Factors Influencing the Adoption of Internet Banking

Margaret Tan
National University of Singapore, tlitanm@nus.edu.sg

Thompson S.H. Teo
National University of Singapore, fbateosh@nus.edu.sg

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Margaret Tan
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tlitanm@nus.edu.sg

Thompson S. H. Teo
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fbateosh@nus.edu.sg

Abstract

A research framework based on the theory of planned behavior (Ajzen 1985) and the diffusion of innovations theory (Rogers 1983) was used to identify the attitudinal, social and perceived behavioral control factors that would influence the adoption of Internet banking. An online questionnaire was designed on the World Wide Web (WWW). Respondents participated through extensive personalized e-mail invitations as well as postings to newsgroups and hyperlinks from selected Web sites.

The results revealed that attitudinal and perceived behavioral control factors, rather than social influence, play a significant role in influencing the intention to adopt Internet banking. In particular, perceptions of relative advantage, com-

patibility, trialability, and risk toward using the Internet were found to influence intentions to adopt Internet banking services. In addition, confidence in using such services as well as perception of government support for electronic commerce were also found to influence intentions. The implications of the study are discussed and suggestions for future research presented.

Keywords: Internet banking, electronic services, electronic commerce, Internet adoption, Singapore

I. INTRODUCTION

Banking has always been a highly information intensive activity that relies heavily on information technology (IT) to acquire, process, and deliver the information to all relevant users. Not only is IT critical in the processing of information, it provides a way for the banks to differentiate their products and services. Banks find that they have to constantly innovate and update to retain their demanding and discerning customers and to provide convenient, reliable, and expedient services. Driven by the challenge to expand and capture a larger share of the banking market, some banks invest in more bricks and mortar to enlarge their geographical and market coverage. Others have considered a more revolutionary approach to deliver their banking services via a new medium: the Internet.

Since the introduction of the Internet in 1969, it has evolved from the sole domain of the computer nerd and the academic to a mainstream channel of communication (Nehmzow 1997). Recently, it has been rapidly gaining popularity as a potential medium for electronic commerce (Crede 1995; Ooi 1999; U.S. Department of Commerce 1999). The rapid growth of the Internet has presented a new host of opportunities as well as threats to business. Today, the Internet is well on its way to become a full-fledged delivery and distribution channel and among the consumer-oriented applications riding at the forefront of this evolution are electronic financial products and services.

With the rapid diffusion of the Internet, banking in cyberspace is fast becoming an alternative channel to provide banking services and products. In the USA, banks are already providing services on the Internet and Internet banks, such as Security First National Bank, are beginning to appear. The Internet is now being considered as a strategi=c weapon and will revolutionize the way banks operate, deliver, and compete against one another, especially when competitive advantages of traditional branch networks are eroding rapidly (Nehmzow 1997; Seitz 1998). As *Business Week* noted, "Banking is essential to a modern economy, banks are not" (quoted in *Financial Times* 1996). This statement is supported by a recent report from Booz Allen & Hamilton (Warner 1996) that claims the Internet poses a very serious threat both to the customer base of the traditional banking oligopoly and to its profits. Their belief is that the Internet promises a revolution in retail banking of monumental proportions. High street or brick and mortar banks as we know them may largely disappear.

Indeed, the emergence of Internet banking has prompted many banks to rethink their IT strategies in order to stay competitive. Customers today are demanding much more from banking services. They want new levels of convenience and flexibility (Birch and Young 1997; Lagoutte 1996) on top of powerful and easy to use financial management tools and products and services that traditional retail banking could not offer. Internet banking has allowed banks and financial institutions to provide these services by exploiting an extensive public network infrastructure (Ternullo 1997). Despite the many potential benefits, many teething problems will need to be addressed before Internet banking can become widely adopted. It is believed that, in the future, Internet banking will recede in importance as a strategic application to become a competitive necessity that must be adopted by most if not all banking and financial institutions.

WHAT IS INTERNET BANKING?

Internet banking allows customers to perform a wide range of banking transactions electronically via the bank's Web site. When first introduced, Internet banking was used mainly as an information presentation medium in which banks marketed their products and services on their Web sites. With the development of asynchronous technologies and secured electronic transaction technologies, however, more banks have come forward to use Internet banking both as a transactional as well as an informational medium. As a result, registered Internet banking users can now perform common banking transactions such as writing checks, paying bills, transferring funds, printing statements, and inquiring about account balances. Internet banking has evolved into a "one stop service and information unit" that promises great benefits to both banks and consumers.

Internet banking services are crucial for long-term survival of banks in the world of electronic commerce (Burnham 1996). The market for Internet banking is forecast to grow sharply in the next few years, affecting the competitive advantage enjoyed by traditional branch banks (Duclaux 1996; Liao et al. 1999). Indeed, it also was estimated that financial institutions that failed to respond to the need for Internet banking services would likely lose more than 10% of their customer base by the year 2000 (Orr 1998; Tower Group 1996).

Internet banking would help banks present a potentially low cost alternative to brick and mortar branch banking. Burnham found that the majority of banks with Web sites spent less than US$25,000 to create a Web presence, and less than US$25,000 a year maintaining it. He suggested that even if these figures were to rise as banks began to offer Internet banking services, they would still be less costly than the traditional branch banking. For example, it requires US$1.5 million to US$2 million to set up a traditional brick and mortar branch and US$350,000 to US$500,000 a year to operate it. Note that Burnham's figure of US$25,000 is just for creating an electronic presence on the Web. A fully functional Internet banking site is likely to cost US$1 million to US$2 million. However, while traditional banks' operating costs account for between 50% and 60% of revenues, running costs of

Internet banking is estimated at between 15% and 20% of revenues (Booz-Allen & Hamilton 1997).

From the consumers' perspective, Internet banking provides a very convenient and effective approach to manage one's finances as it is easily accessible 24 hours a day, and seven days a week. Besides, the information is current. For corporate customers, sophisticated cash management packages offered through Internet banking provide them with up to the minute information, allowing for timely funds management decisions (Kalakota and Whinston 1996).

INTERNET BANKING IN SINGAPORE

As of March 1997, five local banks in Singapore had their own corporate Web sites on the Internet. They were Development Bank of Singapore (DBS Bank), Overseas-Chinese Banking Corporation (OCBC), Overseas Union Bank (OUB), Post Office Savings Bank (POSBank), and United Overseas Bank (UOB). However, with respect to providing Internet banking services, these banks adopted a somewhat conservative stance. According to Ng (1996), while local banks agreed that Internet banking services could take over routine banking transactions, customer contact was still important in value-added services such as investment advice. None of the banks would take the lead to offer Internet banking services as they felt it might precipitate a change in the basis of competition. Moreover, customers were not really pressuring them to offer Internet banking services as yet.

Interestingly, by January 1998, the conservative attitude toward offering Internet banking services took a more positive direction. For example, United Overseas Bank and DBS Bank were already providing Internet banking services. Overseas Chinese Banking Corporation and POSBank were testing their Internet banking services, while Overseas Union Bank announced their plans to launch Internet banking services in the latter part of 1998. Two reasons were suggested in *The Straits Times* (14 September 1997) for such a positive move. Banks were beginning to view Internet banking services as a strategic move to provide total distribution networks to their customers. In addition, by providing Internet banking

services early, they would be able to position themselves as movers in the market. Note that Internet banking in Singapore primarily offers traditional services (e.g., checking account, transfer funds) rather than enhanced services (e.g., brokerage).

It is apparent by now that the local banks are jumping onto the bandwagon of Internet technology by providing Internet banking services. Despite the numerous studies conducted to investigate the acceptance of Internet banking and its impact on the banking industry (e.g. Booz-Allen & Hamilton 1997; Seitz and Stickel 1998), few were conducted from the perspective of consumer acceptance. As consumer acceptance is important in determining the feasibility and successful implementation of new, technology-based banking services (Dover 1993), it is timely to undertake this study to provide greater insight into consumer intentions to adopt Internet banking services.

The objective of this study is to identify and understand the attitudinal, social, and behavioral control factors that are significant in explaining intentions to adopt Internet banking services in Singapore. A framework based on the theory of planned behavior (Ajzen 1985) and diffusion of innovations Theory (Rogers 1983) is used to derive the factors. The combined framework will provide a multi-dimensional approach to comprehensively understand adoption intentions. The study contributes to theory and practice. The findings will help in understanding the theoretical constructs of the framework in the adoption of Internet banking. In practice, the findings will assist banks in understanding the key factors that influence the adoption of Internet banking services. They will also provide infor-mation on the needs and preferences of the potential customers. Banks can then make informed decisions, thereby providing better services to their customers.

This paper is organized as follows: it describes the research framework followed by the research method. It then discusses the online questionnaire that was used to conduct the survey. The findings are presented and discussed. The paper concludes by analyzing the research implications.

II. RESEARCH FRAMEWORK

The research framework for this study is adapted from Taylor and Todd (1995a) and is based on the theory of planned behavior (TPB) (Ajzen 1985) and the diffusion of innovations theory (Rogers 1983). Specifically, the decomposed TPB model first introduced by Taylor and Todd was used since it was found to have better predictive power compared to the technology acceptance model (TAM) and traditional TPB models. Further, Taylor and Todd commented that,

> in comparing the two versions of TPB, we believe that there is value added as a result of the decomposition, in terms of increased explanatory power and a better, more precise, understanding of the antecedents of behavior. Thus, in our view, the decomposed TPB is preferable to the pure form of the model. (p. 169)

In comparing the model to TAM, Taylor and Todd commented that, if

> the sole goal is the prediction of usage, then TAM might be preferable. However, the decomposed TPB provides fuller understanding of usage behavior and intention and may provide more effective guidance to IT managers and researchers interested in the study of system implementation. (p. 170).

The decomposed TPB model uses constructs from the innovation literature (e.g., relative advantage, compatibility). It also explores subjective norms (e.g., social influence) and perceived behavioral control more completely by decomposing them into more specific dimensions. It provides a comprehensive way to understand how an individual's attitude, subjective norms and perceived behavioral control can influence his or her intention to use banking services on the Internet.

The framework postulates that a person's intention to adopt Internet banking is determined by three factors. They are (1) *attitude*, which describes a person's perception towards Internet banking; (2) *subjective norms*, which describe the social influence that may affect a person's intention to use Internet banking; and (3) *perceived behavioral control*. which describes the beliefs about having the necessary resources and opportunities to adopt Internet banking. Intention to adopt Internet banking services, in return, is expected to affect the actual adoption of

Internet banking. In the context of the framework, intention to adopt Internet banking services is thus the dependent variable, while the independent variables comprise attitude, subjective norms, and perceived behavioral control. Figure 1 shows the research framework for the adoption of Internet banking services.
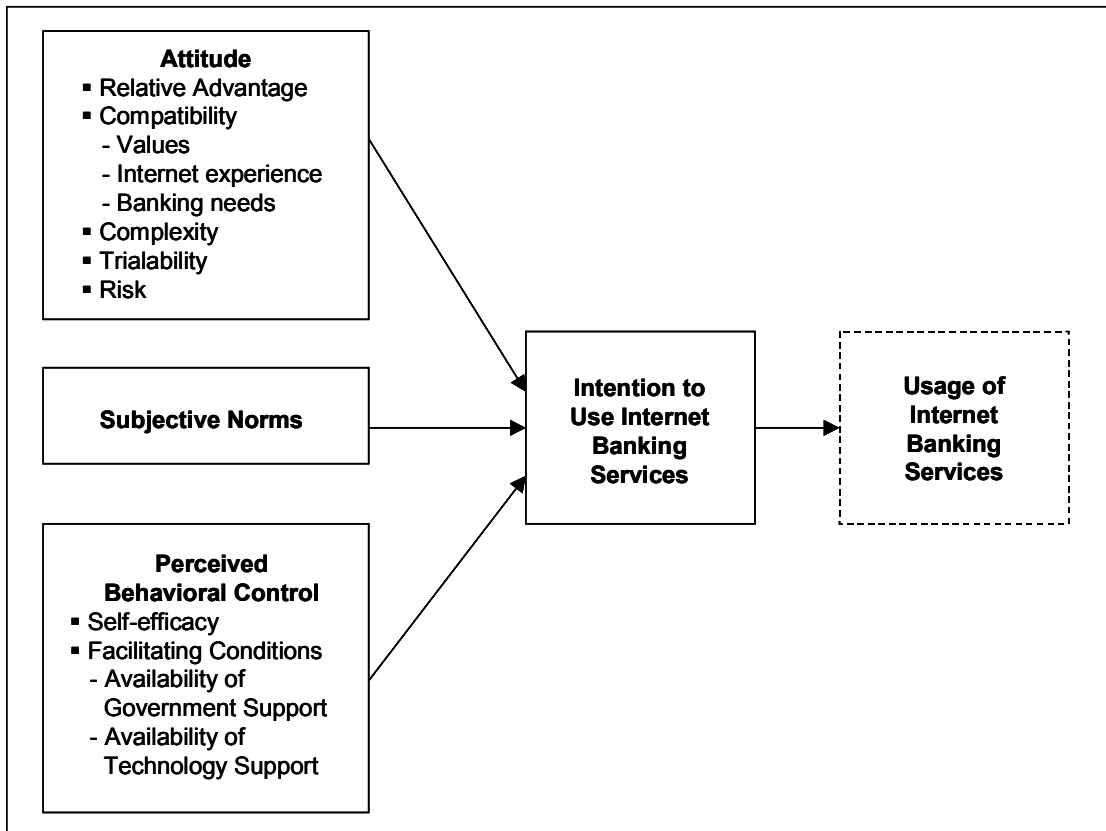
Figure 1. Framework for the Adoption of Internet Banking

ATTITUDE

Attitude is defined as an individual's positive or negative feelings (evaluative affect) about performing a target behavior (Fishbein and Ajzen 1975). It is related to behavioral intention because people form intentions to perform behaviors toward which they have positive affect. The attitude-behavioral relationship is fundamental to TRA, TAM, and related models presented by Triandis (1977) and Bagozzi (1981).

Taylor and Todd (1995b) suggest that the different dimensions of attitudinal belief toward an innovation can be measured using the five perceived attributes (relative advantage, compatibility, complexity, trialability, and observability) of an innovation. These attributes, originally proposed in the diffusion of innovations theory (Rogers 1983), are applied in this framework with the exception of observability. Observability is considered irrelevant in this study because an important characteristic of doing banking is privacy. Therefore, observing others using Internet banking services may prove difficult unless one makes a conscious effort to do so.

Relative Advantage. Tornatzky and Klein (1982) found relative advantage to be an important factor in determining adoption of new innovations. In general, perceived relative advantage of an innovation is positively related to its rate of adoption (Rogers 1983). Likewise, as Internet banking services allow customers to access their banking accounts from any location, at any time of the day, it provides tremendous advantage and convenience to users. It also gives customers greater control over managing their finances, as they are able to check their accounts easily. In view of the advantages that Internet banking services offer, it would thus be expected that individuals who perceive Internet banking as advantageous would also be likely to adopt the service. This leads to the hypothesis:

> *H1A: The greater the perceived relative advantage of using Internet banking services, the more likely that Internet banking will be adopted.*

Compatibility. In Tornatzky and Klein's meta-analysis of innovation adoption, they find that an innovation is more likely to be adopted when it is compatible with individuals' job responsibilities and value system. Internet banking has been viewed as a delivery channel that is compatible with the profile of the modern day banking customer, who is likely to be computer-literate and familiar with the Internet (*The Straits Times*, 14 September 1997). Therefore, it is expected that the more the individual uses the Internet, and the more he or she perceives the Internet as

compatible with his or her lifestyle, the more likely that the individual will adopt Internet banking. Thus, the hypotheses are:

H1B: The greater the perceived compatibility of Internet banking with one's values, the more likely that Internet banking will be adopted.

H1C: The greater the experience with using the Internet, the more likely that Internet banking will be adopted.

In terms of compatibility with the needs of the potential adopters, Internet banking can be seen as an expeditious tool that allows customers to better manage their multiple accounts. As there are more financial products and services, it is expected that individuals who may have many financial accounts and who subscribe to many banking services will be more inclined to adopt Internet banking. This leads to the following hypothesis:

H1D: The greater the use of banking products and services, the more likely that Internet banking will be adopted.

Complexity. Past research has indicated that an innovation with substantial complexity requires more technical skills and needs greater implementation and operational efforts to increase its chances of adoption (Cooper and Zmud 1990; Dickerson and Gentry 1983. As the Internet is very user friendly with its "point and click" interface, it is likely that potential customers may feel that Internet banking services are less complex to use, and hence would be likely to use such services. This leads to the hypothesis:

H1E: The lower the perceived complexity of using Internet banking, the more likely that Internet banking will be adopted.

Trialability. Rogers argues that potential adopters who are allowed to experiment with an innovation will feel more comfortable with the innovation and are more likely to adopt it. Thus, if customers are given the opportunity to try the innovation, certain fears of the unknown may be minimized. This is especially true when

customers find that mistakes could be rectified, thus providing a predictable situation. This leads to the hypothesis:

> *H1F: The greater the trialability of Internet banking, the more likely that Internet banking will be adopted.*

Risk. Bauer (1960), Webster (1969), and Ostlund (1974) introduced risk as an additional dimension in diffusion and adoption. A common and widely recognized obstacle to electronic commerce adoption has been the lack of security and privacy over the Internet (Bhimani 1996; Cockburn and Wilson 1996; Quelch and Klein 1996; Rhee and Riggins 1997). This has led many to view Internet commerce as a risky undertaking. Thus, it is expected that only individuals who perceive using Internet banking as a low risk undertaking would be inclined to adopt it. This leads to the hypothesis:

> *H1G: The lower the perceived risk of using Internet banking, the more likely that Internet banking will be adopted.*

SUBJECTIVE NORMS

Subjective norms refer to "the person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein and Ajzen 1975, p. 302). It is related to intention because people often act based on their perception of what others think they should do. Subjective norms have been found to be more important prior to, or in the early stages of innovation implementation when users have limited direct experience from which to develop attitudes (Hartwick and Barki 1994; Taylor and Todd 1995a). In terms of a consumer-oriented service, the consumer-relevant groups around the individual may influence the individual's adoption. Chua (1980) suggests that the adopter's friends, family, and colleagues/peers are groups that will potentially influence the adoption. Although there is no basis on which to predict how each of these groups will affect intentions to adopt Internet banking, it is nonetheless expected that the influence of these groups as a whole will be significantly related to the individual's intention

to adopt Internet banking. Therefore, the following hypothesis warrants investigation.

H2: The beliefs associated with subjective norms are significantly related to an individual's intention to adopt Internet banking.

PERCEIVED BEHAVIORAL CONTROL

Perceived behavioral control refers to the factors that may impede the performance of the behavior. This definition encompasses two components. The first component is self-efficacy and is defined as an individual's self-confidence in his or her ability to perform a behavior (Bandura 1977 1982). The second component is "facilitating conditions" and it reflects the availability of resources needed to engage in the behavior (Triandis 1979).

Hill et al. (1986) found that self-efficacy predicts intentions to use a wide range of technologically advanced products. Thus, an individual confident in having the skills in using the computer and the Internet is more inclined to adopt Internet banking. This is because the individual is comfortable in using the innovation. This leads to the hypothesis:

H3A: The greater the self-efficacy toward using Internet banking, the more likely that Internet banking will be adopted.

The second component, "facilitating conditions," refers to the easy access of technological resources and infrastructure. Goh (1995) suggests that, as supporting technological infrastructures become easily and readily available, Internet commerce applications such as banking services will also become more feasible. As a result, Internet users would be expected to be more inclined to adopt Internet banking. Goh also suggests that the government can play an intervention and leadership role in the diffusion of innovation. In Singapore, it has been well documented that the local government is a major driving force in the diffusion of information technology (Gurbaxani et al. 1990; Jussawalla et al. 1992; Tan 1998; Toh and Low 1993). Potential users, in turn would view new applications such as

Internet banking services more favorably, and hence be more likely to use them. The above arguments lead to the following hypotheses:

H3B: The greater the extent of perceived technological support for Internet banking, the more likely that Internet banking will be adopted.

H3C: The greater the extent of perceived government support for electronic commerce, the more likely that Internet banking will be adopted.

III. RESEARCH DESIGN

This study adopts an online questionnaire survey conducted over the World Wide Web. The online questionnaire method is used because the Internet is the most suitable medium through which to reach the desired sample of Internet users. As this is an exploratory study, it is more appropriate to survey the sample of Internet users to test the hypotheses. Hence, the findings can only apply to Internet users rather than the general population.

Note also that a decision was made to restrict the survey to Singapore for four reasons. First, the pool of Internet users is very large worldwide, thus making it impractical for the survey to be worldwide. Second, if the survey is done world-wide, the study becomes very much more complicated as there are a whole range of issues to consider, e.g., whether or not adequate responses are received from each country, differences in infrastructure that may make access to the Internet difficult, existence of Internet banking (different countries will be at different stages). Third, the researchers are from Singapore and hence there was particular interest in what is happening in Singapore. Fourth, by focusing solely on Singapore, the results are more readily compared with previous studies done elsewhere, making the findings more insightful to researchers and practitioners.

Table 1 summarizes how an Internet survey is different from traditional mail surveys. In terms of manpower and costs, mail surveys are usually more costly than Internet surveys. The presence of suitable software, e.g., Microsoft Frontpage, makes Web design easy. Javascript can be used to check that respondents

answered all questions. Rental or maintenance of server space to host the Web page is usually minimal (especially when the research institution already has an Internet account and server space).

Table 1. Internet vs Mail Surveys

Characteristics	Mail Survey	Internet Survey
Manpower	Insert survey into envelopes, paste stamps or frank envelopes.	Design Web page and write Javascript.
Cost	Envelopes, stamps, photocopying of questionnaires.	Rental/maintenance of server space to host Web page.
Sampling frame	Restricted to sample that received the questionnaire.	Restricted to people with access to the Internet.
Response rate	Can be computed. Percentage of respondents is dependent on follow-up mailings.	Cannot be computed. Percentage of respondents is dependent on publicity of the survey as well as follow-up reminders via e-mails to potential respondents.
Time frame	Usually takes about a month for surveys to be returned.	Responses can usually be collected within two weeks.
Quality of data	Dependent on whether target respondents, e.g., CIO, respond to questionnaire. Systematic bias is reduced with the use of a random sample and also by obtaining a high response rate.	Adequate if the target respondent is the general Internet user population. Potential for systematic bias if only people with certain characteristics respond.
Generalizability of results	Results generalizable to target population if response rate is adequate.	Difficult to determine since there may be a systematic bias in terms of who actually responds to the questionnaire.
Suitability	Must be able to identify potential respondents. Can reach out to the general public regardless of computer access.	Survey of people/companies with Internet access or who are users of the Internet.
Problems	Costly and slow.	Unable to control who responds. Data must be screened for unsuitable respondents (e.g., responses from children or other countries).

The sampling frame for mail surveys is usually restricted to a random sample of the target population. Consequently response rate can be computed. For Web surveys, the sampling frame is restricted to people with Internet access. However, since there is no way to know how many people are actually aware of the survey (when advertised through newsgroups and/or hyperlinks), the response rate cannot be computed. It is difficult, if not impossible, to control who actually responds to the Internet survey. This may result in an inherent bias as people with certain characteristics or backgrounds may be more likely to respond. This problem can be partially mitigated through screening of responses as well as targeted e-mails to potential respondents.

In summary, mail surveys are suitable if we are able to randomly sample our target population (which consists of people with or without computer access). It is usually easier to implement and less costly than face-to-face interviews (but more costly than Internet surveys). Internet surveys are suitable when the target population consists of people with Internet access and also when a short time frame for responses is required.

QUESTIONNAIRE DESIGN

The online questionnaire consists of three sections (see the questionnaire at http://www.fba.nus.edu.sg/isworld/question.htm). Section 1 gathers information about the respondents' banking habits and their Internet usage. Section 2 consists of two parts. The first part solicits respondents' views on their feelings toward the Internet and the second part seeks the perceptions of respondents toward using Internet banking services. Finally, section 3 gathers demographic information. The seven point Likert scale is used to elicit responses on the questionnaire.

Table 2 shows the operationalization of each attitude variable. Items in the form of statements assessing relative advantage, compatibility with values, complexity, and trialability were adapted from Moore and Benbasat (1991). The statements were modified to reflect perceptions toward the use of Internet banking. Besides compatibility with values, compatibility with Internet experience as well as

Table 2. Operationalization of Attitude Variables

		ATTITUDE	
Variable	*Item*	*Description*	*References*
Relative Advantage (RELADV)	RELADV1	Internet banking makes it easier for me to conduct my banking transactions.	Moore and Benbasat (1991)
	RELADV2	Internet banking gives me greater control over my finances.	
	RELADV3	Internet banking allows me to manage my finances more efficiently.	
	RELADV4	Internet banking is a convenient way to manage my finances.	
	RELADV5	Internet banking allows me to manage my finances more effectively.	
	RELADV6	I find Internet banking useful for managing my financial resources.	
Compatibility with Values (COMPAT)	COMPAT1	Internet banking is compatible with my lifestyle.	Moore and Benbasat (1991)
	COMPAT2	Using Internet banking fits well with the way I like to manage my finances.	
	COMPAT3	Using the Internet to conduct banking transactions fits into my working style.	
Internet Experience (INTEXP)	INTUSE1	Span of Internet usage.	Lai (1995); Novak and Hoffman (1997)
	INTUSE2	Frequency of Internet usage.	
	INTUSE3	Intensity of Internet usage.	
	INTUSE4	Diversity of Internet usage.	
	INTSKILL1	I am very skilled at using the Internet.	
	INTSKILL2	I consider myself knowledgeable about good search techniques on the Internet.	
	INTSKILL3	I know less about using the Internet than most users. (R)	
	INTSKILL4	I know how to find what I want on the Internet using a search engine.	
Banking Needs (BNKNDS)	BNKNDS	Number of banking products and services currently using.	SRI Consulting (1997)

Variable	Item	Description	References
Complexity (COMPLEX)	COMPLEX1	Using Internet banking requires a lot of mental effort.	Moore and Benbasat (1991)
	COMPLEX2	Using Internet banking can be frustrating.	
	COMPLEX3	Internet banking is an easy way to conduct banking transactions. (R)	
Trialability (TRIAL)	TRIAL1	I want to be able to try Internet banking for at least one month.	Moore and Benbasat (1991)
	TRIAL2	I want to be able to sue Internet banking on a trial basis to see what it can do.	
Risk (RISK)	RISK1	I am confident over the security aspects of Internet banking in Singapore. (R)	Bhimani (1996); Cockburn and Wilson (1996); Lee (1996); Rhee and Riggins (1997)
	RISK2	Information concerning my Internet banking transactions will be known to others.	
(R) – Reverse-scored item	RISK3	Information concerning my Internet banking transactions can be tampered with by others.	

with banking needs are also measured. Internet experience is assessed on the four dimensions of Internet usage (span of use, frequency of use, intensity of use, and diversity of use) adapted from Lai (1995), and a fifth dimension—Internet skill level—is measured using a four-item instrument by Novak and Hoffman (1997). Asking the respondents to indicate from a list of banking products and services provides an assessment of their banking needs.

To measure subjective norms, respondents were asked to indicate their agreement or disagreement with the extent to which they believed that their decision to adopt Internet banking would be influenced by their friends, family, and colleagues/peers.

Table 3 illustrates the operationalization of each perceived behavioral control dimension. To measure self-efficacy toward using Internet banking systems, the instrument developed by Compeau and Higgins (1995) was adapted in the context of Internet banking. Respondents were asked to indicate their confidence in using Internet banking under five different usage situations. The items used to measure

Table 3. Operationalization of Perceived Behavioral Control Variables

PERCEIVED BEHAVIORAL CONTROL			
Variable	*Item*	*Description*	*References*
Self-efficacy (SELFEFF)	SELFEFF1	I am confident of using Internet banking if I have only the online instructions for reference.	Compeau and Higgins (1995)
	SELFEFF2	I am confident of using Internet banking even if there is no one around to show me how to do it.	
	SELFEFF3	I am confident of using Internet banking even if I have never used such a system before.	
	SELFEFF4	I am confident of using Internet banking if I have just seen someone using it before trying it myself.	
	SELFEFF5	I am confident of using Internet banking if I have just the online "help" function for assistance.	
Government Support (GOVSUPP)	GOVSUPP1	The government endorses Internet commerce in Singapore.	Goh (1995); NCB, 9 October 1997; NCB, 29 April 1997.
	GOVSUPP2	The Singapore government is active in setting up the facilities to enable Internet commerce.	
	GOVSUPP3	The Singapore government promotes the use of the Internet for commerce.	
Technology Support (TECHSUPP)	TECHSUPP1	Advances in Internet security technology provide for safer Internet banking.	Ko (1990); Leong (1997); *The Business Times*, 4 December 1996
	TECSUPP2	Faster Internet access speed is important for Internet banking.	
	TECHSUPP3	Internet technology, like the Singapore ONE network, makes Internet banking more feasible.	

government support and technology support for Internet banking were constructed based on relevant literature.

Two items were used to assess respondents' intentions to adopt Internet banking. The first item asks respondents the extent to which they would be interested in using Internet banking if it were available to them. The second item asks respondents the likelihood that they will adopt Internet banking in the next 6, 12, and 18 months. To derive a value representative of such a scale, Babbie (1990) suggests weighting the responses. With this in mind, a numerical figure for the second item is computed as follows: the time periods of 6, 12, and 18 months are assigned the weights of 3/6, 2/6 and 1/6 respectively. The summation of the responses multiplied by their respective weights would produce a value between 1 and 7 for the second item that represents the respondent's intention to adopt Internet banking.

For example, assuming that the respondent indicated 1 for all three time frames, the value will be calculated as

$$1 \times 3/6 + 1 \times 2/6 + 1 \times 1/6 = 1$$

Similarly, if the respondent indicate 7 for all the three time frames, the value will be calculated as:

$$7 \times 3/6 + 7 \times 2/6 + 7 \times 1/6 = 7$$

Hence, the minimum and maximum values produced by this transformation are 1 and 7 respectively. Other combinations of values for the three time frames will produce a value between 1 and 7.

PROGRAMMING THE QUESTIONNAIRE

The preliminary survey was programmed in Hyper Text Markup Language (HTML). To ensure that all items are filled in completely, Javascript commands were embedded into the HTML coding to caution respondents of incomplete responses. In addition, all of the anchors and their corresponding numerical indicators were color-coded as it was anticipated that respondents might scroll down to a point where they would lose sight of the anchors of a Likert scale while

answering the questions. The numerical indicator of "1" and its corresponding anchor was color-coded in red while the numerical indicator of "7" and its corresponding anchor was color-coded in blue.

PILOT TESTING

A pilot test was conducted on the preliminary questionnaire to assess its comprehension and the average completion time. The questionnaire was put on the Web through a free Web hosting service offered by Geocities. Two rounds of pre-testing were conducted. The first round was conducted on three undergraduate Internet users (one male and two females). Based on feedback from this first round, some questions were rephrased for clarity. The second round of pre-testing was conducted with three other young working Internet users (two females and one male). They found the questions generally clear; thus, the questionnaire was deemed ready for data collection.

DATA COLLECTION PROCEDURE

The online questionnaire survey was hosted on a server at the Faculty of Business Administration at the National Unviersity of Singapore. To allow for continued data collection in the event that the faculty's server was down, a secondary site was set up at Geocities. To improve response rates, 300 phone cards valued at S$2 each were offered to early respondents as incentives to stimulate participation. The subject heading, "Web Banking Survey – Free Phone cards For First 300 Participants," was included in publicity efforts in newsgroups and in personalized e-mails. Confidentiality of responses was assured and potential respondents were invited to forward any queries via e-mail to the address provided.

Messages advertising the survey were posted at one-week intervals on two types of newsgroups. The first category of newsgroups was chosen for their neutrality of discussion topics and wide reach. The second type of newsgroups was chosen due to their high number of postings, which indicate a high traffic flow of Internet users. The same advertising message was also posted on two public

mailing lists maintained by Singnet, "Coffeeshop Talk" and "Personal Pages." A hyperlink was established from the Faculty of Business Administration's "Events" page. The high traffic at the faculty Web page helped to boost response rates by reaching out to users in the University as well as visitors to the faculty Web page. As this research is basically interested in Internet users (regardless of their occupations), responses by students or faculty members are considered appropriate. A total of 2,002 personalized messages were sent individually via e-mail to the three Internet service providers, Singnet, Pacific Internet, and Cyberway subscribers.

RESPONSE RATE

Responses submitted through the primary survey site were saved onto a file in the faculty server, which was then downloaded at intervals of two days. Responses submitted through the secondary survey site at Geocities were collected in the form of formatted text via e-mail. The responses were then separated into two groups: data from personalized e-mails or data from newsgroups, public mailing lists, and hyperlink. This was done by tallying the e-mail addresses from each response set with the personalized mailing list.

Of the 2,002 personalized e-mails sent out, 316 were returned by the servers as the intended recipient was either no longer a user of the particular Internet Service Provider or the recipient's mailbox had exceeded its quota. Therefore, only 1,686 personalized e-mails were effectively sent. A total of 470 sets were collected. Out of this lot, 96 were found to have missing data. Follow-up e-mail to recover the missing data resulted in the recovery of 80 sets. Therefore, data were collected from a total of 454 sets.

RELIABILITY AND VALIDITY ASSESSMENT

Prior to data analysis, the research instrument was assessed for its reliability as well as construct validity. Cronbach's coefficient alpha was computed for each variable to test for reliability. Table 4 shows the Cronbach's alpha for the constructs

in the research framework. Nunnally (1967) suggested that a minimum alpha of 0.6 sufficed for early stages of research. As the Cronbach's alphas range from 0.6254 to 0.9406, the constructs are deemed to have adequate reliability for the next stage of validity analysis.

Table 4. Reliability Analysis

Factor	Variable	Cronbach's Alpha
Attitude	Relative Advantage	0.9386
	Compatibility with Values	0.9406
	Internet Experience	0.6254
	Complexity	0.6473
	Trialability	0.8563
	Risk	0.6567
Subjective Norms	Subjective Norms	0.8962
Perceived Behavioral Control	Self-Efficacy	0.8767
	Technology Support	0.6444
	Government Support	0.9201

To analyze for convergent and discriminant validity of the constructs, factor analysis was used. The results are shown in the Appendix. In general, the results show that both discriminant validities are satisfied. Similarly, the statistical tests shown in the Appendix revealed the absence of problems with heteroskedasticity and multicollinearity.

IV. FINDINGS AND ANALYSIS

The respondents' demographics profile is presented in Table 5.

Table 5. Demographic Profile of Respondents

Variable		Frequency	Percent
Gender	Male	637	80.8
	Female	87	19.2
Age	Under 20	43	9.5
	20–29	291	64.1
	30–39	92	20.3
	40–49	23	5.1
	50–59	3	0.7
	Over 59	2	0.4
Highest Education Attained	Primary School	5	1.1
	Secondary School	53	11.7
	Junior College/Polytechnic	215	47.4
	Bachelor's Degree	135	29.7
	Master's Degree	36	7.9
	Doctorate Degree	3	0.7
	Others	6	1.3
	Missing	1	0.2
Current Profession	Student	176	38.8
	Professional	153	33.7
	Academic	9	2.0
	Self-employed	13	2.9
	Manager	35	7.7
	Executive	30	6.6
	Technician	17	3.7
	Retiree/Housewife	2	0.4
	Others	19	4.2
Income	Less than S$1,000	12	4.3
	S$1,000–S$1,999	45	16.2
	S$2,000–S$2,999	97	34.9
	S$3,000–S$3,999	40	14.4
	S$4,000–S$4,999	31	11.2
	S$5,000 or more	53	19.1
	Not applicable (Students)	–	–

About 81% of the respondents are males. This is consistent with previous studies (e.g., Teo and Lim 1998; Teo et al. 1999) that found a predominance of males among Internet users in Singapore. In fact, the percentage of males in this study is lower than Teo and Lim's study, where males comprised 89% of the sample. This indicates that the percentage of male Internet users tend to decreased over time. For example, in the GVU WWW user surveys

), the percentage of males was as follows: the second GVU survey was greater than 90% males; the fourth GVU was 70.7% males; the sixth GVU was 68.6% males; the eighth GVU was 61.5%; the tenth GVU was 66.4%. Because the United States is more advanced in Internet experience than Singapore and initial users are usually predominantly males, the high proportion of males in the present sample should not be surprising.

The respondents are relatively young, with 64.1% between 20 and 29 years old. This is consistent with Teo and Lim's study, which found that most Internet users are youths (less than 21 years old: 22.5%) and young adults (21 to 30 years old: 56.6%). Respondents with at least a junior college certificate or polytechnic diploma make up 85.7% of the respondents. In terms of profession, most are students (38.8%) while working professionals (33.7%) form the next largest group. Of those who are working, 34.9% earn an average monthly income of between S$2,000 and S$2,999.

Eleven hypotheses were formulated for the study. Multiple linear regression analysis was used to test the hypotheses. The independent variables (attitude, subjective norms, and behavioral controls) were regressed on "intention to adopt" as the dependent variable. Table 6 presents the results of the regression.

Table 6 shows that all of the hypotheses, with the exception of H1E (complexity), H2 (subjective norms), and H3B (technology support) are supported. The support for H1A (relative advantage) is expected since past literature has consistently shown that perceived relative advantage has a significant and positive influence on the adoption of new innovations (Holak and Lehmann 1990; Tornatzky and Klein 1982). Similarly, the support for H1B (compatibility with values) is similar to previous findings (Cooper and Zmud 1990; Tornatzky and Klein 1982), which have shown that the perceived compatibility of an innovation has a positive influence on the adoption of the innovation. In other words, Internet users who feel that using Internet banking is compatible with their values about living and working are more inclined to adopt such services.

Table 6. Results of Multiple Linear Regression

Factor	Hypothesis	Variable	Beta	p-value
Attitude	H1A	Relative Advantage	0.142	0.006
	H1B	Compatibility with Values	0.149	0.008
	H1C	Internet Experience	0.095	0.004
	H1D	Banking Needs	0.092	0.005
	H1E	Complexity	-0.029	0.397
	H1F	Trialabilty	0.321	0.000
	H1G	Risk	-0.081	0.017
Subjective Norms	H2	Subjective Norms	0.026	0.431
Perceived Behavioral Control	H3A	Self-Efficacy	0.159	0.000
	H3B	Technology Support	-0.021	0.559
	H3C	Government Support	0.106	0.004

The support for H1C (Internet experience) is consistent with Rogers' suggestion that compatibility of an innovation with a previously introduced idea can influence the adoption of the innovation. Further, Hirschman (1980) has suggested that prior experience with a product class (e.g., the Internet) may lead to greater acceptability of new products (e.g., Internet banking), hence increasing the likelihood that they will be adopted. In the context of intentions to adopt Internet banking, an individual will thus be more inclined to adopt such a service if he or she has had enough experience with its supporting technology: the Internet.

In a similar vein, the support for H1D (banking needs) is expected as SRI Consulting (1997) has reported that potential adopters of Internet banking services are likely to own multiple banking accounts and subscribe to various banking services. In addition, Rogers also suggested that an innovation is more likely to be adopted if it meets a felt need. Therefore, it is likely that Internet users who have many bank accounts and who subscribe to many banking services would have

higher needs for convenient and easily accessible delivery channels such as Internet banking and thus be more likely to adopt them.

Also, the support for H1F (trialability) is consistent with Rogers' argument that potential adopters who are able to experiment with an innovation will be able to give meaning to it and feel more comfortable with it. As a result, they are more likely to adopt the innovation.

The support for H1G (risk) reflects similar arguments in the Internet banking literature (Bhimani 1996; Cockburn and Wilson 1996; Lee 1996; Quelch and Klein 1996), which states that the perceived security and privacy risk associated with banking on the Internet is a major impediment to the adoption of Internet banking.

As expected, H3A (self-efficacy) is supported. Hence, Internet users who are confident of their abilities to use Internet banking services are more likely to adopt such services. This is consistent with the findings of previous studies (Burkhardt and Brass 1990; Hill et al. 1986), which found that self-efficacy has a significant influence on intentions to adopt new innovations. Similarly, the support for H3C (government support) is not surprising as government support lends credibility as well as feasibility to new electronic commerce applications such as Internet banking, thereby making them more likely to be accepted by potential adopters.

Conversely, the lack of support for H1E (complexity) is in contrast with previous findings (Cooper and Zmud 1990; Dickerson and Gentry 1983; Moore 1987), which indicated that the more complex an innovation is to use, and the greater the skill and effort needed to adopt it, the less likely that it will be adopted. However, Moore and Benbasat have suggested that perceived complexity of using an innovation begins to play a more instrumental role only after one has started hands-on trials and/or use of the technology. Since Internet banking in Singapore is still in the early stages of implementation, not many Internet users have tried it to be able to develop a perception about its complexity. As a result, their perceived complexity of using such services may not be significant in influencing their intentions to adopt Internet banking.

The results also show that the influence of the Internet user's consumer-relevant groups (H2) on his or her adoption is not significant. This result is in contrast with the results reported by Hartwick and Barki and by Taylor and Todd (1995a), who found subjective norms to be important in affecting adoption in the early stages of introducing an innovation, when users have only limited direct experience from which to develop attitudes. A possible explanation for the lack of support for this hypothesis is that the easy access to information about the Internet has made potential adopters less reliant on the information provided by their referent groups. For example, a preliminary check of the Internet banking Web sites of local banks indicates that all the sites have "Frequently Asked Questions" (FAQ) pages as well as e-mail addresses through which the potential Internet adopter can gather the relevant information he or she needs in deciding whether to adopt such services. Another possible reason is that since Internet banking in Singapore is still in its early stages of implementation, respondents may feel that their referent groups are unlikely to know much about such services. Hence, their influence is not significant in affecting the Internet user's adoption intentions.

Perceived technology support for Internet banking is found to have no significant influence on intentions to adopt Internet banking services ($\beta = -0.021$, $p > 0.05$). One possible explanation for this could be that the necessary technology support required for conducting banking transactions on the Internet is already in place and is readily available to anyone who is interested in using the Internet. As a result, Internet users may tend to take this availability for granted, hence the indifference to technology support as an influencing factor in the adoption of Internet banking.

PREFERRED INTERNET SERVICES AND PRODUCTS

In addition to the hypothesis testing, further descriptive findings were analyzed to provide a better understanding of the needs and preferences of the potential adopter of Internet banking services. Table 7 shows the list of typical Internet banking services and products and their relative usefulness to the

respondents. Most respondents rate account information and balance inquiry as being the most useful, followed by bill payments, summary reports of transactions, funds transfer, and check facilities. Other Internet banking products and services that are felt to be useful were also suggested. They included financial products such as Initial Public Offerings (IPO), unit trusts, bankdrafts, and traveler's checks; information on bank and currency rates; as well as wire transfer services.

Table 7. Useful Internet Banking Services

Internet Banking Service	Mean*	Standard Deviation
Account information and balance enquiry	6.54	0.96
Electronic bill payments	6.13	1.30
Summary reports of transactions	5.78	1.51
Funds transfer	5.63	1.60
Check cancellation	5.59	1.65
Checkbook application	5.41	1.65
Financial planning and analysis	4.48	1.80
Loan application	4.38	1.92
Share margin trading account	4.09	2.00

*Respondents were asked to indicate their opinions of the extent of usefulness of each banking product/service on a scale of 1 (not at all useful) to 7 (very useful).

Table 8. Criteria for Selecting Internet Banking Service

Criterion	Mean*	Standard Deviation
Reputation of bank	6.33	0.98
Variety of services offered by bank	6.31	0.95
Size of bank	5.53	1.39
Ownership of bank — Local	4.84	1.84
Ownership of bank — Overseas	4.31	1.83

*Respondents were asked to rank from 1 (not at all important) to 7 (very important) each of teh criteria for choosing an internet bank.

In contrast, banking products and services that were found to be less useful included financial planning and analysis, loan applications, and share margin trading facilities. One possible reason is that respondents may consider such services to require more personalized interactions with bank personnel, hence a preference for direct contact with bank staff.

Respondents feel that the reputation of the bank is most important in choosing an Internet banking service (see Table 9). The variety of services offered and familiarity with the bank are also important criteria. The size of the bank is another consideration. It appears that respondents are generally indifferent as to whether or not the Internet banking is provided by a local or overseas bank. This is to be expected since respondents have already indicated that the reputation of the bank is most important, be it a local or overseas bank.

Table 9. Preferred Internet Banking Charges

Charging Scheme	Mean*	Standard Deviation
No fee	6.57	1.12
Flat fee per month	2.45	1.77
Flat fee per month plus fee per transaction	1.76	1.24

*Respondents were asked to rank from 1 (very unlikely) to 7 (very likely) their likelihood of using Internet banking if each different charging scheme was imposed.

Where charging for Internet banking services is concerned, the findings indicate that respondents are most likely to adopt Internet banking services if the services are free. Furthermore, should the banks impose any fees, the usage of Internet banking services would be greatly reduced. Among the different charging schemes, paying a flat fee per month plus a fee per transaction for Internet banking services was viewed least favorably as compared to paying a time-based fee or a flat fee.

In terms of the ideal features of Internet banking Websites, the findings indicate that it is most important for the Website to be easily retrieved. Next in

importance is the clarity of the instructions. The next two features perceived to be important are the interactivity of the Website and the resemblance of the Website to the physical symbols of the actual bank. Multimedia entertainment effects such as music and animated graphics are not important to the respondents. This finding also reflects similar sentiments expressed by the local banks, which prefer to emphasize the value adding content of the information provided (Ng 1996).

V. LIMITATIONS OF THIS ONLINE STUDY

This study has four main limitations. First, the use of an online survey limits us to a pool of Internet users. Hence, the results may not be generalizable to non-Internet users. Second, the samples of Internet users for this study were mostly those who tend to be more knowledgeable about the Internet and are thus experienced Internet users. Besides, most maintain their own Web pages on the Internet. Thus, the sample of respondents may be skewed toward more experienced Internet users. This may also restrict the generalizability of the findings. Third, the "intention to adopt" construct is self-reported. Ideally, adopters should have been surveyed rather than having their "intention to adopt" measured. However, it is very difficult to get the list of adopters from banks. Further, since Internet banking is relatively new in Singapore, the pool of adopters may be quite small.

Fourth, some respondents had problems with accessing the online questionnaire. Very early in the data collection phase, it was noted that Microsoft Internet Explorer browsers were not able to handle some of the functions in the questionnaire. It was discovered that respondents using Internet Explorer 3.0 could not submit the questionnaire online while respondents using Internet Explorer 4.0 could submit their responses, although some data dropped. To address the first problem, a warning of Internet Explorer 3.0 incompatibility was included in subsequent personalized messages. Respondents who were using Internet Explorer 4.0 were encouraged to participate in the survey. Missing data from their responses

were then recovered by sending another e-mail explaining the problem and appealing to them to spend a few minutes to answer the 10 questions attached.

VI. DISCUSSIONS AND CONCLUSION

The findings show that intention to adopt Internet banking services can be predicted by attitudinal and perceived behavioral control factors, but not by subjective norms. The attitudinal factors that are significant include relative advantage; compatibility with respondent's values, experience, and needs; trialability; and risk. Although the findings show that perceived complexity has a negative relationship with adoption intentions, this relationship is not significant. One possible reason is that since Internet banking in Singapore is relatively new, most Internet users have yet to try it. As a result, they are unable to effectively assess the complexity of using such systems and the influence that such complexity may have on their intentions.

Subjective norms, in the form of the influence of the Internet user's consumer-relevant groups, are found to have no significant relationship with intention to adopt Internet banking. One possible reason is that relevant information is readily available from banks, thereby reducing the reliance of potential adopters on their friends, family, or colleagues for information about these services. Alternatively, the fact that Internet banking in Singapore is relatively new may mean that Internet user's consumer-relevant groups have yet to try them out. As a result, they are unable to provide the necessary information and give knowledgeable recommendations.

With regard to perceived behavioral control, both self-efficacy and government support are found to be important while technology support is not. One likely reason for the lack of support is that the necessary technology for providing Internet banking services is already in place (since Singapore has one of the best technology infrastructures in Asia). Consequently, respondents may take this ready accessibility for granted and not see supporting technology as a facilitating condition that will affect their intentions to adopt Internet banking. While government support

is found to be important in Singapore, such a case may not apply to countries like the U.S. where government's role in encouraging innovation adoption may be less salient due to the greater role of the private sector.

The findings generated from this study have important implications for both research and the banking community. In terms of research, this study provides further evidence on the appropriateness of using Rogers innovation attributes to measure the different dimensions of attitude toward Internet banking. Of the four innovation attributes measured, only the relationship between perceived complexity of using Internet banking services and intentions to adopt such services was not supported. This discrepancy could be due more to the inherent characteristics of the sample of Singapore Internet users rather than the inappropriateness of the measure.

The results from this study have also shown that there are other factors besides attitudinal ones that can help us to better understand the adoption intentions of Internet banking. Two additional influencing factors (subjective norms and perceived behavioral control) proposed by Ajzen in the theory of planned behavior, were included in this study. Although subjective norms were not found to significantly influence adoption intentions, perceived behavioral control dimensions were nonetheless found to have significant influences. In particular, self-efficacy toward using Internet banking services and the facilitating condition of perceived government support for Internet commerce, were both found to significantly affect intentions to adopt Internet banking services.

The findings of this study also hold important practical implications for banks that are currently offering Internet banking services as well as banks that are planning to offer such services. For example, in promoting Internet banking, since potential adopters are found to rely more on their own efforts to search for information rather than rely on referent groups, banks offering Internet banking services should launch campaigns to direct awareness to these individuals. Issues such as fears of privacy and security risks together with relative advantages of using Internet banking services could be highlighted to educate potential customers.

To boost confidence and enhance self-efficacy in using Internet banking services, demonstrations via video presentations could be made at bank branches to showcase the user-friendliness of such services. Such initiatives will help customers to be more familiar with the bank and its Internet banking service, an important criterion in helping potential adopters select the Internet bank.

The types of products and services offered through Internet banking should be those frequently used and requiring few interactions with bank officers. Such services include account balance and enquiries, bill payments, summary reports of transactions, and check facilities. Advanced, value-added banking and services that require interactions with bank officers ought to be introduced at a later phase if customers warrant their provision.

Ideally, the Internet bank should not be charging any fees for similar services that are free-of-charge in the physical world. However, certain transactions, such as check cancellations and wire transfers, would still require administrative charges. Since the cost of operating Internet banking services is low, Internet banks should look for opportunities to lower the charges and transfer the cost savings to customers. Emphasizing the lower charges for online transactions as one of the key benefits should be a feature of promotional efforts.

SUGGESTIONS FOR FUTURE STUDIES

This study was conducted to explore the factors influencing intentions to adopt Internet banking services. As such, there is still room for further investigation into the adoption of Internet banking services. Following are some recommendations for future studies. First, future studies should be carried out on non-Internet users to investigate their adoption intentions of such services. Second, as Internet banking services are still relatively new in Singapore, this study has been unable to measure the actual usage behavior of such services, which was suggested by the theory of planned behavior (Ajzen 1985). Future studies should incorporate this measure once the number of Internet banking customers has reached a critical mass. In this way, a more comprehensive investigation of Internet

banking intentions and usage behavior can be conducted. Third, the study on adoption intentions of Internet banking services in Singapore can be extended to corporate customers. Comparison can then be made between individual customers and corporate customers in terms of the factors influencing their adoption decisions, the criteria for selecting an online banking service, and the types of products and services perceived to be useful.

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VIII. REFERENCES[1]

Ajzen, I. "From Intentions to Actions: A Theory of Planned Behavior," in *Action Control: From Cognition to Behavior*, J. Kuhl and J. Beckmann (eds.), New York: Springer-Verlag, 1985, pp.11-39.

Babbie, E. *Survey Research Methods*, Belmont, CA: Wadsworth Publishing Company, 1990.

Bagozzi, R. P. "Attitudes, Intentions and Behavior: A Test of Some Key Hypotheses," *Journal of Personality and Social Psychology* (41), 1981, pp. 607-627.

Bandura, A. "Self-Efficacy: Toward a Unifying Theory of Behavioral Change," *Psychological Review* (84), 1977, pp. 191-215.

Bandura, A. "Self-Efficacy Mechanism in Human Agency," *American Psychologist* (37:2), February 1982, pp. 122-147.

Bauer, R. A. "Consumer Behavior as Risk Taking" in *Dynamic Marketing in a Changing World*, R. S. Hancock, R.S. (ed.), Chicago: American Marketing Association, 1960, pp. 389-398.

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[1]Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers with the ability to access the Web directly or are reading the paper on the Web can gain direct access to these linked references. Readers are warned, however, that

1.   these links existed as of the date of publication but are not guaranteed to be working thereafter.
2.   the contents of Web pages may change over time. Where version information is provided in the References, different versions may not contain the information or the conclusions referenced.
3.   the author(s) of the Web pages, not AIS, is (are) responsible for the accuracy of their content.
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Bhimani, A. "Securing the Commercial Internet," *Communications of the ACM* (39:6), 1996, pp. 29-35.

Birch, D., and Young, M. A. "Financial Services and the Internet: What Does Cyberspace Mean for the Financial Services Industry," *Internet Research* (7:2), 997, pp. 120-128.

Booz-Allen & Hamilton. "Booz-Allen's Worldwide Survey Revealed a Huge Perception Gap Between Japanese and American/European Banks Regarding Internet Banking," 1997 (http://www.bah.com/press/jbankstudy.html; current April 22 1997).

Burkhardt, M. E., and Brass, D. J. "Changing Patterns or Patterns of Change: The Effects of a Change in Technology on Social Network Structure and Power," *Administrative Science Quarterly*, March 1980, pp. 140-157.

Burnham, B. "The Internet's Impact on Retail Banking," Booz-Allen Hamilton Third Quarter, 1996 (http://www.strategy-business.com/briefs/96301/).

Business Times. "15 Singapore Firms to Start Internet Commerce," December 4, 1996, p. 1.

Chua, E. K. "Consumer Intention to Deposit at Banks: An Empirical Investigation of its Relationship with Attitude, Normative Belief and Confidence," Academic Exercise, Faculty of Business Administration, National University of Singapore, 1980.

Cockburn, C., and Wilson, T. D. "Business Use of the World Wide Web," *International Journal of Information Management* (16:2), 1996, pp. 83-102.

Compeau, D. R., and Higgins, C. A. "Computer Self-Efficacy: Development of a Measure and Initial Test," *MIS Quarterly* (19:2), June 1995, pp. 189-211.

Cooper, R. B., and Zmud, R. W. "Information Technology Implementation Research: A Technological Diffusion Approach," *Management Science* (36:2), February 1990, pp. 123-139.

Crede, A. "Electronic Commerce and the Banking Industry: The Requirement and Opportunities for New Payment Systems Using the Internet," *Journal of Computer-Mediated Communication* (1:3), December 1995.

Dickerson, M. D., and Gentry, J. W. "Characteristics of Adopters and Non-Adopters of Home Computers," *Journal of Consumer Research* (10), September 1983, pp. 225-234.

Dover, P. A. "Why Home Banking Bombed in Britain," *Journal of Retail Banking* (15:4), Winter 1983, pp. 30-38.

Duclaux, D. "The Call of the Web," *ABA Banking Journal*, 1996, pp.20-22.

Financial Times. "Internet Poses Growing Threat to Traditional Banks," August 1996.

Fishbein, M., and Ajzen, I. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*, Reading, MA: Addison-Wesley, 1975.

Goh, H. P. *The Diffusion of Internet in Singapore*, Academic Exercise, Faculty of Business Administration, National University of Singapore, 1995.

Gujarati, D. N. *Basic Econometrics*, New York: McGraw-Hill, 1995.

Gurbaxani, V., King, J. L., Kraemer, K. L., Jarman, S., Jason, D., Raman, K. S., and Yap, C. S. "Government as the Driving Force Toward the Information

Society: National Computer Policy in Singapore," *Information Society* (7), 1990, pp. 155-185.

Hair, J. F., Anderson, R. E., Tatham, R. L., and Black, W. C. *Multivariate Data Analysis with Readings,* New York: Macmillan, 1992.

Hartwick, J., and Barki, H. "Explaining the Role of User Participation in Information System Use," *Management Science* (40:4), 1994, pp. 440-465.

Hill, T., Smith, N. D., and Mann, M. F. "Communicating Innovations: Convincing Computer Phobics to Adopt Innovative Technologies," *Advances in Consumer Research* (13), 1986, pp. 419-422.

Hirschman, E. C. "Innovativeness, Novelty Seeking and Consumer Creativity," *Journal of Consumer Research* (7), December 1980, pp. 283-295.

Holak, S. L., and Lehmann, D. R. "Purchase Intentions and Dimensions of Innovation: An Exploratory Model," *Journal of Product Innovation Management* (7), 1990, pp. 59-73.

Jussawalla, M., Toh, M. H., and Low, L. "Singapore: An Intelligent City-State," *Asian Journal of Communication* (2:3), 1992, pp. 15-29.

Kalakota, R., and Whinston, A. B. *Frontiers of Electronic Commerce*, Reading, MA: Addison Wesley, 1996.

Kleinbaum, D. G., Kupper, L. L., and Muller, K. E. *Applied Regression Analysis and Other Multivariate Methods*, Boston: PWS, 1988.

Ko, K. H. "Promotion of IT Applications in Singapore: Policy Issues and Strategic Thrusts," in *Information Technology and Singapore Society: Trends, Policies and Applications*, C. Y. Kuo, C. M. Loh, and K. S. Raman (eds.), Singapore: Singapore University Press, 1990.

Lagoutte, V. "The Direct Banking Challenge," Unpublished Honours Thesis, Middlesex University, 1996.

Lai, Y. C. *Technological Acceptance of the Internet in Singapore*, Academic Exercise, Faculty of Business Administration, National University of Singapore, 1995.

Lee, P. "The Cutting Edge: So Far, Online Banking is Mostly Wishful Thinking," *Los Angeles Times*, September 30, 1996, p. D-1.

Leong, Y. L. "ECH Programme Hits Its Stride," *ComputerWorld* (3:13), 1997.

Liao, S., Shao, Y. P., Wang, H., and Chen, A. "The Adoption of Virtual Banking: An Empirical Study," *International Journal of Information Management* (19:1), 1999, pp. 63-74.

Moore, G. C. "End User Computing and Office Automation: A Diffusion of Innovations Perspective," *INFOR* (25:3), 1987, pp. 214-235.

Moore, G. C., and Benbasat, I. "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation," *Information Systems Research* (2:3), 1991, pp. 192-222.

NCB. "The Singapore SET Pilot," October 9, 1997 (http://www.set-pilot.org.sg/standard/pilot).

NCB. "First Secure Visa Card Payment Over Internet," April 29, 1997 (http://www.ncb.gov.sg/ncb/press/set1.asp).

Nehmzow, C. "The Internet will Shake Banking Medieval Foundations," *Journal of Internet Banking and Commerce* (2:2), March 1997 (http://www.arraydev.com/commerce/jibc/9702-01.htm).

Ng, S. E. *A Study on Bank Use of the World Wide Web*, Academic Exercise, Faculty of Business Administration, National University of Singapore, 1996.

Novak, T. P., and Hoffman, D. "Modeling the Structure of Flow Experience Among Web Users," Vanderbilt University, 1997 (http://www2000.ogsm.vanderbilt.edu/papers/flow.abstract.mit.1998/Modeling.the.Structure.of.the.Flow.Experience.html).

Nunnally, J. C. *Psychometric Theory*, New York: McGraw-Hill, 1967.

Orr, B. "Where Will Internet Banking be in Two Years?" *APA Banking Journal*, March 1998, p. 56.

Ooi, S. "Surge in E-commerce Transactions," *SME IT Guide*, December 1999, p. 6.

Ostlund, L. E. "Perceived Innovation Attributes as Predictors of Innovativeness," *Journal of Consumer Research* (1), September 1974, pp. 23-29.

Quelch, J. A., and Klein, L. R. "The Internet and International Marketing," *Sloan Management Review*, Spring 1996, pp. 60-75.

Rhee, H. S., and Riggins, F. "GVU's WWW User Surveys: High Level Summary of Internet Banking Survey," 1997 (http://www.gvu.gatech.edu/user_surveys/survey-1997-04/graphs/banking/report.html).

Rogers, E. M. *Diffusion of Innovations,* New York: Free Press, 1983.

Seitz, J., and Stickel, E. "Internet Banking: An Overview," *Journal of Internet Banking and Commerce* (3:1), January 1998 (http://www.arraydev.com/commerce/JIBC/9801-8.htm).

SRI Consulting. "Boomers with Young Children are Best Prospects for Home Banking and Investing," SRI Consulting, Menlo Park, CA, April 15. 1997.

Straits Times. "Cyberbanking Will Open New Windows," September 14, 1997, p. 5.

Tan, M. "Plugging into the Wired World: Perspectives from Singapore," *Information, Communication and Society* (1:3), 1998, pp. 217-245.

Teo, T. S. H., and Lim, V. G. K. "Usage and Perceptions of the Internet: What has Age Got to Do with It?" *CyberPsychology and Behavior* (1:4), 1999, pp. 371-381.

Teo, T. S. H., Lim, V. G. K., and Lai, R. Y. C. "Intrinsic and Extrinsic Motivation in Internet Usage," *Omega* (27), 1999, pp. 25-37.

Taylor, S., and Todd, P. A. "Assessing IT Usage: The Role of Prior Experiences," *MIS Quarterly* (19:3), 1995a, pp. 561-570.

Taylor, S., and Todd, P. A. "Understanding Information Technology Usage: A Test of Competing Models," *Information Systems Research* (6:2), June 1995b, pp. 144-176.

Ternullo, G. "Banking on the Internet: New Technologies, New Opportunities and New Risks," Boston Regional Outlook, Second Quarter, 1997 (http://www.fdic.gov/index.html).

Toh, M. H., and Low, L. "The Intelligent City: Achieving the Next Lap", *Technology Analysis and Strategic Management* (5:2), 1993, pp. 187-202.

Tornatzky, L. G., and Klein, K. J. "Innovation Characteristics and Innovation Adoption-Implementation: A Meta-Analysis of Findings," *IEEE Transactions on Engineering Management* (29:1), February 1982, pp. 28-45.

Tower Group. "Establishing an Internet-Based Banking Service," 1996 (http://www.towergroup.com/pages/notes/v10/v10_015R.htm; access must be requested from Tower Group).

Triandis, H. C. *Interpersonal Behavior,* Pacific Grove, CA: Brooks/Cole, 1977.

Triandis, H. C. "Values, Attitudes and Interpersonal Behaviour" in *Nebraska Symposium on Motivation, Beliefs, Attitudes and Values*, Lincoln, NE: University of Nebraska Press, 1979, pp. 195-259.

U.S. Department of Commerce. *The Emerging Digital Economy II*, 1999 (http://www.ecommerce.gov/ede/).

Warner, J. "Internet Waits in Wings for Banking Dinosaurs," *The Independent*, August 17, 1996, p.17.

Webster, F. E., Jr. "New Product Adoption in Industrial Markets: A Framework for Analysis," *Journal of Marketing* (33:3), 1969, pp. 35-39.

IX. ABOUT THE AUTHORS

Margaret Tan is an adjunct associate professor at the Logistic Institute—Asia Pacific at the National University of Singapore. Prior to this, she was an associate professor in the Department of Decision Sciences and the Graduate School of Business and a program director of the International Business Institute at the National University of Singapore. A founder of the Pacific Asia Conference for Information Systems (PACIS), she is currently its executive chair. She is also the Chair of the Asian Assembly for the Decision Analysis Society (DAS) of (INFORMS); an advisory board member for McGraw-Hill (UK) in the Information Systems Series, an associate of the ORBICOM UNESCO Network, and a Fellow of the International Center for Electronic Commerce in Korea. She was the council member of Association for Information Systems for the Asia Pacific. In Singapore, she is on the Board of Comdex/Asia Conferences, and was the Conference Chair for Asia's First Cyber Education. She is also on various editorial boards of international journals. Her research interests include the national information infrastructure of Asia Pacific, diffusion and adoption of electronic commerce, telemedicine, and port management and strategies.

Thompson S. H. Teo is an associate professor and Information Systems Area Coordinator in the Department of Decision Sciences at the National University of Singapore. He received his Ph.D. in Management Information Systems from the University of Pittsburgh. His current research interests include IS planning, tele-working, IT personnel, IT adoption and diffusion, and electronic commerce. He has published more than 50 papers in international journals such as *Communications of the ACM*, *Communications of the AIS*, *Database*, *Decision Sciences*, *Decision Support Systems*, *European Journal of Information Systems*, *Information and Management*, *Information Technology and People*, *International Journal of Electronic Commerce*, *Journal of Economic Psychology*, *Journal of Management Information Systems*, and *Omega*.

APPENDIX A
FACTOR ANALYSIS

The Kaiser-Meyer-Olkin measure of sampling adequacy (MSA) was first computed to determine the suitability of using factor analysis. For this study, the MSA was found to be 0.884. Thus, it was deemed appropriate to apply factor analysis. To determine the minimum loading necessary to include an item in its respective construct, Hair et al. (1992) suggested that variables with loadings greater than 0.3 were considered significant; loadings greater than 0.4, more important; and loadings 0.5 or greater were very significant. For this study, the general criteria were to accept items with loadings of 0.4 or greater. Two rounds of factor analysis were performed. The final results are shown in Table A1.

A total of nine factors with eigenvalues greater than 1.0 were identified. These factors explained 71% of the total variance. The items measuring compatibility with values (COMPAT1 through COMPAT3) were found to load together with those that measured relative advantage (RELADV1 through RELADV6). A possible explanation for this could be that respondents who perceived banking on the Internet as compatible with their values might tend to view them more favourably.

Hence, they would be more likely to perceive Internet banking services as an advantageous innovation as well.

Two items (COMPLEX3 and RISK1) were found to load less than 0.4 for their respective constructs. However, when compared across factors, it was found that they were still loaded highest on their own factors. COMPLEX3 loaded 0.379 while RISK1 loaded 0.274. Therefore, these items were retained in their respective measures.

During the first round of analysis, it was found that one technology support item (TECSUPP1) cross-loaded on two factors instead of one distinct factor. TECSUPP1 was thus dropped for the second analysis. The Cronbach's alpha for the subsequent two-item measure for technology support was found to reduce only marginally from 0.6444 to 0.6151, thus meeting Nunnally's (1967) suggested minimum alpha value of 0.6.

Therefore, with the exception of the above-mentioned discrepancies, the results of the factor analysis indicate that, with minimum factor loadings of 0.4 suggested by Hair et al., the conditions of convergent and discriminant validity are satisfactorily met.

Prior to regression analysis, the data were tested for heteroskedasticity and multicollinearity. Heteroskedasticity refers to the occurrence of unequal variances while multicollinearity refers to high correlations among the independent variables. Occurrences of these two effects violate some of the basic assumptions for regression analyses (refer to Gujarati [1995] for more details). Note that it is important to test for heteroskedasticity as different sample populations that make up the pool of respondents may have different variances. To test for hetero-skedasticity, Spearman's rank correlation was used. Gujarati suggests that for heteroskedasticity to exist, the correlation coefficient should be significant (i.e., $p < 0.05$). Since results indicate that the coefficient is not significant (Spearman's correlation coefficient = -0.011, t = 0.234, $p > 0.05$), there is thus no hetero-skedasticity that may cause misleading conclusions in the hypothesis testing.

Table A1. Factor Analysis

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9
RELADV5	**0.899**	0.118	0.098	0.020	0.081	-0.037	-0.002	-0.030	0.055
RELADV3	**0.893**	0.065	0.068	-0.040	0.065	-0.025	0.024	-0.010	0.102
RELADV6	**0.868**	0.150	0.071	0.018	0.055	-0.041	-0.033	0.077	0.070
RELADV4	**0.899**	0.153	0.100	0.006	0.045	-0.008	-0.096	0.042	0.014
RELADV2	**0.819**	0.140	0.079	-0.024	0.088	-0.099	0.046	0.008	-0.007
COMPAT2	<u>0.806</u>	0.240	0.090	-0.003	0.117	-0.020	-0.037	0.241	0.118
COMPAT1	<u>0.731</u>	0.235	0.102	-0.055	0.128	-0.036	-0.053	0.295	0.063
RELADV1	**0.730**	0.125	0.132	-0.046	0.065	-0.043	-0.095	0.142	0.065
COMPAT3	<u>0.730</u>	0.240	0.100	0.012	0.154	-0.024	-0.103	0.298	0.095
COMPLEX3	-0.465	-0.190	-0.181	0.020	-0.006	0.104	<u>0.379</u>	-0.069	-0.090
SELFEFF3	0.222	**0.823**	0.062	-0.156	0.144	-0.028	-0.066	0.052	0.002
SELFEFF2	0.221	**0.806**	0.077	-0.145	0.161	-0.040	-0.010	0.053	0.002
SELFEFF5	0.233	**0.766**	0.091	-0.002	-0.004	0.026	-0.057	0.094	-0.022
SELFEFF4	0.108	**0.764**	0.060	0.052	0.032	0.027	-0.040	0.070	0.047
SELFEFF1	0.217	**0.726**	0.064	-0.004	0.019	-0.063	-0.049	0.108	0.109
GOVSUPP2	0.140	0.057	**0.909**	-0.042	0.079	0.018	-0.044	0.076	0.123
GOVSUPP3	0.157	0.053	**0.890**	0.007	0.055	-0.018	-0.054	0.086	0.127
GOVSUPP1	0.184	0.161	**0.844**	0.016	0.024	0.052	-0.041	0.090	0.118
RISK1	-0.310	-0.318	-0.398	0.006	0.106	<u>0.274</u>	-0.099	-0.029	-0.035
SUBNORM1	0.001	-0.025	-0.025	**0.931**	-0.036	0.048	0.064	0.021	0.091
SUBNORM3	-0.003	-0.060	-0.013	**0.904**	-0.002	0.014	0.014	-0.037	0.062
SUBNORM2	-0.059	-0.086	0.028	**0.864**	-0.038	0.033	0.077	0.010	0.012
INTUSE2	0.091	0.056	-0.032	-0.076	**0.739**	0.055	-0.049	-0.001	0.075
INTSKILL	0.173	0.159	0.074	-0.087	**0.693**	0.016	-0.063	0.065	-0.066
INTUSE3	0.085	0.031	-0.100	0.019	**0.664**	-0.017	-0.149	-0.075	0.294
INTUSE1	-0.041	0.002	0.117	0.004	**0.563**	-0.085	0.129	0.253	-0.279
INTUSE4	0.260	0.036	0.174	0.130	**0.419**	0.024	-0.049	-0.099	-0.172
RISK2	-0.081	-0.013	-0.002	0.047	-0.009	**0.915**	0.137	-0.006	-0.016
RISK3	-0.113	-0.032	0.020	0.045	0.024	**0.915**	0.097	0.011	0.067
COMPLEX1	0.009	-0.051	-0.004	0.074	-0.091	0.067	**0.864**	-0.087	-0.000
COMPLEX2	-0.146	-0.067	-0.051	0.071	-0.073	0.132	**0.824**	-0.028	0.014
TRIAL2	0.213	0.183	0.126	-0.000	0.026	0.038	-0.111	**0.805**	0.059
TRIAL1	0.244	0.234	0.161	-0.005	0.045	-0.030	-0.077	**0.743**	0.112
TECSUPP2	0.182	-0.000	0.162	0.063	-0.027	-0.000	0.008	0.138	**0.783**
TECSUPP3	0.174	0.157	0.230	0.148	0.022	0.059	0.002	-0.003	**0.672**
Eigenvalue	9.926	2.961	2.495	2.147	1.940	1.854	1.394	1.139	1.004
% of Variance	28.361	8.461	7.129	6.134	5.554	5.298	3.983	3.254	2.869
Cumulative %	28.361	36.822	43.951	50.085	55.629	60.927	64.910	68.164	71.033

To test for multicollinearity, Kleinbaum et al. (1988) suggest computing the variance inflation factor (VIF) for each independent variable. They also suggest that, as a rule of thumb, if the VIF of a variable exceeds 10, that variable is said to be highly collinear and will pose a problem to regression analysis. This condition is adopted to check for multicollinearity among the independent variables. Table A2 shows the variables together with their respective VIF values. From the table, all of the VIF values are well below 10, ranging from 1.098 to 3.254. Therefore, there is really no problem of multicollinearity.

Table A2. VIF Values of Variables

Variable	*VIF Value*
Relative advantage	2.700
Compatibility with values	3.254
Internet experience	1.146
Banking needs	1.111
Complexity	1.241
Trialability	1.611
Risk	1.164
Subjective norms	1.098
Self-efficacy	1.405
Technology support	1.333
Government support	1.354