STRUCTURAL MODELING AND MAPPING OF M-BANKING INFLUENCERS IN INDIA

S. P. Ketkar,
Department of Management Studies,
Indian Institute of Technology Delhi,
New Delhi, India
shriram.ketkar@dmsiitd.org

Ravi Shankar
Department of Management Studies,
Indian Institute of Technology Delhi,
New Delhi, India
ravi1@dms.iitd.ernet.in

D. K. Banwet
Department of Management Studies,
Indian Institute of Technology Delhi,
New Delhi, India
dkbanwet@dms.iitd.ac.in

ABSTRACT

Given that government reckons mobile phone as a vehicle for financial inclusion; banks view it as a cost-effective way of reaching out and telcos see mobile banking as an emerging stream of revenue; several enablers and drivers are at play in India's m-banking space. At the same time, low adoption of mobiles as a channel for banking, even after two years of the Reserve Bank notifying the operating guidelines, points to existence of several barriers blocking/inhibiting the spread of mobile banking in India. In these circumstances, a method like Interpretive Structural Modeling (ISM), which forces the managers to consider linkages amongst issues, can provide a better insight than the conventional survey merely seeking ranking or rating of the importance of issues.

ISM of enablers/drivers brings out the factors such as 'facility to get quick updates', 'time and cost saving', 'reach of telecom distribution' and 'need for telcos to improve customer retention' as the key drivers. On the other hand, 'lack of need for banking', 'quality of telecom service reach and reliability' and 'interoperability among banks and Telcos' emerge as the inhibitors likely to have highest impact on success of m-banking implementation. Finally, juxtaposition of the two outputs on a common driver-dependency grid segregates the issues to be addressed in different stages of implementation and also highlights the factors needing attention of the top levels in government, Banks and Telcos.

Keywords: M-banking, drivers, barriers, ISM - Interpretive Structural Modeling, MICMAC

1. Introduction

Banking and payment services constitute the central theme of many policies and regulations of the Reserve Bank of India (RBI) and have been the focus of several studies in the past. These studies have shown that RBI directives to open 'No frill Accounts' and deploy BCs (Business Correspondents - bank's agents to provide financial services on their behalf) for improving the 'reach' have not yielded much dividend and large proportion of India's population in the rural areas continues to live with no access to basic financial services. With barely 34% of population engaged in formal banking, mobile handsets could become the sole banking channel for 135 million financially excluded households in India [Boston Consulting Group 2007].

Utility of mobile phones for improving financial inclusion by 'reaching out the banking services', has been amply demonstrated by Smart Money and G-Cash in Philippines [Wishart 2006]; MTN Banking and Wizzit in South Africa [CGAP 2006; Richardson 2008] and M-Pesa in Kenya for microfinance applications [CGAP 2010]. In India, RBI issued operating guidelines for Mobile Banking Transactions [RBI 2008] and then liberalized the daily cap to INR 50,000 (USD 1,000) per customer for fund transfer and/or purchase of goods/services [RBI 2009]. Also, realizing the immense potential of mobile phones for improving financial inclusion, government constituted an Inter

Ministerial Group (IMG) in 2009 and has accepted group's recommendations for implementation of mobile based delivery of financial services.

Although banks in India have a limited network of 69,160 branches and 60,153 ATMs [RBI 2009-10], current m-banking guidelines of the RBI are based on a 'bank-driven' model and allow mobile banking/payment only for existing customers of banks. It is merely seen as another channel for accessing bank/card accounts and appears far away from its potential for contributing to financial inclusion. It points to several barriers, at the level of stakeholders and users, blocking/inhibiting the acceptance of mobile banking and payments.

At the same time, TRAI (Telecom Regulatory Authority of India) Performance Indicators for the quarter ended September 2010 show that India has 688 million wireless subscribers with a wireless teledensity (number of subscribers per 100 population) of nearly 60%. However, Telcos (Telecom Companies) are concerned about their low ARPU (Average Revenue per User) of INR 110 and INR 73 per month from GSM and CDMA users respectively and subscriber churn in excess of 40% per annum. Therefore, telcos see mobile banking as an attractive business opportunity to enhance their revenues and improve customer retention. Thus, RBI push and telco pull are both expected to drive up the initial acceptance and sustained usage of mobile banking applications.

Implementation of mobile banking varies based on who takes the lead [Booze Allen Hamilton 2008]; how supportive the financial regulation in the country is [GSM Association 2007] and whether mobiles are deployed for additive banking or transformational banking [CGAP 2008]. In any case, collaboration between mobile operators and banks is imperative and convergence of payments and mobile communications is not just logical, but it is inevitable [Wyk 2008].

In this context, this paper first identifies the barriers/hurdles as well as enablers/drivers of m-banking and payments in India and uses the framework of Interpretive Structural Modeling (ISM) for better understanding of their interactions, driving powers and dependencies. These positive and negative influences are then mapped on a common driver-dependency grid, to gain a better insight for implementation.

2. Literature review

Mobile banking leverages the reach of telecom networks and serves as extension of banks' payment infrastructure to deliver banking services to consumers [Finmark 2007]. Banks/Telcos can deploy STK (SIM Tool Kit) or J2ME (Java2 Micro Edition) on the client side or rely on WAP (Wireless Application protocol), USSD (Unstructured Supplementary Service Data), SMS or IVR as options on the server side for implementation of mobile banking (Fig. 1). Although, STK, J2ME and WAP may have limited coverage of about 30% users [Finmark Trust 2007], SMS and IVR options for m-banking can address 100% of mobile subscribers. Given that convenience has been the main motivator of consumers for adoption of internet banking [Lichtenstein and Williamson 2006], mobile phones that as personalized devices allow consumers to use it anytime, anywhere; m-banking is likely to penetrate far more than internet banking [Okazaki 2005].

The Philippines is credited as pioneer of m-banking implementation in the developing world and two major service providers there, Smart Money and G-Cash, offer a wide range of features like Cash deposits, Cash withdrawals, Transfers of credit to prepaid account, Transfers of cash to and from other users, Transfers of airtime credit from one user to another, Cashless purchase at shops, Direct credit from employer payroll, Bill payments and Inward international remittances from Overseas Filipino Workers [Wishart 2006]. These features together with the instant information of transactions and updates on financial market practically cover all transactions related to banking and payment services.

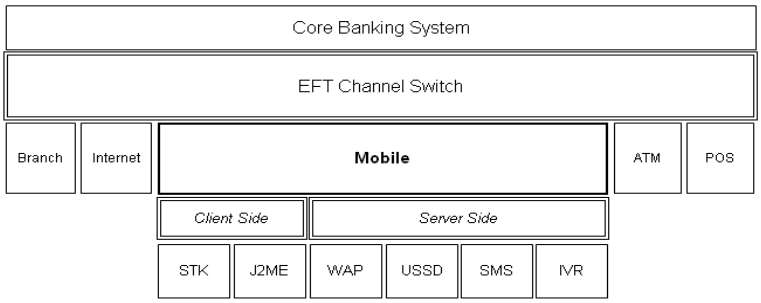


Figure 1 Mobile banking in the overall banking system architecture (modified from Finmark Trust 2007)

In India, several banks have introduced mobile banking as an additional channel for their existing customers but services like fund transfer are often restricted to accounts with the same bank and consumer registration for service

and post-registration usage has not really picked up. Telcos offer certain carrier centric services like subscription to VAS, within what is termed as Walled Garden Model [Bossuyt and Hove 2007] and many PSPs (Payment Service providers) like mCheck, Obopay Paymate, ngpay etc. are active in the market for handling utility payments.

However, RBI study of electronic transactions in India shows that these are mainly used for large business-centric payments [RBI 2009-10] and in spite of 'deeper than Internet reach' adoption of m-banking has been slow. Although m-banking enables operators to expand their service offerings [Bains 2008] and they promote it actively; consumers have concerns like usage/psychological barriers, safety of handsets and security of transactions. Also, there are certain external factors which work as barriers in the eco-system and are delaying the spread/growth of these services.

2.1. Barriers to m-banking implementation

Keeping in view the need to understand all influencers operating in the m-banking space, literature survey first focuses on identification of barriers/hurdles (Table 1a) to implementation of mobile banking/payment services in India.

2.1.1. Conservative regulation

Mobile banking guidelines [RBI 2008] only allow the banks that are licensed and have physical presence in India to offer m-banking/payment services, subject to a daily cap of INR 50,000 (approximately USD 1,000) for fund transfer and/or purchase of goods/services [RBI 2009]. Mobile banking is also subject to KYC (Know Your Customer), AML (Anti Money Laundering), CFT (Combating the Financing of Terrorism) and all other RBI guidelines issued from time to time. Such a conservative m-banking policy makes the system very 'restrictive' and works as a barrier for its growth. Reaching out the un-banked masses requires Transformational Mobile Banking Model (not merely as additional channel for existing bank customers) and coordinated efforts at policy-making level [CGAP 2008]. Further, it needs to be supported by a 'Proportionate risk-based regulation' [Azad 2008], meaning that a policy is open to certain level of risks in favor of the larger objective of improving financial inclusion.

2.1.2. Business model issues among Banks, Telcos and Retailers

Mobile banking/payment needs banking and telecom service providers to jointly address the business model issues relating to customer ownership, sharing of revenues and costs to retailers for accepting payments via mobiles. Telcos cannot expect to go it alone if they are to provide the kind of content and range or services that customers will increasingly demand [Cranfield and Rylander 2006]. Cellphone Banking is much more than providing access to the un-banked and can create significant value for banks as well as for Telcos [Wyk 2008]. Lack of clarity on business model, among various partners in the chain is likely to operate as a barrier/hurdle for success of m-banking.

2.1.3. Reach and coverage reliability of Telecom networks

Although the net addition of 52.21 million subscribers during the quarter ended September 2010 has taken the total wireless subscriber base in India to 687.71 Million (GSM + CDMA); India's rural teledensilty at 27.32%, according to the Performance Indicator Reports for quarter ended September 2010 [TRAI 2010], continues to be significantly lower than the urban teledensity. Further, telecom service providers in remote areas are reportedly defaulting on the TRAI quality norms and their service coverage in those areas, which are not adequately addressed by formal banking system, is poor. Therefore, even in the event that m-banking finds early acceptance; the reach and reliability of telecom service in remote areas, which need an alternative channel for delivery of banking services, would be a barrier for mobile banking in India.

2.1.4. Interoperability among Banks and Telco networks

Mobiles offer SIM Tool Kit and J2ME as the client-side options and WAP, USSD, IVR and SMS as the server-side options for implementation of mobile banking services [Finmark Trust 2007]. Given the multiplicity of telecom service providers operating on diverse technology platforms of different vendors, wide range of handsets in use and variations in banking system configurations, it is extremely essential that all systems and consumer handsets can work together to deliver 'quality experience' to users. Otherwise, heterogeneous interests of stakeholders [Lim 2007], lack of technology standards [Juniper Research 2008] and technology stability issues [DFID 2006] are likely to be the barriers in early stages of mobile banking implementation.

2.1.5. Critical mass of users for growth

Failure to create critical mass has impacted the continuance of several payment systems [Van Hove 1999] and consumer decision to adopt mobile payments is also dependent on merchants and others using the system [Mallat 2007]. New consumers adopting a payment system indirectly increase value of network for all consumers because they attract new merchants to join the network and if adequate retailers and consumers do not adopt the system, non-formation of critical mass of users can leave it a non-starter.

2.1.6. Usage difficulties (Handset limitations and SMS/IVR language)

Although there are six technology options for implementation of mobile banking, a large percentage of low-ARPU subscribers mostly use entry-level handsets and are not quite adept at browser type applications for accessing

bank accounts or shopping portals. Therefore, only SMS and IVR will be the practical options for m-banking in India. Also, Innovation resistance studies suggest that usage barrier could be the main source of consumer resistance to innovations that demand radical changes to established habits [Laukkanen et al. 2007]. Therefore, non availability of SMS/IVR options in a language of users' choice could become a direct barrier for consumer adoption of mobile banking services in India.

2.1.7. Consumer concern over security of transactions and loss of handset

Perceived risk relating to inherent uncertainty of an innovation can be identified as physical, social, economic or functional [Laukkanen et al. 2007] but in case of m-banking, security of transactions – encompassing confidentiality, authentication, integrity and non-repudiation is very critical for its success. Website security/privacy in case of internet banking [Shergill and Chen 2005] and fear of losing the handset can keep the consumers away from use of mobiles for financial transactions and low education levels [RBI 2007] may aggravate the impact of security as a barrier for mobile banking and payments services in India.

2.1.8. Lack of basic need for banking/payment services

Besides the addressable impediments like poor proximity to financial services, lack of suitable products, poor financial literacy and alienation from banks; lack of steady and substantial source of income has been a major reason for financial exclusion in India [BCG 2007]. According to the RBI, nearly 72% of those earning less than INR 50,000 per annum (USD 1,000 pa), largely depend on cash transactions and do not have any bank account. A summary of bank account ownership as a percentage of urban and rural populations for five categories of income highlights such a lack of need for banking by low-income groups.

Annual income (INR)	*< 50,000*	*50 ~ 100,000*	*100 ~ 200,000*	*200 ~ 400,000*	*> 400,000*	*Overall*
Urban	34.1%	75.5%	91.8%	95.5%	98.0%	61.7%
Rural	26.8%	41.2%	87.4%	93.6%	96.3%	38.0%
Total	**28.3%**	73.0%	89.9%	94.9%	97.6%	44.9%

Given that 37% of Indian households are estimated to be earning below USD 1,000 per annum and another 25% have annual income between USD 1,000 to 2,000; the lack of need for banking/payment services would be a major barrier to 'banking' as well as 'mobile banking'. Aggressive microfinance, government programs for rural employment generation and efficient targeting of subsidies would be necessary to get these segments into financial inclusion category [Rangarajan 2008].

2.1.9. Cost of usage to consumer

From consumers' perspective, transactions by any mode other than cash involve some additional costs for payment. Therefore, cost of transaction, is not only important in one-time choice of payment instrument [RBI 2007] but is continuously evaluated by consumers [Ondrus and Pigneur 2006] and migration to any new payment channel like internet or mobiles is based on consumer's assessment of the costs involved, inclusive of service charges levied by banks and other service providers [Mallat 2007]. Direct costs to consumer in a highly competitive Indian market may not be prohibitive, but these costs together with charges payable by merchants/retailers would determine the pool of revenue to be shared by banks, telcos and PSPs and consumers' perception of costs, rather than the actual cost could become a barrier to growth of mobile banking/payments.

2.1.10. Lack of consumer trust in services of Telcos and their retailers

Trust, is the extent of consumer belief in systems, processes and procedures of the service provider and its channel. It appears as a key variable that reduces perceived risk [Manzano et. al, 2009] but lack of it can become a serious block for acceptance of any service. Given that a million retailers selling prepaid recharges in a fiercely competitive telecom market are spread much wider than limited banking network of 69,160 branches and 60,153 ATMs [RBI 2009-10], 'quality' of service interaction is not maintainable across so many touch-points. Therefore, poor experience at any outlet could lead to destruction of consumer trust on telco operations and turn into a barrier for adoption of mobile banking.

2.1.11. Low responsiveness of Telcos for resolution of issues

Development of new technologies has changed the way customers interact with service providers and perceived performance is a key dimension underlying customer choice of channel, whether it is defined in terms of service quality or satisfaction [Patrı´cio et al. 2003]. SERVQUAL is known to be a valuable tool for assessing quality of telecom services and responsiveness, assurance and empathy are its most critical dimensions [Lai et al. 2007]. Customer service with respect to payment systems includes 'service level at the point of service', 'information dissemination' and 'grievance redressal' [RBI 2007] and poor response at any stage, particularly for financial information/transaction could lead to a serious dissatisfaction and loss of consumer trust in services of telcos and its channel.

Table 1a summarizes all the barriers to implementation of m-banking/payment services in India, as identified from literature survey.

Table 1a: Summary of barriers to growth of m-banking/payment services in India

S.N.	Brief description of the barrier	References
1	Conservative regulation on use of Mobiles for banking and payment	[Wishart 2006], [RBI 2008], [RBI 2009], [CGAP 2008], [Azad 2008]
2	Business model issues among Banks, Telcos and Retailers	[Cranfield and Rylander 2006], [Mallat et al. 2004], [Wyk 2008], [GSM Association 2007]
3	Reach and coverage reliability of Telecom networks	TRAI Performance Reports for Quarter Ending September 2009 and December 2009
4	Interoperability among Banks and Telco networks	[Finmark Trust 2007], [Lim 2007], [Juniper Research 2008], [DFID 2006], [RBI 2008]
5	Critical mass of users for growth	[Szmigin and Bourne 1999], [Van Hove 1999], [Mallat 2007]
6	Usage difficulty - Handset limitations and SMS/IVR language	[Finmark 2007], [Ram and Sheth 1989], [Condos et al. 2002], [Laukkanen et al. 2007], [Gounaris and Koritos 2008], [Huang et al. 2007]
7	Consumer concern over security of transactions and loss of handset	[Laukkanen et al. 2007], [RBI 2007], [Manzano et al. 2009], [Martın and Camarero 2009]
8	Lack of basic need for banking/payment services	[BCG 2007], [Rangarajan 2008]
9	Cost of usage to consumer	[RBI 2001], [RBI 2007], [Ondrus and Pigneur 2006], [Mallat 2007], [Wei et al. 2009]
10	Lack of consumer trust in services of Telcos and their retailers	[Manzano et al. 2009], [Martın and Camarero 2009], [RBI 2009-10], [Manzano et al. 2009]
11	Low responsiveness of Telcos for resolution of issues	[Patrı´cio et al. 2003], [Lai, et al. 2007], [RBI 2007], [Grace et al. 2009], [Martın and Camarero 2009]

2.2. Enablers and Drivers for m-banking implementation

After listing the negative influencers, literature survey identifies enablers/drivers (Table 1b) or factors that are expected to positively influence the implementation of m-banking/payment services in India.

2.2.1. Government policy push

RBI issued the operative guidelines for mobile banking transactions, for adoption by banks in India, in October 2008. At that time, the daily cap was fixed at INR 5,000 (USD 100) for fund transfers and INR 10,000 (USD 200) for purchases. Later, in December 2009, the daily limit was liberalized to INR 50,000 (USD 1,000) per customer for both fund transfers and payment transactions. Also, realizing the immense potential of mobile phones for improving financial inclusion, government constituted an Inter Ministerial Group (IMG) in November 2009, to workout relevant norms and modalities for mobile based delivery of financial services and accepted the IMG recommended framework for implementation, in April 2010.

2.2.2. Telco's focus on retention and revenue growth

With 460.63 million wireless subscribers (GSM and CDMA together), urban teledensity (number of phones subscribed by 100 persons living in urban area) in India has reached 137.25%. Average Revenues per User (ARPU) have hit new low of INR 110 and INR 73 for GSM and CDMA services respectively [TRAI 2010] and competition is leading to further pressure on ARPUs. Moreover, given that most service areas have as many as eight telcos, subscribers frequently switch from one provider to another and churn rates continue to be in excess of 3% per month. Therefore, telcos are continuously on the lookout for new services to enhance their revenues and improve customer retention.

2.2.3. Need for banks to improve their reach and cost of service delivery

Given that costs associated with branch operations have been on the rise [Kamesan 2003], bank managements have been opting for technology tools to improve their reach and lower their cost of service delivery. Therefore, 227.08 million rural mobile phones [TRAI 2010] offer a big opportunity for banks to reach out to the remote areas. At the same time, urban teledensity of 137.25% presents an attractive target for banks to replace the plastic money by mobile-based credit/debit cards.

2.2.4. Perceived Ease of Use

Perceived Ease of Use (PEOU) is a belief that use of technology will be free of effort and it has been one of the two planks of Technology Acceptance Model (TAM) for predicting behavioral intention of users to adopt new technologies. While TAM has been modified with inclusion of other variables such as Trust, Cost [Wei et al. 2009]; Credibility, Expressiveness [Amin 2008] and Perceived Risk [Manzano et al. 2009], PEOU has been a common 'enabler' in most studies relating to adoption of internet and mobile banking.

2.2.5. Consumer Convenience and usage experience

Consumer studies conducted in a southern state of India found that channel convenience, channel control and channel security play an important role in selection of channel by the consumers [Srivatsa and Srinivasan 2007]. However, for e-banking customers in China, easy accessibility and convenience are a source of satisfaction [Poon 2008]. Researchers have examined convenience and usage efficiency as attributes of 'Perceived Usefulness Construct' and found those to be key drivers of m-commerce [Wei et al. 2009], internet banking [Gounaris and Koritos 2008] and m-shopping intentions [Manzano[2] et al. 2009].

Table 1b: Enablers and drivers for growth of m-banking/payment services in India

S. N.	Enablers / Drivers	References
1	Government Policy	[Wyk 2008], [Booze Allen Hamilton 2008], [Reddy 2006], [Rangarajan 2008], [RBI 2007], [GSM Association 2007], [Bossuyt and Hove 2007], [CGAP 2008], [Azad 2008]
2	Telco's focus on retention and revenue growth	[Robertson 2008], [TRAI 2009], [Wishhart 2006], [Juniper Research 2007; 2008], [CGAP 2006], [Richardson 2008]
3	Need for banks to improve reach and cost of service	[Kamesan 2003], [TRAI 2009], [Reddy 2006], [Diwakar and Vaidya 2008], [Leeladhar 2005]
4	Perceived Ease Of Use	[Davis 1989], [Wei et al. 2009], [Manzano et al. 2009], [Laukkanen et al. 2007]
5	Consumer Convenience and usage experience	[Srivatsa and Srinivasan 2007], [Poon 2008], [Laukkanen 2007], [Wei et al. 2009], [Grace et al. 2009], [Manzano et al. 2009]
6	Service marketing/promotion for m-banking	[Carlsson and Walden 2002], [RBI 2007], [Khalifa and Shen 2008], [Gounaris and Koritos 2008], [Laukkanen et al. 2007]
7	Reach of telecom distribution network	New factor introduced in this study
8	Facility of getting quick information updates	[Ho and Ko 2008], [RBI 2007], [Huang et al. 2007], [Manzano et al. 2009]
9	Time saving for consumers using m-banking/payment transactions	[Gounaris and Koritos 2008], [Wei et al. 2009], [Huang et al. 2007], [Manzano et al. 2009], [Martın and Camarero 2009], [Ho and Ko 2008]
10	Lower cost to consumers for m-banking/payment transaction	[Ondrus and Pigneur 2006], [RBI 2007], [Mallat 2007], [Brown et al. 2003], [Laukkanen et al. 2007], [Manzano et al. 2009]
11	Consumer Trust on telcos	[Martın and Camarero 2009], [Manzano et al. 2009], [Grace et al. 2009], [Wei et al. 2009]

2.2.6. Service marketing/promotion for m-banking

Factors affecting the choice of payment instrument can be classified as Sociological, 'Instrument specific' and 'Service provider related' factors. Marketing, mass media advertising and promotion fall under 'service-provider' category and have a significant influence on consumer's decision making process [RBI 2007]. While marketing and advertising are generally considered important from producers' perspective [Carlsson and Walden 2002], mobile banking spans across three sectors – banking, telecom and support (from Payment Service Providers) and is expected to witness a lot of co-promotion efforts from all providers.

2.2.7. Reach of telecom distribution network

Of about 12 million retail outlets spread across the country in organized and unorganized sectors, nearly a million are estimated to be associated with the telecom sector. All those outlets either 'stock-and-sell' the physical recharge vouchers or do recharges by electronic transfer of talk-time to subscribers. Such a reach of nearly one million telecom outlets is much wider than the coverage achieved by formal banking system through 69,160 bank branches and 60,153 ATMs (as of March, 2010). Therefore, the vast network of consumer touch-points of telecom service providers can work as a significant enabler for reaching of m-banking/payment services to many areas, including those yet to be reached adequately by the country's banking network.

2.2.8. Facility of getting quick information and transaction updates

Service level at the point of contact and quick information dissemination are vital for banking services and customer satisfaction [RBI 2007]. By using the Internet and mobiles for banking, consumers gain considerably by way of quick and unassisted access to their accounts and instantaneous updates from bank on emails/SMS. Timely communication from bank and flexibility to obtain the required information on various financial products as per consumer convenience actually contribute to the Perceived Usefulness and can work as drivers of m-banking services [Ho and Ko 2008].

2.2.9. Time saving for consumers using m-banking/payment transactions

Use of mobiles for banking is seen as a time saver on three counts. Anytime-anywhere access does away with the time to reach a bank branch or ATM. It saves 'waiting time' in case of crowding at the branch/ATM and it makes most transactions faster as these can be completed without any human intervention. Such time saving benefit,

which can be an important driver of m-banking, has been studied as one of the dimensions of Perceived Usefulness Construct in several consumer studies relating to acceptance of internet banking [Gounaris and Koritos 2008], m-commerce [Wei et al. 2009], m-learning [Huang et al. 2007], and m-shopping [Manzano2 et al. 2009].

2.2.10. Lower cost to consumers for m-banking/payment transaction

Banks have experienced that deployment of technology brings down their 'effective cost' of delivering service and have been encouraging consumers to use ATMs, Phone-banking and Internet banking as means of access. For consumers, use of mobiles for financial transactions saves cost of commuting to a bank/ATM and given that cost of mobile usage is very competitive, mobiles bring down the total cost associated with every transaction. Therefore, lower transaction cost forms a key dimension of 'Perceived Usefulness' to drive the acceptance of m-banking.

2.2.11. Consumer Trust on telcos

Trust appears as a key variable that reduces perceived risk and plays an important role in increasing perceived ease of use [Manzano et al. 2009]. Therefore, perceived reliability of telco systems to handle large volume of transactions with minimal errors is a key factor for consumer's trust on m-payment system and is expected to be its important driver.

Table 1b summarizes all the eleven enablers/drivers of m-banking/payment implementation, as identified from literature survey.

3. Methodology and model development

Businesses often involve a large number of issues relating to the desired goals and objectives. Each issue when considered independently appears as the most important one and individual attempting to deal with the situation may encounter mental limitations in understanding all the issues together. Further, given that an individual's span of immediate recall of interrelationships among variables is known to be in the region of 7 ± 2 'chunks of information'; even a system involving merely three variables (issues) each of which has a two-way interrelation with every other variable (Fig. 2), may seem complex [Janes 1988].

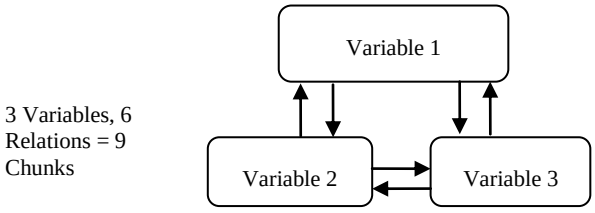


Figure 2 Complexity of relationships

Any methodology for dealing with complex issues must, therefore, be able to break complexity down into manageable chunks of information so that the human mind can deal with it. In such situations, systematic analysis of elements for establishing a hierarchy and mapping of those variables on a driver-dependency grid can help in classification/ categorization/ prioritization of issues and provide clarity of thought for optimum allocation of resources and better scheduling, monitoring and controlling of projects. Interpretive Structural Modeling (ISM) tries to do this, by enabling an individual or a group of individuals to focus on the interrelations between two elements of an issue at a time, without losing sight of the properties of the whole [Morgado et al. 1999].

ISM provides a framework for delineation of a hierarchy amongst variables, influencers or elements of any project under consideration [Warfield 1974; Sage 1977]. ISM is seen as a useful tool that helps careful, logical thinking in approaching complex issues and then communicating the results of that thinking to others. Term "interpretive structural modeling" (ISM) connotes systematic application of elementary notions of graph theory in such a way that theoretical, conceptual, and computation leverage is exploited to efficiently construct a directed graph, or network representation, of the complex pattern of a contextual relationship among a set of elements [Malone 1975]. ISM is much more flexible than many conventional quantitative modeling approaches that require variables to be measured on ratio scales. It offers a qualitative modeling language for structuring complexity and thinking on an issue by building an agreed structural model [Morgado et al. 1999].

ISM as a tool is interpretive because it is based on interpretation and judgment of group members on whether and how elements are related and it is structural as it extracts overall hierarchy form a complex set of variables. It has a mathematical foundation, philosophical basis and a conceptual and analytical structure. It provides the means to transform unclear and poorly articulated mental hierarchies into visible, well-defined models for better planning of strategies [Barve et al. 2007; Faisal et al. 2006; Hasan et al. 2007; Kumar et al. 2008]. Unlike a conventional questionnaire requiring respondents to merely rate the importance of key issues, Interpretive Structured Modeling (ISM) forces the managers to consider various linkages among key issues [Morgado et al. 1999].

ISM allows handling of several elemental classes under various structural types (Table 2a) and varied relationships amongst those elements (Table 2b). It helps in understanding of several ill-defined elements that are related in systems [Bolan et al. 2005]. It also helps in summarizing relationships among specific items and imposing an order and direction on the complex relationship among elements of the system [Thakkar et al. 2007].

Table 2a: Types of structures and classes of elements

Type of structure	Element class	Relation type	Specific relation(s) that could be used in applications
Intent structure	Objectives, goals	Influence	"Supports", "helps achieve" intentions
Priority structure	Budget line items	Comparative	"Is of equal or higher priority than", "is of equal or higher value than"
DELTA chart	Activities, events	Temporal	"Should precede or coincide with" decisions
Problematic	Problems	Influence	"Aggravates"
Field	Option	Definitive	"Is in the same category as"
Design quad	Dimension	Influence, temporal	"Is dependent on", "should be explored first in making design choices"

Table 2b: Types of relationships

Definitive	Comparative	Influence	Temporal	Spatial	Mathematical
Includes	Is greater than	Causes	Must precede	Lies east of	Is a function of
Is included in	Is heavier than	Affects	Must follow	Lies west of	Affects the likelihood of
Implies	Is preferred to	Aggravates	Precedes/ coincides with	Lies to the right of	Can be computed by
Is a member of	Is of higher priority than	Enhances	Requires more time than	Lies to the left of	Is computable from
Covers	Is more useful than	Supports	Overlaps with	Lies above	Is disjoint with
Is a partition of	Is more important than	Confirms	Is disjoint in time with	Lies below	Has a non-zero intersection with
Is necessary / sufficient for	Is more critical than	Strengthens /Weakens		Has a component to the left of	Equals / Is greater /less than
Is assigned to		Is independent of			Is a cover of, partition of

For the problem under consideration, with eleven barriers/hurdles and as many enablers/drivers identified; ISM framework is used to understand the contextual relationships and compute the driving powers and dependencies of these elements influencing m-banking implementation in India. Given that elements under study are of two types, contextual relationship based on 'priority for addressing' is applied for understanding the barrier/hurdles and 'reinforcement or positive influence' is used for interpreting interdependence among enablers/drivers.

3.1. Methodology

Details of various steps involved in ISM are as follows

1. Identify and list elements/variables relevant to the problem under consideration, through a literature review, field survey or any group activity for the purpose.
2. Use expert opinion or group techniques to determine contextual relationships amongst identified variables, in line with the objectives of the study.
3. Develop a Structural Self Interaction Matrix (SSIM) for variables, indicating pair-wise relationships among variables being studied.
4. Convert the SSIM developed into a reachability matrix.
5. Test the reachability matrix for transitivity (if A depends on B and B depends on C, then by principle of transitivity, A depends on C), make modifications to satisfy the transitivity requirements and derive the final reachability matrix.
6. Delineate levels by iterative partitioning of the final reachability matrix.
7. Translate the relationships of reachability matrix into a diagraph and convert it into an ISM (Interpretive Structural Model).
8. Review the model for conceptual inconsistencies and make modifications in SSIM if necessary.
9. Use the driving power and dependency of each influencer to map the driver-dependency grid for better insight into interdependencies.

3.2. Structural self-interaction matrix

For development of Structural Self interaction Matrix (SSIM), ISM methodology suggests that experts' views are used for defining contextual relationship among variables, in line with objectives of the study. In this research, entire list of influencers, barriers/hurdles as well as enablers/drivers, identified from literature survey was presented

to a group of eight participants of 'Executive MBA Program'. Executives selected had 6~10 years of work experience in different fields like banking, software development, power generation and telecom services. All were users of telecom as well as banking services for several years and two of them were also registered for m-banking facility offered by a large private sector bank in India. Group was explained the background of study and was asked to deliberate whether the list of eleven barriers/hurdles and eleven enablers/drivers adequately covered all factors influencing m-banking or there was a need to include any other factor(s). The group came up with 'fear of losing handset and consequent loss' as a hurdle. It is clubbed with consumer's concern for transaction security.

In the next stage, list of influencers was presented to a group of seven senior executives from government, telecom service providers and Banks; for definition of two sets of contextual relationships separately for barrier/hurdles and for enablers/drivers.

In case of barriers, the brief given was; if barrier 'j', is seen as the main barrier after 'i' is addressed, 'i' should be considered as higher than 'j' on priority for addressing. Critical mass as a barrier was understood well by the telecom industry executives but others were not able to prioritize it on their own. Later, upon further discussions on importance of critical mass as a barrier, they treated it as closely related to business models and cost of m-banking/payment services to consumers.

Four symbols were used to denote the type and direction of relationship between a pair of barriers 'i' and 'j' (referring to serial number of a barrier in row and column respectively).

V – barrier 'i' needs to be addressed before barrier 'j'
A – barrier 'j' needs to be addressed before barrier 'i'
X – both barriers 'i' and 'j' need to be addressed simultaneously and
O – barriers 'i' and 'j' can be addressed independent of each other

For example, the group agreed that 'conservative regulation' as a barrier needs to be addressed simultaneously with three other barriers viz. 'cost of usage to consumers', 'critical mass for growth' and 'business model issues amongst banks, telcos and retailers'. These relationships are marked as "X". 'Conservative regulation' was noted as independent of two other barriers, viz. 'low responsiveness of telcos' and 'usage difficulties due to handset limitations and language of SMS/IVR'. This is indicated by "O". All other barriers, viz. 'lack of consumer trust', 'lack of basic need for banking, 'consumer concern over security of transaction', 'interoperability' and 'reach and coverage reliability of telco networks' were identified as more critical for success of m-banking than the impact of 'conservative regulation'. Thus, for all these factors, which need to be addressed ahead of 'regulatory hurdles', their relationships were marked as "A". Similar interpretations of the group were used to evolve the entire SSIM for barriers/hurdles (Table 3a).

Table 3a Structural Self Interaction Matrix (SSIM) for m-banking barriers/hurdles

S/N	Barrier	11	10	9	8	7	6	5	4	3	2
1	Conservative regulation on using Mobiles for banking/ payment	O	A	X	A	A	O	X	A	A	X
2	Business model issues among Banks, Telcos and Retailers	O	O	X	A	A	A	X	A	A	
3	Reach and coverage reliability of Telecom networks	V	V	V	A	V	V	V	X		
4	Interoperability among Banks and Telco networks	V	V	V	A	V	V	V			
5	Critical mass of users for growth	A	A	A	A	A	A				
6	Usage difficulty - Handset limitations and SMS/IVR language	V	V	V	O	V					
7	Consumer concern over handset loss and security of transactions	X	X	O	O						
8	Lack of basic need for banking/payment services	O	O	O							
9	Cost of usage to consumer	O	O								
10	Lack of consumer trust in services of Telcos and their retailers	A									
11	Low responsiveness of Telcos for resolution of issues										

For enablers/drivers, the group was asked to deliberate a reinforcing/ameliorating type of contextual relationships amongst the factors. For instance, the group agreed that 'government policy' would be influenced by 'reach of telecom distribution' and 'need for telcos to improve retention and ARPU' but would not impact those factors. These relationships are marked as "A". Financial inclusion policy and the 'need for Banks to improve their cost of service delivery' were seen to be influencing each other and hence marked as "X". 'Marketing and promotion of m-banking/payment services' was not considered as influencer of government policy but policy was seen impacting the content, the tone and the frequency of marketing communications. This is represented by "V" type of relationship between the two variables. Other variables were neither seen influencing the government policy nor were they influenced by it, leading to "O" for those pairs. Interpretations of the group were used to cover all ((N*(N-1))/2 interactions and evolve an SSIM for enablers/drivers (Table 3b).

Table 3b Structural Self Interaction Matrix (SSIM) for m-banking enablers/drivers

S/N	Driver / Enabler	11	10	9	8	7	6	5	4	3	2
1	Government policy (particularly on Mobiles for financial inclusion)	V	O	O	O	A	V	O	O	X	A
2	Need for Telcos to improve on retention and ARPU	V	X	O	O	X	V	O	O	O	
3	Need for Banks to improve on their reach and cost of service delivery	O	A	O	O	A	V	A	O		
4	Perceived Ease Of Use of m-banking/payment services	O	O	A	A	O	O	X			
5	Consumer convenience and usage experience of m-banking	V	O	A	A	A	O				
6	Marketing and promotion of m-banking services	V	A	A	O	A					
7	Reach of telecom distribution network	V	V	V	O						
8	Facility of getting quick information and transaction updates	V	V	V							
9	Time Saving on m-banking/payment transaction for consumers	V	V								
10	Lower cost of m-banking/payment transaction to consumers	V									
11	Consumer trust on Telcos										

3.3. Reachability Matrix

SSIM developed from contextual relationships were converted into binary matrices called initial reachability matrices, by replacing V, A, X and O by a combination of 1s and 0s in accordance with the VAXO rules.

If entry (i,j) in SSIM = 'V', enter element (i,j) as '1' and (j. i) as '0' in initial reachability matrix
If entry (i,j) in SSIM = 'A', enter element (i,j) as '0' and (j. i) as '1' in initial reachability matrix
If entry (i,j) in SSIM = 'X', enter element (i,j) as '1' and (j. i) as '1' in initial reachability matrix
If entry (i,j) in SSIM = 'O', enter element (i,j) as '0' and (j. i) as '0' in initial reachability matrix

Applying the VAXO rules, initial reachability matrices were constructed for barriers/hurdles (Table 4a) and for enablers/drivers (Table 4b).

Table 4a Initial reachability matrix for m-banking barriers/inhibitors

S/N	Barrier / inhibitors	1	2	3	4	5	6	7	8	9	10	11
1	Conservative regulation on use of Mobiles for banking and payment	1	1	0	0	1	0	0	0	1	0	0
2	Business model issues among Banks, Telcos and Retailers	1	1	0	0	1	0	0	0	1	0	0
3	Reach and coverage reliability of Telecom networks	1	1	1	1	1	1	1	0	1	1	1
4	Interoperability among Banks and Telco networks	1	1	1	1	1	1	1	0	1	1	1
5	Critical mass of users for growth	1	1	0	0	1	0	0	0	0	0	0
6	Usage difficulty - Handset limitations and SMS/IVR language	0	1	0	0	1	1	1	0	1	1	1
7	Consumer concern over handset loss and security of transactions	1	1	0	0	1	0	1	0	0	1	1
8	Lack of basic need for banking/payment services	1	1	1	1	1	0	0	1	0	0	0
9	Cost of usage to consumer	1	1	0	0	1	0	0	0	1	0	0
10	Lack of consumer trust in services of Telcos and their retailers	1	0	0	0	1	0	1	0	0	1	0
11	Low responsiveness of Telcos for issue resolution	0	0	0	0	1	0	1	0	0	1	1

Table 4b Initial reachability matrix for m-banking enablers/drivers

S/N	Enabler / Driver	1	2	3	4	5	6	7	8	9	10	11
1	Government policy (on Mobiles for financial inclusion)	1	0	1	0	0	1	0	0	0	0	1
2	Need for Telcos to improve on retention and ARPU	1	1	0	0	0	1	1	0	0	1	1
3	Need for Banks to improve on their reach, cost of service delivery	1	0	1	0	0	1	0	0	0	0	0
4	Perceived Ease Of Use of m-banking/payment services	0	0	0	1	1	0	0	0	0	0	0
5	Consumer convenience and usage experience	0	0	1	1	1	0	0	0	0	0	1
6	Marketing and promotion of m-banking services	0	0	0	0	0	1	0	0	0	0	1
7	Reach of telecom distribution network	1	1	1	0	1	1	1	0	1	1	1
8	Facility of getting quick information and transaction updates	0	0	0	1	1	0	0	1	1	1	1
9	Time Saving on m-banking/payment transaction for consumers	0	0	0	1	1	1	0	0	1	1	1
10	Lower cost of m-banking/payment transaction to consumers	0	1	1	0	0	1	0	0	0	1	1
11	Consumer trust on Telcos	0	0	0	0	0	0	0	0	0	0	1

Final reachability matrix was then obtained for barriers/hurdles (Table 5a) by incorporating the changes necessary to satisfy transitivity requirements detailed in step 5 of ISM methodology. Similarly the Final reachability matrix was obtained for enablers/drivers by satisfying the transitivity requirements for enabler/drivers (Table 5b). Final reachability matrices also indicate the driving power and dependency for each variable. Driving power is total number of variables, including itself, which it impacts (equals the count of 1's in a row) and dependency is total number of variables, including itself, which have an impact on it (equals the count of 1's in a column).

Table 5a Final reachability matrix for m-banking barriers/hurdles

S/N	Barrier	1	2	3	4	5	6	7	8	9	10	11	Driving Power
1	Conservative regulation on use of Mobiles for banking	1	1	0	0	1	0	0	0	1	0	0	**4**
2	Business model issues among Banks, Telcos and Retailers	1	1	0	0	1	0	0	0	1	0	0	**4**
3	Reach and coverage reliability of Telecom networks	1	1	1	1	1	1	1	0	1	1	1	**10**
4	Interoperability among Banks and Telco networks	1	1	1	1	1	1	1	0	1	1	1	**10**
5	Critical mass of users for growth	1	1	0	0	1	0	0	0	1	0	0	**4**
6	Usage difficulty - Handset limitations, SMS/IVR language	1	1	0	0	1	1	1	0	1	1	1	**8**
7	Consumer concern over handset loss, transaction security	1	1	0	0	1	0	1	0	1	1	1	**7**
8	Lack of basic need for banking/payment services	1	1	1	1	1	1	1	1	1	1	1	**11**
9	Cost of usage to consumer	1	1	0	0	1	0	0	0	1	0	0	**4**
10	Lack of consumer trust in Telcos and their retailers	1	1	0	0	1	0	1	0	1	1	1	**7**
11	Low responsiveness of Telcos for resolution of issues	1	1	0	0	1	0	1	0	1	1	1	**7**
	Dependency	**11**	**11**	**3**	**3**	**11**	**4**	**7**	**1**	**11**	**7**	**7**	**76/76**

Table 5b Final reachability matrix for m-banking enablers/drivers

Sr. No.	Enabler / Driver	1	2	3	4	5	6	7	8	9	10	11	Driving Power
1	Government policy (on Mobiles for financial inclusion)	1	0	1	0	0	1	0	0	0	0	1	**4**
2	Need for Telcos to improve on retention and ARPU	1	1	1	1	1	1	1	0	1	1	1	**10**
3	Need for Banks to improve their reach, cost of service	1	0	1	0	0	1	0	0	0	0	1	**4**
4	Perceived Ease Of Use of m-banking/payment services	1	0	1	1	1	1	0	0	0	0	1	**6**
5	Consumer conv and usage experience of m-banking	1	0	1	1	1	1	0	0	0	0	1	**6**
6	Marketing and promotion of m-banking services	0	0	0	0	0	1	0	0	0	0	1	**2**
7	Reach of telecom distribution network	1	1	1	1	1	1	1	0	1	1	1	**10**
8	Getting quick information and transaction updates	1	1	1	1	1	1	1	1	1	1	1	**11**
9	Time Saving on m-banking/payment for consumers	1	1	1	1	1	1	1	0	1	1	1	**10**
10	Lower cost of m-banking/payment to consumers	1	1	1	1	1	1	1	0	1	1	1	**10**
11	Consumer trust on Telcos	0	0	0	0	0	0	0	0	0	0	1	**1**
	Dependency	**9**	**5**	**9**	**7**	**7**	**10**	**5**	**1**	**5**	**5**	**11**	**74 / 74**

3.4. Level Partitioning

Final reachability matrix obtained after incorporating transitivity requirements is used for level partitioning. It involves comparing the 'recahability' and 'antecedent' sets of variables and delineating levels on the basis of intersection sets. Reachability set for a variable is arrived at by considering the variable itself and other variables that it impacts, whereas antecedent set consists of the variable itself and all other variables that have an impact on it. The variable, for which reachability and intersection sets are same, is assigned the top level in ISM hierarchy (Table 6). These variables would not impact any other variables. In this case factor no. 1, 2, 5 and 9 emerge as the top-level barriers in ISM hierarchy.

Table 6 Level partitioning for m-banking barriers - Iteration I

Barrier	Reachability Set	Antecedent Set	Intersection Set	Level
1	1, 2, 5, 9	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	1, 2, 5, 9	**I**
2	1, 2, 5, 9	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	1, 2, 5, 9	**I**
3	1, 2, 3, 4, 5, 6, 7, 9, 10, 11	3, 4, 8	3, 4,	-
4	1, 2, 3, 4, 5, 6, 7, 9, 10, 11	3, 4, 8	3, 4,	-
5	1, 2, 5, 9	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	1, 2, 5, 9	**I**
6	1, 2, 5, 6, 7, 9, 10, 11	3, 4, 6, 8	6	-
7	1, 2, 5, 7, 9, 10, 11	3, 4, 6, 7, 8, 10, 11	7, 10, 11	-
8	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	8	8	-
9	1, 2, 5, 9	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	1, 2, 5, 9	**I**
10	1, 2, 5, 7, 9, 10, 11	3, 4, 6, 7, 8, 10, 11	7, 10, 11	-
11	1, 2, 5, 7, 9, 10, 11	3, 4, 6, 7, 8, 10, 11	7, 10, 11	-

Once the top level is determined, variable(s) in the identified level are dropped from further analysis and the process of comparing reachability and antecedent sets is repeated to identify subsequent levels. The iterative process is carried on till levels are determined for each variable (Tables 7, 8, 9, 10). Five iterations are required in this case and entire process partitions the barriers/hurdles into five levels.

Table 7 Iteration II

Barrier	Reachability Set	Antecedent Set	Intersection Set	Level
3	3, 4, 6, 7, 10, 11	3, 4, 8	3, 4,	-
4	3, 4, 6, 7, 10, 11	3, 4, 8	3, 4,	-
6	6, 7, 10, 11	3, 4, 6, 8	6	-
7	7, 10, 11	3, 4, 6, 7, 8, 10, 11	7, 10, 11	**II**
8	3, 4, 6, 7, 8, 10, 11	8	8	-
10	7, 10, 11	3, 4, 6, 7, 8, 10, 11	7, 10, 11	**II**
11	7, 10, 11	3, 4, 6, 7, 8, 10, 11	7, 10, 11	**II**

Table 8 Iteration III

Barrier	Reachability Set	Antecedent Set	Intersection Set	Level
3	3, 4, 6	3, 4, 8	3, 4,	-
4	3, 4, 6	3, 4, 8	3, 4,	-
6	6	3, 4, 6, 8	6	**III**
8	3, 4, 6, 8	8	8	-

Table 9 Iteration IV

Barrier	Reachability Set	Antecedent Set	Intersection Set	Level
3	3, 4	3, 4, 8	3, 4,	**IV**
4	3, 4	3, 4, 8	3, 4,	**IV**
8	3, 4, 8	8	8	-

Table 10 Iteration V

Barrier	Reachability Set	Antecedent Set	Intersection Set	Level
8	8	8	8	**V**

3.5. Building up the ISM

After partitioning the levels, relationships between various barriers/hurdles are depicted by drawing a node for each variable and connecting those nodes by arrows as per the direction of relationship. The diagraph is examined and validated for transitivity, as described in methodology and it is then converted into an ISM model (Fig. 3a).

The model shows that barriers such as 'lack of need for banking/payment services, 'reach and reliability of telecom networks' and 'interoperability among banks and telco networks' appear at the bottom of hierarchy and would have maximum impact on success of m-banking/payment services implementation in India. 'Usage difficulty due to handset limitations', 'lack of consumer trust in services of Telcos and their retailers', 'consumer concern over security of transaction' and 'low responsiveness of telcos for issue resolution' are barriers in the middle rung of hierarchy and will need to be addressed by operations management teams of telcos. Barriers at these levels would assume larger significance, once the barriers at the bottom of hierarchy are addressed or partially mitigated.

The other four barriers in the study, 'cost of usage to consumer', 'business model issues among Banks, Telcos and Retailers', 'conservative regulation on use of Mobiles for banking' and 'critical mass of users' emerge as barriers that will need to be jointly addressed by policy-making levels in the government and top managements of banks and telcos. These top level barriers do not impact lower level barriers but are interdependent and two or more need to be handled together by the concerned stakeholders.

Similarly, when level partitioning iterations are applied to Final reachability matrix for enablers/drivers, a six-level hierarchy emerges for an ISM of enablers/drivers (Fig. 3b). Model shows that performance factors such as facility to get quick updates, time and cost saving for consumers, reach of telecom distribution and need for telcos to improve customer retention and ARPU will drive the implementation of m-payment services in India.

Consumer usage experience will drive the factors at strategic level, such as need for banks to improve on their 'reach and cost of service delivery' and the 'government policy for improving financial inclusion'. Government policy will drive the content, tone and frequency of marketing communication for promotion of m-banking, which will need to reinforce the consumer trust in telcos for continued use of mobiles for accessing financial services.

'Consumer trust' at the top level in ISM hierarchy of drivers will be vital for success of mobile based banking and payment services in India.

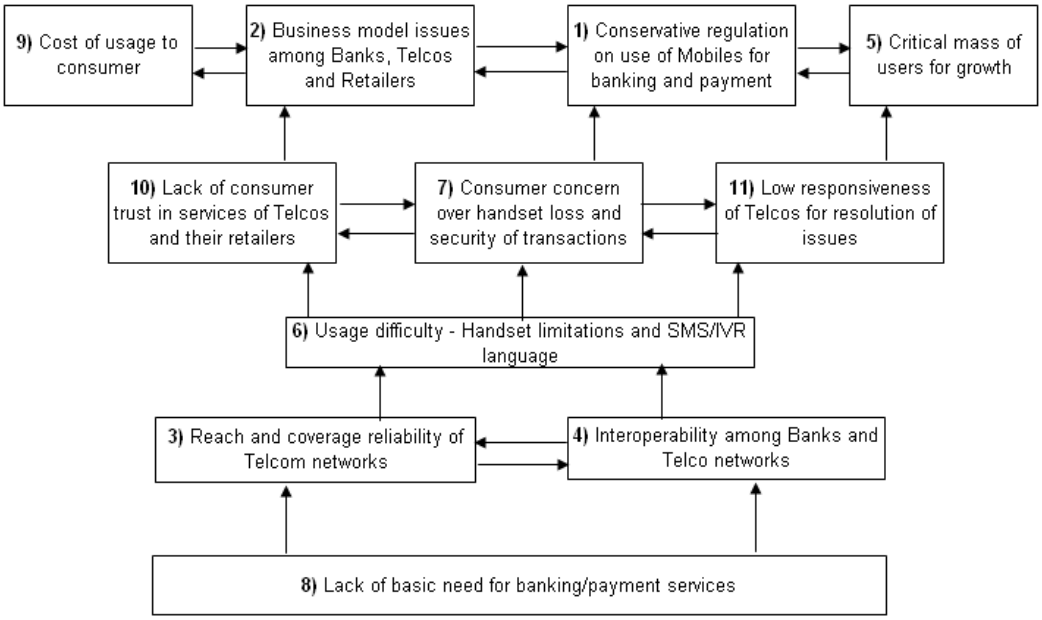


Figure 3a ISM Model for barriers/hurdles to m-banking/payments services in India

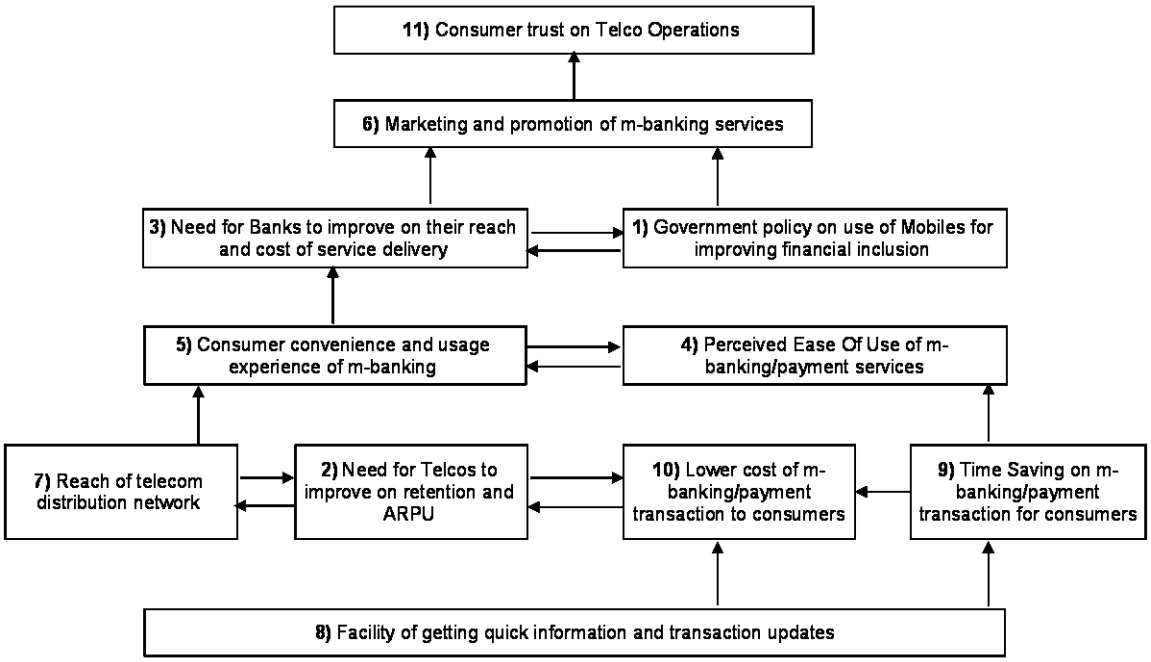


Figure 3b ISM Model for enablers/drivers of m-banking/payments services in India

4. Discussion and analysis

Both the hierarchies of barriers/hurdles and enablers/drivers, evolved using 'contextual relationships' defined by industry experts were presented back to them for their examination and comments.

4.1. Hierarchy of influencers

For the barriers model, practicing managers considered 'Lack of need for banking' at the bottom as very appropriate. One expert commented that lack of stable employment at the bottom of pyramid is indeed the main

reason for banking exclusion but this needs to be addressed by the government on a wider platform. Measures such as strengthening of micro-finance sector, rural employment generation, programs for poverty alleviation and better targeting of subsidies by the government can generate demand for banking service but all these would mostly fall outside the purview of Telecom and Banking sectors. Telcos and Banks can only work on elimination/amelioration of the barriers relating to mobile phone users who need banking facilities but have certain inhibitions in adopting mobiles for their banking/payment transactions.

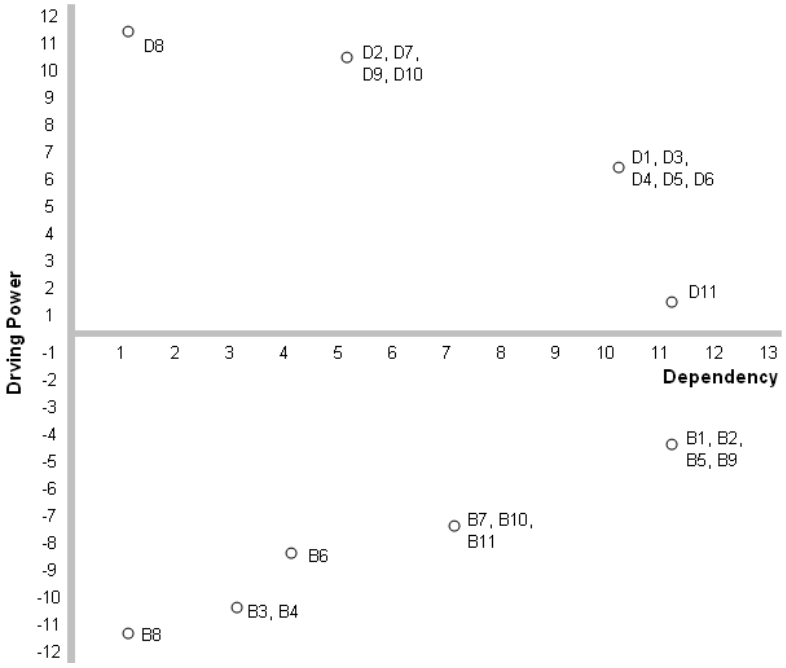
Reach and reliability of telecom network, interoperability among telcos and bank systems and usage difficulties were seen to be rightly appearing as operational level barriers and were reckoned as immediate actionable items for telcos. Further, service deliverables like 'consumer trust', 'transaction security' and 'responsiveness' were found to be correctly occupying a level below the strategic factors like 'business model issues' and 'conservative policy'.

For the hierarchy of enablers/drivers, industry experts agreed that 'cost and time saving' alongwith 'easy access to information' appeared as prime drivers at the bottom of hierarchy and 'need for banks to improve cost of service' and 'government policy' emerged at the top strategic level. They also mentioned that sharp fall in ARPUs and stiff tariff competition among telcos leads to inadequate focus on customer service and this brings down the consumer trust in telcos. Therefore, 'consumer trust in telco's services appearing as the top-level driver was seen as a correct reflection of the current situation.

Besides the comments on hierarchies generated using ISM, practitioners opined that two independent hierarchies, of eleven barriers/hurdles and as many enablers/drivers, do not facilitate formulation of any combined strategy for leveraging the benefits of enablers/drivers and mitigating the impact of barriers/hurdles. It was suggested that mapping of all influencers on a common grid could provide a valuable insight for prioritizing the strategic actions. As per the suggestion, influencers were plotted on a single Driver-dependency map, using the driving powers and dependencies computed in final reachability matrices.

4.2. Driver-Dependency map

In order to gain further insight into the hierarchy generated by ISM, variables can be classified using MICMAC analysis into four categories, viz. autonomous, independent, linkage and dependent [Mandal and Deshmukh 1994]. This study uses a modified MICMAC and extends the mapping concept by treating driving power of enablers/drivers as positive and that of barriers/hurdles as negative. Such a juxtaposition of two plots brings all the influencers (positive and negative) of autonomous and dependent types closer to dependency axis and puts independent and linkage variables on the extremes of driving power axis (Fig 4).



Sr No.	Description of drivers and barriers	Dep	Driv Power
D1	Government policy	10	6
D2	Retention and ARPU	5	10
D3	Banks reach and cost of service	10	6
D4	Perceived Ease Of Use	10	6
D5	Consumer convenience and usage	10	6
D6	Marketing and promotion	10	6
D7	Reach of telecom distribution	5	10
D8	Quick info/ transaction updates	1	11
D9	Time Saving	5	10
D10	Lower cost of transaction	5	10
D11	Consumer trust on Telcos	11	1
B1	Conservative regulation	11	-4
B2	Business model issues	11	-4
B3	Reach and coverage of networks	3	-10
B4	Interoperability	3	-10
B5	Critical mass	11	-4
B6	Usage difficulty	4	-8
B7	Security of transactions	7	-7
B8	Lack of need for banking	1	-11
B9	Cost of usage	11	-4
B10	Lack of consumer trust	7	-7
B11	Low responsiveness of Telcos	7	-7

Figure 4 Driving power-dependency mapping of influencers

The combined Driver-dependency map shows that there are no drivers or barriers with low driving powers and low dependencies. It means that there are no autonomous influencers relatively disconnected from the system.

Variables D8 and B8 have low dependencies and high driving powers making them independent driver and a barrier respectively. D8 represents quick information and transaction updates as a benefit for users and can form an important plank for all marketing communications to drive usage. B8 on the other hand denotes lack of need for banking and its impact can only be addressed by suitable policy measures for poverty alleviation and direct transfer of subsidies to the poor etc. Both these variables being independent of other drivers and barriers can be addressed in the early stage of m-banking implementation.

B3, B4 and B6, which refer to 'reach and coverage of telecom networks', 'interoperability' and 'usage difficulties' respectively appear as next set of influencers, which can yield significant dividends if addressed during the introduction phase. By MICMAC categorization, all these factors fall in 'Independent quadrant', characterized by strong driving power and low dependence. Mitigation of these three barriers could improve the initial acceptance and also lead to continued usage of m-banking by early adopters.

D2, D7, D9 and D10 representing 'retention and ARPU considerations of telcos', 'reach of telecom distribution', 'time saving' and 'cost saving' together with B7, B10 and B11 covering 'security of transactions', 'lack of consumer trust' and 'low responsiveness of telcos' form a set of drivers and barriers with moderate dependencies. These influencers are mostly the deliverables of Telcos but expected to play a major role in acceptance and usage of m-banking. Therefore, service providers in the market could significantly gain by shifting their operational focus on leveraging/mitigating these drivers/barriers, during the growth stage of m-banking/payment services. Within this set of influencers, improving on distribution reach (D7) may help in mitigating responsiveness hurdle (B11) and that in turn could strengthen Telco's retention efforts (D2). Thus, it may be useful to work simultaneously on this entire block of drivers and barriers, which have similar level of dependencies within their own hierarchies.

The remaining influencers, particularly relating to 'government policy', 'business model', 'critical mass', 'cost of service delivery' and 'marketing promotion' would need the attention of senior bureaucrats and top managements of Banks and Telcos. It must be noted that 'lack of consumer trust' appears as a barrier at operational level and would have to be overcome to ensure growth of service but 'trust' would have to be sustained to turn it into a driver for continued usage of service.

4.3. Limitations and scope for future research

This study identified a wide range of factors relevant for m-banking implementation and finalized a list of 11 barriers and 11 drivers of m-banking/payment services in India. After identification of factors, industry experts were consulted for understanding the contextual relationship among factors. Those experts may have introduced an element of bias in development of the model. However, it must be noted that if views of the group emerge only after discussion on issues, collective opinion is less likely to have strong individual biases.

Further, experts could either say that there was a relationship between a given pair of factors or the two factors were not related to each other. The ISM method did not allow for partial relationships or for factoring in the probability of impact/dependence of one factor on the other. It is planned to overcome this in future by introducing fuzziness in MICMAC analysis. This is proposed to be done by replacing the 1's in final reachability matrix by Experts' assessment of the probability or extent of contextual relationships (value between 0 and 1) and re-computing the driving powers and dependencies to be used for mapping.

In addition to the fuzzy modeling, it is proposed to deploy MDS (Multi Dimensional Scaling) technique with 5 ~ 6 top level factors identified by ISM. These factors with high dependencies would play an important role in the growth stage of m-banking service and MDS could serve as guidance for developing competitive positioning strategy vis-à-vis the major players.

5. Summary and Conclusion

As the reach of Indian telecom network spreads and mobile acquisition as well as usage becomes more affordable for the masses, mobiles present a unique opportunity for improving financial inclusion, particularly in the remote areas. Many countries have already deployed mobiles for banking, but India with its large base of nearly 700 million mobiles and inadequate reach of banking, is in a position to gain the most from use of mobiles for banking and payment services.

Reserve Bank of India (RBI) reckons the significance of this option and has already issued operating guidelines for use of mobiles for banking/payment services. Although RBI guidelines are based on a bank-driven model for m-banking implementation, Telcos are also keen to capitalize on this opportunity for their revenue enhancement and customer retention. Consequently, several enablers/drivers for m-banking are active in the system. However, 'bank-driven' m-banking is merely seen as another channel for accessing bank/card accounts and actual registrations for mobile based banking/payment and usage after registration continue to be low, pointing to a host of barriers blocking/inhibiting widespread consumer adoption.

Under these circumstances, if any m-banking enabler/driver or barrier/hurdle is considered independently, it appears to be the most critical one, needing immediate attention and highest priority. Therefore, for better understanding of the interdependence amongst variables and for planning strategic actions to leverage the potential of drivers and mitigate the impact of barriers, a method is required to classify/categorize and prioritize the variables. Interpretive Structural Modeling provides such a framework for comprehensive understanding of the role of all influencers.

In this study, positive and negative influencers were identified from literature survey and expert opinion was used to define contextual relationships between each pair of drivers and between every pair of barriers. ISM framework was then applied to generate two independent hierarchies of drivers and barriers. 'Model of drivers' put performance factors like 'facility for quick updates' along with 'time and cost savings' at the bottom of hierarchy and 'consumer trust', 'government policy' and 'marketing' in the strategic levels at the top. Barriers' model on the other hand, marked 'need for banking', 'reliability of telecom network' and 'interoperability' as factors with high driving powers and categorized 'conservative regulation' and 'business model issues' as most dependent hurdles.

To develop further on the insights gained by generation of hierarchies of drivers and barriers, all influencers are plotted on a common 'driver-dependency map' by treating driving power of barriers as 'negative'. Such a mapping brings together 'high-driving-power, low-dependency' variables to be addressed during the early stages of m-banking implementation. The next block of 'medium-dependency' variables emerge as influencers needing attention in the growth stage and 'high-dependency' variables fall into a separate cluster requiring strategic attention of senior echelons in the government, Banks and Telcos.

Although ISM is an interpretive modeling technique based on judgment of experts, Driver-dependency grid does evolve an overall mapping of m-banking influencers and helps in classification/categorization/prioritization of variables for optimum allocation of resources. The concept of plotting drivers and barriers on a common driver-dependency map, to gain strategic insights for implementation can be extended to projects/programs in any field/area.

REFERENCES

Amin, H., "Factors affecting the intentions of customers in Malaysia to use mobile phone credit cards", Management Research News, Vol. 31, No. 7: 493-503, 2008.

Azad, D. H., "Relevance of regulation for MNOs", Mobile Money Transfer Summit (May-08), available on GSMA website at www.gsmworld.com, 2008.

Bains, N., "Pay by Mobile 3GSM Mobile World Congress", Barcelona, available on GSMA website at www.gsmworld.com, 2008.

Barnes, S. J., "The Mobile commerce Value chain: Analysis and future developments", International Journal of Information Management Vol. 22: 91-108, 2002.

Bolan R., Zaragoza A., Nenclares A. and Pastor P., "Using interpretive structural modeling in strategic decision-making groups", Management Decision, Vol. 43, No. 6: 877-895, 2005.

Booze Allen Hamilton, whitepaper (Feb 2008), The Pay-by-Mobile Ecosystem - A macro-economic perspective, 2008.

Bossuyt Michae¨ l Van and Hove Leo Van, Mobile payment models and their implications for NextGen MSPs, Belgium, Vol. 9: 31-43, 2007.

Boston Consulting Group - BCG, The next billion Consumers - A roadmap for expanding financial inclusion in India, Nov 2007.

Brown, I., Cajee, Z., Davies, D. and Stroebel, S., "Cell phone banking: predictors of adoption in South Africa—an exploratory study", International Journal of Information Management, Vol. 23: 381-394, 2003.

Carlsson, C. and Walden, P., "Mobile Commerce: A Summary of Quests for Value-Added Products and Services", Electronic Commerce Conference, Bled, Slovenia, June 17 - 19, 2002.

CGAP (Consultative Group to Assist the Poor), UN Foundation and Vodafone Group Foundation, Mobile Phone Banking and Low-income customers: Evidence from South Africa - A report, 2006.

CGAP, "Microfinance and Mobile Banking: The Story So Far", Focus note no. 62, Jul 2010.

CGAP, "Critical Challenges to Delivering Successful Mobile Money Solutions: Regulatory Environment", May 2008.

Condos C., Tames A., Every P. and Simpson T., "Ten usability principles for the development of effective WAP and m-commerce services", Aslib Proceedings, Vol. 54, No. 6: 345-355, 2002.

Diwakar, H. and Vaidya, A., "Information analysis for enabling optimal utilization of service delivery channels in Indian banks", Seventh IEEE/ACIS International Conference on Computer and Information Science, 2008.

Faisal, M. N., Banwet, D. K. and Shankar, R., "Supply chain risk mitigation: modeling the enablers, Business Process Management Journal, Vol. 12, No. 4: 535-552, 2006.

Faisal, M. N., Banwet, D. K. and Shankar, R., "Information risks management in supply chains: an assessment and mitigation framework", Journal of Enterprise Information Management, Vol. 20 No. 6: 677-699, 2007.

Gounaris, S. and Dimitriadis, S., "Assessing service quality on the web: evidence from business-to-commerce portals", Journal of Service Marketing, Vol. 17, No. 5: 529-548, 2003.

Gounaris, S., and Koritos, C., "Investigating the drivers of internet banking adoption decision: A comparison of three alternative frameworks", International Journal of Bank Marketing, Vol. 26, No. 5: 282-304, 2008.

GSM Association, Pay by Mobile, (Nov-07) Business Opportunity Analysis – A White Paper GSMA Mobile Money Transfer summit, 2007.

Hasan M. A., Shankar, R. and Sarkis, J, "A study of barriers to agile manufacturing" Int. J. Agile Systems and Management, Vol. 2, No. 1: 1-22, 2007.

Ho, Shu-Hsun and Ko, Ying-yin, "Effects of self-service technology on customer value and customer readiness: The case of Internet banking", Internet Research, Vol. 18, No. 4: 427-446, 2008.

Huang, J. H., Lin, Y. R and Chuang, S. T., "Elucidating user behavior of mobile learning", The Electronic Library, Vol. 25, No 5: 585-598, 2007.

Janes F. R., "Interpretive Structural Modeling (ISM): a methodology for structuring complex issues", Trans Inst MC Vol. 10, No 3, 1988.

Juniper Research Limited, Mobile Payments Markets - Money transfers and remittances 2008~13, Getting the right balance - Money transfers on mobile - a white paper extract, 2008.

Juniper Research, Mobile - The ATM in your Pocket, a whitepaper extract from Mobile Finance Services - Banking and Payment Markets 2007 ~ 11, 2007.

Kamesam Vepa, Dy Governor RBI, Retail Banking: Challenges Ahead in Distribution Channels in Urban/Rural India, Twenty-Fifth Bank Economists, Conference - 2003, available on www.rbi.org.in, 2003.

Kamesam Vepa, Dy Governor RBI, "Recent Technological Developments in Indian Banking", available under speeches archives on www.rbi.org.in, 2003.

Ketkar, S. P., "Mobile network as banking channel, The Financial Express, New Delhi, 8 September, 2010.

Khalifa, M., and Shen, K., N., "Explaining the adoption of transactional B2C mobile commerce", Journal of Enterprise Information Management, Vol. 21, No. 2: 110-124, 2008.

Kumar, P., Shankar, R. and Yadav, S. S., "Flexibility in global supply chain: modeling the enablers", Journal of Modelling in Management, Vol. 3, No. 3: 277-297, 2008.

Laukkanen T., Sinkkonen S., Kivija M. and Laukkanen P., "Innovation resistance among mature Consumers", The Journal of Consumer Marketing, Vol. 24, No. 7: 419-427, 2007.

Laukkanen, T., "Internet vs mobile banking: comparing customer value perceptions", Business Process Management Journal Vol. 13, No. 6: 788-797, 2007.

Leeladhar, V., "Banking with Technology - The Road Ahead": IT@BFSI-200 Conclave, Key note Address available on RBI's website at www.rbi.org.in, 2005.

Lichtenstein, S. and Williamson, K., "Understanding Consumer adoption of Internet Banking: An interpretive study in the Australian Banking context" Journal of Electronic Commerce Research, Vol. 7, No.2: 50-66, 2006.

Mallat Niina, Exploring consumer adoption of mobile payments - A qualitative study, Journal of Strategic Information Systems Vol. 16: 413-432, 2007.

Mallat, N., Rossi, M. and Tuunainen, V. K., "Mobile banking services", COMMUNICATIONS OF THE ACM, Vol. 47, No. 5, 2004.

MALONE, D. W., Proceedings of the IEEE Vol.63, No. 3, 1975.

Manzano, J. A., Navarre, C., L., Mafe, C., R. and Blas, S., S., "Key drivers of internet banking services use", Online Information Review, Vol. 33 No. 4: 672-695, 2009.

Manzano, J., A., Mafe, C., R. and Blas, S. S., "Exploring individual personality factors as drivers of M-shopping acceptance", Industrial Management & Data Systems Vol. 109, No. 6: 739-757, 2009.

Manzano, J., A., Navarre, C., L., Mafe, C. R. and Blas, S., S., "The role of consumer innovativeness and perceived risk in online banking usage", International Journal of Bank Marketing, Vol. 27, No. 1: 53-75, 2009.

Manzano2, J., A., Mafe, C., R. and Blas, S. S., "Exploring individual personality factors as drivers of M-shopping acceptance", Industrial Management & Data Systems Vol. 109, No. 6: 739-757, 2009.

Martın, S., S., and Camarero, C., "How perceived risk affects online buying", Online Information Review Vol. 33, No. 4: 629-654, 2009.

Mohammed, I. R., Shankar, R. and Banwet, D.K., "Creating flex-lean-agile value chain by outsourcing", Business Process Management Journal, Vol. 14, No. 3: 338-389, 2008.

Morgado E.M., Reinhard N., and Watson, R. T., "Adding Value to Key Issues Research", Communications of AIS Vol. 1, 1999.

Okazaki, S., "NEW PERSPECTIVES ON M-COMMERCE RESEARCH", Journal of Electronic Commerce Research, Vol. 6, No.3: 160-64, 2005.

Poon, W.C., "Users' adoption of e-banking services: the Malaysian perspective", Journal of Business & Industrial Marketing, Vol 23, No. 1: 59–69, 2008.

Ram, S. and Sheth, J.N., "Consumer resistance to innovations: the marketing problem and its solutions", The Journal of Consumer Marketing, Vol. 6, No. 2: 5-14, 1989.

Rangarajan, C., Committee Report (Jan 2008) on Financial Inclusion, available on NABARD website at www.nabard.org, 2008.

Reddy, Y.V., RBI Governor's speech at Banking Technology Awards Function (Sep-06), Institute for Development and Research in Banking Technology, 2006.

RBI - Monthly Bulletin, Reserve Bank of India, Monthly Bulletin - Sep 2009, (Vol. LXII No. 9) available at www.bulletin.rbi.org.in, 2009.

RBI, Report on Internet Banking Part 1 and Part 2 available on RBI's website at www.rbi.org.in, 2001.

RBI, Mobile Banking Transactions in India - Operative Guidelines for Banks, Sep-08, available at www.rbi.org.in, 2008.

RBI, Annual Report, available on RBI's official website at www.rbi.org.in under "publications" Reports - Annual – Statutory, 2007-08.

RBI - DIT, "Financial Sector - Technology Vision Document", Reserve Bank of India, Department of Information Technology (Jun 2007), available on www.rbi.org.in, 2007.

Richardson, B., "Mobile Money Transfer Summit (May 2008)", organized by GSM Association available on GSMA website (www.gsmworld.com) in Sep-08, under initiatives section, 2008.

Robertson, M., GSMA's Mobile Money Transfer Summit (May 2008), "The Mobile Virtual Banking Operator (MVBO) - redefining what it means to be "banked", available in Sep-08 on GSMA website (www.gsmworld.com), 2008.

Shergill, G. S. and Chen. Z., "Web-based shopping: Consumers' Attitude towards Online Shopping in New Zealand", Journal of Electronic Commerce Research, Vol. 6, No.2: 79-94, 2005.

Srivatsa H.S. and Srinivasan R., Banking Channel Perceptions An Indian Youth perspective, International Marketing Conference on Marketing & Society, 8-10 April, 2007, IIMK, 2007.

Szmigin, I., Bourne, H., "Electronic cash: a qualitative assessment of its adoption", International Journal of Bank Marketing Vol. 17, No. 4: 192–202, 1999.

Thakkar J., Deshmukh S.G., Gupta A.D. and Shankar R., "Development of a balanced Scorecard - An integrated approach of Interpretive Structural Modeling (ISM) and Analytic Network Process (ANP)", International Journal of Productivity and Performance Management, Vol. 56, No. 1: 25-59, 2007.

Van Hove L., "Electronic money and the network externalities theory: lessons for real life", Netnomics Vol. 1, No 2: 137–171, 1999.

Wei T., T., Marthandan, G., Chong, A., Y, Ooi, K. B. and Arumugam, S., "What drives Malaysian m-commerce adoption? An empirical analysis", Industrial Management & Data Systems, Vol. 109, No. 3: 370-388, 2009.

Wishart, Neville, Micro payment systems and their application to mobile networks, A publication from infoDev / World Bank in partnership with IFC (International Finance Corporation) and GSMA (GSM Association): http://www.infodev.org/en/Publication.43.html, 2006.

Wyk, Y. V., "How Bank-led models generate benefit for Mobile Operators", Mobile Money Transfer conference – GSMA, 2008.

Xue, M., Hitt, L. M. and Harker, P. T., "Customer Efficiency, Channel Usage and Firm Performance in Retail Banking", 2006.