

Predicting internet banking adoption in India: A perceived risk perspective

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Predicting internet banking adoption in India: A perceived risk perspective

ABSTRACT

The emergence of internet banking has transformed the banking systems across the globe. As a channel to market, internet banking allows geographical constraints to be overcome by offering various products and services at lower customer costs. An understanding of the factors influencing customer adoption of internet banking is both relevant and timely. This study integrates technology acceptance model and perceived risk theory in understanding internet banking acceptance among Indian bank account holders. Specifically, this study categorizes perceived risk as external risk and internal risk, and examines its influence on customer beliefs and adoption of internet banking. Using two-step predictive analytics of structural equation modeling and artificial neural network analysis, the 270 responses reveal that both external risk and internal risk inhibit customer acceptance of internet banking. More importantly, neural network analysis reveals that perceived ease of use and external risk are two important factors determining how well internet banking is accepted by customers. The implications of the study findings and future research directions are presented.

Keywords: internet banking, perceived risk, technology acceptance model, Indian banking, attitude.

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INTRODUCTION

The advancement of information technology has resulted in significant technological changes in the financial sector, more specifically the banking industry. Internet banking has changed the landscape of the banking industry (Yu, Balaji, & Khong, 2015). It has transformed the way banks operate and offer products and services to customers by reducing the geographical constraints and costs of financial transactions (Durkin, O'Donnell, Mullholland, & Crowe, 2007). Internet banking has made banks more efficient, highly competitive, user friendly, and able to provide improved customer services (Martins, Oliveira, & Popović, 2014). As a channel to market, it is considered as one of most profitable e-commerce applications over the last 10 to 15 years as well as becoming ubiquitous within the banking sector (Lee, 2009; Yadav, Chauhan, & Pathak, 2015).

Despite the benefits offered by internet banking, its adoption rate in India remains modest with only seven percent of bank customers in the country using it (Business Standard, 2011). The recent McKinsey Asia Personal Financial Services Survey (2014) reveals that while digital banking penetration in India rapidly increased to 18 percent in 2014, it still remains low compared to other developing Asian countries, such as Indonesia (36 percent) and Malaysia (41 percent), or developed Asian countries, such as South Korea (96 percent). As only one third of internet users take advantage of internet banking (eMarketer, 2014), there is a need to understand what prevents bank account holders from adopting internet banking in India. Moreover, with more than 190 million new bank accounts opened under the

financial inclusion campaign launched in 2014 (Tiwari, 2015), an understanding of factors influencing acceptance of internet banking will be valuable for Indian banks wishing to promote internet banking use among their customers.

Prior research studies on internet banking adoption have mainly focused on customer motivations for using internet banking by engaging dominant information system adoption theories, such as technology acceptance model (TAM) (Lai & Li, 2005; Lee, 2009; Montazemi & Qahri-Saremi, 2015; Rawashdeh, 2015). However, limited attention has been paid to understanding the role of inhibitors, such as perceived risk in customer adoption of internet banking (Patsiotis, Hughes, & Webber, 2012; Al-Ajam & Nor, 2015). While internet banking offers numerous benefits to its users, it seems the potential associated risks can adversely affect customers' assessment and adoption of internet banking. As prospect theory indicates that people exhibit loss aversion such that they evaluate the same amount of loss as being more significant compared to the value they gain (Kahneman & Tversky, 1979), there is a need to consider both motivators and inhibitors in understanding internet banking adoption.

Therefore, the research presented here addresses the key question "what role do the motivators and inhibitors play in customer adoption of internet banking in the Indian context?" Specifically, this research proposes and tests an integrated model of customer adoption of internet banking based on TAM and perceived risk theory. As previous research suggests that customers' perceptions of risk can ensue from either external sources or internal sources (Kaplan, Szybillo, & Jacoby, 1974; Featherman & Pavlou, 2003), we conceptualize perceived risk as consisting of external and internal risk and examine its role along with TAM antecedents, i.e. perceived usefulness and perceived ease of use on customer attitude and behavioral intentions towards internet banking in a developing economy such as India. This

study contributes to existing literature by adopting a novel perspective of perceived risk that identifies the source of customer risk as being external or internal in their acceptance of internet banking. Furthermore, two-stage predictive analytics using structural equation modeling and artificial neural network analysis is used to investigate the linear and non-linear effects of external risk, internal risk, perceived ease of use, and perceived usefulness in internet banking adoption.

The remainder of the article takes the following structure. In the next section, we examine the theoretical background, with an emphasis on the perceived risk theory, and present the descriptions for perceived risk dimensions. We then present the literature review, hypotheses, and research model, which are followed by our research method and results. Finally, discussion of the results, including implications for academicians and banks, and limitations and future research directions, are outlined.

THEORETICAL BACKGROUND

Perceived Risk

The concept of perceived risk has been related to a variety of customer behaviors over the last five decades. Substantial research has demonstrated the significant role perceived risk plays in traditional decision making, hedonic consumptions, and online customer decision making (Delgado-Ballester, Hernandez-Espallardo, & Rodriguez-Orejuela, 2014; Punj, 2012). Peter and Ryan (1976) define perceived risk as “the expectation of losses associated with purchase”, and Bauer (1960) suggests that most customer procurement behaviors are perceived as risk because of uncertainty or the potential for unpleasant outcomes. In the internet banking context, Lu et al. (2011, p. 356) define perceived risk as “the uncertainty that consumers face when they cannot foresee the consequences of their online transaction

behavior”. Other researchers have described perceived risk as the “subjective expectations of loss” (Laroche, Vinhal, & Richard, 2010, p. 198) and “negative characteristics that relate to one’s felt uncertainties and suspicions” (Nicolaou & McKnight, 2006, p. 335). Still, others have related perceived risk with the monetary and non-monetary loss customers expect from uncertain purchase situations (Featherman & Pavlou, 2003; Lee, 2009; Lu et al., 2011). In this study, we define perceived risk as customers’ subjective expectations related to the monetary and/or non-monetary loss associated with the use of internet banking for bank transactions. As the introduction of new technology brings with it market and technological uncertainties, such as reliability, performance, and market acceptance, customers perceive the adoption of internet banking to be a risky decision. Thus, the present study considers the role of perceived risk as it may act as a barrier to internet banking adoption.

Prior researchers agree that perceived risk is a multidimensional construct. However, various conceptualizations exist in the previous literature. For example, Howarth (1987) identified two types of perceived risk, namely objective risk and subjective risk. Similarly, Bettman (1973) made a distinction between inherent risk and handled risk in a purchase situation. Cunningham (1967) also identified two major categories of perceived risk, those being performance risk and psychological risk. Performance risk was further classified into economic, temporary, and effort, with psychological risk further classified as psychological and social. Later, performance risk was further categorized as having six dimensions, namely performance, financial, opportunity, safety, social, and psychological risk. Recent studies have, however, considered varying dimensions of perceived risk depending on the product/service category (Luo et al., 2010; Sai and Mishra, 2012; Yang et al., 2015).

Because a generalizable model that captures the complex nature of perceived risk has yet to be developed, in the present study we categorize perceived risk into two dimensions,

namely external risk and internal risk, based on the source of uncertainty or negative outcome. Researchers have proposed and discussed a number of perceived risk dimensions that reflect external risk in online contexts. These include performance risk (Aldás-Manzano et al., 2009; Lee, 2009; Kassim & Ramayah, 2015), financial risk (Lee, 2009; Martins, Oliveira, and Popović, 2014), privacy risk (Hanafizadeh & Khedmatgozar, 2012; Takeddine & Sun, 2015), social risk (Littler & Melanthiou, 2006, Lee, 2009; Martins, Oliveira, & Popović, 2014), and information risk (Luo et al., 2010; Bryce & Fraser, 2014). Because external risk represents the perceived risk resulting from external factors that is manifested by these five dimensions of risk, the current study conceptualizes external risk as a second-order construct reflected by these five first-order risk factors. Internal risk refers to the extent to which customers possess the necessary skills, capabilities, and self-confidence to conduct successful banking transactions using internet banking. It is, therefore, related to the customers' self-efficacy levels.

Performance risk refers to the risk that the transactions being processed using internet banking may not work efficiently, while privacy risk refers to the customers' concerns that the information provided by them through conducting a financial transaction using internet banking could be misused or disclosed to a third party. Financial risk is concerned with the customers' apprehension regarding the security of their bank transactions using internet banking. As internet banking involves monetary transactions, the likelihood that the information available on the internet banking website is useful for successful completion of a financial transaction results in information risk. Finally, social risk refers to the extent to which using internet banking for financial transactions may lead to embarrassment before one's social group.

In summary, this study categorizes perceived risk as external risk (second-order factor consisting of performance risk, privacy risk, social risk, information risk, and financial risk) and internal risk (self-efficacy) in examining the internet banking acceptance among the bank users in an Indian banking context.

LITERATURE REVIEW and HYPOTHESES DEVELOPMENT

Technology Acceptance Model (TAM) and Internet Banking Adoption

The TAM developed, which is based on the theory of reasoned action and theory of planned behavior, proposes a causal relationship between beliefs, attitude, intentions, and behavior for explaining and predicting potential users' acceptance of new technology (Davis, 1989). TAM is widely used by prior researchers in understanding and exploring the drivers of adoption of new technology by individuals and organizations (Hoon Yang, Lee, & Lee, 2007; Lee, Xiong & Hu, 2012; Muk & Chung, 2015). This model has been extensively used for understanding customers' beliefs towards adopting new technology (King & He, 2006; Venkatesh, Thong, & Xu, 2012). Likewise, TAM is also used to predict customers' intentions to develop and maintain a long-term association with new technology (Chiu et al., 2009). In the marketing literature, TAM has been applied to a wide range of technology adoptions, such as online shopping, social media advertising, near-field communication mobile phone service, mobile payment services, and others (Chen & Chang, 2013; Ashraf, Thongpapanl, & Auh, 2014). Thus, TAM serves as a useful foundation for examining the determinants of customer adoption of internet banking.

TAM is a parsimonious and robust model which suggests that customers' acceptance of a new technology is significantly driven by two determinants, namely perceived usefulness and perceived ease of use of the new technology (Davis, 1989). Perceived usefulness is the

extent to which an individual believes that adoption of a new technology will improve their job performance (professional and personal) (Davis, 1989). In the present study, perceived usefulness refers to the ability of internet banking to help customers perform and complete their financial transactions and other banking services more efficiently and effectively. Conversely, perceived ease of use refers to the extent to which an individual believes that adoption of a new technology will not exhaust their cognitive resources (Davis, 1989). Therefore, in the current study, perceived ease of use is the ease with which customers can use internet banking to complete their financial transactions. It is evident from prior research that perceived ease of use affects customer behavior towards the new technology indirectly through perceived usefulness (Venkatesh & Davis, 2000; Lee, Xiong, & Hu, 2012).

Lai and Li (2005) show that gender, age, and IT competency do not affect perceived ease of use and perceived usefulness in internet banking adoption. Akhlaq and Ahmed (2013) consider perceived ease of use and perceived enjoyment as intrinsic motivations, and perceived usefulness as extrinsic motivation, in understanding internet banking acceptance in a low-income country. The study findings show that intrinsic motivation plays a key role in developing trust and, in turn, intentions towards using internet banking. In a recent study, Montazemi and Qahri-Saremi (2015) use extended TAM to identify factors affecting pre-adoption and post-adoption of online banking. The results of the meta-analysis reveal that while both perceived usefulness and perceived ease of use impacted pre-adoption of online banking, only perceived usefulness had a significant impact on post-adoption of online banking. Based on the previous discussion and for consistency with other internet banking studies, the following hypotheses are proposed:

H₁: Perceived usefulness has a positive influence on attitude towards internet banking.

H₂: Perceived ease of use has a positive influence on attitude towards internet banking.

H₃: Perceived usefulness has a positive influence on behavioral intentions towards internet banking.

H₄: Perceived ease of use has a positive influence on perceived usefulness of internet banking.

H₅: Attitude has a positive influence on behavioral intentions towards internet banking.

Perceived Risk and Internet Banking Adoption

As discussed earlier, based on the source of risk, this study conceptualizes perceived risk as external risk and internal risk. External risk refers to sources of uncertainty or adverse outcomes of internet banking arising from external factors, such as transaction security; internet fraud, deficiencies, or malfunction of the internet banking website; information security; and, loss of status in social group. This external risk is expected to inhibit customer acceptance of internet banking. For instance, Lee (2009) finds that performance risk, time risk, financial risk, and security risk all have a negative influence on customer attitude towards internet banking. Further, the author found that performance risk inhibits perceived usefulness of internet banking. In the context of mobile banking services, Luo et al. (2010) find that customers' trust beliefs influence their perceived risk, which directly and indirectly, through performance expectancy, influence behavioral intentions. For the purpose of this study, we conceptualize perceived risk as a higher-order factor consisting of the following first-order factors: performance risk, financial risk, time risk, psychological risk, social risk, physical risk, privacy risk, and overall risk.

Building on the premise that using internet banking services is risky; Martins, Oliveira, and Popović (2014) examine the role of higher-order perceived risk and unified

theory of acceptance and use of technology (UTAUT) variables as predictors of internet banking adoption in Portugal. The authors find that perceived risk conceptualized as a higher-order factor similar to the way Luo et al. (2010) operationalize has a negative influence on performance expectancy and behavioral intentions towards internet banking. Rawashdeh (2015) shows that customers' perceptions of privacy with internet banking play a significant role in shaping their attitude and intentions to using internet banking in Jordan. More recently, Yang et al. (2015) show that total risk, consisting of economic risk, function risk, security risk, time risk, privacy risk, service risk, and psychological risk, reduces customers' trust and negatively influences their intentions and evaluation of online payments among young Chinese customers.

The aforementioned studies suggest that external risk will reduce customers' trust and that this may affect their favorable evaluation or assessment of internet banking for conducting financial transactions. Furthermore, customers who perceive high levels of external risk may seriously doubt the usefulness of internet banking in providing a superior banking experience when compared with conventional face-to-face banking. Thus, external risk is expected to negatively impact customers' beliefs of the usefulness of internet banking. Based on this discussion, the following hypotheses are forwarded.

H₆: External risk has a negative influence on attitude towards internet banking.

H₇: External risk has a negative influence on perceived usefulness of internet banking.

Self-efficacy, or the extent to which an individual believes in their ability to use internet banking successfully, might affect their acceptance of internet banking. Especially, customers who have high self-efficacy might find using internet banking much easier than those with low self-efficacy levels. Self-efficacy is influenced by four sources of information,

namely performance accomplishment, verbal persuasion, vicarious or indirect experience, and psychological state (Bandura, 1977). As self-efficacy determines the customers' resources and opportunities for adopting a certain behavior (Ajzen, 1991), it is considered an important motivational variable that might influence customer acceptance of internet banking. For example, Wang et al. (2003) show that customers with high self-efficacy levels favorably evaluate the usefulness and ease of use of internet banking. It is argued that low levels of self-efficacy make it difficult for customers to understand and complete tasks using internet banking, thus hindering their motivations to use the technology.

Nasri and Charfeddine (2012) examine the role of attitude, subjective norm, and perceived behavioral control in internet banking adoption in Tunisia. The authors find that self-efficacy positively influences perceived behavioral control which, in turn, influences customers' adoption intentions of internet banking. More recently, Alalwan et al. (2015) show that self-efficacy, along with trust, hedonic motivation strongly predict internet banking use in Jordan. Based on the prior discussion, we postulate that customer perception of internal risk, i.e. low levels of self-efficacy, will reduce customers' confidence and ability to use internet banking. Thus, they are likely to exhibit lower motivation to accept the service. Further, they might perceive internet banking as complex, which affects their intentions to use. Thus, we propose that:

H₈: Internal risk (self-efficacy) has a negative influence on attitude towards internet banking.

H₉: Internal risk (self-efficacy) has a negative influence on perceived ease of use of internet banking.

METHOD

Measurement Instruments

All measurement items (see Appendix 1) are adapted from the previous literature, with some minor modifications. Perceived ease of use and perceived usefulness are measured using a three-item scale adapted from Venkatesh and Davis (1996), with a three-item scale adapted from Zhou (2012) being used to measure self-efficacy. The measures for financial risk, privacy risk, and performance risk are adapted from Featherman and Pavlou (2003), Lifan Zhao et al. (2010), and Chiu et al. (2014). Social risk is measured with a three-item scale adapted from Aldás-Manzano et al. (2009), with information risk being measured using three items developed from Bryce and Fraser's (2014) study. Attitude towards internet banking is measured with a four-item semantic differential scale adapted from Fusilier and Durlabhji (2005). Finally, behavioral intention is measured using three items adapted from Venkatesh and Bala (2008). All measurement items (except for attitude) are measured using a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5).

Data Collection

The survey questionnaire was developed and administered in English, which reduced the chances of error caused by forward and backward translation. Prior to the main study, the survey questionnaire was pre-tested on 20 and 50 respondents, respectively. This sample consisted of students, faculty members, and working professionals who were requested to provide suggestions on the wording, content, structure, and layout of the questionnaire. Following minor changes and adjustments, the actual online questionnaire was developed for the main study. The pre-test survey respondents were not included in the main study.

A total of 1,000 students and ex-students of a large, private university in India and faculty members of various universities in metropolitan cities of India were contacted by email and provided with the survey link. A reminder email was sent to those who had not responded to the survey after two weeks. Following a three-week period, a total of 270 valid responses were obtained. The sample distribution of the responses obtained in the first two weeks and those obtained in the third week were compared and the means suggested that nonresponse bias was not a major issue in this research (Ryans, 1974). The valid responses obtained for the study ($n = 283$) exceeded the minimum sample recommended ($n = 245$) for structural equation modeling with 11 latent variables, 30 observed variables, p level 0.05, and anticipated size effect 0.3 (Soper, 2014). Thus, the sample size was considered adequate for analyzing customers' acceptance of internet banking.

Sample Profile

The sample respondents consisted of 59 percent males and 41 percent females. Regarding age, the majority of respondents (40 percent) belonged to the 31-40 year group. About 40 percent of respondents held a Bachelor's degree followed by 37 percent with a Master's degree as their education level. The majority of respondents (36 percent) reported working in business firms. Regarding income levels, 40 percent of the respondents were categorized into the higher-income group, 36 percent into the average-income group, and the remaining 24 percent into the lower-income group. Thirty-four percent of the respondents reported holding their primary bank account in public sector banks, 18 percent in regional rural banks, and 48 percent in private banks.

Common Method Bias

A common method bias test was carried out to mitigate the risk of common method variance in our sample (Podsakoff et al., 2003). The Harman's one-factor test is conducted by entering all the measurement variables in an exploratory factor analysis using IBM SPSS 22.0. The sample would have a common method bias problem if a single construct explained more than 50 percent of the extracted variance (Podsakoff et al., 2003). The exploratory factor analysis extracted a six-factor solution explaining 68 percent of the variance. However, the first factor explained only 38 percent of the variance, indicating that common method bias was not a problem in this data set.

Data Analysis

Research hypotheses were examined using the partial least squares structural equation modeling (PLS-SEM) method with SmartPLS 3.0. The PLS-SEM method is appropriate considering the nature, complexity, and sample size of the study (Hair et al., 2012). Moreover, it allows the operationalization of higher-order variables through repeated use of manifest variables (Sarstedt, Ringle, & Hair, 2014). The model evaluation in PLS-SEM is based on the R-square values for the dependent variables, cross-validated redundancy approach, and significance levels and t-values of the structural path coefficients. Bootstrapping with 5,000 sub-samples was used to estimate the standard errors and t-values of the structural model (Henseler, Ringle, & Sinkovics, 2009).

Although structural equation modeling is often used to test the hypothesized relationship, it may sometimes oversimplify the complexities of relationships that could exist among the variables (Chong, 2013). To address this issue, artificial neural network analysis was used in the present study as it has the capability to examine the complex linear and non-

linear relationships between the TAM variables, perceived risk dimensions, and attitude towards internet banking. The neural network model has the ability to learn from the input data and predict unseen patterns not observed in training data. Even though neural network is a good tool for prediction, it does not test hypothesized relationship (Bejou, Wray, & Ingram, 1996). Thus, this study integrates structural equation modeling with artificial neural network analysis to have a better understanding of the factors that determine internet banking acceptance in an Indian context.

RESULTS

Measurement Model

In this study, external risk is conceptualized as a higher-order factor with performance risk, information risk, privacy risk, social risk, and financial risk as first-order factors. The present study modeled external risk as a type 1 construct consisting of reflective second-order and reflective first-order factors (Jarvis, MacKenzie, & Podsakoff, 2003). Hair et al. (2011) suggest that empirical support for such conceptualization is achieved when the indicator weights for each first-order factor are significant with construct reliability, average variance extracted exceeds the threshold levels of 0.7 and 0.5 respectively, R^2 for each factor exceeds 0.5, and dimensional correlations are less than the second-order factor loadings.

As shown in Figure 1, the path coefficients from each of the first-order factors to the higher-order external risks indicate a strong factor loading, ranging from 0.70 for social risk to 0.88 for information risk. The composite reliability and average variance extracted (see Table 1) for the first-order factors exceeded the threshold levels of 0.70 and 0.50 respectively. Similarly, the correlations between the first-order factors (see Table 2) were less than the second-order factor loadings. Finally, the R^2 values exceeded the threshold levels of 0.50,

ranging from 0.50 for social risk to 0.78 for information risk. In summary, the operationalization of external risk resulted in a reliable higher-order construct, with five reflective first-order factors of performance risk, information risk, privacy risk, social risk, and financial risk.

Insert Figure 1 about here

Bootstrapping analysis with 5,000 resamples was used to assess the outer model for the validity and reliability of the variables. Table 1 presents the factor loadings, t-value, Cronbach's alpha, composite reliability, and average variance extracted of the study variables. As can be seen in Table 1, the loading of each reflective measurement item on its corresponding latent construct is significant and greater than the recommended level of 0.50 (Hair et al., 2006), ranging from 0.64 (FR3) to 0.89 (SR2). The reliability of the variables as indicated by Cronbach's alpha and composite reliability is greater than the recommended threshold levels of 0.70 and 0.80 respectively (Hair et al., 2006). This suggests that the measurement model has adequate internal consistency. The convergent validity is obtained as the average variance extracted for each construct exceeded the threshold level of 0.50 (Hair et al., 2006).

Insert Table 1 about here

The discriminant validity was assessed using the Fornell and Larcker (1981) method. As shown in Table 2, the square-root of average variance extracted of each construct was greater than the correlations it shared with other constructs. For example, square-root average variance extracted for financial risk is 0.76 and this is greater than the correlation it shares with other constructs. As this was the case with all constructs, discriminant validity was obtained.

Insert Table 2 about here

The explanatory power of the model was assessed using the measure of explained variance. As shown in Figure 2, the R^2 value of perceived usefulness (52 percent), attitude (60 percent) and behavioral intentions (66 percent) indicated large effect sizes (~ 0.25 , Cohen, 1988). The R^2 value of perceived ease of use (9 percent) indicated medium effect size (~ 0.09 , Cohen, 1988). The R^2 values for the dependent variables, i.e. attitude and behavioral intentions, were greater than the recommended cut-off values of 0.30 (Gefen & Straub, 2005), suggesting good explanatory power for the model. Furthermore, the Stone-Geisser Q^2 for exogenous latent variables in the model were all positive, suggesting satisfactory predictive relevance and interpretation of the hypothesized relationships in the model.

The mean cross-validated communality and redundancy were used to measure the global quality of the measurement and structural model (Tenenhaus et al., 2005). The results indicated that both communality (0.31) and redundancy (0.35) for the model exceeded the recommended level of 0.30 (Tenenhaus et al., 2005). This indicated good quality of the

measurement and structural model. Moreover, the goodness-of-fit (GoF), which is calculated as the geometric mean of the average communality and average R^2 , is 0.38, exceeding the threshold value of 0.36 and indicating a satisfactory quality of the measurement and structural model (Wetzels, Odekerken-Schröder, & Van Oppen, 2009). In summary, the results provide adequate psychometric properties of the measures and suggest that the model has adequate explanatory power.

Structural Model

As the reliability and validity of the variables are established, the path coefficients are used to examine the hypothesized relationships. Table 3 presents the results of the structural model.

Insert Table 3 about here

The hypotheses H_1 – H_5 predicted the relationship between TAM variables. As hypothesized, both perceived usefulness ($\beta = 0.33$, $p < 0.01$) and perceived ease of use ($\beta = 0.38$, $p < 0.01$) significantly affect attitude towards internet banking, supporting H_1 and H_2 . H_3 is supported as perceived ease of use has a significant influence on perceived usefulness ($\beta = 0.71$, $p < 0.01$). Providing support for H_4 , perceived usefulness has a significant direct impact on behavioral intentions towards internet banking ($\beta = 0.26$, $p < 0.01$). Attitude towards internet banking has a significant impact on behavioral intentions ($\beta = 0.62$, $p < 0.01$), supporting H_5 . Regarding the role of perceived risk, H_6 was supported as external risk was found to have a negative influence on attitude towards internet banking ($\beta = -0.29$, $p <$

0.01). H₇ is not supported as external risk did not impact perceived usefulness ($\beta = -0.05$, $p = 0.18$). Internal risk did not impact attitude towards internet banking ($\beta = 0.05$, $p = 0.53$). Thus, H₈ is not supported. Post-hoc analysis reveals that attitude fully mediates the effect of external risk on behavioral intentions towards internet banking. Internal risk was found to have significant negative influence on perceived ease of use ($\beta = -0.16$, $p < 0.01$) providing support for H₉. Post-hoc analysis shows that perceived ease of use fully mediates the influence of internal risk on attitude towards internet banking.

A competing model with direct paths from external risk and internal risk to intentions to use internet banking did not significantly improve the explanatory power of the model (R^2 with paths from perceived risk to intentions = 0.663; R^2 without paths = 0.66). Further, the results show that external risk ($\beta = 0.08$, $p = 0.21$) and internal risk ($\beta = -0.07$, $p = 0.32$) did not have a significant influence on behavioral intentions.

Further examination of the role of age, income group, and primary bank type revealed no significant differences in the relationships between perceived risk, perceived ease of use, perceived usefulness, and attitude towards internet banking. This is a significant finding as prior reports suggest that the penetration of internet banking is higher among the younger age and higher-income level groups. This finding suggests that the perception of risk associated with internet banking is prevalent across the different strata of Indian banking customers. Thus, the strategies aimed at reducing the perceived risk and improving the internet banking adoption should be focused on all groups of customers.

Neural Network Analysis for Predicting Internet Banking Adoption

As discussed in the earlier sections, the TAM variables and perceived risk dimensions are used to develop neural network analysis. In this study, a multi-layer perceptron (MLP)

with feedforward-backpropagation algorithms is conducted using IBM SPSS 22.0. Attitude towards internet banking is modeled as the dependent variable with perceived ease of use, perceived usefulness, external risk, and internal risk as predictors. The number of hidden nodes was automatically generated, and sigmoid function was used as the activation function for both hidden layers and output layer (Tan et al., 2014). A ten-fold cross validation was performed with 90 percent of the data used for training and the remaining 10 percent used to predict the accuracy of the trained network (Chong, 2013).

The findings of neural network analysis suggest that all predictor variables, namely perceived ease of use, perceived usefulness, external risk, and internal risk, are relevant. The accuracy of the neural network model was assessed using the root mean square of error (RMSE), while sensitivity analysis was used to calculate the normalized importance of each predictor variable. The average RMSE values of the neural network for the training and testing model are 0.49 and 0.45 respectively. This suggests that the neural network model is quite reliable in capturing the relationships between the predictors and outputs. Sensitivity analysis reveals that perceived ease of use (importance = 0.35; normalized importance = 100 percent) is the most important factor determining the attitude towards internet banking. This was followed by external risk (importance = 0.33, normalized importance = 95 percent) and perceived usefulness (importance = 0.29, normalized importance = 83.3 percent). Another neural network analysis with individual dimensions of perceived risk reveals that perceived ease of use (importance = 0.34, normalized importance = 100 percent), performance risk (importance = 0.24, normalized importance = 72.5 percent), and financial risk (importance = 0.13, normalized importance = 38.5 percent) are the most important determinants of attitude towards internet banking. Privacy concern is found to be least important in determining the customer acceptance of internet banking.

In summary, while the structural equation modeling shows that external risk and internal risk along with TAM variables determine the customers' attitudes and behavioral intentions towards internet banking, the artificial neural network analysis extends this understanding by showing that perceived ease of use and external risk, specifically performance risk and financial risk, play a significant role in customer acceptance of internet banking.

DISCUSSION and IMPLICATIONS

The study findings provide support for the extended TAM research model presented in Figure 2 and for the hypotheses regarding the relationships between perceived risk, perceived usefulness, perceived ease of use, attitude, and behavioral intentions towards internet banking in India. The research model explains 66 percent of variance in behavioral intentions and 60 percent of variance in customer attitude towards internet banking, suggesting that the extended TAM model with perceived risk is capable of explaining a high proportion of variance in customer acceptance of internet banking. Several key implications for academicians and practitioners emerge from this study.

For theorists, this study contributes to the marketing literature in several ways. First, the results suggest that perceived risk increases the predictive power of the TAM model in explaining customer acceptance of internet banking. While TAM variables' perceived usefulness and perceived ease of use explain nearly 52 percent of variance in attitude towards internet banking, the inclusion of perceived risk contributes to an increase of 8 percent of variance explained in customer attitude, thereby providing a better predictive power. Compared to other research studies on internet banking adoption, the present study presents a stronger explanatory power. For instance, Lee and Chung's (2011) extended TAM model

with self-efficacy, internet experience, and facilitating conditions explained 32.3 percent of variance in behavioral intentions among South Korean users. In another study, Yang et al. (2015) show that total risk along with trust explained 55 percent of variance in intentions towards internet banking among China's younger generation users.

Second, the study findings show that while external risk directly influences attitude, internal risk indirectly influences attitude through perceived ease of use. This indicates that perceived risk plays a crucial role in shaping customers' beliefs and perceptions, which, in turn, impact their attitude and intentions to use internet banking. This might explain some of the contrasting findings in the literature regarding the role of perceived risk in internet banking acceptance. For instance, Yadav, Chauhan, and Pathak (2015) did not find a significant effect of perceived risk in customers' intentions to use internet banking. On the contrary, Martins et al., (2014) show that perceived risk directly impacts behavioral intentions towards the service. The results of this study, along with the previous research findings, indicate that perceived risk affects customer intentions to use internet banking through beliefs and perceptions.

Third, this study conceptualizes perceived risk as consisting of two dimensions, namely external risk and internal risk. As extant literature suggests that perceived risk in the context of internet banking could be due to external factors beyond the control of the customers, such as privacy concerns and inability to provide additional benefits (Aldás-Manzano et al., 2009; Yang et al., 2015), or due to internal factors within the customers' control, such as lack of knowledge about the internet banking process (Alalwan et al., 2015), this study considers both external risk and internal risk in examining the customer adoption of internet banking. The study findings extend our understanding of the role of perceived risk in internet banking acceptance. For instance, recent studies have considered the role of overall

perceived risk (Martins et al., 2014) or extrinsic dimensions of perceived risk (Lee, 2009), and unidimensional conceptualization of perceived risk, in examining internet banking acceptance (Kesharwani & Bisht, 2012). These studies overlook the differential role of extrinsic and internal risk in internet banking adoption.

This study shows that while external risk, or risk caused by external factors, reduces the customers' favorable attitudes towards internet banking, internal risk, or risk due to lack of self-efficacy, decreases the perceived ease of use of internet banking. The non-significant relationship between internal risk and attitude is in line with the findings of Yuen, Yeow, and Lim (2015). A possible explanation could be that self-efficacy impacts customer' beliefs about the ease with which they can complete their financial transaction using internet banking, which, in turn, affects their acceptance of internet banking. These findings have key implications for our understanding, and further deciphering, of the process by which perceived risk impacts customer beliefs towards internet banking.

Finally, this study used two-stage predictive analytics consisting structural equation modeling and neural network analysis. Integrating these two methods provides a more holistic understanding of the factors influencing customer adoption of internet banking in an Indian context. This is because consumers use both compensatory and non-compensatory decision strategies during the purchase decisions. Thus, integrating the non-compensatory neural network analysis complements the compensatory and linear structural equation modeling helps in better understanding of the factors driving customer adoption of internet banking. From a statistical point of view, integrating the two methods provides a significant methodological contribution to the marketing literature (Shmueli & Koppius, 2010).

From a strategic practitioner standpoint, this study reveals that perceived risk is a significant factor affecting customer beliefs towards internet banking. Specifically, the results

show that while external risk directly influences customer attitude, internal risk, on the other hand, influences customer attitude indirectly through perceived ease of use. While building a risk-free internet banking system might be very difficult, practitioners can focus on risk-reducing strategies to enable its acceptance by customers. For instance, external risk was found to have a negative influence on both perceived usefulness and attitude towards internet banking. Thus, bank managers should ensure that internet banking is technically sound with good security systems to reduce the risk for the customers.

In minimizing the external risk, the sector should focus mainly on performance risk and financial risk while also reducing information risk, social risk, and privacy risk. Despite already being in place, practitioners could strengthen authentication and encryption for internet banking in order to detect fraud, intrusion, and identity theft. Bank managers should communicate about the information security features to the users and thereby enhance customer trust in internet banking. Regarding performance risk, banks should offer expanded banking services through the internet and emphasize the benefits of internet banking in their advertising to the users. To minimize the financial risk, banks should inform customers of the guidelines and instructions, explaining their rights and the bank's responsibilities. Additionally, banks should use other risk-reducing strategies, such as guarantee of satisfaction, money-back guarantees, and improved customer service. They should also communicate utility benefits with internet banking and provide digital receipts for financial transactions.

As internal risk was found to negatively influence perceived ease of use, the banks could take steps to educate customers about internet banking. Specifically, the banks could use clarification workshops and video demos to enhance customer knowledge. These exercises may communicate the use and benefits of internet banking, which could improve

customer attitude. Moreover, it may convey a favorable image of the bank thereby enhancing the customers' intentions to use internet banking.

Limitations and Future Research

While this study contributes to the existing body of knowledge on customer acceptance of internet banking, it also acknowledges that limitations of the study provide avenues for future research. First, this study is limited to investigating the role of few endogenous constructs for parsimony. Future research studies could examine the impact of trust, perceived benefits, and subjective norms in understanding customer acceptance of internet banking (Wu, Jayawardhena, & Hamilton, 2014; Yu et al., 2015). Second, this study used a convenience sampling method. Thus gathering a large random sample could enhance the generalizability of the research findings. Third, the conclusions drawn in this study are based on cross-sectional data. Future research studies could employ a longitudinal study in order to understand the impact of perceived risk in different time periods, and compare their effects, to obtain more insights into internet banking adoption. Finally, risk propensities might differ across customers and this is likely to influence how customers perceive the presence of risk as well as assess risk (Weber & Hsee, 1998). Thus, future research could examine the role of cultural differences in understanding the role of perceived risk in internet banking adoption.

Appendix 1: Measurement items

Perceived Usefulness

- PU1. Internet banking services will improve my efficiency in conducting bank transactions.
- PU2. I think internet banking allows me to manage my banking activities more efficiently.
- PU3. Using the internet banking would improve my performance in conducting banking transactions.

Perceived Ease of Use

- PEOU1. It is very easy to do transactions through internet banking.
- PEOU2. Using internet banking does not require a lot of mental effort.
- PEOU3. It is easy to learn how to use internet banking.

Self-efficacy

- SEF1. I am confident of using internet banking if I have only the online instructions for reference.
- SEF2. I am confident of using internet banking even if there is no one around to show me how to do it.
- SEF3. I am confident of using internet banking even if I have never used such a system before.

Financial Risk

- FR1. The internet banking system is insecure for conducting bank transaction.
- FR2. Internet banking services are not safe to conduct banking transactions.
- FR3. Internet banking websites may be misused or hacked.

Privacy Risk

- PR1. There is a possibility that others will misuse my personal details, if I use internet banking services.
- PR2. My username and password information will not be safe from unauthorized third parties, while using internet banking.
- PR3. There is a possibility of leakage of my personal information, when I use internet banking.

Performance Risk

- PER1. Internet banking is not capable enough to perform banking transactions.
- PER2. Internet banking does not provide any better service as compared to traditional banking service.
- PER3. I am concerned that the internet banking does not provide any financial advantages as suggested by the bank.

Social Risk

- SR1. I think using internet banking worsens the image my friends and relations have of me.
- SR2. Some people, whose opinion I value, think I am not acting correctly when I use internet banking instead of traditional retail banking.

Information Risk

- IR1. Internet banking allows me to get sufficient information to perform the financial transactions.
- IR2. The information on the internet banking website is pretty much what I need to carry out my tasks.
- IR3. The internet banking website does not adequately meet my information needs.

Attitude Towards Internet Banking

- ATT1. All things considered, my using the internet banking is a (good/bad) idea.
- ATT2. All things considered, using the internet banking for financial transactions is a (foolish/wise) idea.
- ATT3. I (like/dislike) the idea of using the internet banking.
- ATT4. Using the internet banking would be (unpleasant/pleasant).

Behavioral Intentions Towards Internet Banking

- BI1. Assuming that I had access to the internet banking, I intend to use it.
- BI2. Given that I have access to the internet banking, I predict that I would use it.
- BI3. I plan to use/continue the internet banking in the next 6 months.

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