“A use intention survey of mobile banking with smart phones – an integrated study of security anxiety, internet trust and TAM”

AUTHORS	Yenhui Ouyang

ARTICLE INFO	Yenhui Ouyang (2012). A use intention survey of mobile banking with smart phones – an integrated study of security anxiety, internet trust and TAM. *Innovative Marketing* , *8*(1)
RELEASED ON	Thursday, 26 April 2012
JOURNAL	"Innovative Marketing "
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES
0

NUMBER OF FIGURES
0

NUMBER OF TABLES
0

© The author(s) 2026. This publication is an open access article.

Yenhui Ouyang (Taiwan)

A use intention survey of mobile banking with smart phones – an integrated study of security anxiety, Internet trust and TAM

Abstract

This paper proposes Internet trust and security anxiety as antecedent factors of the TAM model, which directly affect the intention to use mobile banking. This research adopts an extended TAM perspective to examine consumer behavior in the mobile banking context, drawing data from 427 consumers. An empirical test of the model demonstrates that security anxiety and Internet trust predict PU and PEOU, which mediate the effects of trust and security anxiety on behavioral attitudes and usage intention with regard to mobile banking. Internet trust and security anxiety thus constitute important indirect factors influencing the adoption of mobile banking. Furthermore, security anxiety has a significant and negative influence on trust, while security anxiety has no significant direct effect on PEOU. Trust has a significant influence on PEOU, and no significant direct effect on PU. This paper contributes to the theoretical and empirical analyses by demonstrating the critical roles of security anxiety and Internet trust in the adoption of mobile banking and its antecedents.

Keywords: smart phone, mobile banking, security anxiety, Internet trust, TAM.

Introduction

The technology acceptance model (TAM) has been applied to many fields of technology, such as a university (Jan and Contreras, 2011), tourism (Usoro, Shoyelu & Matthew, 2010) and on-line shopping (Baier & Stuber, 2010), and has been shown to be very useful in predicting and assessing the acceptance of new technologies and the related behavioral intentions.

Internet banking is increasingly popular, and mobile and wireless technology is rapidly changing the way personal financial services are designed and delivered (Luarn & Lin, 2005). Several domestic banks in Taiwan now provide mobile banking through devices connected to the Internet, such as smart phones. Mobile banking allows customers to accomplish a wide range of banking and personal financial management transactions anytime and anywhere, faster, more conveniently, and cheaper than is possible using traditional, real-world bank branches, which are limited by time and place. Early mobile banking services only provided information about interest rates, currency exchange rate, and general financial consulting. Nowadays, in addition to providing private consulting services, transfer and payments, some banks even offer mutual fund transactions and booking of tickets and restaurants via smart phones. Although the mobile banking can now offer many services, individuals may have different usage intentions due to their varied Internet trust and security anxiety, and greater understanding of this could increase adoption of such services.

Based on the TAM presented in Davis et al. (1989), two major determinants (PU and PEOU) of the attitudes of using mobile banking are first identified in this work. This paper also uses attitude towards mobile banking as the dependent variable in the research model. Most studies of consumer behavior consider attitude as a key factor that influences both behavioral intentions and actual behavior (Ajzen, 1991). Based on Venkatesh et al.'s (2003) explanation of attitude toward accepting technology, this paper considers attitude toward mobile banking as representing customers' largely affective responses the use of such services.

Past research has recognized that trust in e-commerce may be an important factor that gives consumers the confidence to engage in online transactions (Kim et al., 2008). However, most researchers have not explored how security anxiety and trust may work in combination to influence the consumer acceptance of mobile banking. This paper develops a consumer decision-making model in mobile banking that proposes PEOU and PU may directly influence behavior attitude. Based on the empirical results, this paper provides several marketing strategies that can be used by managers to enhance the competitive advantages of the mobile banking.

This next section reviews the current literature, and then this study applies the modified TAM model, incorporating security anxiety as the antecedent and Internet trust as the mediating construct, to predict attitudes towards mobile banking. The findings of this study provide a good basis for the banking industry to develop an effective service evaluation framework to determine the adoption potential of new mobile banking services. The results of this work should be of interest to banking industry in its general efforts to increase the use of mobile banking and to better understand the factors affecting its related attitudes and intentions.

© Yenhui Ouyang, 2012.

1. Review of the related literature and hypotheses development

Many banks in Taiwan about ten years ago cooperated with telecommunication companies to develop mobile banking services. However, the network technology of the day was not mature enough to develop comprehensive functions and security systems to meet the demands of customers, and thus only very limited services were initially offered. However, with the recent rise in the use of smart phones, banks have started offering a far more comprehensive range of services. Based on the existing literature, this paper fills a research gap by examining how trust and security anxiety act as antecedents in the TAM with regard to the adoption of mobile banking.

1.1. Technology acceptance model (TAM). Based on the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980), Davis et al. (1989) developed TAM to predict the acceptance of IT, and it has been widely applied to study the adoption and acceptance of new technologies. Many studies have proven that behavioral attitudes to a technology are positively related to intention to use it (Gopi and Ramayah, 2007; Ramayah et al., 2009).

According to TAM, an individual's intention to adopt a technology is determined by their attitude toward using it and the perceived ease of use. The TAM posits that the perceived usefulness (PU) and perceived ease of use (PEOU) are the major determinants of intention to use TAM and the related behaviors. PU is an individual's perception that using a technology can enhance their performances. PEOU encapsulates the degree to which the potential user perceives that using a technology free from physical or psychological effort (Davis, 1989). Lam et al. (2007) stated that information technologies can raise competitiveness, decrease costs, save time, and improve the acquisition and sharing of information. However, previous empirical studies noted that the constructs of TAM are too limited, and that PU and PEOU might not be the only beliefs that mediate the influence of the external environment on attitude and intentions. Accordingly, this paper includes Internet trust and security anxiety as external variables to improve the predictive power of the research model.

1.2. Internet trust beliefs. Chung and Kwon (2009) defined trust as a feeling of security and willingness to depend on someone or something. Friedman et al. (2000) provided empirical support for the idea that e-trust has an important effect on consumers' willingness to reveal sensitive private information and conduct financial transactions online. Liu at al. (2004) also stated that online vendors face an important obstacle to the market penetration of e-channels if consumers lack trust in online transactions. In practice, consumer online trust is the key factor in all e-commerce and B-to-C interactions, whereas the influence of technology or system trust is essentially on future online behavior (Grabner-Kräuter and Faullant, 2008). Since there is a high level of uncertainty in a virtual environment, trust can be regarded as a psychological safety mechanism to reduce this uncertainty and increase perceived reliability. Grewal et al. (2004) stated that consumers might not use e-commerce because they lack trust in Internet businesses, and many studies have recognized that trust is one of the major reasons why consumers are willing to release their private information and carry out online transactions (Flavian et al., 2006; Luarn and Lin, 2005). Other research findings show that trust plays a critical role in the adoption and continued use of e-banking (Casalo et al., 2007; Lichtenstein and Williamson, 2006; Vatanasombut et al., 2008). Trust is thus more important in a virtual environment than in a physical one (Pavlou and Fygenson, 2006).

However, consumers are likely to perceive less risk as trust increases, and thus this study postulates that Internet trust can positively affect the acceptance of mobile-banking.

1.3. Security anxiety. Security anxiety is slightly different to perceived risk. Perceived risk is a long-term influence, while security anxiety is a feeling that arises at the moment of using a new technology (Im et al., 2008). Internet security anxiety is often conceptualized as the negative, fearful emotions that an individual may experiences while online (Thatcher et al., 2007). As Internet use is increasing, so the related anxiety is decreasing (Durndell and Haag, 2002). This paper postulates that Internet security anxiety is an important antecedent variable that influences the intention to use mobile banking.

1.4. External variables and the extended TAM. Many empirical studies have applied the TRA as a theoretical basis, and found that trust beliefs are significantly related to attitude, and that attitude positively influences purchase intentions (Chow and Holden, 1997; Macintosh and Lockshin, 1997). Mcknight et al. (1998) thus integrated trust into the TRA as a belief, and found that it can influence future purchase intentions because it helps build a sense of connection and identification with e-commerce vendors. Pavlou (2003) found that trust influences intentions through positive attitudes, and is useful in reducing the perceived risk that consumers often feel is present in an online environment. Wu and Chen (2005) also indicated that trust is an

antecedent of PU, PEOU is an antecedent of trust, and trust beliefs have direct influences on behavioral intentions to use, especially in the online environment. Gefen et al. (2003) and Page et al. (2003) provided empirical support that trust beliefs can reduce social uncertainty, complexity, and perceived related risks concerning the adoption of Internet banking. Based on the importance of trust in an m-commerce setting, this study postulates that Internet trust is an intermediary variable, and that security anxiety is an antecedent variable in determining the acceptance of mobile-banking.

1.5. Hypotheses. Based on the theoretical framework discussed above, this paper proposes the following eight hypotheses and an integrated model, as shown in Figure 1.

H1: PEOU is positively associated with PU.

H2: PEOU is positively associated with customers' behavioral attitudes.

H3: PU is positively association with behavioral attitudes.

H4: Customer behavioral attitude toward using mobile banking is positively associated with usage intentions.

H5: Customer security anxiety is negatively associated with perceptions of ease of use in of mobile banking.

H6: Customers' security anxiety is negatively associated with Internet trust in using mobile banking.

H6a: Internet trust is the mediator of the security anxiety and PEOU relationship, such that the direct effect of security anxiety-PEOU becomes insignificant (or weakens) after Internet trust is considered.

H7: Internet trust is positively associated with the customer perceptions of ease of use of mobile banking.

H8: Internet trust is positively associated with the customers' perceptions of mobile banking usefulness.

H8a: PEOU is the mediator of the Internet trust and PU relationship, such that the direct effect of Internet trust-PU becomes insignificant (or weakens) after PEOU is considered.

1.6. Model overview. This study is based on the literature reviewed above by positioning both security anxiety and Internet trust as complementary antecedents in the TAM to predict the usage intention for mobile banking.

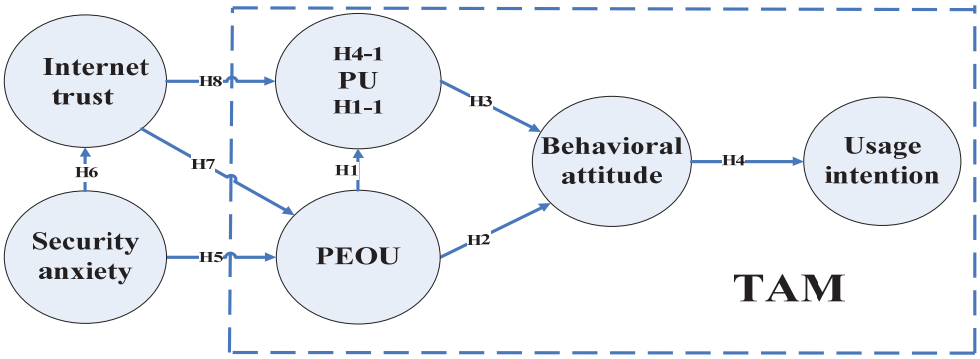


Fig. 1. Research model

2. Research methodology

2.1. Demographic characteristics of respondents. Of the 800 questionnaires administered, 436 usable responses were returned, yielding a response rate of 54.5 percent. The data was collected from the south of Taiwan, and the sample consisted of 41.3% males and 58.7% females, as it is seen in Table 1.

Table 1. Sample demographics

Measure	Items	Frequency	%
Smart phone user	Yes	182	41.7%
	No	254	58.3%
Mobile bank user	Yes	190	43.6%
	No	246	56.4%
Gender	Male	180	41.3%
	Female	256	58.7%
Age	< 25	13	6.2
	26~35	77	36.5
	36~45	86	40.8
	> 46	35	16.6

Table 1 (cont.). Sample demographics

Measure	Items	Frequency	%
Annually income (NTD)	< 370,000	72	16.5%
	370,000~990,000	164	37.6%
	990,000~1,980,000	186	42.7%
	> 1,980,000	14	3.2%
Education	High school	88	20.2%
	College degree	269	59.6%
	Graduate degree	88	20.2%

2.2. Reliability and validity. To ensure the appropriateness of the research instrument, the convergent validity, discriminant validity, and reliability of all the multiple-item scales were examined, following the guidelines in Gefen and Straub (2005). Reliability was assessed in terms of composite reliability, measuring the degree to which items are free from random error and therefore yield consistent results. The composite reliabilities in our measurement model ranged from 0.861 to 0.951, above the recommended cutoff of 0.70 (Fornell and Larcker, 1981; Nunnally and Bernstein, 1994). All items had significant factor loadings higher than 0.7, and the average variances extracted ranged from 0.6194 to 0.8267, exceeding 5 threshold (Hair et al., 1988). The square root of the average variance extracted should be larger than all other entries in the corresponding rows and columns (Bagozzi and Yi, 1988), and this was found in the results. As most of the data satisfied these criteria, the next step was to evaluate the structural model.

Table 2. Descriptives, correlations and discriminant validity for each construct variable

Construct variable	Mean	S. dev.	PEOU	PU	SA	IT	BA	UI
PEOU	4.8956	1.1506	0.8652					
PU	5.2167	1.0880	.739 (**)	0.8778				
Security anxiety	5.2626	1.3247	-.149 (**)	.001	0.9092			
Internet trust	4.6927	1.0787	.674 (**)	.564 (**)	-.196 (**)	0.8249		
Behavior attitude	5.0474	1.1685	.821 (**)	.842 (**)	-.060	.684 (**)	0.8817	
Usage intention	4.8555	1.1807	.792 (**)	.743 (**)	-.200 (**)	.673 (**)	.824 (**)	0.7870
CR *			0.909	0.930	0.951	0.861	0.911	0.764
AVE **			0.7486	0.7705	0.8267	0.6804	0.7774	0.6194

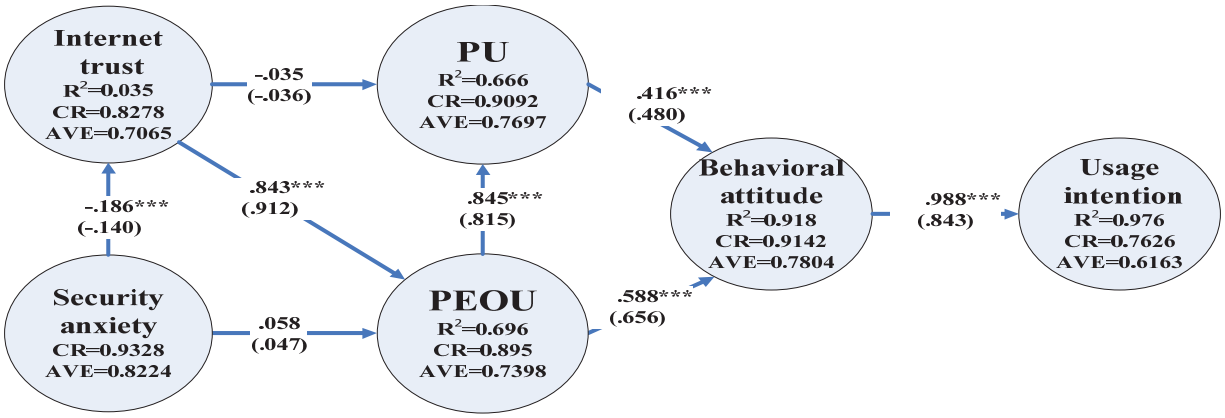
Note: Diagonal elements in the above matrix are the square root of AVE estimate for each construct. Off-diagonal elements are the correlations between the different constructs. * CR is the composite reliability. ** AVE is the average variance extracted estimate.

2.3. Analysis of the structural model. Table 3 presents fit statistics.

Table 3. Fit statistics

Fit statistics	Recommended value	Structural model
Chi-square		357.775
df		96
$X^{2/df}$	< 5 (Schumacker and Lomax, 2004)	3.727
CFI	> 0.95 (Byrne, 1998)	0.959
GFI	> 0.9 (Bagozzi & Yi, 1988)	0.906
RMSEA	< 0.06 (Jöreskog and Sörbom, 2003)	0.079
NFI	> 0.9 (Byrne, 1998)	0.944
AGFI	> 0.8 (Eteza-Amoli & Farhoomand,1996)	0.0867
RMR	0.05~0.08	0.077

The results for the overall goodness-of-fit and the parameters of the SEM were close to or over their respective common acceptance levels, as suggested by previous research, indicating that the proposed model achieved predictive validity (Table 2). The path coefficients and significance levels in the structural model are shown in Figure 2. Except for the paths of Internet-PU and security-PEOU, all paths in the structural model are significant at the 0.001 level. Hypotheses H1, H2, H3, H4, H6, H7 are thus supported, as shown by the path coefficients. Security anxiety had no direct effect on PEOU, while Internet trust had no direct, significant impact on PU. Hypothese H5 and H8 are not supported, as shown by the path coefficients. Instead, security anxiety had an indirect effect on PEOU via Internet trust, and Internet trust also had an indirect effect on PU via PEOU. The empirical results further suggest that Internet trust and PEOU serve as important mediating variables between security-PEOU and Internet trust-PU, and thus H6a and H8a are supported. Among the variables within the TAM, both PU and PEOU play important roles in affecting behavioral attitudes and intentions to use mobile banking. The square multiple correlations (SMCs; R^2) reflect the amount of variance explained by the model or its predictive power and R^2 results indicate that 3.5% of the variance in Internet trust, 69.6% of the variance in PEOU, 66.6% of the variance in PU, 91.8% of the variance in behavioral attitude, and 97.6% of the variance in usage intention are accounted by the model.



Note: All stated standardized regression coefficients are significant at $p = 0.001$, ***$p < 0.001$.

Fig. 2. Path diagram with standardized estimates of the proposed model

Discussion and conclusion

This results show that security anxiety had a negative significant effect on Internet trust and Internet trust had a significant positive effect on PEOU. In addition, security anxiety and Internet trust were found to play important roles in shaping customer perceptions and behaviors. Additionally, an individual's PEOU directly and indirectly significant affects their behavioral attitude through PU. PU was found to have a significant impact on behavioral attitude to use the mobile banking. On the basis of the empirical results, this study offers some practical suggestions to increase customer acceptance of mobile banking. First, PEOU, rather than PU, had a greater effect on customer behavioral attitude, and so mobile banking should be simple to operate and easy to understand in order to attract more customers. The shorter the time needed for customers to master mobile banking, the greater their motivation to accept it will be. Second, security anxiety and Internet trust are critical antecedent factors that can be used to influence the intention to use mobile banking. Service providers must increase security measures to provide a safe transaction environment, so that customers may decrease their security anxiety and increase their Internet trust. In addition, banks must provide timely support in case problems arise when using mobile banking services. Lastly, because Internet trust can influence behavioral attitude via PEOU and PU, banking managers can utilize advertisements to highlight the convenience and benefits of mobile banking, leading more customers to use such services.

This paper has both theoretical and practical implications. From a theoretical standpoint, the TAM decision-making model provides a comprehensive view of consumers' behavioral attitude, incorporating the effects of Internet trust and security anxiety on the intention to use mobile banking. The results of this study not only make more theoretical contributions to the literature on TAM, but also have some meaningful implications for mobile banking practitioners. From a practical perspective, the theoretical results may allow mobile banks to better consider Internet trust and security anxiety mechanisms in their mobile banking websites. The results also highlight the extensive use of the technology in the banking industry, and suggest that this trend will continue.

In future research, more external variables could be examined in the context of behavioral attitude and the acceptance of mobile banking, such as access costs, perceived value, Internet use experience, and user Internet self-efficacy, as this could aid understanding of the antecedents influencing customer beliefs.

References

1. Ajzen, I. (1991). Organizational behavior and human decision processes, *Theories of Cognitive Self-Regulation*, 50 (2), pp. 179-211
2. Ajzen, I. and Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*, Englewood Cliffs, NJ: Prentice-Hall.
3. Bagozzi, R.P. and Yi, Y. (1988). On the use of structural equation models in experimental designs, *Journal of Marketing Research*, 26, pp. 271-284.
4. Baier, D. and Stuber, E. (2010). Acceptance of recommendations to buy in online retailing, *Journal of Retailing and Consumer Services*, 17, pp. 173-180.
5. Casalo, L.V., Flavian, C., and Guinaliu, M. (2007). The role of security, privacy, usability and reputation in the development of online banking, *Online Information Review*, 31 (5), pp. 583-602.
6. Chow, S. and Holden, R. (1997). Toward an understanding of loyalty: the moderating role of trust, *Journal of Managerial Issues*, 9 (3), pp. 275-298.

7. Chung, N. and Kwon, S.J. (2009). Effect of trust level on mobile banking satisfaction: a multi-group analysis of information system success instruments, *Behavior & Information Technology*, 28 (6), pp. 549-562.
8. Davis, F.D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology, *Management Information Sciences Quarterly*, 13, pp. 319- 339.
9. Davis, F.D., Bagozzi, R.P., and Warshaw, P.R. (1989). User acceptance of computer technology: A comparison of two theoretical models, *Management Science*, 35 (8), pp. 982-1002.
10. Durndell, A. and Haag, Z. (2002). Computer self efficacy, computer anxiety, attitudes towards the Internet and reported experience with the Internet, by gender, in an East European sample, *Computers in Human Behavior*, 18 (5), pp. 521-535.
11. Flavian, C., Guinaliu, M., and Torres, E. (2006). How bricks-and-mortar attributes affect online banking adoption, *The International Journal of Bank Marketing*, 24 (6), pp. 406-423.
12. Fornell, C. and Larcker, D. (1981). Evaluating structural equation models with unobservable variable and measurement error, *Journal of Market Research*, 18, pp. 39-50.
13. Friedman, B., Kahn, P.H. Jr., and Howe, D.C. (2000). Trust online, *Communications of the ACM*, 43 (12), pp. 34-40.
14. Hair, J.F., Anderson, R.E., Tatham, R.L., and Black, W.C. (1998). *Multivariate Data Analysis*, Prentice-Hall.
15. Gefen, D., Karahanna, E., and Straub, D.W. (2003). Trust and TAM in online shopping: An integrated model, *MIS Quarterly*, 27 (1), pp. 52-90.
16. Gefen, D. and Straub, D.W. (2005). A practical guide to factorial validity using PLS-Graph: tutorial and annotated example, *Communications of the Association for Information Systems*, 16, pp. 91-109.
17. Gopi, M. and Ramayah, T. (2007). Applicability of theory of planned behavior in predicting intention to trade online: Some evidence from a developing country, *International Journal of Emerging Markets*, 2 (4), pp. 348-360.
18. Grabner-Kräuter, S. and Faullant, R. (2008). Consumer acceptance of Internet banking: the influence of Internet trust, *International Journal of Bank Marketing*, 26 (7), pp. 483-504.
19. Grewal, D., Iyer, G., and Levy, M. (2004). Internet retailing: enablers, limiters and market consequence, *Journal of Business Research*, 57 (7), pp. 703-7013.
20. Im, I., Kim, Y., and Han, H.J. (2008). The effects of perceived risk and technology type on users' acceptance of technologies, *Information & Management*, 45, pp. 1-9.
21. Jan, A.U. and Contreras, V. (2011). Technology acceptance model for the use of information technology in universities, Computers in Human Behavior, Volume 27, Issue 2, pp. 845-851.
22. Kim, D.J., Ferrin, D.L., and Rao, H.R. (2008). A trust-based consumer decision-making model in electronic commerce: The role of trust, perceived risk, and their antecedents, *Decision Support Systems*, 44 (2), pp. 544-564.
23. Lam, T., Cho, V., and Qu, H. (2007). A study of hotel employee behavioral intentions towards adoption of information technology, *Hospitality Management*, 26, pp. 49-65.
24. Lichtenstein, S. and Williamson, K. (2006). Understanding consumer adoption of Internet banking: An interpretive study in the Australian banking context, *Journal of Electronic Commerce Research*, 7 (2), pp. 50-67.
25. Liu, C., Marchewka, J., Lu, J., and Yu, C. (2004). Beyond concern: A privacy-trust-behavioral intention model of electronic commerce, *Information & Management*, 42 (1), pp. 127-142.
26. Luarn, P. and Lin, H.H. (2005). Toward an understanding of the behavioral intention to use mobile banking, *Computers in Human Behavior*, 21, pp. 873-891.
27. Macintosh, G. and Lockshin, L.S. (1997). Retail relationships and store loyalty: a multi-level perspective, *International Journal of Research in Marketing*, 14 (5), pp. 487-497.
28. McKnight, D.H., Cummings, L.L., and Chervany, N.L. (1998). Initial trust formation in new organizational relationships, *Academy of Management Review*, 23, pp. 473-490.
29. Nunnally, J.C. and Bernstein, I.H. (1994). *Psychometric Theory*, New York: McGraw Hill.
30. Page C. and Luding Y. (2003). Bank managers' direct marketing dilemmas – consumers' attitudes and purchase intention, *The International Journal of Bank Marketing*, 21 (3), pp. 147-163.
31. Pavlou, P.A. (2003). Consumer acceptance of electronic commerce: integrating trust and risk with the technology acceptance model, *International Journal of Electronic Commerce*, 7 (3), pp. 101-34.
32. Pavlou, P.A. and Fygenson, M. (2006). Understanding and predicting electronic commerce adoption: An extension of the theory of planned behavior, *MIS Quarterly*, 30 (1), pp. 115-143.
33. Ramayah, T., Rouibah, K., Gopi, M., and Rongel, G.J. (2009). A decomposed theory of reasoned action to explain intention to use Internet stock trading among Malaysian investors, *Computers in Human Behavior*, 25, pp. 1222-1230.
34. Thatcher, J.B., Loughry, M.L., Lim, J., and McKnight, D.H. (2007). Internet anxiety: An empirical study of the effects of personality, beliefs, and social support, *Information & Management*, 44, pp. 353-363.
35. Usoro, A., Shoyelu, S., and Matthew, K. (2010). Task-technology fit and technology acceptance models applicability to e-tourism, *Journal of Economic Development, Management, IT Finance and Marketing*, 2 (1), pp. 1-32.
36. Vatanasombut, B., Igbaria, M., Stylianou, A.C. and Rodgers, W. (2008). Information systems continuance intention of web-based applications customers: The case of online banking, *Information & Management*, 45 (7), pp. 419-428.
37. Venkatesh, V., Morris, M.G., Davis, G.B., and Davis, F.D. (2003). User acceptance of information technology: Toward a unified view, *MIS Quarterly*, 27(3), pp. 425-478.
38. Wu, L.L. and Chen, J.L. (2005.). An extension of trust and TAM model with TPB in the initial adoption of on-line tax: An empirical study, *International Journal of Human-Computer Studies*, 62, pp. 784-808.