

## **Issues in Mobile Banking in India with reference to Regulations**

**Prerna BAMORIYA<sup>1</sup>**

**Abstract:** Mobile Banking in India is in its nascent stage and there are certain prevailing issues which must be addressed for its smooth diffusion. This study was focused on exploring select issues in Mobile Banking in India and analyzing regulatory framework. For this a standardized questionnaire was developed and data was collected from senior bank managers and RBI officials. Analysis revealed that security, interoperability, network, customer illiteracy and standardization issues were significant, where as privacy, coordination and KYC/AML/CFT issue were insignificant. At last, recommendation were made to Mobile Banking service providers and regulators, followed by implications for future research..

**Keywords:** Banking, Issues, Mobile, RBI.

### **1 Introduction**

Technological advances are said to be inseparable from everyday life and business. And, banking sector is no exception where technological advances have witnessed the use of innovative technology (Weiser, 1991). Generally, banking sector has two major concerns on which sector look at technological advances: Firstly, providing the financial services to maximum possible potential customers. Secondly, reducing rising operational cost. It is hoped that technology will help to a great extent in increasing outreach as well as reducing operating costs (Ashta, 2010). One such technology advancement in banking sector is the Mobile Banking (Bhavnani et al., 2008; Bamoriya et al. 2013). Mobile Banking could be defined as Financial transactions undertaken using a mobile device against a bank account accessible from that device (Dasgupta, 2013). Mobile Banking could help banks in reducing cost and expand customer base. Further, a bank may hope to win or retain a positive image amongst technology-savvy sections of the society and strengthen the brand reputation of being innovative and visionary using technology like Mobile Banking (Georgi and Pinkl, 2005). The growth of mobile phone and dynamic use of mobile based services among south Asian population indicates that this region can be a potential region for Mobile Banking adoption especially India (Deloitte, 2008), as more than half of Asia's Mobile Banking customers in 2009 were in India (Lawson, 2010).

As Mobile Banking in India is in its nascent stage there are certain prevailing issues which must be addressed for smooth diffusion of Mobile Banking in the country. This study focuses on exploring select issues and challenges in Mobile Banking in India viz. Security, Interoperability, Privacy, Standardization, Coordination, Anti Money laundering (AML) / Know Your Customer (KYC) /

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<sup>1</sup>Govindram Seksaria Institute of Management & Research, India, Asst Professor (Finance),  
Corresponding author: prernabamoriya@gmail.com.

Combating the Financing of Terrorism (CFT), Network Breakdown, and Customer Illiteracy issue. Further this study focuses on regulatory framework related to Mobile Banking and intends to provide necessary suggestions on the same to RBI. The study should be of interest to banks and telecom operators providing Mobile Banking services and the financial regulators, who are increasingly interested in the issues of Mobile Banking.

## **2. Literature review**

Vyas (2009); Rao and Prathima (2003) provided an extensive theoretical analysis of Mobile Banking in India, and found that as compared to the banks abroad, Indian banks offering Mobile Banking services still have a long way to go by handling various issues. Various authors reported different-different critical issues in the Mobile Banking which must be addressed for the success of Mobile Banking.

### **Security Issue**

Stewart and Segars (2002); Suh and Han (2003); Chen (2006); Weber (2010); Regan (2003); Varshney (2003); Cheny (2008); Tiwari, Buse and Herstatt (2006); Maru (2011); Bamoriya (2011); Laforet and Li (2005); Luarn and Lin (2004); Brown et al. (2003); Makin (2009); Wang et al. (2003); Howcroft et al. (2002); Polatoglu and Ekin (2001) stated that one of the gravest concerns related to Mobile Banking is consumers' security perception. Chen (2006) defined security in context of Mobile Banking as the extent to which the prospective user is concerned about the authentication, confidentiality, non-repudiation and data integrity relevant to mobile payment.

### **Interoperability Issue**

As per Banzal (2010); Agarwal (2007); Amarnani (2009); Mas (2011); Lyman et al. (2008); Gartner (2009); Sinha (2007); Bångens and Söderberg (2008) in Mobile Banking there is a lack of common technology standards and protocols and it is a big challenge for banks to offer Mobile Banking solution on such different type of mobile phones leading to interoperability issue.

### **Privacy Issue**

According to Tan and Teo (2000); Chen (2006); Banzal (2010); Ashta (2010); Smith et al. (1996); Smith (2004); Bhatnagar et al (2000); Jarvenpaa and Todd (1996); Vijayasarithy (2002); Weber (2010); Stewart and Segars (2002); Suh and Han (2003); Wang et al. (2003); Ba and Pavlou (2002); Howcroft et al. (2002); Polatoglu and Ekin (2001); Luarn and Lin (2005) privacy issue is one the critical issue in Mobile Banking. Banzal (2010) stated that privacy issue deals with the risk of disclosure of personal and financial information, it also deals in unauthorized access to stored data, especially personal information and transaction history and location information that may target direct advertising and could also encroach on privacy rights of consumers.

### **Standardization Issue**

Guriting and Ndubisi (2006); Luarn and Lin (2005); Wang et al. (2003); Davis (1989); Karjaluo et al. (2008); Ramayah et al. (2003); Kleijnen et al. (2004); Cheong and Park (2005); Luarn and Lin (2005); Guriting and Ndubisi (2006); Kleijnen et al. (2004); Bamoriya (2011); reported standardization issue as one of the issues of concern in Mobile

Banking. According to Guriting and Ndubisi (2006); Luarn and Lin (2005) memorizing different short codes for different types of transactions imposes challenge to users, further if users were availing Mobile Banking services from multiple banks then it becomes extremely difficult to deal with different SMS short codes of different banks.

#### **Coordination Issue**

Comminos et al. (2008); Weber (2010); Lyman et al. (2008); Makin (2009); Alampay (2010); Banzal (2010); Ashta (2010) stated the criticality of coordination issue in the success of Mobile Banking. On coordination issue Comminos et al. (2008); Weber (2010) suggested that Mobile Banking is forcing the convergence of the financial and telecommunications sectors, unfortunately the convergence of two such heavily regulated industries means that this potential is unlikely to be met unless policy makers lay the ground rules for innovation as well as clarity of responsibility & authority.

#### **KYC/ AML/ CFT Issue**

Alampay (2010); Gupte (2008); Moni (2010); Makin (2009); Hayat (2009); Hannes (2011); Subramanian (2010); Ashta (2010); Weber (2010) reported that among the issues that have been commonly discussed with respect to Mobile Banking pertain to authentication concern, such as Know Your Customer (KYC), authorization and integrity of the transaction, monitoring the amounts kept by individuals and the amounts they send (Anti Money Laundering) etc.

#### **Network Issue**

Laukkanen and Lauronen (2005); Hale and Thakur (2006); Hung et al. (2003); Morawczynski and Miscione (2008); Black et al. (2001); Banzal (2010); Kuisma et al. (2007); Laukkanen (2007); Kumbhar (2011) reported network issue as critical for Mobile Banking. Hale and Thakur (2006) in particular stated that greater speed enhances the user's belief in the usefulness of Mobile Banking. As Mobile Banking services are limited to network coverage provided by the mobile service provider, so a limited and weak network is one of the challenges for Mobile Banking especially in India.

#### **Customer Illiteracy Issue**

Bueno (2008); Epstein and Smith (2007); Chau (2008); Chipchase (2010); Fain and Roberts (1997); Kumbhar (2011); Wang et al. (2003); Cracknell (2004); Peevers, Douglas and Jack (2008) stated that customer illiteracy in terms of textual, technical and financial illiteracy increases complexity of Mobile Banking and is a critical issue

### **3. Research Objectives**

1. To study the significance of select issue as the underlying dimensions of issues and challenges in Mobile Banking.
2. To rank mean scores of the select issue as underlying dimensions of issues and challenges in Mobile Banking.
3. To study the gaps in regulations related to Mobile Banking on the basis of statement wise analysis of select issues in Mobile Banking.

## **Research Methodology**

### **Hypothesis**

- H1. Security is not a significant issue in Mobile Banking.
- H2. Privacy is not a significant issue in Mobile Banking.
- H3. Interoperability of services is not a significant issue in Mobile Banking.
- H4. Network breakdown is not a significant issue in Mobile Banking.
- H5. Know Your Customer / Anti Money Laundering / Combating the Financing of Terrorism is not a significant issue in Mobile Banking.
- H6. Standardization of services is not a significant issue in Mobile Banking.
- H7. Customer illiteracy is not a significant issue in Mobile Banking.
- H8. Coordination between banks and telecom operators is not a significant issue in Mobile Banking.

### **Sampling**

Sampling frame for the study consisted of senior bank managers and RBI officials dealing directly dealing in Mobile Banking. In the light of unavailability of exact number of unit of analysis in this sampling frame and further the fact that they were hard to reach; 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 Jacobsen and Landau (2003).

### **Preliminary Questionnaire Design**

Primary data for the study was collected using a validated structured questionnaire. For this first a preliminary questionnaire was designed on the basis of extensive related literature review. Here, minimum 2 items per construct were ensured as recommended by Joreskog (1993). Further, to ensure that respondents paid proper attention to the questionnaire some items were reverse scored (DeCoster and Claypool, 2004). First part of the preliminary questionnaire had 42 close ended questions on 7 point semantic differential scale (1= agree, 7= disagree). Second part dealt with ranking of select issues (constructs) on ordinal scale. Last part of the questionnaire had demographic questions. Subsequently this preliminary questionnaire was standardized so as to ensure reliability and validity of data.

### **Content Validity**

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 eighteen subject experts and psychometric experts. A total of three structured responses were received, on the basis of which two items from preliminary questionnaire were dropped - one item intended to measure security issue (SC5) and other intended to measure KYC/AML/CFT issue (KC3). Further one item measuring to

interoperability issue was added in the questionnaire (IO4). After this renumbering of items was done and the revised questionnaire was finalized for data collection purpose.

### **Data Collection**

Data was collected through email-administered questionnaire. Process took approx six months. Questionnaire was administered to 289 respondents where finally 41 responses were received. Thus a response rate of 14.1% was achieved which could be considered satisfactory as respondents were hard to reach population.

### **Data Cleaning**

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. In two cases, z scores were found be greater than  $|3|$  which suggested presence of outliers ( $|z| > 3$ , outlier; Barbara, 2006). So these two cases were deleted from the dataset thus total usable responses for final analysis reduced to 39.

### **Data Reliability & Internal Consistency**

To check if any item measuring particular construct was inconsistent with the averaged behavior of the other items measuring the same construct so that it can be discarded from the scale, an item-total correlation test was performed. Corrected item to total correlation for security subscale (total items 11) ranged from .302 to .711 with alpha value .703, suggesting internal consistency thus no item to be deleted. Similarly for privacy subscale (total items 6) corrected item to total correlation ranged from .318 to .631 with alpha value .684, suggesting internal consistency thus no item to be deleted. For interoperability subscale (total items 4) corrected item to total correlation ranged from .581 to .802 with alpha value .809, suggesting internal consistency thus no item to be deleted. For network subscale (total items 3) corrected item to total correlation ranged from .333 to .495 with alpha value .655, suggesting internal consistency thus no item to be deleted. For customer illiteracy subscale (total items 5) corrected item to total correlation ranged from .298 to .520 with alpha value .690, suggesting slight lack of internal consistency. Deleting item CL3 (corrected item to total correlation .298) would increase alpha value by only 0.004. Here item CL3 was not deleted as it was not leading to significant improvement in internal consistency of scale (Field, 2006). For KYC/AML/CFT subscale (total items 7) corrected item to total correlation ranged from .308 to .884 with alpha value .654, suggesting internal consistency thus no item to be deleted. For standardization subscale (total items 2) corrected item to total correlation ranged from .837 to .837 with alpha value .910, suggesting internal consistency thus no item to be deleted. At last for coordination subscale (total items 3) corrected item to total correlation ranged from .307 to .377 with alpha value .699, suggesting internal consistency thus no item to be deleted.

### **Convergent & Discriminant Validity**

For ensuring construct validity of scale convergent and discriminant validities were estimated using product moment correlation matrix of 41 items measuring 8 constructs. Scanning of product moment correlation matrix of 41 items measuring suggested convergent validity, as moderate to strong correlation with highest value .801 and lowest value .541; all significant at .05 was present between items measuring the same construct. Further no strong correlation was found between items measuring different constructs, suggesting discriminant validity.

### Data Normality

The skewness indices for the dataset ranged from -1.77 to 2.80 (index value < |3|, normal; Kline, 2005). Kurtosis indices ranged from -1.56 to 9.42 (index value < |10|, normal; Kline, 2005). Hence, data was regarded as univariate normal.

### Analysis and Findings

#### Significant Issues in Mobile Banking (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 1).

**Table 1.** One Sample t Test

| Test value = 4 , df= 38 |        |        |              |
|-------------------------|--------|--------|--------------|
| Issue                   | Mean   | t      | Significance |
| Security                | 3.2681 | 9.132  | .000         |
| Privacy                 | 4.4872 | 6.303  | .000         |
| Interoperability        | 2.0577 | 15.614 | .000         |
| Network breakdown       | 2.8120 | 10.727 | .000         |
| Customer illiteracy     | 2.5231 | 17.326 | .000         |
| KYC/AML/CFT             | 5.0183 | 10.599 | .000         |
| Standardization         | 2.4359 | 7.969  | .000         |
| Coordination            | 4.6838 | 10.037 | .000         |

It is evident that mean value of security issue 3.27 ( $t=9.132$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. Hence null hypothesis H1 that 'Security is not a significant issue in Mobile Banking' is rejected. **Security is a significant issue in Mobile Banking.**

It is also evident that mean value of privacy issue 4.49 ( $t=6.303$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. Hence null hypothesis H2 that 'Privacy is not a significant issue in Mobile Banking' is not rejected. **Privacy is not a significant issue in Mobile Banking.**

It is also evident that mean value of interoperability issue 2.06 ( $t=15.614$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. Hence null hypothesis H3 that 'Interoperability is not a significant issue in Mobile Banking' is rejected. **Interoperability is a significant issue in Mobile Banking.**

It is also evident that mean value of network (breakdown) issue 2.81 ( $t=10.727$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. Hence null hypothesis H4 that 'Network breakdown is not a significant issue in Mobile Banking' is rejected. **Network breakdown is a significant issue in Mobile Banking.**

It is also evident that mean value of customer illiteracy issue 2.52 ( $t=17.326$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. Hence null hypothesis H5 that 'Customer illiteracy is not a significant issue in Mobile Banking' is rejected. **Customer illiteracy is a significant issue in Mobile Banking.**

It is also evident that mean value of KYC/AML/CFT issue 5.01 ( $t=10.599$ ,  $df=38$ ) which is significantly different from the test value of 4 at 0.001 level. Hence null hypothesis H6 that 'Know Your Customer/ Anti Money Laundering/ Combating Financing of Terrorism is not a significant issue in Mobile Banking' is not rejected. **KYC/ AML/ CFT is not a significant issue in Mobile Banking.**

It is also evident that mean value of standardization issue 2.43 ( $t=7.969$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. Hence null hypothesis H7 that

'Standardization is not a significant issue in Mobile Banking' is rejected. **Standardization is significant issue in Mobile Banking.**

It is also evident that mean value of coordination issue 4.68 ( $t=10.037$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. Hence null hypothesis H8 that 'Coordination is not a significant issue in Mobile Banking' is not rejected. **Coordination is not a significant issue in Mobile Banking.**

#### Ranking of Issues in Mobile Banking

Further to study the ranking of security, privacy, interoperability, network breakdown, customer illiteracy, KYC/AML/CFT, standardization and coordination and to find out relatively which issue is most critical and which is least, data was subject to Friedman test & Kendall's W test, followed by Wilcoxon Signed Ranks test as a post hoc test.

#### Friedman Test & Kendall's W Test

Firstly, Friedman test was conducted to evaluate differences in mean ranks of the select issues in Mobile Banking. Here, Chi square value ( $df=7$ ,  $N=39$ ,  $P=.000$ ) of 135.45 was significant at .001 level. Hence, it is evident that the **mean ranks of the select issues are significantly different**. Further, Kendall's W test was conducted to measure effect size of difference. Here Kendall's coefficient of concordance of .49 ( $df=7$ ,  $N=39$ ,  $P=.000$ ) indicated strong differences among the eight select issues (Green and Salkind, 2008).

#### Wilcoxon Signed Ranks Test

Once a significant difference in mean ranks of select 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 (See Annexure) and their rankings were tabulated (Table 2). It is evident that **interoperability in Mobile Banking is most critical issue where as KYC/AML/CFT is least critical issue.**

**Table 2.** Ranking of Select Issues

| Ranking | Issue               | Mean |
|---------|---------------------|------|
| 1       | Interoperability    | 3.03 |
| 2       | Customer Illiteracy | 3.06 |
| 3       | Network             | 3.1  |
| 4       | Security            | 3.1  |
| 5       | Standardization     | 4.18 |
| 6       | Privacy             | 6.19 |
| 7       | Coordination        | 6.26 |
| 8       | KYC/AML/CFT         | 7.08 |

#### Analysis for Regulatory Framework (One Sample t Test)

For analyzing existing regulatory framework of Mobile Banking in India and making appropriate recommendations, item-wise analysis (items pertaining to select issues) was done using One Sample t test (Table 3).

**Table 3.** One-Sample t Test for Regulatory Framework

| Test value = 4, df= 38 |        |       |       |      |        |       |      |
|------------------------|--------|-------|-------|------|--------|-------|------|
| Item                   | t      | Mean  | Sig.  | Item | t      | Mean  | Sig. |
| SC1                    | 11.897 | 2.56  | .000  | NT1  | .980   | 3.82* | .333 |
| SC2                    | 20.065 | 1.85  | .000  | NT2  | 9.144  | 2.69  | .000 |
| SC3                    | 2.324  | 3.41* | .026  | NT3  | 11.950 | 1.92  | .000 |
| SC4A                   | 1.598  | 3.77* | .118  | CL1  | 32.490 | 1.87  | .000 |
| SC4B                   | 6.393  | 2.77* | .000  | CL2  | 15.815 | 1.64  | .000 |
| SC4C                   | 2.309  | 3.69* | .026  | CL3  | 18.304 | 2.15  | .000 |
| SC4D                   | 4.239  | 3.38* | .000  | CL4  | 6.438  | 2.82  | .000 |
| SC5                    | .374   | 4.08* | .711  | CL5  | .580   | 4.13* | .565 |
| SC6                    | 1.281  | 4.28* | .208  | KC1  | 16.817 | 5.87* | .000 |
| SC7                    | 25.212 | 1.64  | .000  | KC2  | 5.344  | 5.15* | .000 |
| SC8                    | 2.799  | 3.51  | .008  | KC3  | .805   | 4.18* | .426 |
| PV1                    | 3.561  | 4.49* | .001  | KC4  | 15.857 | 5.97* | .000 |
| PV2                    | .264   | 3.95* | .793  | KC5  | 3.987  | 3.05  | .000 |
| PV3                    | 11.423 | 5.36* | .000  | KC6  | 14.133 | 5.72* | .000 |
| PV4                    | 7.797  | 4.92* | .000  | KC7  | 5.779  | 5.18* | .000 |
| PV5                    | .000   | 4.00  | 1.000 | SD1  | 7.282  | 2.54  | .000 |
| PV6                    | .870   | 4.21* | .390  | SD2  | 7.979  | 2.33  | .000 |
| IO1                    | 8.356  | 2.13  | .000  | CO1  | 13.658 | 4.92* | .000 |
| IO2                    | 14.442 | 1.95  | .000  | CO2  | 13.180 | 5.23  | .000 |
| IO3                    | 18.019 | 1.69  | .000  | CO3  | .850   | 3.90* | .401 |
| IO4                    | 14.951 | 2.46  | .000  | -    |        |       |      |

\*reverse coded

As it is evident that mean value of SC1 2.56 ( $t=11.897$ ,  $df=38$ ) is significantly different from test value of 4 at 0.001 level. It may therefore be said that **mobile phones used for Mobile Banking could be easily hacked remotely, posing security threat.**

It is also evident that mean value of SC2 1.85 ( $t=20.065$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **mobile phones lacking personal firewalls may pose security threat.**

It is also evident that mean value of SC3 3.41 ( $t=2.324$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **in Mobile Banking at least 128 bit SSL encryption is not being used by all banks.**

It is also evident that mean value of SC4A 3.77 ( $t=1.598$ ,  $df=38$ ) is not significantly different from the test value of 4.

It is also evident that mean value of SC4B 2.77 ( $t=6.393$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **Mobile Banking is not secured against potential threats of malicious codes.**

It is also evident that mean value of SC4C 3.69 ( $t=2.309$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.05 level. It may therefore be said that **Mobile Banking is not secured against potential threats of phishing.**



It is also evident that mean value of SC4D 3.38 ( $t=4.239$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said **that Mobile Banking is not secured against potential threats of SMiShing.**

It is also evident that mean value of SC5 4.08 ( $t=0.374$ ,  $df=38$ ) is not significantly different from the test value of 4.

It is also evident that mean value of SC6 4.28 ( $t=1.281$ ,  $df=38$ ) is not significantly different from the test value of 4.

It is also evident that mean value of SC7 1.64 ( $t=25.212$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **recent increase in 'fund transfer limit without end to end encryption for banks' from Rs.1000 to Rs. 5000; may lead to increase in fraudulent cases.**

It is also evident that mean value of SC8 3.51 ( $t=2.799$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.01 level. It may therefore be said that **Real Time Notification after all transactions should be made mandatory.**

It is also evident that mean value of PV1 4.49 ( $t=3.561$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.01 level. It may therefore be said that **most of the banks have effective system to ensure privacy of personal data of mobile users.**

It is also evident that mean value of PV2 3.95 ( $t=.264$ ,  $df=38$ ) is not significantly different from the test value of 4.

It is also evident that mean value of PV3 5.36 ( $t=11.423$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **data exchanged during Mobile Banking transactions is restricted to legitimate users only.**

It is also evident that mean value of PV4 4.92 ( $t=7.797$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said **that banks and telecom operators have effective system in place to ensure third party privacy.**

It is also evident that mean value of PV5 4.00 ( $t=0$ ,  $df=38$ ) is not significantly different from the test value of 4.

It is also evident that mean value of PV6 4.21 ( $t=.870$ ,  $df=38$ ) is not significantly different from the test value of 4.

It is also evident that mean value of IO1 2.13 ( $t=8.356$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said **that in Mobile Banking, there is lack of common technology.**

It is also evident that mean value of IO2 1.95 ( $t=14.442$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. 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 ( $t=18.019$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. 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 ( $t=14.951$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **all Mobile Banking service providers should adopt common ISO-8583 message format to ensure interoperability among banks.**

It is also evident that mean value of NT1 3.82 ( $t=.980$ ,  $df=38$ ) is not significantly different from the test value of 4.

It is also evident that mean value of NT2 2.69 ( $t=9.144$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **network congestion creates serious problem in conducting Mobile Banking transactions.**

It is also evident that mean value of NT3 1.92 ( $t=11.950$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **network congestion at peak texting times is a major source of dissatisfaction among customers as they may not receive confirmation of transaction.**

It is also evident that mean value of CL1 1.87 ( $t=32.490$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **providing Mobile Banking services in preferred language/dialect of user is critical.**

It is also evident that mean value of CL2 1.64 ( $t=15.815$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **mobile handset based on Latin language supporting software creates a major problem for the users not familiar with English as first language.**

It is also evident that mean value of CL3 2.15 ( $t=18.304$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **prospective mobile customer might feel that the Mobile Banking is technologically too complex for them.**

It is also evident that mean value of CL4 2.82 ( $t=6.438$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said **that in general users might consider Mobile Banking complicate to use.**

It is also evident that mean value of CL5 4.13 ( $t=.580$ ,  $df=38$ ) is not significantly different from the test value of 4.

It is also evident that mean value of KC1 5.87 ( $t=16.817$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **banks have written policies documenting the processes that they have in place to prevent, detect and report suspicious transactions.**

It is also evident that mean value of KC2 5.15 ( $t=5.344$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **banks have an internal audit function/ independent third party that assess AML policies and practices on a regular basis.**

It is also evident that mean value of KC3 4.18 ( $t=.805$ ,  $df=38$ ) is not significantly different from the test value of 4.

It is also evident that mean value of KC4 5.97 ( $t=15.857$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said **that in general banks have policies and procedures on updating customer data.**

It is also evident that mean value of KC5 3.05 ( $t=3.987$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **host to host connectivity should be made mandatory so that Bank could verify customer information with the information customer has provided to the telecom companies.**

It is also evident that mean value of KC6 5.72 ( $t=14.133$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **policy should be there restricting customers to avail the Mobile Banking only on the mobile number (SIM) which is registered to him/her only.**

It is also evident that mean value of KC7 5.18 ( $t=5.779$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **existing regulation of KYC/AML is sufficient for Mobile Banking.**

It is also evident that mean value of SD1 2.54 ( $t=7.282$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. 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 ( $t=7.979$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. 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 CO1 4.92 ( $t=13.658$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.001 level. It may therefore be said that **there are clear guidelines on the part of ownership of customers by bank and/or telecom operators.**

It is also evident that mean value of CO2 5.23 ( $t=13.180$ ,  $df=38$ ) is significantly different from the test value of 4 at 0.01 level. It may therefore be said that **two regulatory domains – TRAI and RBI are not overlapping.**

It is also evident that mean value of CO3 3.90 ( $t=.850$ ,  $df=38$ ) is not significantly different from the test value of 4.

### **Recommendations**

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

#### **Recommendations on Security Issues**

1. Mobile phones used for Mobile Banking could be easily hacked remotely, posing security threat. To address this, banks should execute restricted functionality option while providing Mobile Banking services. Pande (2009) suggested that due to this restricted functionality user needs to apply for adding a new payee or for increasing payment limit thus preventing the initiation of unauthorized payments from the user's mobile phone remotely.
2. Further to manage remote hacking of mobile and subsequent fraud; one-time password (OTPs) should be used. When a request is received, a password is sent to the user's phone via SMS. This password is expired once it has been used or once its scheduled life-cycle has expired.
3. Still many banks are using less than 128 bit SSL (Secure Socket Layer) encryption in Mobile Banking, which poses risk of data transmitted over the air being intercepted. RBI should make it mandatory for banks to apply at least 128 bit SSL encryption. Further to add in security banks should opt for VeriSign verification.
4. Many a time mobile phones engaged in wireless access protocol (WAP) based Mobile Banking, lack personal firewalls which may pose security threat. Here banks should try to build customer awareness regarding use of firewall, regular updation of antivirus program in mobile phones.
5. Mobile Banking is not much secured against potential threats of malicious code, phishing and SMiShing. To make it secure against malicious codes users must be made aware about use of antivirus and antimalware program in JAVA enabled phones and smart phones. Again to protect users from the threat of phishing and SMiShing consumer awareness in the key.
6. There is a fear that recent increase in 'fund transfer limit without end to end encryption for banks' by RBI from Rs.1000 to Rs. 5000; may lead to increase in fraudulent cases. This issue should be addressed very prudently as there is tradeoffs for increased security, mainly higher operational cost to banks
7. Real Time Notification (RTN) after any Mobile Banking transactions should be made mandatory so as to quickly inform customers of suspicious or potentially fraudulent activities and empower them to immediately take action.

#### **Recommendations on Interoperability Issues**

8. 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. 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 the banks, telecom operators and mobile

handset manufacturers' mutual understanding, which is must for achieving economies of scale and reducing operational cost.

9. 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 interoperability issue would automatically get resolved.

#### ***Recommendations on Network Issues***

10. Network congestion creates serious problem in conducting Mobile Banking transactions, further network congestion at peak texting times is a major source of dissatisfaction among customers as they may not receive confirmation of transaction. For this it is extremely important that SMS gateway providers can provide a decent quality of service for banks and financial institutions in regards to SMS services. Therefore, the provision of service level agreements (SLAs) is a requirement for mobile service providers as it is necessary to give customers the delivery guarantees of all messages, as well as measurements on the speed of delivery, throughput, etc. Thus SLAs give the service parameters in which a messaging solution is guaranteed to perform.

#### ***Recommendations on Customer Illiteracy Issues***

11. Providing Mobile Banking services in preferred language/dialect of user is critical. According to John Kattakayam, mCheck (2009) that to resolve this problem there is need for multilingual service support and for illiterate people there should be voice-based service support. In this respect a Mobile Banking interface system based on concept such as dividing information into easy to remember chunks, consistent use of visual interface elements etc.
12. Prospective mobile customer might feel that the Mobile Banking is technologically too complex for them. For this, banks should attempt raising awareness of what a mobile phone can do and how to do it etc. Additionally, a special task force should be trained specifically to pass on the knowledge to users to tackle technical illiteracy issue.

#### ***Recommendations on KYC/AML/CFT Issues***

13. To check money laundering and terrorist financial activities, host-to-host connectivity should be made mandatory so that banks could verify customer information with the information customers have provided to the telecom companies. Sultana (2009) also stated that in Bangladesh customer will have to fill out an application form at bank then the will verify the customer information and that information must match the information with the bank and the information he or she provided to telecom companies, through host to host connectivity.
14. Policy should be there restricting customers to avail the Mobile Banking only on the mobile number (SIM) which is registered to customer only, as in Bangladesh.
15. Unique Identification Number (UID) should be made mandatory for user registering for Mobile Banking, once this UID project is implemented in the country. Such concept is already implemented in South Africa, Bangladesh and Kenya.

#### ***Recommendations on Standardization Issues***

16. Users availing Mobile Banking services from multiple banks find it difficult to deal with different SMS short codes of different banks. So RBI should give guidelines to standardize short code for a particular type of transaction of bank.

17. 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 low; but rising very sharply) like of Rworld in South Africa, which is much easier to use and offer development of more complex transactions similar to that of internet banking without using any short codes.

#### **4. Conclusions**

Some critical issues in Mobile Banking India must be addressed by service providers and must be properly regulated by RBI, so as to facilitate smooth adoption of Mobile Banking services in the country. This study was focused on the select issues; to name Security, Interoperability, Privacy, Standardization, Coordination, KYC/AML/CFT, Network breakdown, and Customer illiteracy issue, keeping in view the regulatory guidelines. Further this study focused on regulatory framework related to Mobile Banking and intends to provide necessary suggestions on the same to RBI. Study was conducted on senior bank managers and RBI officials dealing directly dealing in Mobile Banking. Out of eight proposed null hypotheses 5 were rejected. Security, interoperability, network, customer illiteracy and standardization issues were found to be significant issues in Mobile Banking, where as privacy, coordination and KYC/AML/CFT issue were insignificant. Further, interoperability issue was found to be most critical followed by customer illiteracy, network, security where as standardization issue was least critical among the significant issues in Mobile Banking in India. At last on the basis of in-depth analysis recommendation were made to Mobile Banking service providers and regulators.

#### **Scope of Future Research**

As far as scope for future research is concerned, one obvious area is non bank led model of Mobile Banking. As the two models of Mobile Banking are different in approach i.e. 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.

Secondly, there could be other relevant issues, which may become prominent once Mobile Banking enters into growth stage of its life cycle. So such issues viz. Timeline of transaction (currently, varies from less than an hour to 3-5 days), limited usage of GPRS, installation & updation of application software, Customization, etc. should be studied from future prospective of Mobile Banking in India.

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**ANNEXURE: Wilcoxon Signed Ranks Test**

|                        | RANKPV - RANKSC     | RANKIO - RANKSC     | RANKNT - RANKSC    | RANKCL - RANKSC    | RANKKC - RANKSC     | RANKSD - RANKSC     |
|------------------------|---------------------|---------------------|--------------------|--------------------|---------------------|---------------------|
| Z                      | -5.283 <sup>a</sup> | -2.239 <sup>b</sup> | -.039 <sup>b</sup> | -.064 <sup>b</sup> | -5.418 <sup>a</sup> | -2.331 <sup>a</sup> |
| Asymp. Sig. (2-tailed) | .000                | .811                | .972               | .949               | .000                | .020                |

|                        | RANKCO - RANKSC     | RANKIO - RANKPV     | RANKNT - RANKPV     | RANKCL - RANKPV     | RANKKC - RANKPV     | RANKSD - RANKPV     |
|------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Z                      | -5.078 <sup>a</sup> | -4.662 <sup>b</sup> | -4.780 <sup>b</sup> | -4.604 <sup>b</sup> | -1.905 <sup>a</sup> | -3.439 <sup>b</sup> |
| Asymp. Sig. (2-tailed) | .000                | .000                | .000                | .000                | .057                | .001                |

|                        | RANKCO - RANKPV    | RANKPV - RANKIO     | RANKNT - RANKIO    | RANKCL - RANKIO    | RANKKC - RANKIO     | RANKSD - RANKIO     |
|------------------------|--------------------|---------------------|--------------------|--------------------|---------------------|---------------------|
| Z                      | -.247 <sup>b</sup> | -4.662 <sup>a</sup> | -.155 <sup>b</sup> | -.268 <sup>a</sup> | -5.336 <sup>a</sup> | -2.586 <sup>a</sup> |
| Asymp. Sig. (2-tailed) | .805               | .000                | .877               | .788               | .000                | .010                |

|                        | RANKCO - RANKIO     | RANKPV - RANKNT     | RANKIO - RANKNT    | RANKCL - RANKNT    | RANKKC - RANKNT     | RANKSD - RANKNT     |
|------------------------|---------------------|---------------------|--------------------|--------------------|---------------------|---------------------|
| Z                      | -5.012 <sup>a</sup> | -4.780 <sup>a</sup> | -.155 <sup>a</sup> | -.262 <sup>a</sup> | -5.318 <sup>a</sup> | -2.006 <sup>a</sup> |
| Asymp. Sig. (2-tailed) | .000                | .000                | .877               | .794               | .000                | .045                |

|                        | RANKCO - RANKKC     | RANKPV - RANKSD     | RANKIO - RANKSD     | RANKNT - RANKSD     | RANKCL - RANKSD     |
|------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Z                      | -2.741 <sup>b</sup> | -3.439 <sup>a</sup> | -2.586 <sup>b</sup> | -2.006 <sup>b</sup> | -3.253 <sup>b</sup> |
| Asymp. Sig. (2-tailed) | .006                | .001                | .010                | .045                | .001                |

|                        | RANKKC - RANKSD     | RANKCO - RANKSD     |
|------------------------|---------------------|---------------------|
| Z                      | -4.715 <sup>a</sup> | -4.470 <sup>a</sup> |
| Asymp. Sig. (2-tailed) | .000                | .000                |

a. Based on negative ranks.  
b. Based on positive ranks.