used to impute the strength of the causal relationships. In this study, ISM was applied to a well-studied technology, the bottlenecks observed in the spread of M-commerce reachability.

The paper intends to meet the following key objectives:

- to identify and rank the barriers affecting the spread of M-commerce reachability among mobile service providers and ultimately to end-users;
- to model the interaction among the identified barriers for M-commerce using ISM; and
- to investigate the managerial implications of this research.

3.2 Steps involved in the ISM methodology

The various steps involved in the ISM methodology are as follows (Al-Zaabi *et al.*, 2013; Faisal and Rahman, 2008; Pfohl *et al.*, 2011; Talib *et al.*, 2011b):

- *Develop an ISM implementation group*: Identify a pool of experts with relevant experience, knowledge, skills and work backgrounds related with the study area.
- *Identify and select the key elements*: With the help of a brainstorming technique and a pool of experts, a list of key elements was prepared.
- *Formation of the structural self-interaction matrix (SSIM)*: Through the use of the expert pool, the contextual relationship among the key elements was derived during the brainstorming activity to examine the interrelationship between these elements. The pairs of elements were examined with respect to "leads to". This matrix indicates pair-wise relationships among key elements of the system under consideration.
- *Develop the reachability matrix*: Based on the SSIM, the reachability matrix was developed. The reachability matrix was verified for transitivity of the relation. Transitivity states that if a variable "A" is related to variable "B" and "B" is related to variable "C", then variable "A" is necessarily related to variable "C".
- *Decompose the reachability matrix into different levels*: The reachability matrix is decomposed to generate the structural model. That is, a desired graph is drawn and the transitivity links are removed.
- *ISM development*: The resultant digraph is converted into an ISM by replacing element nodes with statements.
- *Check for consistency*. The ISM developed in Step 6 is reviewed for conceptual inconsistency. If necessary, modifications are made.
- *Perform the MICMAC analysis*. Classify all the key elements into four clusters using the MICMAC analysis, viz., autonomous, dependent, linkage and drivers.

The flowchart for the ISM methodology is shown in Figure 1.

3.3 Formation of pool of experts

First step in the development of ISM is the identification of barriers relevant to the study objectives and generating contextual relationships among them. For that, the ISM technique suggests the use of expert opinions. Because the nature of the e-mobile service involves the highest level of decision makers and practitioners within the organization, hence it is important that the participants chosen for the study must be having enough experience in the subject and have knowledge about the barriers that may affect the spread of M-commerce. Therefore, an idea engineering exercise as suggested by Chander *et al.* (2013) with a group of experts and professionals working in the field of M-commerce technology

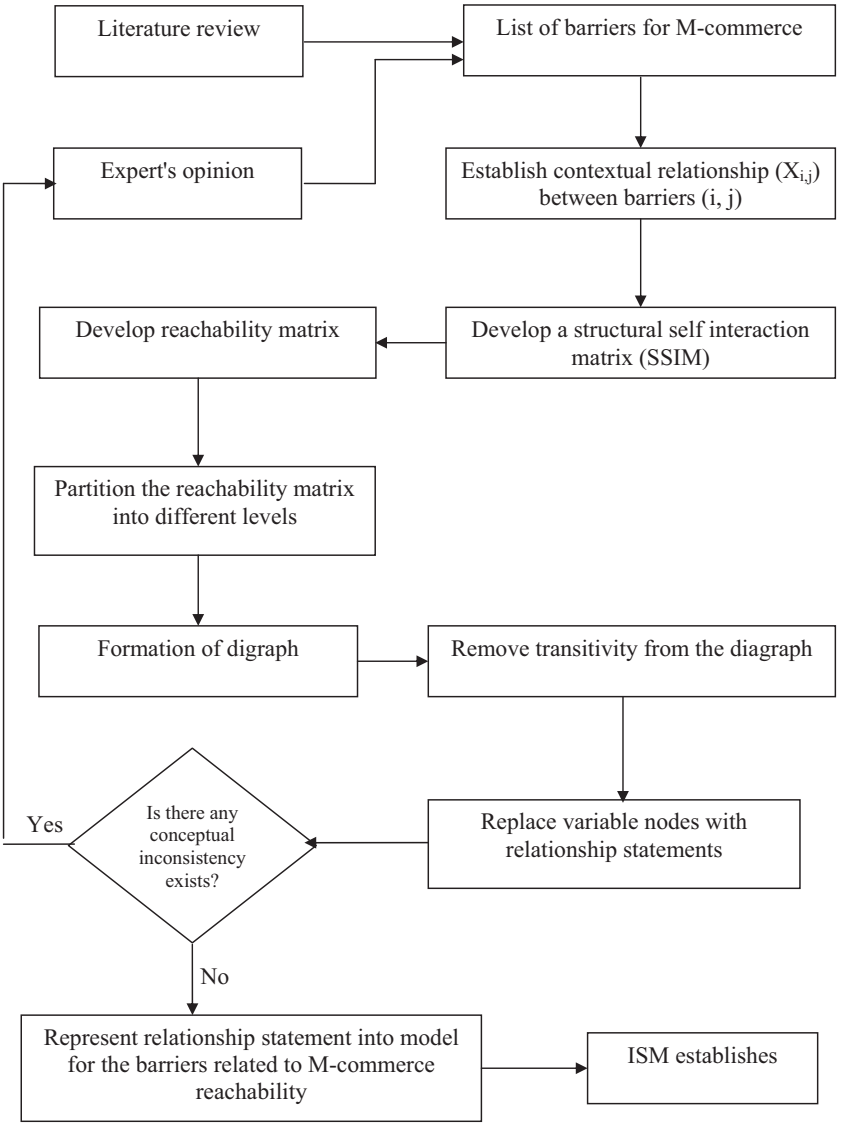

Figure 1.
Flow diagram for preparing the ISM for barriers

Sources: Al-Zaabi *et al*. (2013); Kannan and Haq (2006)

and/or mobile service technology serving in various organizations, government and academia was carried out. A total of ten participants were chosen. Three were from industry, five were from academia and two were from government departments. All the participants had more than eight to ten years of experience in the field of banking and cellular network services. Additionally, all the participants had an experience of being in the panel for selection of the best practices and making strategic decisions in their organizations.

3.4 Identification of barriers and their relationships for M-commerce

Unlike the idea engineering exercise, the brainstorming approach has become the most widely used concept, where experts with distinctive competences contribute by offering their individual but important insights (Jain and Banwet, 2013). This study adopted the brainstorming approach to identify and develop the contextual relationship among the barriers for M-commerce as suggested by previous studies (Al-Zaabi *et al.*, 2013; Govindan *et al.*, 2012; Tripathy *et al.*, 2013; Jain and Banwet, 2013). Hence, in this study for identifying the M-commerce barriers and contextual relationships among them in mobile service industries, several brainstorming sessions were conducted consisting of pool of experts (ten in number) as explained in the earlier section.

In the first round of the brainstorming session, a prioritizing exercise was performed where barriers were listed down. As the discussion progressed, several other barriers got added in the list. After some debate during the second and third rounds, few barriers were deleted and many more were further added. Finally, 15 barriers were anonymously selected after detailed discussion and were found relevant for the final scope of the research work. The group of experts analyzed the listed barriers and a contextual relationship of "leads to" type was chosen, implying that one variable leads to another variable. Based on this criteria, a contextual relationship between a pair of barriers was discussed and developed.

3.5 Structural self-interaction matrix)

Keeping in mind the contextual relationship developed for each barrier in the previous section, the existence of a relationship between any two barriers "i" and "j" and the associated direction of this relation was classified into four alphabets as V, A, X or O. The four alphabets used to denote the direction of the relationship between any two barriers (i and j) are given below:

- V→ Barrier i will help to achieve barrier j;
- A→ Barrier j will be achieved by barrier i;
- X→ Barrier i and barrier j will help to achieve each other; and
- O→ Barrier i and barrier j are unrelated.

The SSIM for the barriers is summarized in Table II.

To elaborate the application of these alphabets, following cases will provide support as examples:

- Barrier 1 helps achieve barrier 3, implying that as "high operating cost" increases the "low proliferation of M-commerce" increases as well. Thus, the relationship between barriers 1 and 3 is denoted by "V" in the SSIM.
- Barrier 2 can be achieved by barrier 12, i.e. barrier 12, "complexity of technology", helps achieve barrier 2, "high initial cost". Complexity of technology would promote the high initial cost. Thus, the relationship between these barriers is denoted by "A" in the SSIM.
- Barriers 9 and 10 help achieve each other. Barrier 9, "lack of trust/reliability", and barrier 10, "perceived risks", help achieve each other. Thus, the relationship between these barriers is denoted by "X" in the SSIM.

Barrier no.	M-commerce barrier	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
1	High operating cost	O	O	V	A	O	O	O	O	O	V	V	O	V	O	–
2	High initial cost	O	O	V	A	O	O	O	O	O	V	O	O	V	–	
3	Low proliferation of M-commerce	A	A	A	A	A	A	A	A	A	A	A	A	–		
4	Device inefficiency (small screen/resolution/poor user interface)	V	O	V	A	O	O	O	O	O	X	X	–			
5	Slow connection and/or data transfer	V	O	V	A	O	O	O	O	O	X	–				
6	Poor coverage of networks	V	A	V	A	O	O	O	O	O	–					
7	Privacy intrusion	V	A	V	A	O	V	V	X	–						
8	Lack of security	V	A	V	A	O	V	V	–							
9	Lack of trust/reliability	V	A	V	A	O	X	–								
10	Perceived risks	V	O	V	A	A	–									
11	Lack of computer and new technology skill	V	X	V	A	–										
12	Complexity of technology	V	V	V	–											
13	Incompatibility with existing business	A	A	–												
14	Low awareness of M-commerce and its benefits	V	–													
15	Customer's anxiety about technology	–														

Table II.
Structural self-interaction matrix (SSIM)

Notes: Barrier number: V: variable *i* will help achieve variable *j*; A: variable *j* will be achieved by variable *i*; X: variable *i* and *j* will help achieve each other; and O: variables *i* and *j* are unrelated

- No relationship exists between "poor coverage of networks" (barrier 6) and "privacy intrusion" (barrier 7), and hence, the relationship between these barriers is denoted by "O" in the SSIM.

Following the aforementioned contextual relationships, the SSIM is developed for all the 15 identified barriers of M-commerce (Table II).

3.6 Initial reachability matrix

In this step, the SSIM is converted into a binary matrix, called the initial reachability matrix. The information present in SSIM coded in V, A, X and O is substituted by 0s and 1s as per the case. The rules used for substitution are (Al-Zaabi *et al.*, 2013; Talib *et al.*, 2011a, 2011b; Ahuja *et al.*, 2009; Azevedo *et al.*, 2013) as follows:

- If the cell (i, j) entry in SSIM is "V", then the (i, j) entry in initial reachability matrix becomes 1 and the cell (j, i) entry becomes 0.
- If the cell (i, j) entry in the SSIM is "A", then the cell (i, j) entry in the initial reachability matrix becomes 0 and the cell (j, i) entry becomes 1.
- If the cell (i, j) entry in the SSIM is "X", the cell (i, j) entry in the initial reachability matrix becomes 1 and the cell (j, i) entry also becomes 1.
- If the cell (i, j) entry in the SSIM is "O", the cell (i, j) entry in the initial reachability matrix becomes 0 and the (j, i) entry also becomes 0.

Following these rules, the initial reachability matrix for barriers is developed as depicted in Table III.

Barrier no.	M-commerce barrier	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	High operating cost	1	0	1	0	1	1	0	0	0	0	0	0	1	0	0
2	High initial cost	0	1	1	0	0	1	0	0	0	0	0	0	1	0	0
3	Low proliferation of M-commerce	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
4	Device inefficiency (small screen/resolution/ poor user interface)	0	0	1	1	1	1	0	0	0	0	0	0	1	0	1
5	Slow connection and/or data transfer	0	0	1	1	1	1	0	0	0	0	0	0	1	0	1
6	Poor coverage of networks	0	0	1	1	1	1	0	0	0	0	0	0	1	0	1
7	Privacy intrusion	0	0	1	0	0	0	1	1	1	1	0	0	1	0	1
8	Lack of security	0	0	1	0	0	0	1	1	1	1	0	0	1	0	1
9	Lack of trust/reliability	0	0	1	0	0	0	0	0	1	1	0	0	1	0	1
10	Perceived risks	0	0	1	0	0	0	0	0	1	1	0	0	1	0	1
11	Lack of computer and new technology skill	0	0	1	0	0	0	0	0	0	1	1	0	1	1	1
12	Complexity of technology	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	Incompatibility with existing business	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
14	Low awareness of M-commerce and its benefits	0	0	1	0	0	1	1	1	1	0	1	0	1	1	1
15	Customer's anxiety about technology	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1

Table III.
Initial reachability matrix

3.7 Final reachability matrix

The final reachability matrix is obtained by incorporating the transitivities as enumerated in Step 4 of the ISM methodology. It is a basic assumption made in ISM (Govindan *et al.*, 2012; Soti *et al.*, 2010; Talib *et al.*, 2011a, 2011b). The final reachability matrix is presented in Table IV. In this table, the driving power and dependence of each barrier are also shown along with their rank. The driving power of a particular barrier is the sum of barriers (including itself) which it may help achieve. The dependence is the sum of barriers which may help achieve it. These will be used in the MICMAC analysis section.

3.8 Level partitions

Next step involves extraction of a hierarchical ordering from the final reachability matrix by level partitioning, which makes construction of digraph from the reachability matrix easy and simple (Al-Zaabi *et al.*, 2013; Pfohl *et al.*, 2011). From the final reachability matrix, the reachability and the antecedent sets for each barrier are obtained (Govindan *et al.*, 2012; Jain and Banwet, 2013). The elements of the reachability set are the elements that are related to or lead to other elements. Whereas, the antecedent set holds those elements which are influenced by other elements. After finding both the sets, the intersection between these sets is derived for the barriers. If it occurs that the reachability set and the intersection set are the same for any barrier, then that barrier is given the top level (Level-I) in the ISM hierarchy (Kannan and Haq, 2006; Diabat *et al.*, 2013) which would not influence any other barrier above their own level. This is the end of iteration i as shown in Table V.

From Table V, it is observed that the "low-proliferation of M-commerce" is at Level-I. Thus, it would be placed at the top of the ISM and is discarded from the other remaining barriers, and iteration ii is done with the same procedure as above. The iteration process

Table IV.
Final reachability matrix

Barrier no.	M-commerce barrier	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Driving power	Rank
1	High operating cost	1	0	1	1†	1	1	0	0	0	0	0	0	1	0	1†	7	IV
2	High initial cost	0	1	1	1†	0	1	0	0	0	0	0	0	1	0	1†	6	V
3	Low proliferation of M-commerce	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	IX
4	Device inefficiency (small screen/resolution/poor user interface)	0	0	1	1	1	1	0	0	0	0	0	0	1	0	1	6	V
5	Slow connection and/or data transfer	0	0	1	1	1	1	0	0	0	0	0	0	1	0	1	6	V
6	Poor coverage of networks	0	0	1	1	1	1	0	0	0	0	0	0	1	0	1	6	V
7	Privacy intrusion	0	0	1	0	0	0	1	1	1	1	0	0	1	0	1	7	IV
8	Lack of security	0	0	1	0	0	0	1	1	1	1	0	0	1	0	1	7	IV
9	Lack of trust/reliability	0	0	1	0	0	0	0	0	1	1	0	0	1	0	1	5	VI
10	Perceived risks	0	0	1	0	0	0	0	0	1	1	0	0	1	0	1	5	VI
11	Lack of computer and new technology skill	0	0	1	1†	0	0	1†	1†	1†	1	1	0	1	1	1	10	III
12	Complexity of technology	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	I
13	Incompatibility with existing business	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	2	VIII
14	Low awareness of M-commerce and its benefits	0	0	1	1†	0	1	1	1	1	1†	1	0	1	1	1	11	II
15	Customer's anxiety about technology	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	3	VII
	Dependence power	2	2	15	8	5	7	5	5	7	7	3	1	14	3	13		
	Rank	VIII	VIII	I	IV	VI	V	VI	VI	V	V	VII	IX	II	VII	III		

Note: 1†Entries are included to incorporate transitivity

Barrier (Bi)	Reachability set R(Bi)	Antecedent set A (Bi)	Intersection set R(Bi) ∩ A(Bi)	Level
Iteration i				
1	1,3,4,5,6,13,15	1,12	1	
2	2,3,4,6,13,15	2,12	2	
3	3	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	3	I
4	3,4,5,6,13,15	1,2,4,5,6,11,12,14	4,5,6	
5	3,4,5,6,13,15	1,4,5,6,12	4,5,6	
6	3,4,5,6,13,15	1,2,4,5,6,12,14	4,5,6	
7	3,7,8,9,10,13,15	7,8,11,12,14	7,8	
8	3,7,8,9,10,13,15	7,8,11,12,14	7,8	
9	3,9,10,13,15	7,8,9,10,11,12,14	9,10	
10	3,9,10,13,15	7,8,9,10,11,12,14	9,10	
11	3,4,7,8,9,10,11,13,14,15	11,12,14	11,14	
12	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	12	12	
13	3,13	1,2,4,5,6,7,8,9,10,11,12,13,14,15	13	
14	3,4,6,7,8,9,10,11,13,14,15	11,12,14	11,14	
15	3,13,15	1,2,4,5,6,7,8,9,10,11,12,14,15	15	
Iteration ii				
1	1,4,5,6,13,15	1,12	1	
2	2,4,6,13,15	2,12	2	
4	4,5,6,13,15	1,2,4,5,6,11,12,14	4,5,6	
5	4,5,6,13,15	1,4,5,6,12	4,5,6	
6	4,5,6,13,15	1,2,4,5,6,12,14	4,5,6	
7	7,8,9,10,13,15	7,8,11,12,14	7,8	
8	7,8,9,10,13,15	7,8,11,12,14	7,8	
9	9,10,13,15	7,8,9,10,11,12,14	9,10	
10	9,10,13,15	7,8,9,10,11,12,14	9,10	
11	4,7,8,9,10,11,13,14,15	11,12,14	11,14	
12	1,2,4,5,6,7,8,9,10,11,12,13,14,15	12	12	
13	13	1,2,4,5,6,7,8,9,10,11,12,13,14,15	13	II
14	4,6,7,8,9,10,11,13,14,15	11,12,14	11,14	
15	13,15	1,2,4,5,6,7,8,9,10,11,12,14,15	15	

(*continued*)

Table V.
Barriers to M-commerce level

Table V.

Barrier (Bi)	Reachability set R(Bi)	Antecedent set A (Bi)	Intersection set R(Bi) ∩ A(Bi)	Level
Iteration iii				
1	1,4,5,6,15	1,12	1	
2	2,4,6,15	2,12	2	
4	4,5,6,15	1,2,4,5,6,11,12,14	4,5,6	
5	4,5,6,15	1,4,5,6,12	4,5,6	
6	4,5,6,15	1,2,4,5,6,12,14	4,5,6	
7	7,8,9,10,15	7,8,11,12,14	7,8	
8	7,8,9,10,15	7,8,11,12,14	7,8	
9	9,10,15	7,8,9,10,11,12,14	9,10	
10	9,10,15	7,8,9,10,11,12,14	9,10	
11	4,7,8,9,10,11,14,15	11,12,14	11,14	
12	1,2,4,5,6,7,8,9,10,11,12,14,15	12	12	
14	4,6,7,8,9,10,11,14,15	11,12,14	11,14	
15	15	1,2,4,5,6,7,8,9,10,11,12,14,15	15	III
Iteration iv				
1	1,4,5,6	1,12	1	
2	2,4,6	2,12	2	
4	4,5,6	1,2,4,5,6,11,12,14	4,5,6	IV
5	4,5,6	1,4,5,6,12	4,5,6	IV
6	4,5,6	1,2,4,5,6,12,14	4,5,6	IV
7	7,8,9,10	7,8,11,12,14	7,8	
8	7,8,9,10	7,8,11,12,14	7,8	
9	9,10	7,8,9,10,11,12,14	9,10	IV
10	9,10	7,8,9,10,11,12,14	9,10	IV
11	4,7,8,9,10,11,14	11,12,14	11,14	
12	1,2,4,5,6,7,8,9,11,12,14	10,12	12	
14	4,6,7,8,9,10,11,14	11,12,14	11,14	

(*continued*)

Table V.

Barrier (Bi)	Reachability set R(Bi)	Antecedent set A (Bi)	Intersection set R(Bi) ∩ A(Bi)	Level
Iteration v				
1	1	1,12	1	V
2	2	2,12	2	V
7	7,8	7,8,11,12,14	7,8	V
8	7,8	7,8,11,12,14	7,8	V
11	7,8,11,14	11,12,14	11,14	
12	1,2,7,8,11,12,14	12	12	
14	7,8,11,14	11,12,14	11,14	
Iteration vi				
11	11,14	11,12,14	11,14	VI
12	11,12,14	12	12	
14	11,14	11,12,14	11,14	VI
Iteration vii				
12	12	12	12	VII

is continued until all the barriers' levels are obtained. The remaining iterations are presented in Table V (iteration ii-vii).

3.9 Interpretive structural model

From the level partitions as shown in Table V (iteration i-vii), the ISM is constructed as illustrated in Figure 2. In this ISM, all the 15 barriers are summarized into seven levels. It is observed from Figure 2 that the barrier "complexity of technology" appearing at Level-VII is a very significant barrier in spreading the M-commerce reachability among mobile phone users, as this barrier becomes the base of the ISM hierarchy Table V (iteration vii).

3.10 MICMAC analysis

With the help of the ISM developed, a MICMAC analysis is done. The purpose of MICMAC analysis is to analyze the driving and dependence power of the barriers (Sagheer *et al.*, 2009). As per Duperrin and Godet (1973), barriers can be classified into four clusters, namely: autonomous, dependent, linkage, and driver/independent:

(1) *Autonomous barriers*: In this quadrant, barriers have weak driving power and weak dependence. They are relatively disconnected from the system, with which they have only few links, which may be strong. These are represented in quadrant I.

(2) *Dependent barriers*: This cluster includes those barriers which have weak driving power but strong dependence power and are placed in quadrant II.

(3) *Linkage barriers*: In this category, barriers have strong driving power as well as strong dependence and are placed in quadrant III. They are also unstable, so any action on them will have an effect on the others and will feedback on themselves.

(4) *Independent barriers*: In this cluster, barriers have strong driving power but weak dependence power. These are represented in quadrant IV.

The driving power and dependence of each of the barriers are depicted in Table IV. In Table IV, an entry of "1" added along the columns and rows indicates the dependence and driving power, respectively. Once the driving power and the dependence power for all the barriers are derived, they are plotted in a grid as shown in Figure 3. It can be observed from Figure 3 that "high operating cost" (barrier 1), "high initial cost" (barrier 2), "slow connection and/or data transfer" (barrier 5), "poor coverage of networks" (barrier 6), "privacy intrusion" (barrier 7), "lack of security" (barrier 8), "lack of trust/reliability" (barrier 9) and "perceived risks" (barrier 10) fall in the category of autonomous cluster, thus implying that they have little driving power and little dependence and are relatively disconnected from the system. The second cluster consists of dependent barriers that have a little driving power but strong dependence. In the present case, barrier numbers 3, 4, 13 and 15, that is "low proliferation of M-commerce", "device inefficiency (small screen/resolution/poor user interface)", "incompatibility with existing business" and "customer's anxiety about technology", are in the cluster of dependent barriers.

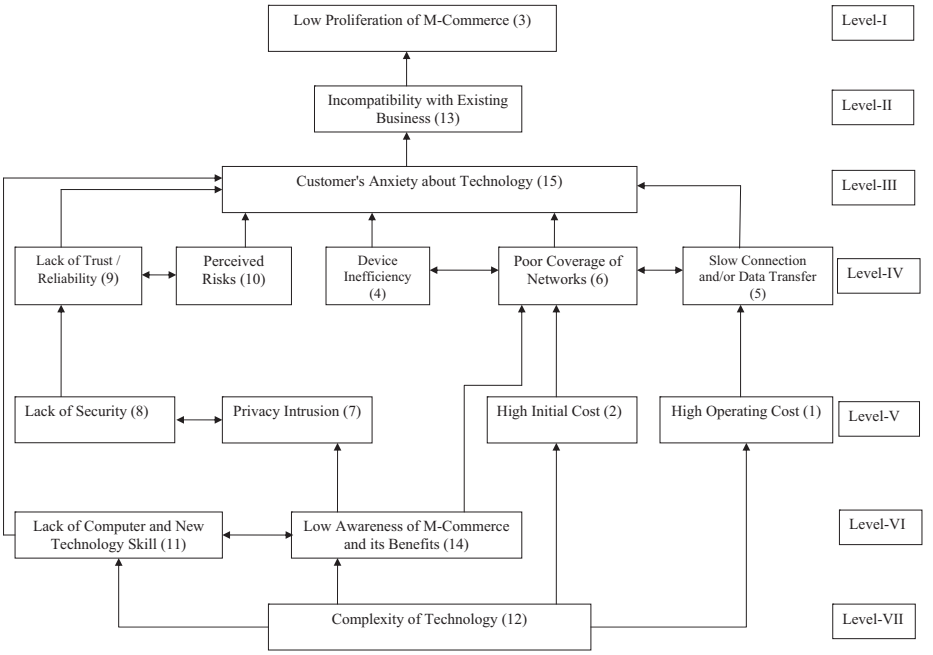

Figure 2.
Proposed ISM on barriers to M-commerce

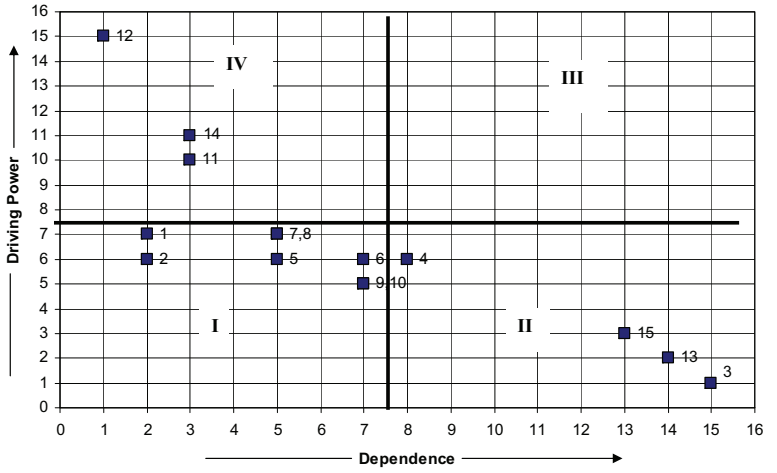

Figure 3.
Driving power and dependence diagram

Notes: (I) Autonomous drivers; (II) dependent drivers; (III) linkage drivers; (IV) independent drivers

The third cluster consists of linkage barriers that have strong driving power and high dependence. In the present study, there are no linkage measures. The remaining three barriers fall in the independent cluster, with strong driving power and low dependence. These barriers are:

(1) "lack of computer and new technology skill" (barrier 11);
(2) "complexity of technology" (barrier 12); and
(3) "low awareness of M-commerce and its benefits" (barrier 14).

4. Discussion and conclusions

The objective of this research work was to study and analyze the interrelationships among the barriers affecting the spread of M-commerce reachability for mobile service providers as well as to present a hierarchical model of identified barriers for M-commerce using the ISM approach. Several interesting and useful outcomes about the barriers in the spread of M-commerce reachability can be reported from the application of the ISM approach. Banking services across the globe are leaping day-by-day with the adoption of newer and advanced technologies like mobile banking services. With the intervention of M-commerce in banking services, financial services across the globe are ranked at highest in terms of banking apps, branchless banking, digital wallet and micro-insurance. At the same time, banking institutions are under tremendous pressure to increase their financial efficiency and satisfy their customers. This study tried to come up with the modeling of the barriers of M-commerce, which could help the mobile service providers to understand them and remove them for better results like return customers, achieve affinity and loyalty toward organization, etc.

From the ISM in Figure 2, "complexity of technology" (barrier 12) in adoption of M-commerce is at the bottom level of the model. This has higher driving power, as also supported by MICMAC analysis (Figure 3). Hence, the top management should focus on this issue by improving and designing the technique as user-friendly so as to enable the customer to accept M-commerce. Perception of complexity of technology as a barrier in the adoption of M-commerce by customers can prove to be a great loss to the organizations.

Further, the MICMAC analysis also shows that there are eight autonomous barriers,"high operating cost" (barrier 1), "high initial cost" (barrier 2), "slow connection and/or data transfer" (barrier 5), "poor coverage of networks" (barrier 6), "privacy intrusion" (barrier 7), "lack of security" (barrier 8), "lack of trust/reliability" (barrier 9) and "perceived risks" (barrier 10), in Cluster I and they have relatively low driving power and dependence, but majority of them fall near the middle of the matrix.

These may be the regulating barriers situated mostly at the system's center of gravity, implying that they are secondly levers and more influenced than dependent (Chander *et al.*, 2013). Only two barriers in this cluster, i.e. "high operating cost" (barrier 1) and "high initial cost" (barrier 2), are found to be disconnected in the current model, as they fall on the extreme left corner of the Cluster I, indicating that these barriers are not the drivers in spread of M-commerce reachability. The second cluster consists of barriers which have low driving power and high-dependence and are termed as result variables, as they are influenced by driving variables of the matrix. In the present case, "device inefficiency" (barrier 4), "low-proliferation of M-commerce" (barrier 3), "incompatibility with existing business" (barrier 13) and "customer's anxiety about technology" (barrier 15) are the barriers which come in this category. There are no barriers which have high driving and dependence power. The fourth cluster is of those barriers which have high driving and low dependence power. These barriers are critical and totally independent. The barriers that fall in this category are "lack of computer and new technology skill" (barrier 11), "complexity of technology" (barrier 12) and "low-awareness of M-commerce and its benefits" (barrier 14). This may be attributed to

strict needs of M-commerce reachability, as they are key barriers that affect the end results and the top management and service providers should focus on them and minimize them for high reachability of M-commerce technology toward customers.

Although the scope of this research work is restricted to Qatari institutions, the model can be generalized to other countries in the GCC region. This model provides useful guidance for the service industry, the telecommunication industry, information technology (IT) firms and business process outsourcing industries. For generalization, the model will need certain modifications because the experts from the telecommunication and information technology/information systems (IT/IS) service industries have to be accommodated to know some more barriers which affect them while implementing the IT/IS tools and techniques, so that the present model may be modified accordingly and adopted for the aforementioned service user domain. Further, the ISM presented provides the significance of the barriers in spread of M-commerce reachability to mobile phone users. The barriers that form the basis of the hierarchy must be given utmost consideration by the top-management leaders and service providers. Thus, the awareness about these barriers will help the institutions to overcome or to minimize the risk from identified barriers.

Finally, in this work, an interrelationship model among the barriers of M-commerce has been developed using the ISM approach. The model was obtained on the basis of the team of experts' opinion by judging the contextual relationships between the barriers, but it was not validated statistically. For future research, it is suggested that a quantitative study along with qualitative study be conducted using the primary data collection process through the questionnaire survey approach, and then the structural equation modeling technique be clubbed to get new insights of ISM. Future research may also develop intrarelationships using the analytic network process (ANP) or the fuzzy-ANP approach.

5. Implications for practitioners

This study provides some important implications for practice:

- This is one of the first known studies that examined the relationships among various barriers that affect M-commerce proliferation in a developing economy. Qatar is one of the fastest-growing M-commerce markets, and a study of barriers will help M-commerce providers to formulate appropriate strategies to counter them.
- The model shows that lack of security and privacy intrusion are important barriers in the adoption of M-commerce. Privacy concerns are very important, as the Qatari society is still conservative in sharing personal information and the consumers are skeptic that the information they provide on M-commerce Web sites might be shared without their consent. Thus, policy makers should convince the consumers that not only is their information secure, but it would not be shared without their consent. Organizations' commitment toward security and trust can be further enhanced by using third-party certifications like Verisign or Truste.
- This study suggests that low awareness of M-commerce and its benefits is a major barrier to the proliferation of M-commerce. Thus, marketers of M-commerce can stimulate consumers by using mass media to develop a favorable environment that encourages M-commerce adoption.

- The model also suggests that to improve the acceptance of M-commerce, the network operators need to work on costing of mobile plans. Though the speed of mobile data is continually enhanced, the cost remains prohibitive for majority of the users.
- M-commerce adoption studies usually investigate how likely users are to use M-commerce (Chong, 2013). However, such studies often do not indicate variables that negatively affect the migration to M-commerce. This study has proposed a relationship model based on variables that limit the proliferation of M-commerce in an economy experiencing a very fast pace of growth in mobile technology adoption.

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