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Abstract

This paper examines the use of Internet banking systems and several critical factors related to Internet banking services. The analysis suggests that the constructs tested considerably explain the variation in customer interactions. Perceived usefulness and perceived ease of use are important in facilitating customer interactions. Perceived security, responsiveness and convenience also represent the primary avenues affecting customer interactions. Security requirements in terms of stringent authorized access, confidentiality, and serious security procedures are fundamental to secure electronic banking operations and financial transactions in virtual environments. Moreover, a prompt responsiveness to service requests should enhance customer confidence in Internet banking services.

Keywords: Customers, Internet banking, security, services, system usage

1. Introduction

Internet banking systems play an increasingly important role in expanding banking services and enhancing service quality in competitive market environments. However, the actual usage of Internet banking services involve a number of considerations in terms of perceived usefulness, ease of use and other factors. In terms of technology-based services, customers tend to apply a compensatory process to evaluate multiple attributes and gradually form their expectations on the basis of experience (Dabholkar 1994). Research of this nature is useful in describing acceptance and adoption of a particular technology, while the quality of service can be assessed using consumption-based perceptions (Cronin and Taylor 1992). Dabholkar (1996) constructs a service quality model, within which the expectations assigned to speed of delivery, perceived ease of use, reliability, enjoyment and control determine expected service quality, which might in turn affect the individual's intention. A market orientation towards customer demands should help the achievement of competitive advantage and an increase of the value of services. As far as this is concerned, our paper aims to measure the impact of various critical factors on Internet banking systems from customer perspective.

2. Hypotheses

This study is based on the Technology Acceptance Model (TAM) (Davis 1989). The TAM has been extensively used to examine user behavior associated with the use of computer-based information systems. It asserts that the influence of external variables upon user behavior is mediated through user beliefs and attitudes (Davis, Bagozzi and Warshaw 1989). Actually, the TAM adapts the Theory of Reasoned Action (TRA), which is specifically tailored for modeling user acceptance of information systems (Davis 1989). Perceived usefulness is defined as the prospective user's subjective probability that using a specific application system could enhance job performance within an organizational context. It captures the extent to which a potential adopter views the innovation as offering value over alternative ways of performing similar task (Agarwal and Prasad 1999). Individual behavioral intention to use a system is affected by an attitude towards the system, while attitude is a learned response that

refs to an individual's evaluation of a concept (Fishbein and Aizen 1975). The TAM postulates that individual attitudes and perceived usefulness are determinants of behavioral intention, while behavioral intention directly influences the actual usage of the system. Evan if Internet banking is an innovative alternative banking service, it is not an unfamiliar phenomenon. It would be meaningful to examine customer interactions in terms of the actual use of the services beyond individual attitudes. Figure 1 depicts our research model incorporating several constructs.

Figure 1   Research Model
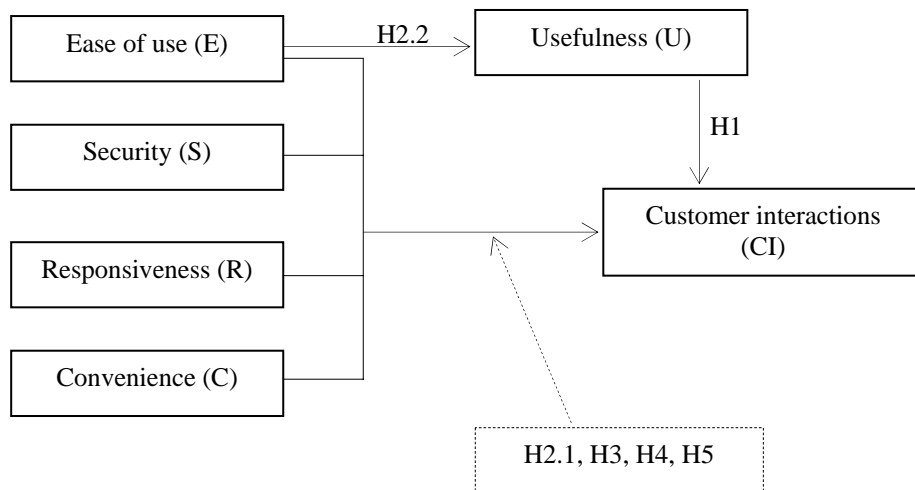
Perceived usefulness refers to whether a user believes that using a particular system would be functional and beneficial (Davis 1989). It may significantly affect the usage of an information system, because of the reinforcement value of outcomes. Perceived usefulness is postulated to have an effect on behavioral intentions to the use of an innovation via its influence on individual attitudes (Davis, Bagozzi and Warshaw 1989). Previous studies indicate that perceived usefulness is influenced by various variables in different environments (Davis 1993). Therefore, we would test the following hypotheses:

H1   *Perceived usefulness will have a positive effect on customer interactions.*
H1a   *The ability to provide current banking information is positively related to perceived usefulness.*
H1b   *The ability to enable immediate banking transactions is positively related to perceived usefulness.*
H1c   *The ability to facilitate investment planning is positively related to perceived usefulness.*

The perceived ease of use could influence system usage through perceived usefulness (Davis 1989). A number of studies suggest that the perceived ease of use is a determinant for the adoption of innovative services or products. For instance, Daniel (1999) also suggests perceived ease of use to be one of the factors for customer acceptance of electronic banking. Customers of technology-based services tend to be concerned about the effort required to use such options and the complexity of the process of service delivery (Dabholkar 1996). Because Internet banking is performed on the screen of a computer-based device, a user-friendly interface should help search information and manage assets. Hence, perceived ease of use should be evaluated in terms of simple navigation procedure and intuitive search engine for

acquiring information and performing transactions. Behavioral intention to use a system is directly determined by an individual's attitude toward using the system and its perceived usefulness, while the perceived ease of use is hypothesized to be a predictor of perceived usefulness. Even if a given system is useful, the user may feel that it is too hard to use. In this case, the perceived benefits from suing the system may be out-weighed by the effort of using the application (Davis 1989).

H2.1   *Perceived ease of use will have a positive effect on customer interactions.*
H2.2   *Perceived ease of use is positively related to perceived usefulness.*
H2a   *Logical presentation of information is positively related to perceived ease of use.*
H2b   *An intuitive search and navigation is positively related to perceived ease of use.*
H2c   *The provision of clear instruction is positively related to perceived ease of use.*

Security is a general concern in the use of the Internet for electronic transactions (Edwards 1996). Individual customers might feel uncertain when using Internet banking that involves private data. They should expect banks to have a stringent security procedure for securing online banking. Authentication must also be guaranteed through passwords and digital signatures. Moreover, it is necessary to assure confidentiality by protecting communications between customers and banks. The perceived security implies that customers expect a service with promised security. In general, those expecting a higher level of perceived security usually have a more favorable attitude towards the service (Dutta and McCrohan 2002).

H3   *Perceived security will have a positive effect on customer interactions.*
H3a   *Rigorous security procedure implemented is positively related to perceived security.*
H3b   *Authorized access is positively related to perceived security.*
H3c   *Confidentiality is positively related to perceived security.*

With the Internet banking systems, individuals can get instantaneous access to most current banking information and place a request for banking service. Hence, a customer's service request should be processed in an efficient manner and responsiveness becomes a variable affecting customer satisfaction. In addition, the reliability of service is demanded because it directly affects the usage of technology-based self-service (Dabholkar 1996). In particular, Internet banking involves the transfer of fund and the exposure of customer data. One would normally worry about how accurate a request is processed, because Internet banking is not conducted face-to-face over counters (Bahia, Paulin and Perrien 2000).

H4   *Responsiveness will have a positive effect on customer interactions.*
H4a   *Prompt response to a request for services is positively related to responsiveness.*
H4b   *The reliable service is positively related to responsiveness.*

It has been argued that e-business can create great convenience to customers. Internet banking is convenient because it reduces the time spent on banking services and saves physical effort of visiting counters (Howcroft, Hamilton and Hewer 2002). Liao and Cheung (2002) suggest that location and time convenience are likely to be significant in differentiating Internet banking from traditional retail banking. Individuals can get into the Internet anywhere at any time. Therefore, Internet banking is not restricted by geographic and time constraints.

H5   *Perceived convenience will have a positive effect on customer interactions.*

3. Research Methods

This project involves a survey of individual assessments of the Internet-enabled banking services, provided by Citibank, Standard Chartered, and other commercial banks in Singapore. These financial institutions have recently developed Internet-enabled banking services, allowing individuals to easily access retail-banking services through the Internet. In terms of the design of a questionnaire for our survey, a complex construct should be rich in meaning and multi-dimensional. As shown in Table 1, multiple measures are employed to evaluate the attributes suggested in the previous section, Usefulness (three variables, C1-C3), Ease of Use (five variables, E1-E5) and System Security (four variables, S1-S4), Responsiveness (two variables, R1-R2), and Convenience (C). Respondents are requested to give their opinions regarding the perceived importance of each variable, on the basis of a seven-point Likert-scale, with which "1" represents "not important at all" or "Strongly disagree," while "7" represents "extremely important" or "Strongly agree". Validity of our study is tested via construct validity and reliability. The causal relationships are examined on the basis of path analysis.

Our questionnaire containing research questions related to those hypotheses proposed in the previous sections were circulated to individuals by adopting the simple random sampling technique. Respondents were requested to access various attributes with respect to Internet banking currently provided by banks. Because Internet users are likely to appreciate the idea of on-line banking and financial transactions, they may be able to give reasonable expectations in response to our research questions. We also restrict the interviewees who possess experience on Internet banking services. The survey results in responses from 320 individuals who possess experience on Internet banking services.

On the basis of the assumed causal relationships of different variables and their potential impacts on customer interactions with Internet-enabled banking (Figure 1), we validate the measures in an egalitarian way including the following procedures. Exploratory factor analysis is conducted to examine all the items within the five exogenous variables and the endogenous variable to obtain the factor loadings. The reliability analysis is then applied to obtain the value of Cronbach alpha and to examine the reliability of the items. The structural equation model of the path analysis is used to perform confirmatory factor analysis (CFA).

4. Results

The results of exploratory factor analysis are displayed in Table 1. Firstly, the factor loadings of those items associated with perceived usefulness are 0.9302, 0.8788, and 0.6047, respectively, all are positively significant and explain 65.45% of the variance. Similarly, the factor loadings of five items in relation to perceived ease of use explain 70.52% of the variance; the factor loadings of four items in relation to security explain 60.55% of the total variance; and the factor loadings of the two items associated with responsiveness explain 80.42% of the total variance, which are positively significant.

The results from the reliability test confirm that the items are associated with each other. The values of Cronbach alpha resulted from reliability analysis support the internal consistency of the sample data. As shown in Table 2, the values of Cronbach alpha are 0.7606 (Usefulness), 0.8987 (Ease of use), 0.8327 (Security) and 0.7238 (Responsiveness), respectively. These results suggest that the items associated with each factor mentioned above are considerably related to each other. In addition, the correlations between different attributes are significantly different from zero at the 0.01 level and positive in value.

Goodness of Fit Index (GFI) is 0.9125 and the GFI Adjusted for Degrees of Freedom (AGFI) is 0.8469. According to Bagozzi and Yi (1988), AGFI values higher than 0.80 suggest a good fit of the hypothesize model. In addition, the Root Mean Square Residual (RMR) is 0.0521. Usually, an RMR value less than 0.1 is considered a good fit, while a value less than 0.05 is considered a very good fit of the data to the research model (Bagozzi and Yi 1988). GFI is a measure of the relative amount of variances and covariances jointly accounted for the model, while RMR is a measure of the average of the residual variances and covariances. Moreover, Bentler and Bonett's Non-normed Index is 0.9149, Bollen Non-normed Index is 0.9438, and Bentler's Comparative Fit Index is 0.9433. Finally, the Chi-square statistic (211.47, d.f. = 52) suggests the validity of constructs is statistically significant (Boudreau, Gefen and Straub 2001). In sum, the above statistics not only show that the hypothesized model considerably explains the causal relationships between the endogenous variable and exogenous variables, but also indicate that the constructs within the model have acceptable predictive validities.

Table 1　Results of Exploratory Factor Analysis

Construct	Item	Description	Factor Loading
Usefulness (U)	U1	Looking for the latest banking information	0.9302
	U2	Performing banking transactions	0.8788
	U3	Making investment plan	0.6047
Ease of use (E)	E1	Logical presentation of information	0.8346
	E2	Clear procedure for site navigation	0.8759
	E3	Intuitive search engine	0.8321
	E4	Help function	0.8464
	E5	Supportive instruction	0.8424
Security (S)	S1	Authorized access	0.8803
	S2	Confidentiality	0.8807
	S3	Serious security procedure	0.7888
Responsiveness ®	R1	Prompt response to service requests	0.8989
	R2	Reliable processing of service requests	0.8989

Table 2　Summary Statistics of Correlation and Reliability Tests

	CI	E	S	U	R	Mean	s.d.	Cronbach Alpha
Interactions (CI)	1.00					5.52	1.17	
Ease of use (E)	0.51***	1.00				5.81	1.12	0.8987
Security (S)	0.37***	0.53***	1.00			6.66	0.68	0.8327
Usefulness (U)	0.47***	0.38***	0.31***	1.00		5.89	1.01	0.7238
Responsiveness ®	0.35***	0.48***	0.27***	0.25***	1.00	4.48	1.24	0.7606
Convenience ©	0.21***	0.32***	0.26***	0.25***	0.09	5.70	0.81	

Note:　$* \, p < 0.1$, $** \, p < 0.05$, $*** \, p < 0.01$

H1 is supported, because the path coefficient in the CFA model (Perceived usefulness – Customer interactions) is 0.2939, and positively significant at the 0.01 level. H1a, H1b and H1c are also supported, because the factor loadings resulted from exploratory factor analysis (Perceived Usefulness) range from 0.6047 to 0.9302 (Table 1). There is a confirmation of convergent validity, because the high correlation values between the items associated with the factor, ranging from 0.23 to 0.77, are positively significant at the 0.01 level (Table 2).

Moreover, the factor loadings resulted from the confirmatory factor analysis for Perceived Usefulness" range from 0.8137 to 0.9954, being positively significant at the 0.01 level.

H2.1 is supported, because the path coefficient in the CFA model (Perceived ease of use – Customer interactions) is 0.2747 and positively significant at the 0.01 level. H2.2 is supported, because the path coefficient in the CFA model (Perceived ease of use – Usefulness) is 0.4170, and positively significant at the 0.01 level. H2a, H2b, H2c, H2d and H2e are also supported, because the factor loadings resulted from exploratory factor analysis (Perceived ease of use) range from 0.8321 to 0.8759 (Table 1). There is a confirmation of convergent validity, because the high correlation values between the items associated with the factor, ranging from 0.70 to 0.88, are positively significant at 0.01 level (Table 2). Moreover, the factor loadings in the CFA model, ranging from 0.7590 to 0.9447, are positively significant at the 0.01 level. Finally, H2f is supported, because the path coefficient in the CFA model (Ease of Use – Customer Interactions) is 0.2747 and positively significant at the 0.01 level.

H3 is supported, because the path coefficient in the CFA model (Perceived security – Customer Interactions) is 0.1219 and positively significant at the 0.05 level. H3a, H3b, and H3c are supported, because the factor loadings resulted from exploratory factor analysis (Security) range from 0.5057 to 0.8807 (Table 1). In addition, there is a confirmation of convergent validity – the high correlation values between those items associated with the factor range from 0.56 to 0.75 and are positively significant at 0.01 level (Table 2). Moreover, the factor loadings in the CFA model, ranging from 0.6389 to 0.8754, are significant at the 0.01 level.

H4 is supported, because the path coefficient in the CFA model (responsiveness – Customer Interactions) is 0.1372 and positively significant at the 0.05 level. H4a and H4b are also supported, because the factor loading resulted from exploratory factor analysis (Responsiveness) is 0.8989 (Table 1). In addition, there is a confirmation of convergent validity – the high correlation values between those items associated with the factor is 0.61, and positively significant at the 0.01 level (Table 2). Moreover, the factor loadings resulted from the CFA model are 0.7245 and 0.8398, and positively significant at the 0.01 level. Finally, H5 is reasonably supported, because the path coefficient in the CFA model (Convenience – Customer interactions) is 0.0757 and positively significant at the 0.1 level.

5. Discussion and Conclusion

A comprehensive test of the survey data results in our hypotheses being strongly supported by empirical analysis. In particular, the exploratory factor analysis and reliability analysis show that the individual indices are relevant and reliable. In addition, the convergent validity of the indices is strongly supported by the resulted factor loadings. The present model is supported, and the constructs within the model have been validated. This is because the estimates of path coefficients in the latent variable equation indicate that the endogenous variable is positively affected by exogenous variables. Therefore, customer interactions with Internet banking is affect by perceived usefulness, ease of use, security, responsiveness and convenience.

Firstly, it is desirable if a banking website can improve the perceived usefulness of banking services by allowing customers to interactively search the latest banking information, to conduct real-time banking transactions, and to make investment plans. The provision of such functionalities seems not to be a technically difficult task today. The present use of Internet banking varies from looking for banking information to carrying out financial transactions. It

seems very challenging for banks to effectively enable the services and achieve desirable quality, because the actual operations of Internet banking services is also affected by its perceived ease of use, security and other expectations from customers.

Secondly, perceived ease of use is determined by user-friendly interface, logical navigation procedures, intuitive search engine, help function, and clear instructions. Therefore, these aspects should be taken into account when designing Internet banking systems, in order to enhance the interactivity of an e-banking system. Individual customers tend to appreciate a sophisticated service platform, a desirable banking website should be aesthetically appealing, easy to use, and possess practical functionalities to meet the need of individual customers.

Thirdly, it should be noted that security of Internet banking is a primary concern of many customers, because they are not aware of the security procedures and technologies implemented by banks. It is not uncommon that they might be concerned about uncertainties in terms of unauthorized access, disclosure of private data and release of transactions information. Some might even believe that it should be involved in a high risk when using the Internet. There is little doubt that the worry of Internet banking operations and financial transactions over the Internet becomes a primary barrier to customer acceptance of e-banking services. Therefore, the elimination of security risk is essential for enhancing individual confidence and achieving operational efficiency, when implementing e-banking services. Banks should adopt a series of serious measures to protect customer privacy, secure financial transactions, and look after individual assets. They should also continuously strengthen security of banking information systems by implementing the latest security standards and technologies and continuously allocating substantial resources in this direction, even though the investment is very significant.

Today, customers are enabled to conveniently gain access to banking services through the Internet because it has no restriction in terms of time and geographical location. However, it is vital to provide quality services in the competitive marketplace. Therefore, banks offering Internet banking should strengthen backend support in order to promptly respond to different service requests from customers. They should also continuously refine operations processes in order to achieve consistent service performance.

References

Agarwal, R., and Prasad, J. "Are individual differences germane to the acceptance of new information technologies?" *Decision Sciences*, (30:2), 1999, pp.361-391.

Bagozzi, R.P., and Yi, Y. "On the evaluation of structural equation model," *Journal of the Academy of Marketing Science*, (16:1), 1988, pp.74-94.

Bahia, K., Paulin, M., and Perrien, J. "Reconciliating literature about client satisfaction and perceived services quality," *Journal of Professional Services Marketing*, (21:2), 2000, pp.27-41.

Boudreau, M. C., Gefen, D., and Straub, D. "Validation in IS research: A state-of-the-art assessment," *MIS Quarterly*, (25:1), 2001, pp.1-16.

Cronin, J. J., and Taylor, S.A. "Measuring service quality: A reexamination and extension, *Journal of Marketing*, (56:3), 1992, pp.55-68.

Dabholkar, P. A. "Incorporating choice into an attitudinal framework: analyzing models of mental comparison processes," *Journal of Consumer Research*, (21:1), 1994, pp.100-118.

Dabholkar, P. A. "Consumer evaluations of new technology-based self-service options: an investigation of alternative models of service quality," *International Journal of Research in Marketing*, (13:1), 1996, pp.29-51.

Daniel, E. "Provision of electronic banking in the UK and the Republic of Ireland," *The International Journal of Bank Marketing*, (17:2), 1999, pp.72-82.

Davis, F. D. "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS Quarterly,* (13:3), 1989, pp.319-340.

Davis, F. D. "User acceptance of information technology: system characteristics, user perceptions and behavioral impacts," *International Journal Man-Machines Studies*, (38), 1993, pp.475-487.

Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. "User acceptance of computer technology: A comparison of two theoretical models, *Management Science,* (35:8), 1989, pp.982-1003.

Dutta, A., and McCrohan, K. "Management's role in information security in a cyber economy, *California Management Review*, (45:1), 2002, pp.67-87.

Edwards, M. "Business banks its future on electronic commerce," *Communications News*, (33:4), 1996, p.1.

Fishbein, M., and Azjen, I. *Belief, Attitudes, Intention, and Behavior*, New York: Addison-Wesley, 1975.

Howcroft, B., Hamilton, R., and Hewer, P. "Consumer attitude and the usage and adoption of home-based banking in the United Kingdom," *International Journal of Bank Marketing*, (20:2/3), 2002, pp.111-121.

Liao, Z., and Cheung, M.T. "Internet-based e-banking and consumer attitudes: An empirical study," *Information and Management*, (39:4), 2002, pp.283-295.