

Beyond the Obvious: Standardization and Interoperability Issues in Mobile Banking in India

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Abstract: Objectives: Study aims to explore interoperability and standardization issue in mobile banking and to identify gaps in regulatory framework. Prior Work: Many studies exist which reflects that there are problems in adopting mobile banking in India. There are couple of conceptual research which focus on issues in adopting mobile banking, from those research work a conceptual framework was developed which helps in identifying the standardization and interoperability issues. Approach Survey method was adopted where data was collected using multiple entry non-discriminatory snow ball sampling. Data was checked for statistical assumptions followed by one sample t test, Friedman Test, Kendall's W Test and Wilcoxon signed rank test. Results: Both interoperability and standardization issues were critical. It was found that interoperability was more critical than standardization. Implications: There is need of mutual understanding among banks and telecom operators; and up to some extent among mobile handset manufacturers also. Further regulators should issue regulatory guidelines to standardized short code for a particular type of transaction. Value Paper dealt with interoperability and standardization issues, not studied empirically before from regulators' and practitioners' perspective in India.

Keywords: E-Banking; Mobile Payment; Banking

JEL Classification: M19

1. Introduction

In recent time, banking sector has witnessed the intensive application of technology (Weiser, 1991). Such technology is offering convenience to customers in managing money without handling cash (Karjaluo, 2002) and for banks it is helping in making financial services available to masses and reducing operating cost (Ashta, 2010). One of such technology innovation in banking sector that will help to reach masses and at the same reduce operating cost is mobile banking (Bhavnani et al., 2008; Datta et al. 2001). India is among the fastest growing regions in terms of mobile phone subscribers (ITU Report, 2010). The mobile phones are already

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transforming lives of people here for the better by enabling people to ‘leapfrog’ (Alexander, 2009). In the developing world, there are probably more people with mobile phones than with bank accounts (Porteous, 2006). Further, more than half of the Asia's mobile banking customers in 2009 were in India (Lawson, 2010). Mobile banking has a strong potential in India and realizing the same Reserve Bank of India has already permitted 60 banks to provide mobile banking services to help banks in reducing operational cost and at the same time achieve financial inclusion.

But before this, there are some critical issues & challenges which must be addressed by mobile Bankers and must be properly regulated so that mobile banking could diffuse easily in India. Two such prominent issues in India, yet remaining unexplored are: standardization and interoperability. Standardization could be defined as “a framework of agreements to which all relevant parties in an industry or organization must adhere to ensure that all processes associated with the creation of a good or performance of a service are performed within set guidelines to ensure consistent quality” (Investopedia, 2010). For mobile banking transactions, SMS mediated informational and financial transaction is widely used mode especially in developing countries. So in the study, standardization issue was conceptualized in terms of SMS based mobile banking. Banks design and develop their own systems of various short codes related to particular type of mobile banking transaction to be performed. This leads to standardization issue in the mobile banking (Sharma & Singh, 2009) due to which memorizing and handling different short codes imposes challenge to the mobile banking users. Situation further becomes more complex if a user wants to avail mobile banking services from multiple banks having different types of accounts, due to difficulty in dealing with different SMS short codes of different banks for different transactions (Luarn & Lin, 2005; Wang et al., 2003).

Interoperability is defined as “the ability of diverse systems and organizations to work together”, but this definition goes much beyond in the context of mobile banking (Odinga & Nalika, 2011). In mobile banking, there is a lack of common technology standards, many protocols are being used for mobile banking – HTML, WAP, SOAP, XML to name a few. There are large numbers of different mobile handset and it is a big challenge for banks to offer mobile banking solution on any type of mobile handset. Some of these mobile handset support J2ME and others support WAP browser or only SMS. This situation leads to serious interoperability issue in mobile banking creating hindrance in improving financial inclusion and reducing cost (Banzal, 2010; Agarwal, 2007; Amarnani, 2009). Hence, this study focuses on the standardization and interoperability issues (beyond the obvious issues like security, privacy, customer illiteracy) of mobile banking in India, keeping in view the regulatory guidelines related to the same for smooth diffusion of mobile banking in India. Further this study aims to provide necessary

suggestions on the same to Reserve Bank of India (The Central Bank of India, responsible for regulating mobile banking in India) & service providers. The study should be of interest to the banks and telecom operators providing mobile banking services and the financial regulators, who are increasingly interested in the interoperability and standardization issues of mobile banking.

2. Literature Review

2.1. Standardization Issue

Davis (1989); Karjaluoto et al. (2002); Ramayah et al. (2003); Kleijnen et al. (2004) investigated and agreed that 'perceived ease of use' is valid constructs in understanding an individual's intention to adopt any system and in our study it is mobile banking. As per Davis (1989), perceived ease of use could be defined as the degree to which a person believes that using and dealing with a particular system would be free from effort. In context of the mobile banking it refers to degree to which consumers perceive dealing with mobile banking is hazard free. Cheong and Park (2005); Luarn and Lin (2005) indicated that perceived ease of use has a significant impact on the development of initial willingness to use mobile banking. They also found that there exists a positive causality between perceived ease of use and electronic transaction intentions. Therefore, it is highly predictable that the consumers would use mobile banking only if they find it easy to handle. Guriting and Ndubisi (2006) studied that perceived ease of use had a significant positive effect on behavioral intention to use electronic banking in Malaysia. Similarly, Kleijnen et al. (2004) in their study on wireless finance in Netherlands concluded that perceived ease of use was a significant measure in the development of people's intention to use electronic banking. Guriting and Ndubisi (2006); Luarn and Lin (2005); Wang et al. (2003) studied standardization issue in relation with the different mobile banking short codes provided by different banks. According to them memorizing different short codes imposes challenge to users, further if users were availing mobile banking services from multiple banks and having different types of accounts in that then it becomes extremely difficult to deal with different SMS short codes of different banks. Bamoriya and Singh (2011) in their empirical study on Indian mobile banking sector reported that majority of the mobile banking users feel that mobile banking service standards are lacking among Indian banks which further makes it difficult to do mobile banking from multiple service providers. Standardization is a major issue as lack of standardization of mobile banking services in the country is resulting in increased complexity while using mobile banking services which in turn hamper its growth. They suggested that for resolving this issue banks should develop mobile banking standards in guidance of Reserve Bank of India. Sharma and Singh (2009) stated in their empirical study that users perceive mobile banking as an easier way to do banking in terms of time

saving and anywhere banking. But they find it difficult to remember the different SMS codes for different types of transaction like money transfer, balance check, cheque book request etc. They suggested that banks providing mobile banking services, with their mutual agreements should design and develop uniform global coding to address standardization issue which will ultimately provide ease to the users and helps in the growth of mobile banking in India.

2.2. Interoperability Issue

As per Mas (2011) mobile banking interoperability is a far-reaching vision that promises to improve financial inclusion by leaps and bounds. Further Agarwal (2007) stated that it would be a wise idea for the vendor to develop a mobile banking application that can connect multiple banks' account. It would require either the application to support multiple protocols or use of a common and widely acceptable set of protocols for data exchange. But currently situation is not that rosy and many a times serious interoperability issue in mobile banking is reported. Anderson (2009) stated that emerging mobile banking in developing markets enable two sided markets, bringing together mobile handset users with other mobile users and commercial partners. He argued that the emergence of mobile banking platforms has the potential for spill-over effects, and that these spill-over effects will require regulatory authorities to develop appropriate policy responses. He intended to study the interoperability issue in the mobile banking and his research was derived from the mobile banking strategies of mobile network operators (MNOs) in developing markets, and the regulatory responses to these strategies. His findings suggested that the interoperability of mobile banking platforms between operators based on industry standards will significantly reduce the risk of monopoly dominance by the first-mover, will minimize spill-over impact on the competitive dynamics and will lead to better mobile banking services. Banzal (2010); Agarwal (2007); Amarnani (2009) stated that in mobile banking there is a lack of common technology standards and protocols. Already there are a large number of different mobile handsets and it is a big challenge for banks to offer mobile banking solution on such different type of mobile handsets. Mas (2008) stated that interoperability issue is very critical, as interoperability is required for terminal equipment, transaction switching, interbank clearing and interbank settlement. The risk here is non co-operation among the providers to build a broad basis of an interoperable network. According to Lyman et al. (2008) there are a large number of different mobile handsets and it is a big challenge for banks to offer mobile banking solution on any type of device. Some of these devices support Java2ME and others support SIM Application Toolkit, a WAP browser, or only SMS. The desire for interoperability is largely dependent on the banks themselves, where installed applications (Java based or native) provide better security, are easier to use and allow development of more complex

capabilities similar to those of internet banking while SMS can provide the basics but becomes difficult to operate with more complex transactions. Similarly Gartner (2009) reported that the mobile handset sales in developing markets is skewed, in which contribution of enhanced phone is 47%, basic phones is 43%, entry level smart phones is 7% and featured smart phones is 3%. He further stated that in India maximum banks allow mobile banking on GPRS only, a big hurdle for increasing the customer base in India because such service cannot be availed on all handsets due to interoperability problem. Banzal (2010) stated that with a host of device operating systems and networks make application development for the wireless internet a formidable task. While WAP has been a very important in the evolution of the wireless internet and in turn mobile banking, there are problems/difficulties with the standard, such as the lack of WAP enabled devices and security issues. The lack of standards gives rise to lot of local and fragmented versions of mobile banking lacking interoperability. Further Agrawal (2007) stated that overcoming interoperability issues, however, have been localized, with countries like India using portals like R-World to enable the limitations of low end java based phones, whereas, South Africa have defaulted to the USSD as a basis of communication achievable with any phone. The desire for interoperability is largely dependent on the banks themselves, where java enabled applications are of better security, easier to use and offer development of more complex transactions similar to that of Internet Banking while SMS can provide the basics but becomes a hassle to operate with more difficult transactions. Bankers and telecom operators need to come out with common platform to tackle this interoperability issue for success of mobile banking.

3. Objectives

- to study the significance of interoperability and standardization issue in mobile banking in India.
- to study the gaps in regulations related to mobile banking on the basis of statement wise analysis of interoperability and standardization issues in mobile banking in India.

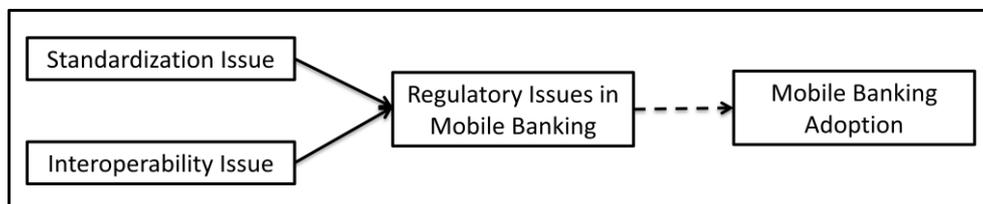


Figure 1. Conceptual Model

4. Research Methodology

4.1. Research Design

This study aimed to explore the interoperability and standardization issues in mobile banking, so a descriptive design was adopted for the same. This research design was cross sectional in nature and was carried out from perspective of banks and Reserve Bank of India.

4.2. Sampling

Sampling frame for the study consisted of senior bank managers of commercial banks and Reserve Bank of India who were directly dealing in mobile banking. In the light of unavailability of exact number and the location of such units of analysis and further the fact that they were hard to reach, so a ‘multiple entry non-discriminatory exponential snow ball sampling’ method was adopted. With multiple entry & non-discriminatory concept in the sampling technique selected, intention was to minimize selection bias inherent in snowball sampling method and to improve representativeness, as suggested by Atkinson and Flint (2001); Jacobsen and Landau (2003).

4.3. Questionnaire and Content Validity

First a preliminary questionnaire was designed. As recommended by Joreskog (1993) minimum two items per construct were ensured while preparing questionnaire. Interoperability construct has total 5 items and Standardization construct has total 3 items. To ensure that the items in preliminary questionnaire were measuring what they were supposed to measure, the content validity was ensured. For this preliminary questionnaire was forwarded to ten subject experts and psychometric experts. A total of two structured responses were received on the basis of which one item measuring to interoperability issue was added in the questionnaire (IO5).

4.4. Data Collection

Data was collected through email administered questionnaire (Google Doc version). Questionnaire was administered to 309 respondents, where finally 39 responses were received.

4.5. Data Cleaning

Data cleaning involved initial check for missing values and outliers. Data was checked for missing values after data collection where no such missing values were found. For detecting outliers, standardized values (z scores of items) were estimated using SPSS10. No outlier was detected ($|z| < 3$, no outlier; Barbara, 2006).

4.6. Data Reliability & Internal Consistency

To check if all items measuring particular construct were consistent with the averaged behavior of the other items measuring the same construct, an item-total correlation test was performed. Corrected item to total correlation for interoperability scale (total items 5) ranged from .581 to .802 with alpha value .809, suggesting internal consistency thus no item to be deleted. For standardization subscale (total items 3) corrected item to total correlation ranged from .837 to .837 with alpha value .910, suggesting internal consistency thus no item to be deleted.

4.7. Convergent & Discriminator Validity

For ensuring construct validity of scale, convergent and discriminator validities were estimated using product moment correlation matrix of 8 items measuring 2 constructs viz. standardization and interoperability. Analysis suggested convergent validity, as moderate to strong correlation with highest value .789 and lowest value .549; all significant at .05 was present between items measuring the same construct. Further no strong correlation was found between items measuring different constructs which suggested presence of discriminator validity.

4.8. Data Normality

Data normality was ensured by estimating and analyzing skewness & kurtosis indices. The skewness indices for the dataset ranged from -2.01 to +2.87. Thus all values were within recommended range of -3 to +3 (index value < |3|, normal; kline, 2005). Similarly kurtosis indices ranged from -3.34 to +8.98 i.e. all values within recommended range of -10 to +10 (index value < |10|, normal; kline, 2005). Hence, data was regarded as univariate normal.

5. Analysis and Findings

5.1. Descriptive Statistics

Data obtained was first subject to descriptive statistics (*Table 1*) using SPSS10 to explore opinions and perceptions of respondents for the select issues on 7-point semantic differential scale (1= agree, 7= disagree). Interoperability was found to be the more critical issue, followed by standardization issue by the respondents.

Table 1. Descriptive Statistics

Issue (<i>average score</i>)	Minimum	Maximum	Mean
Interoperability	1.75	4.00	2.061
Standardization	1.00	6.00	2.448

5.2. Significance of Issues/ One Sample t Test

To analyze significance of the select issues in mobile banking with respect to population, data was further subject to One Sample t test with test value equal to 4 (*Table 2*).

Table 2. One Sample t Test

Issue	Mean	t	df	Sig. (2-tailed)
Interoperability	2.061	14.514	38	.000
Standardization	2.448	8.061	38	.000

It is evident that mean value of interoperability issue 2.06 ($M < 4$, $t=14.51$, $df=38$) is significantly different from the test value of 4 at 0.001 level (*Table 3*). It may therefore be said that *interoperability is a significant issue in mobile banking*.

It is also evident that mean value of standardization issue 2.44 ($M < 4$, $t=8.06$, $df=38$) is significantly different from the test value of 4 at 0.001 level (*Table 3*). It may therefore be said that *standardization is a significant issue in mobile banking*.

5.3. Priority of Issues

Further to identify which of the issues is more prominent and shall be addressed on priority, data obtained using ordinal scale (ranks) was subject to Friedman test & Kendall's W test, followed by Wilcoxon Signed Ranks test as a post hoc test.

5.3.1. Friedman Test & Kendall's W Test

Firstly Friedman test was conducted to evaluate differences in mean ranks of the two issues in mobile banking. Here, Chi square value ($df=1$, $N=39$) of 39.45 was significant at .01 level. Hence, it is evident that the *mean ranks of the select issues are significantly different* (*Table 3*).

Table 3 Friedman Test

N	39
Chi-Square χ^2	39.459
Df	1
Sig.	.002

Further, Kendall's W test was conducted to measure effect size of difference (Table 4). Here, Kendall's coefficient of concordance of .51 indicated strong differences between interoperability and standardization issues (Green and Salkind, 2008).

Table 4. Kendall's W Test

N	39
Kendall's W	.513
Df	1
Sig.	.002

5.3.2. Wilcoxon Signed Ranks Test

Once a significant difference in mean ranks of the two issues was found, next a Post hoc was conducted to find out which is most critical (lowest mean rank) and which is least critical issue (highest mean rank). Pairwise comparisons of mean ranks of select issues was done using Wilcoxon signed ranks test and their rankings were tabulated (Table 5). It is evident that *in mobile banking, interoperability is more critical issue than standardization issue* ($Z = -2.586$; $p < .05$).

Table 5. Paired Wise Comparison in Ranks Test

Ranks Test	RANK Interoperability – RANK Standardization
Z	-2.586*
Sig (2-tailed)	.011

*Based on Positive Ranks

5.4. Analysis for Regulatory Framework/ One Sample t Test

For analyzing existing regulatory framework of mobile banking in India and its application, item-wise analysis (items pertaining to select issues) was done using One Sample t test (Table 6).

Table 6. One-Sample t Test for Regulatory Framework

Item	T	Mean	Sig.	Item	t	Mean	Sig.
IO1	11.079	2.05	.000	SD1	7.282	2.55	.000
IO2	14.442	1.95	.000	SD2	7.979	2.33	.000
IO3	18.019	1.69	.000	SD3	7.543	2.49	.000
IO4	14.951	2.46	.000				
IO5	8.356	2.14	.000				

As it is evident that mean value of IO1; 2.05 ($M < 4$, $t=11.079$, $df=38$) is significantly different from the test value of 4 at 0.001 level (Table 7). It may therefore be said *that in mobile banking there is lack of common technology protocol.*

It is also evident that mean value of IO2; 1.95 ($M < 4$, $t=14.442$, $df=38$) is significantly different from the test value of 4 at 0.001 level (Table 7). It may therefore be said that *offering mobile banking services on any type of mobile handset is a challenge due to difference in support technology.*

It is also evident that mean value of IO3; 1.69 ($M < 4$, $t=18.019$, $df=38$) is significantly different from the test value of 4 at 0.001 level (Table 7). It may therefore be said that *various telecommunication technologies viz. GSM, CDMA, GPRS pose a challenge in offering mobile banking, as each of these requires different support technology.*

It is also evident that mean value of IO4; 2.46 ($M < 4$, $t=14.951$, $df=38$) is significantly different from the test value of 4 at 0.001 level (Table 7). It may therefore be said that *all mobile banking service providers should adopt common ISO 8583 message format to ensure interoperability among banks.*

As it is evident that mean value of IO5; 2.14 ($M < 4$, $t=8.356$, $df=38$) is significantly different from the test value of 4 at 0.001 level (Table 7). It may therefore be said *that in mobile banking, offering services through GPRS poses hurdle due to handset interoperability.*

It is also evident that mean value of SD1; 2.55 ($M < 4$, $t=7.282$, $df=38$) is significantly different from the test value of 4 at 0.001 level (Table 7). It may therefore be said that *it becomes difficult for the users availing mobile banking services from multiple banks, to deal with different SMS short codes of different banks.*

It is also evident that mean value of SD2; 2.33 ($M < 4$, $t=7.979$, $df=38$) is significantly different from the test value of 4 at 0.001 level (Table 7). It may

therefore be said that *the short code for a particular type of transaction should be standardized irrespective of bank.*

It is also evident that mean value of SD3; 2.49 ($M < 4$, $t=7.543$, $df=38$) is significantly different from the test value of 4 at 0.001 level (*Table 7*). It may therefore be said that *standardization of short codes will have a significant impact on the initial willingness to use mobile banking*

6. Recommendations for Regulators & Practitioners

On the basis of key findings of the study following recommendations were made:

6.1. Recommendations on Standardization Issue

Users availing mobile banking services from multiple banks find it difficult to deal with different SMS short codes of different banks. So Reserve Bank of India should issue guidelines to all banks providing mobile banking services to standardized short code for a particular type of transaction irrespective of bank.

Mobile service providers should focus on developing applications for low end java based phones (in India penetration of smart phones and high end java based phones is comparably low; but rising very sharply) like of R-World. Such concept has more perceived ease of use and further offers development and subsequent easy application of more complex mobile banking transactions similar to that of internet banking without using any short codes.

6.2. Recommendations on Interoperability Issue

Various telecommunication technologies viz. GSM, CDMA, GPRS and variety of mobile phones pose an interoperability challenge in offering mobile banking, as each of these requires different support technology & infrastructure. But in practice it is too early in the service lifecycle of mobile banking for interoperability to be addressed within the country. Solution for this would largely dependent on mutual understanding of banks, telecom operators and mobile handset manufacturers. Parties involved in mobile banking should develop this understanding soon to achieve economies of scale (EoS) in mobile banking and offer good services to customers.

To address interoperability issue mobile banking service providers should adopt common ISO 8583 message format. Once banking interfaces are well defined and money movements between banks follow the ISO-8583 standards, this interoperability issue would automatically get resolved.

Further banks should promote JAVA enabled application based mobile banking in India. As JAVA based phones being cheaper day by day in the country, this JAVA application based platform could resolve interoperability issues.

7. Conclusion

Current study focuses beyond the most obvious issues of security and privacy in mobile banking and empirically explores the interoperability and standardization issue in mobile banking in India. Further it makes an attempt to provide recommendations to regulators and service providers. Results showed that both interoperability and standardization issues are critical and must be addressed if regulators wish to have smooth diffusion of mobile banking in India. Further it was found that interoperability is more critical than standardization. On the basis of analysis for interoperability issue, situation calls for mutual understanding among banks and telecom operators; and up to some extent among mobile handset manufacturers also.

Further for standardization issue regulators should issue regulatory guidelines to standardized short code for a particular type of transaction. Mobile service providers also have an important role to play on both interoperability and standardization front. If they could develop mutual understanding and could agree to work using same platform, these issues could easily be addressed. Thus, study makes important implications for regulators and practitioners both. The limitation of the study was data collection approach. The use of self-reports to collect data may lead to the common method variance, a situation where true associations between variables are inflated. As far as scope of future research is concerned, there could be other issues such as network, customer illiteracy, customer authentication, coordination issue and other prominent issues could be studied from future prospective of Mobile Banking. Further one obvious area is non bank led model of Mobile Banking. Two models viz. bank lead and non bank led are different in approach in terms of involvement of parties (banks and telecom operators) & their roles, application of basic technology, realm of services offered. Certain issues pertaining to these 2 models would vary. This provides some good scope for future study on issues and challenges in non bank led model in India.

8. References

- Agarwal, G. (2007). Financial Inclusion through Mobile Phone Banking: Issues and Challenges. *Cab Calling, July-September*.
- Alexander, D. (2009). *Speech at Chatham House on Branchless Banking*. Retrieved from <http://www.dfid.gov.uk/Media-Room/Speeches-andarticles/2009/Douglas-Alexander-sets-out-how-branchless-banking-can-help-the-poorest-people/> (accessed on Sep 5, 2009).
- Amarnani, S. (2009). *Feature – Mobile Banking in India*. Retrieved from <http://www.cashcow.in/?p=580> (accessed on Oct 30, 2009).
- Anderson, J. (2009). *Competitive and Regulatory Implications of Mobile Banking in Developing Markets*. Retrieved from <http://www.emeraldinsight.com/mobile/index.htm?issn=1463->

6697&volume=12&issue=1&articleid=1834525&show=html&PHPSESSID=i3iqfundvjoortq3f43f57pci1 (accessed on Feb 02, 2010).

Ashta, A. (2010). *Evolution of Mobile banking Regulations*. Retrieved from http://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=473010 (accessed on Oct 23, 2010).

Atkinson, R., Flint, J. (2001). *Accessing Hidden and Hard-to-Reach Populations: Snowball Research Strategies*. Retrieved from <http://sru.soc.surrey.ac.uk/SRU33.html> (accessed on Sep 01, 2010).

Bamoriya, Purna Sharma & Singh, P. (2011). Issues & Challenges in Mobile Banking in India: A Customers' Perspective. *Research Journal of Finance and Accounting*. Retrieved from <http://iiste.org/Journals/index.php/RJFA/article/view/189/73> (accessed on July 31, 2011).

Banzal, S. (2010). *Mobile Banking & M-Commerce and Related Issues*. Retrieved from http://public.webfoundation.org/2010/04/tra_i_compendium/25.Mobile_banking_M-commerce_15.03.pdf (accessed on Nov 19, 2010).

Barbara, D.; Domeniconi, C. & Rogers, J. P. (2006). *Detecting Outliers Using Transduction and Statistical Testing*. Retrieved from <http://www.ise.gmu.edu/~carlotta/publications/rtpf719-domeniconi.pdf> (accessed on Nov 11, 2009).

Bhavnani, A.; Chiu, R. W.; Janakiram, S. & Silarszky, P. (2008). *The Role of Mobile Phones in Sustainable Rural Poverty Reduction*. Retrieved from http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/The_Role_of_Mobile_Phones_in_Sustainable_Rural_Poverty_Reduction_June_2008.pdf (accessed on Sep 02, 2009).

Cheong, J. H. & Park, M. C. (2005). Mobile Internet Acceptance in Korea. *Internet Research*, 15(2), pp. 125-140.

Datta, A.; Pasa, M. & Schnitker, T. (2001). Could Mobile Banking Go Global?. *The McKinsey Quarterly*, No 4, pp. 71-80.

Davis, F. D. (1989). *Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology*. Retrieved from <http://www.jstor.org/pss/249008> (accessed on March 11, 2010).

De Vaus, D. A. (2004). *Analyzing Social Science Data, Re-pert*. India: SAGE Pub.

Gartner (2009). *Gartner Report*. Retrieved from <http://www.gartner.com/it/page.jsp?id=1224645> (accessed on Jan 02, 2011).

Green, S. B. & Salkind, N. J. (2008). *Using SPSS for Window and Macintosh: Analyzing and Understanding Data, 5th ed*. Pearson Prentice Hall.

Guriting, P. & Ndubisi, N. O. (2006). Borneo Online Banking: Evaluating Customer Perceptions and Behavioural Intention. *Management Research News*, 29(1/2), pp. 6-15.

Investopedia, (2010). *Standardization*. Retrieved from <http://www.investopedia.com/terms/s/standardization.asp#ixzz1h38879Se> (accessed on Dec 11, 2010).

ITU Report (2010). *International Telecommunication Union*. Available online: <http://www.itu.int/en/pages/default.aspx> (accessed on Oct 12, 2010).

Jacobsen, K. & Landau, L. (2003). The Dual Imperative in Refugee Research: Some Methodological and Ethical Considerations in Social Science Research on Forced Migration. *Disasters*, 27(3), pp. 185-206.

- Joreskog, K. G., (1993). Testing Structural Equation Models. In K. A. Bollen and J. S. Long (Eds.), *Testing Structural Equation Models*. Newbury Park: SAGE Publications.
- Karjaluoto, H. (2002). Selection Criteria for a Mode of Bill Payment: Empirical Investigation among Finnish Bank Customers. *International Journal of Retail & Distribution Management*, 30(6), pp. 331-339.
- Kleijnen, M.; Wetzels, M. & de Ruyter, K. (2004). Consumer Acceptance of Wireless Finance. *Journal of Financial Services Marketing*, 8(3), pp. 206-217.
- Kline, Rex B. (2005). *Principles and Practice of Structural Equation Modeling (2nd Ed.)*. NY: Guilford Press.
- Lawson, S. (2010). Mobile Buying Booms in US. Banking in India. *IDG News Service*, Feb 18.
- Luarn, P., Lin, H. H. (2005). Toward an Understanding of the Behavioural Intention to Use Mobile Banking. *Computers in Human Behaviour*, 21, pp. 873-891.
- Lyman T. R.; Pickens M. & Porteous D. (2008). *Regulating Transformational Branchless Banking: Mobile Phones and Other Technology to Increase Access to Finance. CGPA Focus Note 43*. Retrieved from <http://www.cgap.org/gm/document-1.9.2583/fn43.pdf> (accessed on Mar 14, 2010).
- Mas, I. & Rotman, S. (2008). *Going Cashless at the Point of Sale: Hits and Misses in Developing Countries. CGAP Focus Note 51*. Retrieved from <http://www.cgap.org/gm/document-1.9.7885/FN51.pdf>. (accessed on Feb 12, 2010).
- Mas, I. (2011). *A New Year's Resolution for the Mobile Money Industry: Interoperating*. Retrieved from <http://technology.cgap.org/2011/01/17/a-new-year%E2%80%99s-resolution-for-the-mobile-money-industry-interoperating/> (accessed on May 26, 2011).
- Odinga, M. & Nalika, P. (2011). *Aggregation and Integration Challenges of Mobile Banking*. Retrieved from <http://www.cio.co.ke/view-all-main-stories/2978-aggregation-and-integration-challenges-of-mobile-banking.html> (accessed on March 4, 2011).
- Porteous, D. (2006). *The Enabling Environment for Mobile Banking in Africa*. DFID, Ldn.
- Ramayah, T.; Jantan, M.; Noor M. N. M. & Ling, K. P. (2003). Receptiveness: Internet Banking by Malaysian Consumers. *Asian Academy of Management Journal*, 8(2), pp. 1-29.
- Sharma, Perna, Singh, P. (2009). Users' Perception about Mobile Banking (With Special Reference to Indore and Around). *Review of Business and Technology Research*, 2(1), pp. 1-4
- Wang, Y. S.; Wang, Y. M.; Lin, H. H. & Tang, T. I. (2003). Determinants of User Acceptance of Internet Banking: An Empirical Study. *International Journal of Service Industry Management*, 14(5), pp. 501-519.
- Weiser, M. (1991). The Computer for the 21st Century. *Scientific American*, pp. 94-100.