THE ADOPTION OF INTERNET BANKING: A MODEL OF DECISION FACTORS

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Abstract

This paper tests a model of Internet banking adoption, giving insight into issues that banks consider when adopting the Internet as a delivery channel. It also reveals how a bank's perception of these issues is related to the intent to adopt. The study has two parts. The qualitative study involved literature review and interviews with bank executives, leading to the identification of several potential decision factors and the formation of a tentative adoption model. The quantitative research validated the proposed model by conducting a comprehensive survey targeted at senior bank executives in North America. The result has shown that the adoption decision was mainly determined by various issues such as strategic motivation, the perceived value of Internet banking, customer demand, environmental influences, and operational context. However, only a few of them are able to discriminate the level of adoption intent among banks.

Keywords: Adoption of IT, Internet Banking, Decision Model, Empirical Study, Literature Review, Theory of Planned Behavior, Factor Analysis, Discriminant Analysis.

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Section 1 Introduction: Strategic Use of IT in Banking

In business, the use of Information Technology (IT) is always widely adopted to support business strategies. The banking industry provides a very good example. It has always been the leader in innovative applications of IT and is very aggressive in aligning IT to support business strategies, particularly in the delivery of services and products. Many technical innovations have been developed and adopted in an effort to provide competitive advantages and channel efficiency. For example, "Back Office Automation" was enabled by Electronic Data Processing (EDP) in the 1960s, "Front Office Automation" and "Customer Interface Automation" by the EFT, ATM and POS networks in the 1970s, and geographic expansion by home banking, such as telephone and PC banking, in the 1980s.

In recent years, the potential of the Internet has been widely recognized. Driven by Web technologies, the Internet has now become a major infrastructure providing an economical, quality, fast and, more importantly, a virtual medium for business transactions. It is also an impetus of today's ubiquitous electronic commerce, and its applications can be strategically aligned to business operations. For example, the Internet is now being used as a sales channel, a marketplace for buyers and sellers, an infrastructure of distribution network, an on-line catalogue, a customer support and a means of forming virtual corporations [1](Kosiur, 1997). Its strategic implications, especially to banks, are very significant.

Section 2 Strategic Implications of the Internet to Banking

Competitive Implications. The Internet has changed the competitive landscape of the banking industry. In a way, it poses a threat to large banks for two reasons.

First, since the Internet is size insensitive, small banks can have the opportunity to close the technology gap between them and large banks and offer on-line banking without having to make enormous investments in IT infrastructures such as the design of software applications, support of proprietary back-end systems and dial-in lines and modems for customers access. The burden of technical development has been shifted to such companies as Web browser developers and communication companies. Technically, all that is needed is the use of standard TCP/IP networking and a connection to the Internet (US Web Services, 1998).

Second, since the Internet is also geographic insensitive, it can neutralize the competitive advantage of having the extensive branch network that large banks have. This extends the competition beyond geographic boundaries to become regional or national. By outsourcing the Internet banking operations to service bureaus, such as Fiserv, EDS and Integrion[2], small banks can maintain a full transactional website to customers on a national basis and project the same technology image that large banks have, at a low cost[3] (Marenzi, 1998). Given this unlimited geographic reach, the competitive differentiation between geographical differences will be gradually eroded, subject only to regulatory constraints (Booz, Allen & Hamilton, 1997).

Strategic Benefits. To banks, the adoption of the Internet as a delivery channel is a strategic use of IT to provide channel efficiency. In this aspect, the Internet can promise significant potential benefits, including immediate use of a widely adopted set of technology standards, rapid increases in functionality as standards evolve, integrated marketing and banking content, and access to a large number of customers and prospects at the lowest cost[4] (Ooi et al., 1996, iv).

Strategy Development. The impact of the Internet on banks in formulating strategy can be recognized from several examples. First, banks are replacing existing PC-based services with Internet banking, like the Toronto Dominion Bank's conversion in 1999. It is a strategic move enabled by the evolution of IT, i.e., the Internet and Web technologies. Internet banking has advantages over PC banking because the concept of Internet banking is entirely based on open technology standards, such as TCP/IP and Web browsers, in which the underlying telecommunication network is an open platform shared by the public. This allows banks to escape the constraints of expensive proprietary systems, such as those operated by CheckFree and Visa Interactive, and specially developed software and dial-up interface, such as Quicken and Money (England, 1998). The beauty of Internet banking is the use of the client-server platform to support the interactivity between banks and customers, in which customers run applications that reside at the bank's Web server. Banks can therefore fully customize and differentiate electronic interfaces, and have true brand identity that PC banking cannot offer (Ooi et al., 1996, iii; Five Pace, 1995; Web Tech, 1998).

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[1] Kosiur in his book provides six innovative case studies of Web-based electronic commerce.
[2] Integrion is a consortium found by some of the largest banks and financial institutions in North America. Its goal is to act as an outsourcer for the electronic banking needs of its members (Marenzi, 1998).
[3] For example, initial set up cost is from US20K to $30K, plus $1.5K per month for first 12,000 transactions, which is much lower than the cost in creating in house Internet banking.

Second, the Internet allows Internet-based or so-called virtual banks to appear as new competitors because it breaks the entry barrier created by the high set-up cost of branch network[5]. Internet-based competitors of this type have created a well-branded image and compete directly with traditional banks for time-pressed customers who demand any-time and anywhere banking services. Some traditional banks have responded by either creating a new business[6] or acquiring a business[7] of this type. Meanwhile, it was also suggested that the strategic issue for banks might no longer be how to integrate Internet banking into the portfolio of existing delivery channels, but to consider how and where to build a new barrier before this old barrier completely collapses (Li, 1997). But setting an entry barrier could also be considered as protectionism. "Keeping them (new competitors) out even though they got a better idea is a bad idea, ... what you (banks) need to do is find the way to win, as opposed to find the way to make the other lose" (McGlashon & Ickert, 1998).

Third, the Internet is a force leading to strategic partnerships between banks and other organizations. With the use of the Internet, rich information can simultaneously reach a large number of prospects, thus breaking the traditional trade-off between richness and reach of information. This allows bank customers to navigate a full range of banking options and provides direct access to such financial service providers as credit card companies and mortgage lenders, without having to go through banks. The hierarchy of channels once controlled by banks has been broken (Evans & Wurster, 1997). To a great extent, the Internet is an enabler of disintermediation to the financial industry (McGlashon & Ickert, 1998). In order to maintain their role as a leading financial intermediary and to support a full menu of services that cannot be offered alone, banks are forming strategic partnerships with such companies as insurance and brokerage firms (Ogilve, 1996).

Market Potential. Many studies have indicated that there is great potential in Internet banking. It was projected that 16 million US households, representing 16% of all US households, would use Internet banking by the year 2000[8] (Booz, Allen & Hamilton, 1996). In 1998, Online Banking Report estimated that there were about 4.5 million US households using Internet banking at least

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[4] Some other commonly recognized strategic advantages are summarized in Appendix 1.
[5] Setting up an Internet-only bank costs only between US$1 to US$2 million, which is significantly lower than the costs involved in developing a branch network (Booz, Allen & Hamilton, 1997).
[6] For example, Mbanx was created by the Bank of Montreal and Citizens Bank by Vancouver City Savings Credit Union.
[7] For example, First Security Network Bank was acquired by the Royal Bank.

once a month. That number was expected to increase to 33.5 million by the year 2005 and would represent nearly 31% of all households (US Web Services, 1998). The Tower Group (1996), a consulting firm specializing in financial industry, expected that by the year 2000, 85% of US households with an account at a commercial bank would have that account at a bank offering Internet-based services. Therefore, household demand for Internet banking will be at a level that banks cannot afford to ignore. Worthy of note is the fact that most customers are willing to see more varieties of banking functions available through the Internet. In GVU's study (1997), the majority of surveyed consumers felt that having a variety of features and services (including bill payment) available on the Internet was important[9], while in Ooi, Wei and Goh's survey (1996, i), both bill payment and transfer of funds were viewed as important categories of Internet banking services that should be provided.

Section 3 Research Perspectives

Research Motivation. From the above elaboration, it is reasonable to expect a high adoption rate of full functionality in banks' websites. However, research findings have shown that Internet banking functions adopted by banks varied significantly, and that only a minority of banks had offered advanced level functions such as bill payment and funds transfer (Diniz, 1998; Booz, Allen & Hamilton, 1997). In Diniz's study, only about 15% of bank sites studied provided services in bill payment and funds transfer[10]. Obviously, customer demand does not solely determine the adoption rate and there exist some important issues about providing Internet-based services and products. For banks, integrating the Internet into the existing business portfolio might require a completely different set of considerations that might not be encountered in the adoption of earlier technologies.

However, many journals have tried to explain the adoption of Internet banking from the customers' perspective and attributed the slow growth to customer resistance because they are still not comfortable with the security of the Internet banking and prefer face-to-face interactions with branch tellers. As a result, many studies on Internet banking have been focused on the understanding of the relationship between customer behavior and adoption rate. For example, how the consumer usage of electronic channels was influenced by their needs and opportunity of using electronic channel (Ramaswami et al., 1998), what the user profile of Internet banking was

[8] The analysis was based on the key factors affecting consumer demand, such as Internet usage, computer ownership and consumer acceptance.
[9] Including both respondent groups that had and had not an Internet bank account.

and what factors were affecting their adoption decision (GVU Center, 1997), and what determinants existed to affect customers' usage intention of Internet banking services (Ooi et al., 1996, i). By comparison, studies in the perspectives of banks only have received little attention.

Research Questions. Therefore, this study tries to explain adoption of Internet banking from the perspectives of banks. It intends to investigate the principle issues that banks consider when providing products and services through the Internet, and then to create and validate a model of technological adoption that reveals how these issues affect banks' intent to adopt. The proposed model answers two research questions.

1. ***What are the factors that banks take into account when considering or implementing Internet banking?***
2. ***How are these factors related to banks' level of intent to adopt Internet banking?***

Section 4 Research Methodology

Qualitative Research. This research was divided into two phases. The first phase started with a qualitative research by reviewing the literature of relevant industry publications and scholarly research which have identified many potential factors leading to the adoption of the Internet as a delivery channel, albeit in piecemeal form. These have been augmented by semi-structured interviews with bank executives of several major financial institutions in the Vancouver area. In the interviews, respondents had been allowed to choose the issues they wanted to discuss before the prepared questions were asked. Factors from both sources were combined to generate 56 initial survey items and a tentative adoption model.

Q-Sort Analysis. A Q-sort analysis on the initial survey items was conducted to test the construct validity of the model, which was, specifically, to make sure that correlated questions were grouped within particular categories and ambiguous questions eliminated or revised. After this, the revised survey items were incorporated into an 8-page survey, in which questions measuring the respondents' intent to add particular banking functions to their firms' websites were also included.

Quantitative Research. The second phase was a quantitative research approach designed to analyze the survey result against the proposed adoption model. The survey was desired in this study because factors identified in the qualitative study did not have sufficient empirical

[10] The survey data was collected in October/November 1997.

foundation. The survey approach is able to provide some statistical significance to the findings. The analysis was conducted in three parts. First, factor analysis was used to study how measurement items clustered around some underlying common factors. Secondly, discriminant analysis was used to examine the relationship between the common factors and the level of intent that bank managers had in adopting particular Internet banking functions. Finally, findings were evaluated and summarized, leading to the conclusion of what the common factors were and how they differentiated the level of intent to adopt Internet banking.

Section 5 Previous Research on Technological Adoption

Although there is a very limited quantity of research specifically focusing on Internet banking adoption from a bank's perspective, research on adoption of other technologies by organizations has been continuously emerging in the IS literature. Following are examples of studies focusing on adoption of technology that has similarities to Internet banking, which may provide some insights into the Internet banking adoption decision.

Although Electronic Data Exchange (EDI) is an Interorganizational System (IOS) between two organizations, it is still similar to Internet banking in a way that they both are network-based electronic systems, designed to improve channel efficiency and to facilitate delivery of services and products from an organization to its customers. There are many studies in technological adoption using (EDI) as a unit of analysis, but their research focus of adoption determinants varied differently. For example, O'Callaghan et al. (1992) had studied the impact of *relative advantage, compatibility* [11] and *external influences* (from trading partners) to the EDI adoption in insurance industry, and found that only the *relative advantage* was related to the adoption behavior. But in some later research, compatibility and external influence could also be influential to adoption decision of EDI.

Based on literature review and case studies, Iacovou et al. (1995) investigated the adoption of EDI and found that factors influencing the adoption decision could be organizational and inter-organizational. Factors influencing the intent to adopt EDI were identified as: the perceived potential advantages associated with EDI implementation *(i.e., perceived benefits)*, the level of financial and technological resources of the organization *(i.e., organizational readiness)*, and the

[11] Relative advantage and compatibility are two of the five fundamental factors that can influence the diffusion of innovation. The other three factors are observability, complexity and trialability (Rogers, 1983).

pressure from competitors and trading partners (*i.e., external pressure*). Later, this proposition was statistically validated by a survey approach (Chwelos et al., 1999).

The role of organizational and interorganizational factors were also highlighted in other research. Hart and Saunders (1998) have examined the impact of the interorganizational relationship between the supplier and customer on EDI adoption. The results suggested that *customer power* and *supplier trust* could affect the use of EDI differently. In one study, Premkumar and Ramamurthy (1995, i) tested several factors against the decision mode for EDI adoption. It was found that two organizational factors, *internal needs* (*i.e.,* need and relative advantage) and *top management support,* and two interorganizational factors, *competitive pressure* and *exercise power* of the trading partner, were important factors to differentiate the decision mode among organizations. In a separate study focusing on organizational factors (Premkumar and Ramamurthy, 1995, ii), they found that *compatibility, relative advantage, championing, scope of use within the task environment,* and *being an early adopter* determined the diffusion of EDI internally, while *technical compatibility, top management support,* and *being an early adopter* were key variables influencing the diffusion externally.

Internet banking can be viewed as a customer-oriented strategic system (COSS) [12], which is designed to link to customers and improves a bank's competitive edge. Therefore, insight of adoption of Internet banking can be drawn from a case research by Reich and Benbasat (1990). Reich and Benbasat have investigated eleven COSS and identified some factors that enabled an organization to be a first-mover in developing a strategic system. The results showed that factors influencing the speed with which an organization developed a strategic system were related to the characteristics of the industry *(i.e., high competitive threat from existing competitors and new entrants,* and *customer bargaining power)*, the organization *(i.e., proactive stance, CEO support and champion),* IS function *(i.e., proactive stance, high competence* and *previous COSS experience)* and the system itself *(i.e., high priority, high level of resources, full pilot test* and *avoidance of IS planning)*.

Although Internet banking is more consumer-based[13], to a certain extent it is also a customer-based interorganizational system (CIOS) because its purpose is to facilitate the link to the

[12] As defined, COSS is an information system used to support or shape the competitive strategy of an organization and set up a link to customers. Under such definition, Internet banking can also be categorized as a COSS.

[13] The scope of this study is limited to retailing banking.

customer and to improve customer relationship. Adoption decisions of CIOS were proved to be facilitated by factors in wide range of categories (Grover, 1995). They were: support factor (*i.e., top management support* and *championship*), IOS factor *(i.e., compatibility* and *complexity*), policy factor (*i.e., proactive role of IT* and *management risk-taking position*), organizational factor (*i.e., organizational size, IS infrastructure* and *strategic planning*), and environmental factor (*i.e., number of adaptable innovations*).

Technological adoption can also arise from organizational initiative and environmental pressure. Burke (1996) used the adoption of ATM by banks to study the relationship between the strategic orientation and technological adoption decision and to examine how this relationship was associated with the environmental constraints the organization was facing and the organizational capabilities the organization possessed. The results indicated that banks' *strategic orientations* were related to the timing and extent of adoption, that is, banks aggressively pursuing expansion into new markets adopted ATM significantly earlier than banks with conservative approach, which concentrated on maintaining their current competitive position. The results have also shown that the timing of adoption would differ as a function of *regulatory environment* and *organizational size*. Banks operating in a less restrictive environment or having a larger organizational size would have an earlier adoption.

An EEC-sponsored research project has identified some major barriers to the adoption of service-based IT applications, which were intended to improve customer relationships and the quality of services and delivery (Barras, 1986). Barriers that might inhibit the rate of adoption were believed to have three categories. They included economical factors (*i.e., cost barrier*), social factors (*i.e., fear of depersonalization* [14]*, customer resistance),* political factors (*i.e., government regulations),* institutional factors[15] and legal factors.

The above discussion illustrates that technological adoption is a very broad issue. Factors affecting the adoption decision may vary differently between types of technologies. So, the understanding of the factors specific to Internet banking adoption still requires a thorough study of literature specializing in the banking industry and the Internet technology. This will be discussed in the next section.

[14] The fear of deskilling of the work and loss of jobs.
[15] For example, lack of standardization of procedures and consistency of organization structure.

Section 6 Factor Identification: A Qualitative Study

This study only intends to focus on Internet banking-specific factors because a comprehensive model including a "complete" range of variables as identified by previous research would be difficult to manage and test (Grover, 1995). Potential factors leading to Internet banking decision were mainly identified from literature specializing in the subject and three in-depth interviews with senior executives of major depository institutions in Canada[16]. The relationship of these factors with the banks' intent to adopt Internet banking was tested by several hypotheses. Highlights of the findings, together with the null form of the hypotheses, are provided as follows.

6.1 Strategic Motivation

Adoption of Internet banking is a business strategy motivated by how it can satisfy the ***business need***, ***strategic mission*** and ***organizational goal***. Some examples are found in the banks interviewed. Due to environmental changes[17], the Bank of Montreal (BMO) needed to re-define customer relationship and become totally client-centric and service-driven. With Internet technology, the bank could differentiate the client base and offer appropriate services for individual clients, so that their "segment of one" marketing strategy could be supported[18]. Meanwhile, the launch of Mbanx was mostly a branding strategy required because BMO had a low name recognition in North America. The objective of becoming a future banking brand, as clearly stated in an internal document, translated into the goal of being a distinct organization and a leading force for innovation in North America (McGlashon & Ickert, 1998; Barclay, 1998; Kinsley, 1998; Chisholm, 1998). On the other hand, consideration of Internet banking in Hongkong Bank Group of Canada (HK Bank) was motivated by the need for a low cost delivery channel. As commented (O'Sullivan, 1998), the bank "cannot compete, at least with a certain segment in the customer base, by only offering a higher cost distribution channel". For VanCity, Internet banking could perfectly fit into their mission of being at the leading edge of technology based delivery (Wafer, 1998). The strategic launch of Citizens Bank for VanCity on the other hand was intended to satisfy the need of a small group of customers who shared the interest in technology or customer services (Barclay, 1998). Therefore

H1: The degree to which Internet banking satisfies the business needs is not related to banks' adoption intent

[16] Richard A Wafer, VP Information Systems, Vancouver City Savings Credit Union (VanCity); Sean P O'Sullivan, VP Distribution Systems, Hongkong Bank Group of Canada (HK Bank); Bob McGlashon, Senior VP & Meini Ickert, Senior Manager Sales, the Bank of Montreal (BMO). BMO is one of the largest banks, and VanCity and HK Bank respectively are the largest credit union and foreign bank in Canada.
[17] Democratization of information, globalization, social and demographic shifts, and deregulation of financial industry (Chisholm, 1998).
[18] It is to make customers feel valued as a market segment of one.

$(r < |0.3|)$[19].

H2: The degree to which Internet banking matches the declared missions is not related to banks' adoption intent $(r < |0.3|)$.

H3: The degree to which Internet banking meets the organizational goals is not related to banks' adoption intent $(r < |0.3|)$.

6.2 Valuation of Internet Banking

Characteristics of Internet Banking. Perceptions of Internet banking, as represented by the efficiency and significance of the Internet as a delivery channel, can affect Internet banking decision. A study has found that banks seeing the Internet as the most important delivery channel had sites with more advanced functionality than banks ranking traditional branch as a major delivery channel (Booz, Allen & Hamilton, 1997). It indicates that banks viewing the Internet as a future mainstream channel will have more incentives for a more advanced website. Currently, Internet banking may still be viewed as a strategic advantage, but this opportunity is closing rapidly because it will soon follow the same path as ATM. It will change from a strategic advantage to a strategic necessity, although much faster (US Web Services, 1998). Banking on the Internet will soon become a basic and expected banking service. As one banker commented, Internet banking "does not differentiate you (the bank), it just allows you to be a bank. If you don't offer this stuff, you do not get to a bank anymore" (Tresslar, 1997). Hence

H4: The perceived significance of the Internet as a delivery channel for banking services is not related to banks' adoption intent $(r < |0.3|)$.

Efficiency is mainly about economies, security, and the accessibility and convenience that the Internet can provide as a delivery channel. Among these, security is still perceived as a big issue when banks consider Internet banking. When Toronto Dominion Bank and Canadian Imperial Bank of Commerce first considered Internet banking, it was the security concern that delayed the full implementation (Green, 1996). On the other hand, VanCity considered the security issue as a purely emotional bias, and partly because of that, they became one of the early adopters of Internet banking in Canada (Wafer, 1998). Therefore

H5: The perceived efficiency of the Internet as a delivery channel for banking services is not related to banks' adoption intent $(r < |0.3|)$.

Business Opportunity. It is widely believed that implementing Internet banking is an opportunity for business development, which may lead to an early adoption decision. Banking with the Internet is likely to become just one component of an integrated system, which includes not only

[19] The magnitude of coefficient of correlation (r) will be discussed in the subsequent section.

banking functions, but also a variety of non-banking activities, such as E-commerce and bill presentment (Wafer, 1998). And through this system, banks can keep track of customers' activities and target specific products to specific customers, providing a business opportunity (Tresslar, 1997). Additionally, this business opportunity also means development of technical know-how and managerial skills within the organization. For example, by experimenting with Internet banking, Mbanx has become a center for creativity and innovation that will facilitate problem solving and innovating thinking at all organizational levels (Kinsley. 1998). Hence

H6: The degree to which Internet banking is perceived as a business opportunity is not related to banks' adoption intent ($r < |0.3|$).

6.3 Customer Demand

Managers in a survey have acknowledged the difficulties in predicting when, and at what rate, the usage level of Internet banking by customers would start to grow. This uncertainty made it hard for banks to commit significant investment to Internet banking (Daniel & Storey, 1997). Therefore, it is very common that banks will conduct extensive market research when making their Internet banking decision. A certainty of customer demand is not just a stimulus, but also a requirement to adoption decision. In consensus, ***customers' behavior, demographics*** *and* ***technical capabilities*** of using the Internet may be good indicators of customer demand. The understanding of customer behavior is important because it allows banks to understand customers' preferences towards using the Internet to access banking services. Demographic distribution can show what market segments will generate demand for Internet banking. On the contrary, customers' lack of required skills, hardware, software and connectivity in using the Internet will negatively affect the demand (O'Sullivan, 1998; Barclay, 1998; Wafer, 1998). Therefore

H7: The perceived influence of customer behavior to the demand of Internet banking is not related to banks' adoption intent ($r < |0.3|$).

H8: The perceived influence of customer demographics to the demand of Internet banking is not related to banks' adoption intent ($r < |0.3|$).

H9: The perceived influence of customers' capabilities of using the Internet to the demand of Internet banking is not related to banks' adoption intent ($r < |0.3|$).

6.4 Environmental Influences

Market Competition. Adoption may be a response to competitive threats coming from banks (*e.g.,* Citizens Bank) or non-bank competitors (*e.g.,* ING), whichever can offer low cost alternatives to the customers. Banks nowadays are finding it difficult to compete by only offering a higher cost delivery channel (O'Sullivan, 1998). Timing of entry into Internet banking market is

also important because early adopters can always secure a market share. VanCity has opted for this offensive strategy because they believed that being late in the market would make it difficult for them to "catch up and drag" the customers from competitors (Wafer, 1998). Banks in the future will be subject to significant network pressure in adoption of Internet banking. The Tower Group (1996) estimated that by the year 1999, 90% of the top 50 US banks would offer full service via Internet access. The group also warned that banks would lose 10% of their customers in five years if they failed to offer on-line banking, including the Internet. Provision of Internet banking to a great extent will become a customer retention strategy. Hence

H10: The perceived competitive threats are not related to banks' adoption intent ($r < |0.3|$).

Regulatory Constraints. Regulatory requirements also constrain large-scale Internet banking implementation, at least temporarily. There were legal and compliance issues that just could not be done in the Internet environment such as provision of complete information and issues of signature (Barclay, 1998). Gahtan & Graham (1997) have highlighted some of the issues facing banks in connection with the provision of financial services through the Internet. They include the differences in provincial and international legal requirements, risk in authentication, legality of contractual binding and potential liability from expired information posted on the Internet. To avoid the possibility of violating the jurisdiction of another country, some banks may even choose to restrict their customer base to certain countries. For example, Security First Network Bank only accepts accounts for US and Canadian nationals (Reed, 1997). Therefore

H11: Regulatory challenges associated with Internet banking are not related to banks' adoption intent ($r < |0.3|$).

Technological Complexity[20]. There are technical challenges in using Internet technology, which may defer adoption decision. Many of them are related to the front-end control such as incompatibility between system configurations and browsers, immature programming languages and the connection quality of the Internet. These are the things that banks do not have much control over because improvement of Internet technology is dependent on other intermediaries such as Java, Microsoft and Netscape (Wafer, 1998).

[20] "Technological Complexity" was not hypothesized because the result from Q-sort analysis suggested merging its measurement items into other factor categories.

6.5 *Operational Context*

Channel Management[21]**.** Many operational issues collateral to implementing Internet banking may also exist as challenges. First, there are challenges in managing multiple channels. Adding the Internet into the multiple channel system without reducing traditional costs simply means an addition of overhead. So the key challenge lies in re-engineering and optimizing the traditional network[22] (Nehmzow, 1997), which means that banks need to re-define the role of each channel, especially the branches. It may not be necessary to reduce the number of branches as one study found that only 10% of the surveyed banks intended to reduce the number of branches because Internet banking was offered (Robinson, 1998). Rather, it is how to influence customers' behavior by encouraging them to use the Internet for routine and non-profitable transactions, so that higher-cost channel can handle the more profitable customers who demand more human attention (O'Sullivan 1998; Daniel, 1997).

Product and Service Development. Internet banking is more than just mapping existing services and products into the Internet environment. It also requires some sort of transformation capacity, such as bringing into the Internet some services that cannot be done at branch. As such, Internet banking can differentiate, customize and personalize the products (McGlashon & Ickert, 1998). For example, before Mbanx was launched, a lot of work had gone into the conceptualization of products and services offered, making Mbanx a distinct business, not just an add-on service to the existing service portfolio (Barclay, 1998). Banking in the Internet should be more than just banking, meaning that some other non-banking functions, such as E-commerce, ticket purchase and community event, must be added (Wafer, 1998). Eventually, banking services on their own may not be compelling enough to increase the usage rate of Internet banking. There must be a critical mass of other worthwhile services that users can access (Daniel & Storey, 1997). Hence

> **H12:** The issues in developing appropriate services and products on the Internet environment are not related to banks' adoption intent ($r < |0.3|$).

Management Support. As found in one survey, the lack of commitment and awareness at senior level was the biggest issue hampering the on-line development. A higher level of management support would provide the team working on Internet banking development with a higher organizational status (Daniel & Storey, 1997). Without management support, there may be a lack

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[21] "Channel Management" was not hypothesized because the result from Q-sort analysis suggested that its measurement items were too ambiguous to fit into any factor category. Items have been eliminated or merged into other factor categories.

[22] For large banks, integrating the Internet with existing delivery systems will be much more expensive than setting up an Internet bank from scratch.

of resources for Internet banking development, including capital and IT support (O'Sullivan, 1998). On the other hand, management insight and foresight will facilitate experimentation of Internet banking, hence leading to an early adoption decision (Wafer, 1998). Therefore

H13: Level of management support to Internet banking implementation is not related to banks' adoption intent ($r < |0.3|$).

Technical Context. Technical difficulties can also be found in operating Internet banking. As the number of channels proliferates, banks may find it difficult to integrate the Internet with the existing systems. Integration issue has different facets. It may be about maintaining the flexibility, interoperability and communicability[23] of the entire system (Wafer, 1998), about balancing the trade-off between the complexity of integration and the potential for inconsistent systems data (Tower Group, 1996), about achieving the consistency of interfaces [24] (Robinson, 1998), or even about defining the responsibility for maintaining the website. Two survey findings have shown that responsibility for website maintenance varied from marketing department to IT department (Grant Thornton LLP 1996; Booz, Allen & Hamilton, 1997). Hence

H14: Technical challenges from Internet banking implementation are not related to banks' adoption intent ($r < |0.3|$).

Section 7 Construct Validity: Q-Sort Analysis

Based on the factors identified, 56 initial survey items measuring how bank executives would perceive these factors were developed (Appendix 2). These items were designed to tap into various aspects of the factors. In order to verify the convergent and discriminant validity[25] of the survey items, a Q-Sort Analysis was conducted. Specifically, the analysis was intended to ensure that items in the survey were consistently grouped within particular factor categories, and ambiguous (fitting into more than one factor category) or indeterminate (fitting into no factor category) items eliminated. In the procedure, each item was printed on a card and all cards were then shuffled into random order. Ten judges[26] were asked independently to sort the cards into different categories and give them labels. As an attempt to minimize the potential of

[23] Flexibility means that addition or removal of channels will not require the replacement of the entire system. Interoperability and communicability mean that when a new channel is added, all it needs is to define the communication protocols, so that it can channel communication between the outside world and the existing internal network.

[24] A lot of Internet and voice responses are developed and maintained by different departments, and when they update their records, there is no consistency.

[25] An item is considered to demonstrate convergent validity with the related construct, and discriminant validity with the others if it is consistently placed within a particular category (Moore & Benbasat, 1991).

"interpretational confounding" [27], judges were not told what the underlying factors were. Instead they were asked to define their own labels (Moore & Benbasat, 1991).

Results of the Q-Sort Analysis are summarized in an Items Placement Matrix, which shows how measurement items were grouped and labeled by the judges (Appendix 3). Diagonal entries in the matrix show the number of items that were placed within the targeted categories, while the last column gives the percentage of correct placements. A high percentage can be considered as a high degree of construct validity. Off-diagonal entries on the other hand are the number of items that were placed outside targeted categories. If off-diagonal entries show clustering of items, there is potential that items were mis-classified. These items should then be re-examined and re-classified. If scattering of items occurs, items should be reworded or eliminated as they are too indeterminate or ambiguous to fit into any particular categories.

The result of the Q-sort Analysis is somewhat encouraging, not only because some categories have a very high percentage of correct placements, but also because for those categories that have a low percentage of correct placements, the problems were consistently caused by some particular items. These items were rephrased or eliminated from the survey.

Examination of the Items Placement Matrix has led to some changes to the survey items, as explained in Appendix 4. As a result, only 45 items were retained as potential factors to Internet banking decision and as ***initial predictors*** of the intent to adopt Internet banking. They have been hypothesized into 14 main ***antecedent factors***, as presented in the following table. Based on these changes, a survey was produced and distributed accordingly.

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[26] All judges are graduate students of University of British University, specializing in MIS and having certain degree of knowledge in construct validity.

[27] "Interpretational confounding occurs as the assignment of empirical meaning to an unobserved variable (*e.g.*, factor) other than the meaning assigned to it by an individual priori to estimating unknown parameters (Moore & Benbasat, 1991, P.200)."

Hypothesized Category	Hypothesized Antecedent Factor	Number of Survey Questions
Strategic Motivation	1. Business Needs	2
	2. Strategic Fit	2
	3. Goal Congruence	2
Valuation of Internet Banking	4. Perceived Efficiency as Delivery Channel	4
	5. Perceived Significance as Delivery Channel	3
	6. Business Opportunities	3
Customer Demand	7. Customer Behavior	4
	8. Customer Demographics	4
	9. Technical Capabilities of Using the Internet	3
Environmental Influences	10. Market Competition	4
	11. Regulatory Constraints	3
Operational Context	12. Service and Product Development	3
	13. Management Support	3
	14. Technical Challenges	5

Section 8 Theoretical Foundations

The discussion in the above sections has led to the formulation of the tentative research model as depicted in Figure 1, which focuses on the identification of the antecedent factors of Internet banking decision and on how these antecedent factors are affecting the intent level of adopting Internet banking. In context, this model draws on the theoretical framework of Theory of Planned Behavior (TPB) and integrates the concept of intention-based behavior.

An Application of TPB: The factors tested in this paper can be thought of as the constructs in a TPB-based model, as depicted in Figure 2 (Ajzen, 1988). TPB asserts that one's actual behavior is based on the behavioral intention and that behavioral intention is formed by three basic determinants: the attitude towards behavior, subjective norm and perceived behavioral control. The attitude towards behavior is defined as how the individual evaluates (*i.e., feeling of favorableness or unfavorableness*) performing the target behavior, while subjective norm refers to the individual's perception that most people who are important to him think he should or should not perform the behavior in concern. Perceived behavioral control is the perception of the ease of or difficulty in performing the behavior, which reflects the individual's perception of internal and external constraints or facilitators on the behavior. Generally speaking, an individual has a stronger intention to perform a behavior when he evaluates it positively, believes that significant

others think he should perform it, and perceives a high control over the factors that may prevent the behavior. As such, the factors in this study can be mapped to TPB constructs as follows.

TPB Constructs	Model Constructs Of This Study
Actual Behavior	• Actual adoption decision of Internet banking
Behavioral Intention	• Intent to adopt Internet banking
Attitude Towards Behavior	• Strategic Motivation (*i.e.*, Business Needs, Strategic Fit, Goal Congruence) • Valuation of Internet Banking (*i.e.*, Channel Efficiency, Business Opportunity)
Subjective Norm	• Channel Significance • Market Competition • Customer Demand (*i.e.*, Customer Behavior, Demographics and Technical Capabilities)
Perceived Behavior Control	• Regulatory Constraints • Operational Context (*i.e.*, Product and Service Development, Management Support, Technical Challenge)

The strategic motivation and valuation of Internet banking (except the perceived significance of Internet banking) are equated to the attitude towards behavior because they represent how Internet banking is evaluated in terms of perceived benefits and compatibility with existing needs, strategies and goals. Perceived significance of Internet banking, market competition and customer demand are aspects of subjective norm because they are the significant referents and pressures that urge banks to offer Internet banking. Regulatory constraints and operational difficulties are parallel to perceived behavior control because they are the perceived impediments and obstacles to Internet banking implementation.

As a matter of fact, the factors demonstrated in previous research to be significant factors of technological adoption can also be incorporated into the TPB framework, and related to the model constructs in this study. Table 1 compares these factors to the model constructs in this paper.

Individual Intention and Organizational Decision. In this analysis, bank executives were targeted as study subjects. In a fashion, the study is trying to use the adoption intention of the individuals to predict the intention at an organizational level. This approach is based on the premise that these bank executives have privileged access to the organization information and are the salient actors in Internet banking adoption decisions. They share a common set of organizing

principles about their roles, their organizations and the industry. Under such a shared system, they act with collective goals, visions and ideas in mind in a specific area, for example, about adoption of the Internet as a delivery channel. Their individual perspectives towards Internet banking directly influence their intent to act, which then translates into individual adoption decision. Such a collective intent to act will result in collective action, which eventually shapes the acts that are subscribed to the organization.

Independent Variable. In the qualitative study, 45 initial predictors were identified as the determinants of the Internet banking decision. They were also expected to have predictive power on the dependent variables, the adoption intent. However, they have not been directly measured against the dependent variables. Instead, they have been grouped into a smaller number of common antecedent factors that ultimately represented the independent variables of the model. In a statistical context, the model is exploratory because it intends to identify the actual factor structure by estimating the extent (*i.e.*, ***factor loadings***) to which the speculated initial predictors are related to the common antecedent factors, and generating ***"factor scores"*** to represent initial predictors on the common antecedent factors. This was achieved by factor analysis.

Dependent Variable. The ***"intent to adopt"*** Internet banking functions is the dependent variable of the model. The model was developed in such a way that it could discriminate the level of intent based on the independent variables, the antecedent factors. It was also speculated that the level of intent might vary with how the Internet would be adopted in business operations, which has been classified into five functional categories or ***"feature sets"*** of banking functions. That is, how the Internet can be used as an information delivery medium, a marketing tool, a value-added service, an account transaction platform, and an electronic commerce opportunity. In the analysis, the relationship between each feature set and the antecedent factors was examined.

Section 9 Survey

The survey was designed mainly to measure bank managers' perceptions of the decision factors of Internet banking and their level of intent to adopt Internet banking functions (Appendix 5). The level of intent was measured in Section 1. For each feature set, the level of adoption intent was estimated by several measurement items, each representing a banking function that can be offered via the Internet, as shown in Table 2. The classification scheme emerged from a consolidation of studies in functionality of Internet banking (Diniz, 1998; Booz, Allen & Hamilton Ltd.; Meridien Research Ltd. & Miller Freeman, 1997). Measurement items in Section 2 to Section 6 were

concerned with the decision factors. They all have been designed to find out how the initial predictors identified in qualitative study were perceived by bank managers. Section 7 was intended to solicit background information of the respondents, in which an item verifying respondents' knowledge in Internet banking development within their organization was also included.

As an effort to supplement the analysis on the decision factors, several ***"normative questions"*** were also included in each section of the survey, with the exception of Section 7. Responses to these questions were intended to provide a higher-level perspective of decision factors by identifying who it is who plays significant roles in "framing" the issues behind the factors. These questions were intended to uncover the influences that shaped bank managers' perceptions of the decision factors. Specifically, they were intended to identify who determines, regulates or polices the domain of issues associated with each factor. However, choices were restricted to those parties who the author believed to be influential elements in the issue domain[28], including respondents' organization, the banking industry, government, financial intermediaries and customers.

Section 10 Survey Sample

Sample Size. Based on a leading financial directory (Thomson Financial Publishing, 1997), a mailing list of 1237 individual banks or depository institutions was compiled as the survey sample, 246 from Canada and 991 from the USA. The 246 Canadian institutions included almost all the registered banks and depository institutions in Canada. They included domestic banks, foreign banks, credit unions and trust companies. Since the banking industry in the USA is characterized by the large number of banks of various sizes, only banks from the 1000-list were selected[29]. Targeted respondents were those senior bank executives who have the perceptive necessary to serve as knowledgeable informants about Internet banking development within their organization. This was verified by one question included in the survey.

Survey Response. The original surveys were first distributed in late February of 1999, which gave a response rate of about 10%. Follow-up letters were sent one month later, increasing the initial response rate by 1%. Because of this insignificant difference, an analysis of non-response bias has

[28] The selection was based on the personal judgement of the author in consideration of materials studied in qualitative study.

not been conducted. Of the 1237 surveys sent, 55 could not be delivered because of unknown addresses or unknown recipient, meaning that only 1182 surveys could be successfully delivered. Of the 1182 surveys sent, 132 responses were received, giving a response rate of 11%. However, of all the received responses, only 104 were usable. Reasons for non-usable responses mainly are: respondents' insufficient knowledge in Internet banking and respondents' refusal to participate. Response statistics are summarized as follows.

	Delivered Surveys	Responses	Response Rate	Usable Responses	Non-usable Responses
Canada	231	56	24%	42	14
USA	951	76	8%	62	14
Total	1182	132	11%	104	28

Section 11 Descriptive Statistics

11.1 Perception of Initial Predictors

The statistics in Table 3 provide an understanding of how the factors identified in the qualitative study were perceived by bank managers. Overall, the mean scores are very high in that most of them have a value greater than 3.5. *This can be interpreted in a way that these factors will, to a fairly significant extent, influence the Internet banking decision in the way they have been believed to. Therefore, in a sense, these factors do exist as factors that bank managers consider when implementing Internet banking.*

Some relatively higher scores have been reported in "Business Need", "Strategic Fit" and "Goal Congruence", meaning that implementing Internet banking could significantly satisfy a bank's business need, declared mission and organizational need. This suggests that the implementation of Internet banking is strategically motivated. The finding also suggests that the Internet is widely believed as an efficient channel in delivery banking services because the factor mean scores under "Perceived Efficiency" are also very high. Conversely, the factors under the category of "Regulatory Constraints" have a relatively lower mean score (*i.e.,* less than 3), implying that regulatory and legal issues relatively are not as much of a barrier as they were believed to be.

11.2 Level of Intent to Adopt Internet Banking

Table 4 summarizes the level of intent bank managers had in adopting particular Internet banking functions. As anticipated, the Internet has already been widely used as an "Information Delivery

[29] Several banks in the top-1000 list were not included in the sample because their addresses were not provided.

Medium" because a significant number of respondents have confirmed that the Internet is being used as a medium to provide information about their organization and branch location. There are also a fairly large number of adopters of functions in the feature set of "Marketing Tool", indicating that the Internet is also commonly adopted as a marketing tool. For those non-adopters in this feature set, the level of adoption intent is rather mixed and there is no dominant score. Of all functions under the category of "Value-added Services", those common functions like E-mail, hot-links and calculator mostly have already been provided. Of those functions that have not been offered, search engine, discussion group and software download have received a very low score of adoption intent.

Another important finding is that today more banks are offering more advanced functions through the Internet. More than 40% of banks surveyed in this study have already provided services in bill payment and fund transfer through the Internet. This contradicts previous research (Diniz, 1997) where only about 15% of studied banks had offered these two functions. Meantime, among those banks that do not have these functions on their website, the majority of them have indicated a very high level of adoption intent. It may be an indication that, in the near future, functions of these types will become basic features of Internet banking. Finally, Internet-based electronic commerce in banks is proved to be at an early stage because the number of adopters in this area is still very insignificant. Only a small percentage of respondents indicated a very high level of adoption intent.

11.3 Normative Responses

Table 5 summarizes the responses to the normative questions. Evaluation of the result is based on the physical count of choices made in the normative questions of each section. It is palpable that financial intermediaries and government, in general, do not have much influence in the issue domain associated with the decision factors, and the influence of the banking industry is mostly related to the issues in external environment. To a very great extent, these responses also indicate that customers and the bank itself are the ones who will most influence what issues would be considered when implementing Internet banking.

Internet Banking Functionality. In regard to the functionality offered through the Internet, customers were mostly recognized as the ones who would most influence the type of services that should be offered through the Internet (q2, q3)[30]. Meanwhile, the bank was believed to be the one

[30] Bracketed is the measurement item number of the survey.

who assumed the role in regulating the banking activities, making sure that Internet banking functionality was appropriately selected (q4).

Strategic Motivation. It was also believed that customers would most influence banks' Internet banking strategy because in the belief of bank managers, Internet banking strategy should be consistent with the needs of customers (q11, q12). Despite this, the bank was still the one who determined how the Internet banking should be strategically implemented (q13).

Valuation of Internet Banking. The results suggest that evaluation of Internet banking is strongly influenced by customers. That is to say, the value of Internet banking can be realized only if it is valuable to customers (q17). Even though the banking industry was believed to be the major source of ideas on improving the value of Internet banking (q18), it was still the customers who provided the necessary feedback for improvement of Internet banking services (q19).

Customer Demand. Overwhelmingly, the bank itself was believed to the one who would determine which Internet banking services could meet customer demand and how they might do that (q23, q24). But when bank managers were asked who would decide if the Internet banking services provided could meet customers' expectations, their choices were split between customers and banks (q25).

Environmental Influences. In this area, the responses were mixed. The banking industry and customers were believed to be influential elements in the external environment that banks should consider when making an Internet banking decision (q28). With regard to the party that would be able to provide information on how to best operate Internet banking, the banking industry, customers and banks themselves were all believed to have this ability (q29). As to the choice of the best indicator of problems in the external environment, the banking industry and customers were mostly chosen (q30).

Operational Context. It was believed that the banking industry, including banks themselves, was quite capable in identifying operational factors that would affect Internet banking decision (q34). But it was the banks themselves who would figure out and determine how the Internet banking site should be operated (q35). In determining if the Internet banking site was being operated in an effective way, customers could do so as well (q36).

Section 12 Model Validation: A Quantitative Analysis

12.1 Factor Analysis[31] on Initial Predictors

12.1.1 Objectives

There are three objectives for conducting a factor analysis. First, the qualitative study has produced a fairly large number of survey items (45), each of them could be treated as an initial predictor variable to the intent to adopt. So it makes sense to describe this large set of predictor variables in terms of a small number of factors for further analysis. Second, in order to study the individual contribution of each predictor variable in explanation of variance of dependent variables, factor analysis was used to mitigate possible multicollinearity among the initial predictor variables. A new set of uncorrelated independent variables was generated using factor analysis. Third, initial predictors identified in the qualitative study were pre-hypothesized into different groups based on the logical judgement of the author. Factor analysis was used to verify the clustering of the initial predictors.

12.1.2 Procedures

Approach. The approach of factor analysis in this study is exploratory in a sense that it is intended to identify the actual factor structure of Internet banking decision. It is a theory-generating study, rather than a theory-testing study. It is not a confirmatory study because predictor variables were identified based on literature review rather than on empirical foundation. The analysis attempts to determine how many common antecedent factors are present to affect the Internet banking decision, as well as the pattern of relationship between the common factors and the predictor variables.

Extraction of Provisional Factors. Principal component analysis was adopted to extract a set of uncorrelated provisional factors required by the factor analysis. In determining the number of significant factors that should be retained for further analysis, Kaiser's criterion was employed. In that, only factors with eigenvalues greater than 1 were retained.

Rotation Method. Orthogonal rotation was used because rotated new factors could remain significantly uncorrelated. Again, uncorrelated factors were desired in this study because of the intention of assessing contribution of individual factors to the dependent variables. Of all the orthogonal rotation methods, Kaiser's Varimax was adopted because this would allow factors to

[31] References on factor analysis are from Manly (1986) and Stevens (1996).

load high on a small number of predictor variables and low on other predictor variables. Quartimax was not chosen because it would make each predictor variable load mainly on one single factor and interpretation of factors would be more difficult (Stevens, 1996).

12.1.3 Results

Factor Structure. Eleven common factors were extracted from factor analysis. These common factors can be treated as empirically proved ***antecedent factors*** that bank managers will consider when implementing Internet banking. Output of the analysis is summarized in Tables 6 and 7. Table 6 presents the percentage of variance in predictor variables that is explained by the extracted provisional factors. As seen, these provisional factors in total can account for 70% of the total variance. The Factor Loading Matrix as given in Table 7 shows how the common factors have loaded into the predictor variables. ***Factor loadings*** in the matrix represent the correlation between the predictor variables and the common factors. High loading indicates that the predictor variable is highly related to the factor.

Reliability of the factors extracted was also examined. It was suggested that factors with 4 or more loadings above 0.6 in absolute value were reliable, regardless of sample size (Stevens, 1996). Even though there are several factors that just have 3 loadings, the author still concludes that they are reliable because their loadings are very high, and some of them have loading greater than 0.8. However, Factor 11 is still considered unreliable because it only has 2 loadings. Overall, about 80% of all the highest loadings has a value greater than 0.6 (many of them even have loading greater 0.8), indicating that the common factors are reliable in representing the predictor variables. Furthermore, the communality of most predictor variables is very high, with a mean of 0.73. That is to say, most of the variance of the predictor variables can be accounted for by these eleven common factors. It can be concluded that these eleven common factors effectively represent the predictor variables and can be used as the independent variables for further analysis.

Examination of the result has also led to the conclusion that the grouping of predictor variables to a great extent is consistent with the way they were pre-grouped initially. For example, measurement items from q6 to q10 in the survey were grouped to measure "Strategic Motivation", which now cluster together and tap into the common Factor 1; measurement items from q27a to q27c, which were pre-grouped as "Regulatory Constraints", now are represented by the common Factor 7; all measurement items (q32a to q32c) under the group of "Management Support" now hang around the common Factor 8. This confirms the initial factor structure from

the proposed model. The final grouping of the predictor variables and labeling of the obtained common factors are now concluded in the following table.

Predictor Variable (Measurement Items)	Common Factor Loaded	Label
q6-q10, q15c, q16a – q16c	Factor 1	Strategic Motivation and Business Opportunity
q14a – q14d	Factor 2	Perceived Efficiency of Internet Banking
q21a – q21d, q20c-q20d	Factor 3	Customers' Demographics, Perceived Usefulness and Ease of Use of Internet Banking
q33a – q33e	Factor 4	Technical Challenge
q22a – q22c	Factor 5	Customers' Technical Capabilities of Using the Internet
q15a – q15b, q26d	Factor 6	Perceived Significance of Internet Banking, Timing of Market Entry
q27a – q27c	Factor 7	Regulatory Constraints
q32a – q32c	Factor 8	Management Support
q31a – q31c	Factor 9	Service and Product Development
q26a – q26c	Factor 10	Market Competition
q20a – q20b	Factor 11	Customers' Prior Experiences in Using the Internet and Perceived Risk in Using Internet Banking

Factor Scores: In order to make the results of factor analysis usable as independent variables for further analysis, factor scores for each observation have also been estimated[32]. Factor score is an indication of relative importance of the factor to each observation. Higher value represents higher importance. They were used as the independent variables in discriminant analysis as discussed in the subsequent section. The estimated factor scores have also been proved to be uncorrelated and normally distributed[33]. Uncorrelated factor scores allow the assessment of contribution of individual factors to the intent to adopt Internet banking functions. Normality is an underlying assumption required by discriminant analysis.

12.2 Discriminant Analysis[34]

12.2.1 Objectives

In discriminant analysis, factor scores estimated from factor analysis were used as independent variables to discriminate bank managers' intent level to adopt Internet banking. Specifically, it achieves two objectives. In an explanatory context, it determines which of the common factors have contributed most to discriminating among groups of "intent to adopt". This is concerned with identifying certain linear discriminant functions that separate groups with different levels of intent to adopt Internet banking. In a predictive context, the result of the discriminant analysis will allow assignment of new observations to one of the "intent to adopt" groups based on observations' resultant factor scores.

[32] Estimation of factor scores involves matrix transformation that is usually handled by statistical software. SPSS was used in this study.

[33] For correlation, Pearson and Spearman tests were used. For normality, Normal Probability Plot was used.

12.2.2 Procedures

Underlying Assumption. The optimality of discriminant analysis is conditional upon two assumptions. The first is the multivariate normality of independent variables. In definition, when the independent variables being studied appear to be normally distributed, then it is assumed that the joint distribution is also multivariate normal (Manly, 1986). Fulfillment of this requirement has already been confirmed in factor analysis, it so will not be discussed in the following sections. The second assumption is the equal within-group covariance matrix. That is, the covariance matrix of the dependent variables in each group must be identical, meaning that group dispersion structure across groups must be equal. To test this requirement, the ***Box's M Test*** has been used in this study, in which the *null hypothesis* is equal covariance matrices between groups.

Prior Grouping of "Intent to Adopt". Discriminant analysis involves deriving linear combinations of independent variables that will discriminate between the ***"prior defined"*** groups. Therefore, as a preliminary procedure to the analysis, each observation has to be assigned into a mutually exclusive group. In this study, groups have been defined according to the ***"response category"*** respondents would assign to each item measuring their level of intent to adopt Internet banking. The response categories were represented by a rank of scores in a 5-point Likert-scale, in which scores of 1 and 5 respectively represented a very low and very high level of intent. Since it was also expected that some banking functions might have already been adopted by the respondent's organization, an extra score of 6 was created to represent such a group.

It must be noted that scores used here only represent the level of "intent to adopt" ranked by respondents, and that this 6-categorical-score is not an interval scale. No conclusion can be drawn about the meaning of distance between scale positions, and it can only be interpreted in a way that, for example, score 6 represents an intent level higher than that of all other scores, but not indicating how much higher it is. It is simply an ordinal scale that allows respondents to rank their intent to adopt. It is also because of that a respondent's scores could be totaled, *i.e.,* "summated rating scale" (Moser, 1972), and averaged to give a mean rank that represented its attitude towards Internet banking adoption. In such a measuring process, the respondents' overall responses to each feature set of Internet banking functions (*e.g.,* "Marketing Tool") were measured by their "total score", which was the sum of the scores of the categories they had endorsed for each of the measurement items in the feature set. The total score then was averaged,

[34] References on discriminant analysis are from Marcoulides & Hershberger (1997), Manly (1986), Dillon & Goldstein (1984), and Pedhazur (1982).

producing a mean score ranging from 1 to 6. Based on this mean score, the ***categorical group of intent*** of the observation for **each** feature set could be decided.

Categorical Groups of Intent. In the original plan, responses would be categorized into 5 groups because respondents' mean scores could fall into one of the five equal intervals between 1 and 6. However, in the analysis, respondents were classified into three groups in such a way that each group would have roughly an equal number of observations. There were two reasons for not having five categorical groups of intent level. First, the number of survey responses was not large enough (about 100) to produce sufficient number of observations for all groups of intent. Second, the mean scores obtained were not evenly distributed between 1 and 6. For example, in the feature set of "Account Transaction Platform," there was no score falling into the interval between 2 and 3, while the interval between 5 and 6 had 49 observations (*i.e.,* about 49% of total number of observations). Details of frequency distribution of mean scores can be referred to in Table 8. This uneven distribution in the number of observations would easily violate the assumption of equal within-group covariance matrices[35]. Having an equal number of observations in each group will increase the chance of having equal covariance matrices.

Grouping Procedure. The grouping procedure placed all observations according to their mean scores, so that each of them would be assigned a percentile position. Based on the percentile position, observations could be assigned into different groups. The first group then was defined in such a way that it would include all the observations whose percentile position was in the first 33 percentile. In other words, the first group would have all observations with lowest self-assessed mean scores. The second group was defined similarly so that it would have all observations positioned between the 33rd and the 67th percentile. Eventually, the third group had the remaining observations. The definition of the final three groups is given as follows.

Categorical Group	Definition
Group 1	Observations whose ranked position was in the first 33 percentile
Group 2	Observations whose ranked position was between the 33rd percentile and the 67th percentile
Group 3	Observations whose ranked position was in the last 33 percentile.

[35] An attempt had been made to run a discriminant analysis on 5 intent groups, but was not successful because the requirement of equal covariance matrices has been seriously violated. No discriminant functions could be significantly derived.

Table 9 summarizes the range of mean scores that has been included in each of the defined groups. It is very important to note that the mean score only represents the level of intent self-assessed by the respondents, and is a "response category" assigned by the respondents themselves.

Number of Discriminant Functions. The main goal of discriminant analysis is to construct several ordered and uncorrelated discriminant functions of independent variables, which can account for the differences in the dependent variables. Of all the functions, the first function will account for most of the group differences. The second function will capture as much as possible of the group differences not captured by the first function. The third function will account for most of the residual group differences not explained by the first two functions, and so forth. However, only those functions that can significantly account for the group differences will be retained. In this study, ***Wilks' Lambda Test*** was used to determine what functions should be retained. A brief description of this test procedure is included in Appendix 6.

12.2.3 Results

The result of the Box's M Test and Wilks' Lambda Test are summarized in the following table.

Feature set of Banking Function	**Box's M Test**		**Wilks' Lambda Test**		
	Test Result *	**Significance Level**	**Test Result ***	**Significance Level**	**% of variance DF explains**
Information Delivery Medium	Ho is rejected; Insufficient evidence to support that covariance matrices are the same	0.014	Ho is accepted at the 1st step; No discriminant function is retained; Insufficient evidence to support that at least one DF is significant	0.107	No significant discriminant function.
Marketing Tool	Ho is accepted; Insufficient evidence to support that covariance matrices differ	**0.545**	Ho is accepted at the 1st step; No discriminant function is retained; Insufficient evidence to support that at least one DF is significant	0.232	No significant discriminant function.
Value-added Services	Ho is accepted; Insufficient evidence to support that covariance matrices differ	**0.860**	Ho is rejected only at the 1st step; Only the 1st discriminant function is significant to describe group differences.	**0.003**	93%
Account Transaction Platform	Ho is accepted; Insufficient evidence to support that covariance matrices differ	**0.124**	Ho is rejected only at the 1st step; Only the 1st discriminant function is significant to describe group differences.	**0.001**	77%
Electronic Commerce Opportunity	Ho is accepted; Insufficient evidence to support that covariance matrices differ	**0.839**	Ho is rejected only at the 1st step; Only the 1st discriminant function is significant to describe group differences.	**0.002**	76%

(* tested at an alpha level of significance of 0.05)

Evaluating Equality of Covariance Matrices. The underlined and bolded significance value in Box's M Test indicates that the null hypothesis is accepted, meaning that there is insufficient evidence to suggest that covariance matrices are different. In other words, the group covariance matrices are assumed to be the same. Among all the tests, only the one for "Information Delivery Medium" could not satisfy the requirement of equal covariance matrices. It can be explained by the fact that the majority of respondents had already adopted Internet banking functions in this feature set, making even distribution of the number of observations in each group impossible. Details of the frequency distribution can be found in Table 8.

Evaluating Significance of Discriminant Function. The underlined and bolded significance value in Wilks' Lambda Test indicates that the null hypothesis is rejected, meaning that there is insufficient evidence to support that all discriminant functions are not significant. In other words, at least one discriminant function is significant. The test results show that discriminant function can only be derived for the feature set of "Value-added Services", "Account Transaction Platform" and "Electronic Commerce Opportunity". *This finding has indicated well that the antecedent factors identified do not discriminate bank mangers' level of intent to adopt the Internet as an "Information Delivery Medium" and a "Marketing Tool".* One possible explanation is that these two feature sets have already been widely adopted by banks as basic and undifferentiated features, regardless of how they perceive Internet banking. On the contrary, *the antecedent factors are able to discriminate bank managers' level of intent to adopt the Internet as "Value-added Services", an "Account Transaction Platform" and an "Electronic Commerce Opportunity".* It is also clear that for all of these feature sets, there exists only one discriminant function that can significantly discriminate the intent to adopt, which in all cases can explain a very high portion of group differences. The lowest percentage is 76% while the highest reaches 93%.

Evaluating Individual Contribution. Assessment of individual contribution of antecedent factors to the level of intent is based on the respective ***"discriminant loadings"***, which are represented by the coefficients of structure matrix produced from discriminant analysis. Discriminant loading is the **simple correlation** between each independent variable and the discriminant function, and an indication of relative importance of the antecedent factors on the discriminant function. High discriminant loading means that the factor contributes significantly to the discriminant function. With respect to the concern of how large a discriminant loading should be considered as

meaningful, it is only a matter of opinion. However, as suggested by Pedhazur (1982), only loadings equal to or greater than 0.3 should be treated as meaningful.

As discussed above, based on the antecedent factors, discriminant analysis was unable to discriminate the group differences in level of adoption intent for the feature sets of "Information Delivery Medium" and "Marketing Tool". Therefore, analysis of the individual contribution of the factors was only carried out on the remaining three feature sets. The obtained structure matrices of these three feature sets are now consolidated into one matrix, as depicted in the following table.

Consolidated Structure Matrix

Antecedent Factor		Discriminant Loading		
		Value-added Services ($p < 0.003$)	Account Transaction Platform ($p < 0.001$)	Electronic Commerce Opportunity ($p < 0.002$)
1.	Strategic Motivation and Business Opportunity	-0.091	-0.248	0.221
2.	Perceived Efficiency of Internet banking	-0.024	0.252	-0.060
3.	Customers' Demographics and Perceived Usefulness and Ease of Use of Internet Banking	-0.115	-0.069	0.155
4.	Technical Challenge	-0.241	**-0.381**	-0.074
5.	Customers' Technical Capabilities of Using the Internet	-0.041	-0.168	-0.193
6.	Perceived Significance of Internet Banking & Timing of Market Entry	0.244	**0.340**	**0.453**
7.	Regulatory Constraints	-0.120	-0.204	-0.043
8.	Management Support	0.214	0.255	**0.385**
9.	Service and Product Development	**0.604**	0.265	**0.448**
10.	Market Competition	0.223	0.193	0.054
11.	Customers' Prior Experiences in Using the Internet and Perceived Risk in Using Internet Banking	-0.199	-0.233	-0.147

Discriminant loadings with an absolute value greater than 0.3 are underlined and bolded. In the feature set of "Value-added Services", there is a high loading (0.604) in the antecedent factor of "Service and Product Development", indicating that this factor significantly contributes to the discrimination. That is, the issues of product and service development are critical to discriminating the intent to adopt the Internet to provide more value-added services to customers.

For the feature set of " Account Transaction Platform", "Technical Challenge", "Perceived Significance of Internet Banking" and "Timing of Market Entry" all have mild influence in discriminating the level of intent, but differently. The negative value in "Technical Challenge" is interpreted in a way that the technical issues will negatively affect the degree of adoption intent, thus existing as a barrier to the adoption. This suggests that the higher the challenge the technical issue is perceived to present, the lower the intent bank managers have in adopting the Internet as a

platform for account transactions. This is quite reasonable because the support of account transactions through the Internet requires a relatively higher level of interactivity and a higher security standard. Loadings in perceived significance of Internet banking and timing of market entry suggest that bank managers will have a higher intent to adopt the Internet to support account transactions on-line if they perceive the Internet as a significant channel or believe that being an early adopter of Internet banking is strategically important.

For the feature set of "Electronic Commerce Opportunity", three antecedent factors contribute to the differences in the level of intent. They are "Service and Product Development", "Perceived Significance and Timing of Market Entry" and "Management Support". Their influence in discriminating the intent level is much higher than that of other factors, with a loading of 0.448, 0.453 and 0.385 respectively. Loadings in "Management Support" suggest that participation in electronic commerce requires stronger support and commitment from management. It may be because electronic commerce for banks is still at an experimental stage and its benefits in the near future are yet to be realized. The more management support provided in this area, the higher the intent level bank managers have.

Evaluating Classification Accuracy. This study uses the hit rate to evaluate classification accuracy, which is simply the proportion of the observations correctly classified into the group they come from. Two methods have been used. The first is a ***straightforward approach***, which is simply to re-substitute all observations' resultant factor scores into the discriminant functions obtained. However, this method tends to have a bias in favor of allocating observation to the group that it really comes from because the observation has helped determine that mean score of the group. Therefore, classification of this type always gives a slightly higher number of correct classifications than the other, which is called ***cross-validation method***. Cross-validation classification is a "leave-one-out" approach, in which the discriminant functions are derived N times, each time leaving out one observation. The discriminant functions derived without using this observation are used to classify the observation. The hit rate then is the percentage that the "left-out" cases are correctly assigned. This method can provide a relatively unbiased estimate of classification accuracy because the observation classified has been held out from estimation of the discriminant functions. Classification results from both methods are summarized in the following table.

Classification Result

Feature Set	Percentage (hit rate) and number of correct classification							
	Straightforward Classification				Cross-validation			
	Group 1	Group2	Group 3	Total	Group 1	Group 2	Group 3	Total
Value-added Services	63.6% (21/33)	54.8% (17/31)	66.7% (22/33)	61.9% (60/97)	48.5% (16/33)	29% (9/31)	57.6% (19/33)	45.4% (44/97)
Account Transaction Platform	80% (24/30)	63% (17/27)	52.5% (21/40)	63.9% (62/97)	60% (18/30)	29.6% (8/27)	47.5% (19/40)	46.4% (45/97)
Electronic Commerce Opportunity	70% (21/30)	45.2 (14/31)	64.7% (22/34)	60% (57/95)	56.7% (17/30)	32.3 (10/31)	47.1% (16/34)	45.3 (43/95)

The straightforward method provided satisfactory discriminating power of the discriminant function because the average hit rate for all feature sets is equal to or greater than 60%. The classification accuracy is lower if the cross-validation method is adopted. Although the perception of an acceptable hit rate is rather subjective, the hit rate obtained by straightforward option is generally acceptable. The rate in cross-validation is somewhat lower, but still higher than in random choice.

Section 13 Summary

What are the antecedent factors? The descriptive statistics in Table 3 suggests that all the potential factors identified in the qualitative study are significant factors that bank managers will consider when making Internet banking decisions, except those under the category of "Regulatory Constraints", which are relatively less important when compared to others. The factor analysis also confirms that these potential factors can be well represented by eleven unique and major factors, namely 1) strategic motivation and business opportunity, 2) perceived efficiency of Internet banking, 3) customers' demographics, and perceived usefulness and ease of use of Internet banking, 4) technical challenge, 5) customers' technical capabilities of using the Internet, 6) perceived significance of Internet banking and timing of market entry, 7) regulatory constraints, 8) management support, 9) service and product development, 10) market competition, and 11) customers' prior experiences and perceived risk in using the Internet.

How are the antecedent factors related to adoption intent? Despite the conclusion that there are eleven major factors influencing bank managers' Internet banking decisions, not all of them are able to discriminate their level of intent to adopt particular Internet banking functions. As found, only several factors, *i.e.*, product and service development, management support, technical difficulties, and perceived significance of Internet banking and timing of market entry, have the

discriminating power. The findings also show that the influences of these few factors to the discriminating power vary according to the types of Internet banking functions that are intended to be offered via the Internet. Individual influence of these factors to the intent level is shown in the following table.

	Degree of Discriminating Power		
	Feature Set of Internet Banking Functions		
Antecedent Factor	**Valued-added Services**	**Account Transaction Platform**	**Electronic Commerce Opportunity**
Perceived Significance of Internet Banking & Timing of Market Entry	Insignificant	Moderate	Moderate
Service & Product Development	Strong	Insignificant	Moderate
Management Support	Insignificant	Insignificant	Moderate
Technical Challenge	Insignificant	Moderate	Insignificant

Hypotheses Conclusion. The results from discriminant analysis suggest that, at an alpha level of significance of 0.05, there is insufficient evidence to support the proposed hypothesis **H4, H10, H12, H13** and **H14**, leading to the following conclusions.

- **(H4):** The perceived significance of the Internet as a delivery channel is influential to banks' intent to adopt the Internet as a platform for account transactions ($r = 0.34$, $p < 0.001$) and an electronic commerce opportunity ($r = 0.45$, $p < 0.002$),
- **(H10):** The timing of market entry into the Internet banking market, which is a form of competitive threat, is influential to banks' intent to adopt the Internet as an account transaction platform ($r = 0.34$, $p < 0.001$) and an electronic commerce opportunity ($r = 0.45$, $p < 0.002$),
- **(H12):** The issues of service and product development on the Internet environment are influential to banks' intent to adopt the Internet as value-added services ($r = 0.60$, $p < 0.003$) and an electronic commerce opportunity ($r = 0.45$, $p < 0.002$),
- **(H13):** The level of management support is influential to banks' intent to adopt the Internet as a business opportunity in electronic commerce ($r = 0.39$, $p < 0.002$),
- **(H14):** Technical issues are influential to banks' intent to adopt the Internet as a platform for account transactions ($r = -0.38$, $p < 0.001$).

On the other hand, the results do not provide sufficient evidence to reject the hypothesis that the strategic motivation **(H1, H2, H3)**, the perceived efficiency of the Internet as a delivery channel **(H5)**, the perceived business opportunity Internet banking can provide **(H6)**, customer demand **(H7, H8, H9)**, and regulatory challenges **(H11)** are not influential to banks' intent to adopt the Internet as an information delivery medium, a marketing tool, value-added services, an account transaction platform and an electronic commerce opportunity.

A revised model. To translate the findings into graphical presentation, a revised model of Internet banking adoption is created, as depicted in Figure 3. This revised model shows how the antecedent factors are related to the intent to adopt particular feature sets of Internet banking functions, in which the degree of relationship is indicated by the coefficient of correlation.

Section 14 Conclusions

Interference of Adoption Intent. A mapping of the factors in the revised model and the TPB constructs (as shown in the following table) reveals that discrimination of adoption intent of Internet banking is not a function of attitudinal factors, and only the subjective norm and the perceived behavioral control have the discriminating power.

TPB Construct	Discriminating Factor	Non-discriminating Factor*
Attitude Towards Behavior	Nil	Strategic Fit, Business Need, Goal Congruence, Perceived Efficiency, Business Opportunity
Subjective Norm	Timing of Market Entry, Perceived Significance	Customer Demand
Perceived Behavior Control	Product and Services Development, Management Support, Technical Challenges	Regulator Constraints

** Factors that do not discriminate the adoption intent*

This is a very surprising result because factors parallel to attitude towards behavior are all non-discriminating factors. These factors indeed are the perceived value of Internet banking and can be directly equated to the relative advantage and compatibility with the existing organizational values. This contrasts with the findings of many studies (O'Callaghan et al., 1992; Grover, 1995; Iacovou et al., 1995; Premkumar & Ramamurthy, 1995, i & ii; Chwelos et al., 1999) and the fundamental diffusion theory (Roger, 1985) that the perceived relative advantage and compatibility are two basic determinants of adoption behavior. One possible indication for such a situation is that the benefits of Internet banking and its consistency with strategic vision have already been recognized by banks, and have generally become primary initiatives in Internet banking adoption. But such adoption intent is interfered by the perception of the external pressure (*i.e.,* subjective norm) and the perceived obstacles in Internet banking implementation (*i.e.,* perceived behavior control).

In subjective consideration, external pressure plays a role in recognizing the significance and the legitimacy of the Internet as an integral component of delivery system, and the importance of being an early adopter of Internet banking. In other words, Internet banking is being institutionalized in the banking delivery system, just like what happened to ATM. As indicated, the greater the perceived market pressure, the greater the intent to adopt.

In perceived behavior control, banks' adoption intent is disrupted by some factors that are beyond their control. The level of intent will depend on such factors as the requisite resources in Internet banking implementation. These factors are specific to the difficulties in developing appropriate products and services on the Internet environment, to the technical challenges associated with the implementation and to the lack of support from the senior management. Subject to these obstacles, banks are unlikely to form a strong behavior intention to adopt even if they hold a favorable attitude towards Internet banking. So, it leads to a conclusion that for adoption intent of Internet banking, attitudinal considerations are relatively less important than normative considerations and behavioral control factors.

Significant and Discriminating Factors: It is necessary to point out that the results do not suggest that non-discriminating factors are not significant to banks' Internet banking decisions. For example, Table 3 reveals that almost all bank managers believed that Internet banking could significantly satisfy business need (more than 90% of respondents assigned scores of 4 or 5 in this factor), indicating that such a belief has already become a common attitude towards Internet banking. But, based on this, it is difficult to discriminate banks' adoption intents. What really discriminates the adoption intent is the relative importance of other factors (*i.e.*, discriminating factor) that vary from one bank to another. The significance and discriminating power of a factor in adoption behavior so are two different perspectives. The distinction is very important because the number of factors identified in the banking literature is so large that it is hard to draw conclusions on which factors can explain the differences in adoption behavior among banks. The distinction helps clear up such confusion by revealing what factors really exist as barriers or facilitators in adoption intent. Therefore the results should be interpreted in a way that the discriminating and non-discriminating factors together explain the importance of the factors to Internet banking decisions, while the discriminating factors mediate the effect of non-discriminating factors and explain the differences in the level of adoption intent among banks.

Competitive Differentiation. It is also surprising to see that strategic motivation fails to explain the difference in adoption intent, even though a significant majority of banks believed that Internet banking could satisfy business needs, strategic missions and organizational goals. A deeper analysis leads to the explanation that these benefits are now considered to be basic expectation from offering Internet banking. This confirms that Internet banking is no longer a competitive advantage, but a competitive necessity, and has evolved from a strong "competitive differentiator" to a basic and expected service (US Web Services, 1997). Offering Internet banking does not sharpen a bank's competitive edge, but not offering it will be a competitive disadvantage. However, this is not the end of the story. The competitive implication of Internet banking is still changing. It is not a simple matter of whether or not banks should adopt the Internet as a delivery channel, but a consideration of how to appropriately and creatively apply technology (the Internet) into operations, thus meeting the needs of customers in the changing environment, exploring more market opportunities, and creating a new set of competitive advantages. For example, making use of the inherent capabilities of the Internet in building a sophisticated customer base and tracking customer's banking behavior, thereby developing a better system that can be efficiently adjusted to the changing need of customers. These capabilities will be where banks can develop competitive differentiation and advantages. Again, examples given here do not suggest that they can always differentiate one bank from another because a differentiated product today will soon become a commodity product tomorrow. It is the ability to best use technology that allows a bank to create competitive advantages.

Implications for Practitioners. An interesting issue that surfaced in the results is the importance of operational issues *(i.e., product and service development, technical challenges and management support)* to adoption intent. It may be a good indication that one major impediment to Internet banking adoption indeed exists within a bank's internal environment. Therefore, it will be useful to probe deeper into the aspects of these issues and study the factors that inhibit the adoption of Internet banking.

As revealed, difficulty in product and service development does not emerge from account transaction activities, but is about services extended beyond traditional banking activities. This may indicate that banks are more concerned with the development of non-banking services and products than core-banking activities, such as funds transfer, balance inquiry and bill payment. It is likely because core-banking activities are standard features in a traditional service menu that they do not provide much potential for differentiation. Therefore, product differentiation does not

come from the core-banking activities, but is achieved through non-banking services. Perhaps it is these services that lead to the competitive differentiation and make Internet banking more valuable and attractive to customers. Accepting this premise, it can be concluded that what differentiates a bank from others in competitive context is not the technology itself (the Internet). Rather, it is the way the bank applies technology to product development.

A closer look into survey responses on "Technical Challenges" reveals that security of the Internet is still a significant fear that banks have. In the author's opinion, security issues of Internet banking should be addressed as a psychological obstacle rather than a technical challenge because security technology (*e.g.,* the use of 128-bit encryption, firewall and digital certificate) in the past few years has already greatly advanced. Banking transactions conducted through the Internet are now very secured. So, the fear is not particularly realistic, and it is likely to be the case that banks have little information about the issues. Therefore, when considering Internet banking, banks may first need to deal with the psychological fear of security issues, but not the security risk itself. This psychological barrier can be removed if more awareness of the security of Internet banking is generated among banks, not just customers.

In the light that management support is a crucial element in adoption intent, top management should be more aware that their involvement, commitment and vision about Internet banking may encourage an earlier adoption decision. As noted earlier, research has proved that early technological adoption could be traced to the critical role played by champions (Reich & Benbasat, 1990; Premkumar and Ramamurthy, 1995, i & ii; Grover, 1995). This therefore suggests that it is imperative to develop initiatives at senior management level. The more management support given to the Internet banking implementation, the fewer obstacles bank managers will anticipate, leading to a stronger adoption intent.

Section 15 Research Contributions

This study is distinctive in several ways. First, it demonstrates that in addition to customer demand, Internet banking decision is also based on strategic, perceptual, environmental and operational considerations. This helps explain the low adoption rate of full functionality of Internet banking despite the promising customer demand in the future. Second, the study provides some perspectives into the influences of the supply side (*i.e.,* the bank) on Internet banking adoption, hence supplementing and consolidating previous studies in the demand side (*i.e.,* the customer). Third, the model reveals the pattern of relationship between the adoption intent and

decision factors of Internet banking, giving insights into the current barriers and facilitators in Internet banking implementation. It also suggests that adoption rate of Internet banking will be increased if banks are provided with solutions to the operational difficulties collateral to implementing Internet banking. Finally, since the adoption of Internet banking is a business decision enabled by IT (*e.g.*, adopting the Internet as a strategy of marketing banking products and services), the model in a way correlates the adoption of IT with business strategy, advancing scholarly knowledge in notions of "fit" between IT adoption and business strategy. That is, what factors are governing the application of IT to business operations.

Section 16 Limitations

Some limitations of this study have to be noted. First, the response rate of the survey was rather low, giving a fairly small number of observations for quantitative analysis. This makes it difficult to differentiate the results between banks of different sizes. That is, it is unable to identify the influence of organizational size on adoption intent of Internet banking. In this aspect, it has to be pointed out that organizational size may also be a strong predictor of technological adoption because it may imply differentiation of resource availability.

Second, the scope of the study is limited to the retail banking sector. Adoption of the Internet as a delivery channel in corporate banking was not examined. As believed, adoption decision for corporate banking may require a different set of considerations because corporate banking is relatively more customer-relationship emphasized and corporate clients may demand more custom-developed services and products.

Third, the study is unable to differentiate the results between adopters and non-adopters of Internet banking because it is difficult to generalize a respondent as an adopter or non-adopter, unless the respondent has adopted either none or all of the Internet banking functions as represented in this study. Among all the responses received, there is a very limited number of cases indicating that the respondent is not offering any Internet banking function, and no case that the respondent is providing all Internet banking functions.

Finally, there is a danger that some significant factors have not been included in the model because all model factors were mainly based on literature review specifically related to the banking industry. Factors identified in previous research, although conducted in other industries, may also play a critical role in the adoption of Internet banking and could be model constructs.

Table 1: Comparison of Findings with Previous Research

TPB Constructs	Model Factor	Factor Supported from Previous Research
Attitude Towards Behavior	• Business Needs • Strategic Fit • Goal Congruence • Channel Efficiency • Business Opportunity	• Relative Advantage (O'Callaghan et al., 1992; Premkumar & Ramamurthy, 1995, ii) • Perceived Benefits (Iacovou et al., 1995; Chwelos et al., 1999) • Internal Needs (Premkumar & Ramamurthy, 1995, i) • Compatibility (Premkumar & Ramamurthy, 1995, ii; Grover, 1995)
Subjective Norm	• Channel Significance • Market Competition • Customer Demand (i.e., Customer Behavior, Demographics and Technical Capabilities)	• External Pressures (Iacovou et al., 1995; Chwelos et al., 1999) • Customer Power and Supplier Trust (Hart & Saunders, 1998) • Competitive Pressure, Exercise Power of Trading Partners (Premkumar & Ramamurthy, 1995, i) • Being an early adopter (Premkumar & Ramamurthy, 1995, ii) • Competitive Threat, Customer Bargaining Power (Reich & Benbasat, 1990) • Customer Resistance, Depersonalization Fear (Barras, 1986)
Perceived Behavior Control	• Regulatory Constraints • Operational Context (i.e., Product and Service Development, Management Support, Technical Challenge)	• Economical, Regulatory, Legal, Institutional, Political Barrier (Barras, 1986) • Regulatory Environment (Burke, 1996) • Organizational Readiness (Iacovou et al., 1995; Chwelos et al., 1999) • Top Management Support, Championship (Premkumar & Ramamurthy, 1995, i & ii; Reich & Benbasat, 1990; Grover, 1995)

Table 2: Classification of Banking Functions in the Internet

Feature Set of Functionality	Definition	Measurement Item
Information Delivery Medium[36]	Offering general information of the organization	• Corporate information • Press release • Branch location
Marketing Tool	Offering product information or launching promotional campaign	• Advertisement • Offers announcement • Loans, investment & account application
Value-added Services	Providing extra services to create, maintain or improve customer relationship	• E-mail & suggestion forms • Search engine • Hot links to other sites • Discussion group • Calculator • Investment Advisor • Software download
Account Transaction Platform	Allowing customers to access account information and conduct banking transactions on-line	• Balance inquiry • Statement request • Transaction history • Bill Payment • Funds Transfer
Electronic Commerce Opportunity	Offering Web-based businesses	• Stock & mutual fund trading • Electronic Cash • Bill presentment • Smart Card • Digital Certificate

Remarks: Classification of banking functions is defined in consideration of the following 3 studies.

1. Diniz (1998): 121 bank sites from the USA were studied. About 20% were banks with assets greater than $10 billion, more than 30% between $500 million and $10 billion, and 47% below $500 million.
2. Booz, Allen & Hamilton (1997): 1240 retail banking sites around the world were visited.
3. Meridien Research (1997): over 50 of the top brokerages, banks and insurance companies in the USA were surveyed.

[36] Recruitment form was also a measurement item in the survey, but was dropped because it is irrelevant to customers' banking activities.

Table 3: Frequency Distribution of Evaluation Score on Initial Predicators

Initial Predictors/ Measurement Item No.	Score 1 Count	%	2 Count	%	3 Count	%	4 Count	%	5 Count	%	Mean Score
Business Need											
q6	1	0.97	1	0.97	9	8.74	29	28.16	63	61.17	4.48
Strategic Fit											
q8	2	1.94	0	0	13	12.62	32	31.07	56	54.37	4.36
Goal Congruence											
q10	1	0.96	4	3.85	11	10.58	37	35.58	51	49.04	4.28
Perceived Efficiency as delivery Channel											
q14_a	1	0.96	6	5.77	9	8.65	50	48.08	38	36.54	4.13
q14_b	2	1.92	0	0	7	6.73	33	31.73	62	59.62	4.47
q14_c	1	0.96	0	0	7	6.73	42	40.38	54	51.92	4.42
q14_d	3	2.88	9	8.65	27	25.96	25	24.04	40	38.46	3.87
Perceived Significance as Delivery Channel											
q15_a	4	3.85	27	25.96	27	25.96	33	31.73	13	12.5	3.23
q15_b	1	0.96	7	6.73	22	21.15	49	47.12	25	24.04	3.87
q15_c	1	0.96	1	0.96	9	8.65	38	36.54	55	52.88	4.39
Business Opportunity											
q16_a	2	1.92	5	4.81	22	21.15	42	40.38	33	31.73	3.95
q16_b	4	3.88	6	5.83	25	24.27	51	49.51	17	16.5	3.69
q16_c	5	4.85	10	9.71	41	39.81	33	32.04	14	13.59	3.4
Customer Behavior											
q20_a	3	2.94	10	9.8	16	15.69	46	45.1	27	26.47	3.82
q20_b	3	2.94	9	8.82	31	30.39	29	28.43	30	29.41	3.73
q20_c	2	1.96	1	0.98	20	19.61	48	47.06	31	30.39	4.03
q20_d	2	1.96	3	2.94	21	20.59	40	39.22	36	35.29	4.03
Customer Demographics											
q21_a	5	4.81	11	10.58	37	35.58	38	36.54	13	12.5	3.41
q21_b	2	1.92	6	5.77	28	26.92	50	48.08	18	17.31	3.73
q21_c	2	1.92	8	7.69	33	31.73	50	48.08	11	10.58	3.58
q21_d	1	0.96	12	11.54	29	27.88	48	46.15	14	13.46	3.6
Customers' Technical Capabilities											
q22_a	6	5.83	17	16.5	23	22.33	29	28.16	28	27.18	3.54
q22_b	2	1.94	19	18.45	23	22.33	42	40.78	17	16.5	3.51
q22_c	3	2.91	19	18.45	32	31.07	35	33.98	14	13.59	3.37
Market Competition											
q26_a	3	2.88	11	10.58	35	33.65	32	30.77	23	22.12	3.59
q26_b	3	2.91	14	13.59	28	27.18	37	35.92	21	20.39	3.57
q26_c	3	2.88	10	9.62	21	20.19	45	43.27	25	24.04	3.76
q26_d	8	7.69	34	32.69	36	34.62	17	16.35	9	8.65	2.86
Regulatory Constraints											
q27_a	26	26	34	34	21	21	14	14	5	5	2.38
q27_b	19	19	26	26	32	32	16	16	7	7	2.66
q27_c	13	13	26	26	31	31	21	21	9	9	2.87
Service & Product Development											
q31_a	0	0	1	0.96	13	12.5	44	42.31	46	44.23	4.3
q31_b	0	0	5	4.81	20	19.23	43	41.35	36	34.62	4.06
q31_c	4	3.85	17	16.35	31	29.81	33	31.73	19	18.27	3.44
Management Support											
q32_a	4	3.85	14	13.46	33	31.73	29	27.88	24	23.08	3.53
q32_b	2	1.94	13	12.62	25	24.27	40	38.83	23	22.33	3.67
q32_c	1	0.97	11	10.68	27	26.21	43	41.75	21	20.39	3.7
Technical Challenge											
q33_a	2	1.94	10	9.71	23	22.33	47	45.63	21	20.39	3.73
q33_b	3	2.91	8	7.77	14	13.59	32	31.07	46	44.66	4.07
q33_c	4	3.88	13	12.62	33	32.04	37	35.92	16	15.53	3.47
q33_d	3	2.91	10	9.71	31	30.1	43	41.75	16	15.53	3.57
q33_e	5	4.9	21	20.59	35	34.31	31	30.39	10	9.8	3.2

Score 1: very low
Score 5: very high

Table 4: Frequency Distribution of Level of Intent to Adopt Internet Banking Functions

Banking Functions	Score 1		2		3		4		5		6	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Information Delivery Medium												
Corporate Information	4	3.92	3	2.94	5	4.9	5	4.9	7	6.86	78	76.47
Press Release	12	11.88	9	8.91	9	8.91	9	8.91	6	5.94	56	55.45
Branch Location	4	3.88	1	0.97	3	2.91	2	1.94	14	13.59	79	76.7
Marketing Tool												
Advertisement	6	6.06	3	3.03	9	9.09	13	13.13	9	9.09	59	59.6
Offers Announcement	10	10.1	6	6.06	10	10.1	15	15.15	8	8.08	50	50.51
Loans, Investment & account application	5	5.05	3	3.03	12	12.12	18	18.18	27	27.27	34	34.34
Value-added Services												
E-mail & suggestion form	5	4.85	4	3.88	8	7.77	10	9.71	9	8.74	67	65.05
Search Engine	24	25.53	18	19.15	22	23.4	7	7.45	3	3.19	20	21.28
Hot Links to other sites	11	10.78	13	12.75	16	15.69	9	8.82	7	6.86	46	45.1
Discussion groups	52	55.32	30	31.91	5	5.32	3	3.19	4	4.26	0	0
Calculator	12	11.54	2	1.92	9	8.65	17	16.35	15	14.42	49	47.12
Investment Advisor	15	15.46	19	19.59	18	18.56	19	19.59	9	9.28	17	17.53
Software download	40	40.4	22	22.22	8	8.08	3	3.03	5	5.05	21	21.21
Account Transaction Platform												
Balance inquiry	7	6.86	1	0.98	3	2.94	9	8.82	32	31.37	50	49.02
Statement request	7	6.93	3	2.97	4	3.96	11	10.89	32	31.68	44	43.56
Transaction history	7	6.8	2	1.94	3	2.91	10	9.71	31	30.1	50	48.54
Bill payment	10	9.71	0	0	2	1.94	12	11.65	32	31.07	47	45.63
Funds transfer	7	6.8	4	3.88	3	2.91	12	11.65	28	27.18	49	47.57
Electronic Commerce Opportunity												
Stock & mutual fund trading	24	24.24	17	17.17	17	17.17	13	13.13	13	13.13	15	15.15
Electronic Cash	27	27.84	20	20.62	17	17.53	18	18.56	11	11.34	4	4.12
Bill presentment	16	16	20	20	16	16	21	21	22	22	5	5
Smart Card	31	31.31	21	21.21	19	19.19	15	15.15	12	12.12	1	1.01
Digital Certificate	31	31.96	15	15.46	20	20.62	13	13.4	12	12.37	6	6.19

Score 1: very low intent
Score 5: very high intent
Score 6: function already adopted

Table 5: Frequency Distribution of Responses to Normative Questions

Measurement Item No.	Your Firm		The Banking Industry		Govrnment		Financial Intermediaries		Customers	
	Count	%	Count	%	Count	%	Count	%	Count	%
Functionality of Internet Banking										
q2	17	16.30%	21	20.20%	0	0	6	5.80%	57	54.80%
q3	32	30.80%	15	14.40%	0	0	7	6.70%	47	45.20%
q4	60	57.70%	9	8.70%	22	21.20%	3	2.90%	4	3.80%
Strategic Motivation										
q11	36	34.60%	17	16.30%	0	0	4	3.80%	45	43.30%
q12	16	15.40%	6	5.80%	0	0	3	2.90%	74	71.20%
q13	56	53.80%	7	6.70%	15	14.40%	11	10.60%	5	4.80%
Valuation of Internet banking										
q17	13	12.50%	17	16.30%	0	0	4	3.80%	68	65.40%
q18	17	16.30%	42	40.40%	0	0	12	11.50%	29	27.90%
q19	6	5.80%	7	6.70%	0	0	3	2.90%	84	80.80%
Customer Demand										
q23	74	71.20%	5	4.80%	1	1.00%	5	4.80%	18	17.30%
q24	95	91.30%	3	2.90%			3	2.90%	3	2.90%
q25	44	42.30%	0	0	1	1.00%	2	1.90%	55	52.90%
Environmental Influences										
q28	7	6.70%	31	29.80%	16	15.40%	13	12.50%	35	33.70%
q29	30	28.80%	28	26.90%	5	4.80%	15	14.40%	21	20.20%
q30	6	5.80%	38	36.50%	5	4.80%	13	12.50%	38	36.50%
Operational Context										
q34	35	33.70%	35	33.70%	3	2.90%	21	20.20%	6	5.80%
q35	75	72.10%	4	3.80%	1	1.00%	11	10.60%	10	9.60%
q36	52	50.00%	0	0	1	1.00%	3	2.90%	42	40.40%

Table 6: Percentage of Variance Explained by Provisional Factors

Provisional Factor	Eigenvalue	% of Variance	Cumulative %
1	8.33	19.82	19.82
2	5.62	13.38	33.20
3	3.23	7.69	40.89
4	2.35	5.58	46.48
5	1.97	4.69	51.17
6	1.74	4.13	55.31
7	1.59	3.78	59.09
8	1.42	3.39	62.48
9	1.23	2.94	65.42
10	1.18	2.82	68.23
11	1.06	2.52	70.75

- 11 provisional factors were retained after the principal component analysis. These 11 provisional factors all have eigenvalue greater than 1, and together they will account for about 70% of the total variance of the original predictor variables.
- It can be noted that the first 2 components are relatively more important than the others because they together can account for 33% of the total variance of the predictor variables.

Table 7: Factor Loading Matrix

Measurement Item	Common Factor 1	2	3	4	5	6	7	8	9	10	11	Communalities
q6	**0.72**	0.17	-0.04	-0.06	-0.01	-0.06	0.05	0.07	0.07	0.22	0.25	0.71
q8	**0.74**	0.30	0.06	-0.04	-0.13	-0.08	0.06	0.08	0.16	0.16	0.00	0.74
q10	**0.64**	0.33	0.11	0.10	-0.04	-0.02	0.10	0.20	0.17	0.09	-0.15	0.65
q14_a	0.18	**0.65**	0.03	-0.32	-0.11	-0.02	-0.15	0.09	0.06	0.16	0.21	0.68
q14_b	0.35	**0.77**	0.16	-0.03	0.04	0.13	0.07	0.17	0.14	0.06	0.04	0.81
q14_c	0.33	**0.79**	0.12	-0.05	0.08	0.07	-0.07	0.10	0.08	0.03	-0.10	0.80
q14_d	0.30	**0.55**	-0.06	-0.04	0.18	0.30	-0.16	0.25	-0.10	0.05	-0.01	0.67
q15_a	-0.02	0.23	-0.09	-0.05	-0.11	**0.70**	-0.06	0.22	0.11	0.06	-0.04	0.64
q15_b	0.12	0.12	0.01	-0.22	-0.07	**0.69**	0.04	0.13	0.12	0.20	0.08	0.68
q15_c	**0.42**	0.39	0.26	-0.14	-0.05	0.26	-0.15	0.04	0.22	0.31	0.14	0.71
q16_a	**0.64**	0.12	0.02	-0.10	-0.13	0.42	-0.20	0.20	0.16	0.05	0.02	0.73
q16_b	**0.69**	0.14	0.06	-0.19	0.04	0.41	0.03	0.06	0.18	0.00	0.07	0.77
q16_c	**0.57**	0.15	0.03	0.00	0.06	0.51	0.17	-0.03	0.13	-0.07	0.21	0.78
q20_a	0.03	0.20	0.12	0.07	0.08	0.02	0.13	0.01	0.08	0.02	**0.76**	0.69
q20_b	0.16	-0.24	0.16	0.17	0.17	0.05	0.11	0.12	-0.04	-0.04	**0.73**	0.78
q20_c	0.21	0.26	**0.53**	-0.01	0.13	0.00	0.06	0.04	0.37	0.01	0.39	0.73
q20_d	0.13	0.33	**0.41**	0.11	0.08	0.11	0.08	0.02	**0.47**	-0.07	0.24	0.70
q21_a	-0.05	-0.09	**0.45**	0.21	0.37	0.01	0.09	-0.10	-0.14	0.05	-0.01	0.61
q21_b	0.02	0.05	**0.75**	0.02	0.30	-0.06	0.07	-0.02	0.04	0.00	0.14	0.74
q21_c	0.07	0.05	**0.89**	0.05	0.15	-0.01	0.03	0.02	-0.03	0.01	0.03	0.82
q21_d	0.01	0.10	**0.77**	0.11	-0.04	0.03	0.24	0.10	-0.18	0.03	0.06	0.82
q22_a	-0.01	0.15	0.07	0.05	**0.85**	-0.11	-0.04	0.07	0.01	0.04	0.05	0.82
q22_b	-0.10	0.00	0.19	0.09	**0.88**	-0.09	0.06	-0.03	0.00	0.00	0.03	0.84
q22_c	-0.01	-0.08	0.19	0.17	**0.77**	0.03	0.15	-0.12	-0.06	-0.10	0.23	0.85
q26_a	0.21	0.14	0.04	0.02	-0.07	0.20	-0.01	-0.09	0.19	**0.72**	-0.03	0.68
q26_b	0.15	0.08	0.06	-0.17	-0.10	0.23	0.09	-0.04	0.48	**0.53**	0.05	0.70
q26_c	0.07	0.02	-0.02	0.11	0.08	0.09	0.22	-0.11	-0.13	**0.79**	-0.02	0.75
q26_d	0.14	-0.21	0.08	0.15	-0.08	**0.60**	0.09	0.07	0.31	0.27	-0.03	0.64
q27_a	0.20	-0.08	-0.02	0.15	0.11	0.14	**0.79**	-0.08	0.15	0.00	0.06	0.78
q27_b	0.01	-0.02	0.16	0.15	0.05	0.01	**0.87**	-0.14	0.02	0.12	0.15	0.87
q27_c	-0.09	-0.07	0.18	0.18	-0.01	-0.09	**0.81**	0.00	-0.01	0.13	0.04	0.77
q31_a	0.24	0.14	-0.10	0.06	-0.08	-0.07	-0.15	0.11	**0.59**	0.32	0.18	0.62
q31_b	0.20	0.05	-0.10	-0.13	-0.04	0.27	0.10	0.18	**0.74**	0.00	-0.03	0.74
q31_c	0.17	0.01	-0.01	0.03	0.05	0.35	0.16	0.03	**0.62**	-0.07	-0.07	0.63
q32_a	0.15	0.07	0.01	-0.02	-0.04	0.19	-0.02	**0.82**	0.00	-0.21	-0.03	0.81
q32_b	0.02	0.21	0.11	0.04	-0.01	0.05	-0.16	**0.83**	0.04	-0.04	0.04	0.78
q32_c	0.20	0.05	-0.06	-0.09	-0.03	0.12	-0.04	**0.80**	0.20	0.04	0.10	0.77
q33_a	0.05	0.04	-0.06	**0.61**	0.06	-0.10	0.16	-0.02	-0.05	0.33	0.00	0.54
q33_b	-0.03	-0.31	0.16	**0.47**	0.20	-0.25	0.11	0.26	0.02	0.25	0.01	0.59
q33_c	-0.07	-0.15	0.14	**0.64**	0.35	-0.18	0.02	-0.04	-0.21	0.03	0.02	0.72
q33_d	-0.08	-0.09	0.07	**0.86**	0.09	0.03	0.12	-0.06	-0.02	-0.09	0.03	0.80
q33_e	-0.08	-0.04	0.08	**0.83**	-0.04	0.03	0.17	-0.02	0.10	-0.09	0.16	0.78

Factor Loading

- Highest factor loading for each measurement item is underlined and bolded in the matrix, showing which factor has most significantly loaded on the predictor variables.
- Factor loading is an indication of the correlation between the common factor and the predictor variable. It can be seen that the highest loading in measurement item q6 to q10 is with Factor 1. They so are highly correlated with Factor 1. Similarly, measurement item q22a to q22c are significantly associated with Factor 5 because their factor loadings with Factor 5 are highest. Other measurement items can be interpreted in the same way.
- The way predictor variables are grouped is roughly consistent with the way they were theoretically grouped. But there are also some minor deviations: "Business opportunity" (q16a to q16c) is grouped together with the "Strategic Motivation" (q6 to q10) as one common factor, Factor 1; Predictors in "Customer Behavior" (q20a to q20d) are grouped into different factors.

Communality

- Communality of the predictor variable shows the part of its variance that is related to the factors extracted. The value of communality must be between 0 and 1. The higher the communality is, the more its variance is accounted for by the extracted factors.
- For example, communality for measurement q6 is 0.71, indicating that 71% of its variances can be explained by the 11 common factors. And, the most significant factor in explaining the variance is the one with highest loading, *i.e.,* Factor 1.
- From the table, it can be seen that communalities are fairly high. Most of them are greater than 0.7, with a mean of 0.73. That is to say, most of the variance of the predictor variables is accounted for by the 11 common factors derived.

Table 8: Frequency Distribution of Mean Score in Intent Level

Mean Score	Frequency	Percent	Cumulative Percent
Information Delivery Medium			
1.33	1	1.0	1.0
2.00	1	1.0	2.0
2.50	1	1.0	3.0
2.67	1	1.0	4.0
3.00	1	1.0	5.0
3.33	2	2.0	6.9
3.67	5	5.0	11.9
4.00	4	4.0	15.8
4.33	11	10.9	26.7
4.67	8	7.9	34.7
5.00	8	7.9	42.6
5.33	4	4.0	46.5
5.67	1	1.0	47.5
6.00	53	52.5	100.0
Total	100	100	
Marketing Tool			
1.00	1	1.0	1.0
1.67	1	1.0	2.0
2.33	3	3.0	5.0
2.67	3	3.0	8.0
3.00	1	1.0	9.0
3.33	4	4.0	13.0
3.50	1	1.0	14.0
3.67	8	8.0	22.0
4.00	9	9.0	31.0
4.33	9	9.0	40.0
4.50	1	1.0	41.0
4.67	7	7.0	48.0
5.00	10	10.0	58.0
5.33	5	5.0	63.0
5.67	10	10.0	73.0
6.00	27	27.0	100.0
Total	100	100.0	
Value-added Services			
1.14	1	1.0	1.0
1.29	2	2.0	3.0
1.43	1	1.0	4.0
1.57	1	1.0	5.0
1.86	2	2.0	6.9
2.00	2	2.0	8.9
2.14	2	2.0	10.9
2.29	3	3.0	13.9
2.43	2	2.0	15.8
2.50	1	1.0	16.8
2.57	4	4.0	20.8
2.71	3	3.0	23.8
2.86	4	4.0	27.7
3.00	3	3.0	30.7
3.14	3	3.0	33.7
3.17	2	2.0	35.6
3.29	7	6.9	42.6
3.43	3	3.0	45.5
3.57	3	3.0	48.5
3.71	3	3.0	51.5
3.86	6	5.9	57.4
4.00	7	6.9	64.4
4.14	6	5.9	70.3
4.29	3	3.0	73.3
4.33	1	1.0	74.3
4.50	2	2.0	76.2
4.57	3	3.0	79.2
4.71	3	3.0	82.2
4.86	4	4.0	86.1
5.00	3	3.0	89.1
5.14	1	1.0	90.1
5.17	1	1.0	91.1
5.29	2	2.0	93.1
5.43	1	1.0	94.1
5.57	1	1.0	95.0
6.00	5	5.0	100.0
Total	101	100.0	

Mean Score	Frequency	Percent	Cumulative Percent
Account Information Platform			
1.00	6	5.9	5.9
1.80	1	1.0	6.9
3.20	1	1.0	7.9
3.60	2	2.0	9.9
3.80	3	3.0	12.9
4.00	9	8.9	21.8
4.20	2	2.0	23.8
4.40	2	2.0	25.7
4.60	1	1.0	26.7
4.80	4	4.0	30.7
5.00	21	20.8	51.5
5.20	1	1.0	52.5
5.60	2	2.0	54.5
5.80	5	5.0	59.4
6.00	41	40.6	100.0
Total	101	100.0	
Electronic Commerce Opportunity			
1.00	8	8.1	8.1
1.20	5	5.1	13.1
1.40	2	2.0	15.2
1.60	5	5.1	20.2
1.80	2	2.0	22.2
2.00	7	7.1	29.3
2.20	3	3.0	32.3
2.40	5	5.1	37.4
2.50	1	1.0	38.4
2.60	4	4.0	42.4
2.80	3	3.0	45.5
3.00	8	8.1	53.5
3.20	7	7.1	60.6
3.40	4	4.0	64.6
3.60	6	6.1	70.7
3.67	1	1.0	71.7
3.80	7	7.1	78.8
4.00	3	3.0	81.8
4.20	4	4.0	85.9
4.40	2	2.0	87.9
4.50	1	1.0	88.9
4.60	2	2.0	90.9
4.80	1	1.0	91.9
5.00	5	5.1	97.0
5.40	2	2.0	99.0
6.00	1	1.0	100.0
Total	99	100.0	

**There were missing values in some observations, making the number of observations for analysis less than the total number of received responses (i.e., 104).*

Table 9: Mean Scores in the Defined Groups

Mean Rank	Frequency	%	Cumulative %	Classified Group
Information Delivery Medium				
1 – 4.34	27	27%	27%	1
4.341- 5.67	21	21%	48%	2
5.671 - 6	53*	52%	100%	3
Marketing Tool				
1 - 4	31	31%	31%	1
4.001 – 5.34	32	32%	63%	2
5.341 – 6	37*	37%	100%	3
Value-added Services				
1 - 3.144	34	33%	33%	1
3.145 – 4	31	31%	64%	2
4.001 – 6	36*	36%	100%	3
Account Transaction Platform				
1 – 4.8	31	31%	31%	1
4.801 – 5.8	29	29%	60%	2
5.801 - 6	41*	40%	100%	3
Electronic Commerce Opportunity				
1 – 2.2	32	32%	32%	1
2.201 – 3.4	32	32%	64%	2
3.401 – 6	35	36%	100%	3

* Slightly higher percentage could not avoided due the averaging effect of mean score of 6 (adopter)

Figure 1: A Hypothesized Model of Decision Factors of Internet Banking

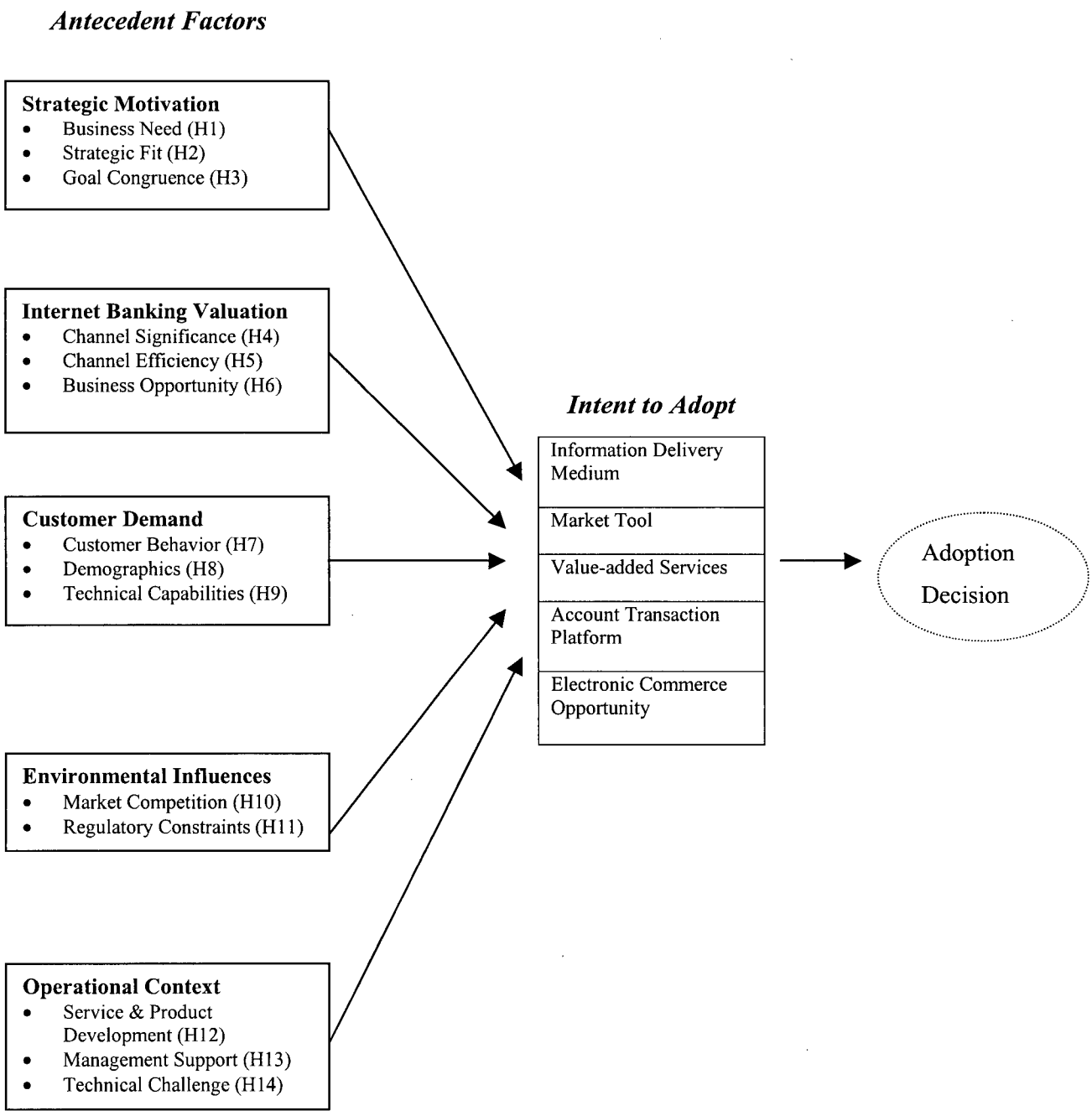


Figure 2: The Theory of Planned Behavior (TPB)

(Adopted from Ajzen, 1988)

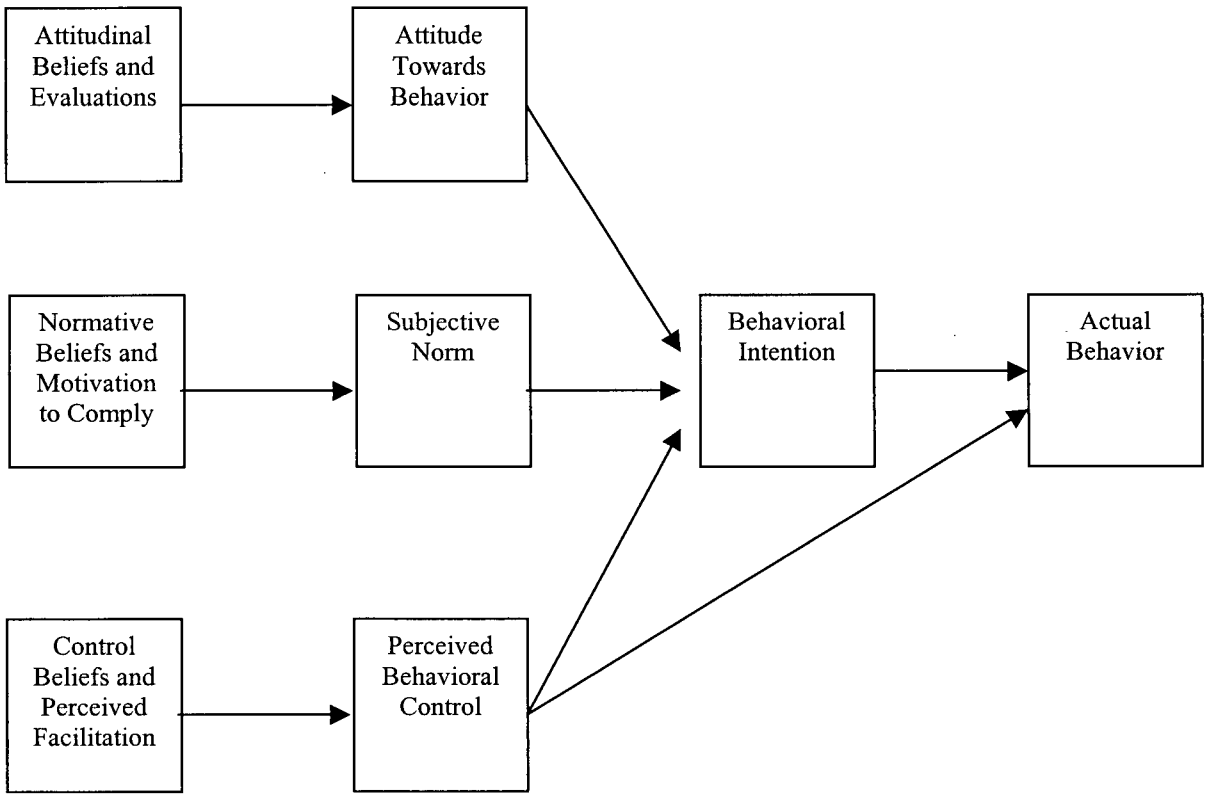
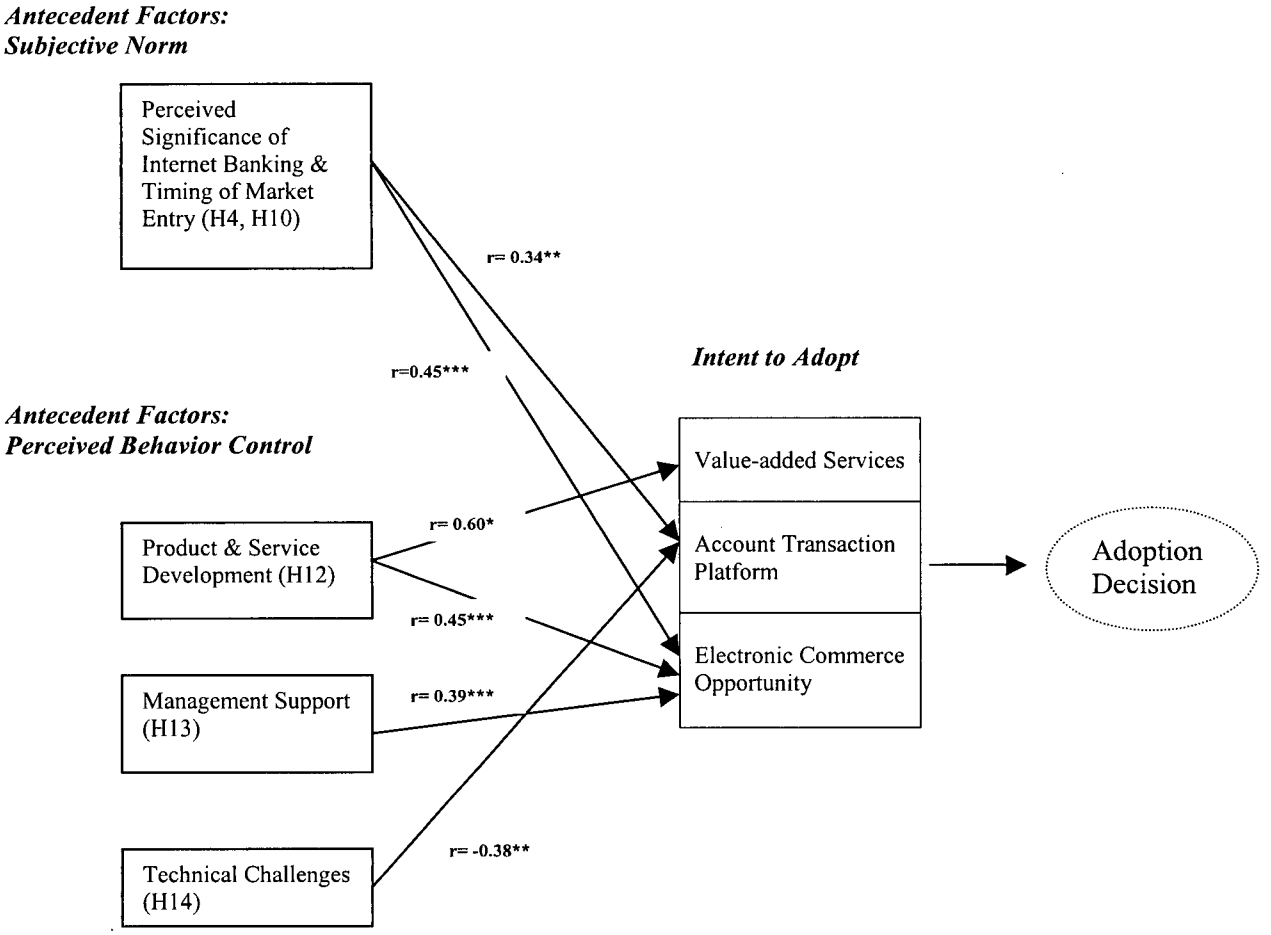


Figure 3: The Adoption of Internet Banking: A Model of Decision Factors



* denotes significance at the p< 0.003 level
** denotes significance at the p< 0.001 level
*** denotes significance at the p< 0.002 level

Appendix 1: Strategic Advantages of Internet Banking

- It increases customer satisfaction by offering alternative and convenient access to banking services at any time and any place, so as to serve as a means of building and strengthening customer relationship.
- It expands product offerings such as brokerage, mutual funds and insurance, either directly or indirectly by setting a Web link with partner organizations. Branches usually do not have the opportunity to "co-brand" offerings of these financial products.
- It increases customer retention because in many cases customers loss is due to the their relocation from one area to another.
- It extends geographic reach and allows banks to gain new market share by expanding customer base.
- It allows banks to cross-sell services. Internet tracking software allows a bank to keep track of transactions conducted through the Web, which so forms a database that allows banks to target selling and identify profitable customers.
- It reduces overall cost mainly in 2 ways: the transaction cost and cost in physical branch operation.
- It allows banks to experiment with the technology and assess future impact on business.

Source: Booz, Allen & Hamilton, 1997; US Web Services, 1998; Daniel & Storey, 1997; Tower Group, 1996; Ooi et al., 1996, (ii).

Appendix 2: Initial Measurement Items

Initial survey questions are designed to tap into factors identified.

Strategic Motivation

1. Does Internet banking satisfy one or more business opportunities for your firm?
2. Does Internet banking solve one or more existing business problems for your firm?
3. How well does Internet banking meet the following needs for your firm?
   - Improving your firm's name recognition
   - Re-defining customer relationship
   - Serving unique market segments (*e.g.* customers who have interests in technology or needs global access to banking services)
   - Developing cost-efficient delivery channels
   - Serving customers who cannot be reached by branch network
4. How important are the following to your firm's strategic mission?
   - Cost savings
   - Maintaining or increasing market share
   - Increased revenue
   - Innovation leadership
5. To what extent does Internet banking enable the following business drivers for your firm?
   - Cost savings
   - Maintaining or increasing market share
   - Increased revenue
   - Innovation leadership
6. Which of the following do you believe most closely matches your firm's strategic mission? *(Please check **one box only**)*
   - **Branding** strategy of improving or maintaining your firm's brand image
   - Technology adoption strategy of **experimenting with the technology** and assessing its future impact on business
   - **Customer-oriented** strategy of creating or improving customer relationship
   - **Market-coverage** strategy of widening the geographic-reach without having to extend the branch network
7. How closely does Internet banking support your firm's mission statement?
8. To what extent do the following match your strategic expectations about Internet banking?
   - Improving or maintaining **brand image**
   - **Experimenting** with technology and assessing its future impact on business
   - Creating or improving **customer relationship**
   - Widening the **geographic-reach** to customers
   - Being cost competitive by developing **lower cost delivery channels**
9. Which of the following do you believe most closely matches your firm's organizational goals? *(Please check **one box only**)*
   - Being positioned as a distinctive and innovative organization and having a **well-branded image**
   - **Development of expertise** in technology-based service delivery
   - Creation or improvement of **customer relationship**
   - Widened **market coverage** and expanded accessibility to banking services
   - Expansion or retention of **market share**
   - Having **cost advantage** by reducing transaction and branch operation cost
10. To what degree do you believe that Internet banking meets the following goals?
    - Being positioned as a distinctive and innovative organization and having a well-branded image
    - Development of expertise in technology-based service delivery
    - Creation or improvement of customer relationship
    - Widened market coverage and expanded accessibility to banking services
    - Expansion or retention of market share
    - Having cost advantage by reducing transaction and branch operation cost

Valuation of Internet Banking

11. To what extent do you believe that banking transactions conducted over the Internet are highly secured?
12. To what extent do you believe that the Internet expands the accessibility to banking services?
13. To what extent do you believe that the Internet is a convenient service channel for bank customers?
14. To what extent do you believe that the Internet is a less-expensive channel for delivering banking services?
15. To what extent do you believe that the Internet will become **the mainstream** delivery channel for banking services?
16. To what extent do you believe that Internet banking has migrated from a strategic advantage to a strategic necessity?
17. To what extent do you believe that Internet banking will lay the foundation for your firm's future business development in Electronic Commerce (*e.g.* bill presentment, E-cash, digital certificate, smart card etc.)?
18. To what extent do you believe that more banking services must be added to make Internet banking successful?
19. To what extent do you believe that other non-banking services must be added to make Internet banking successful?
20. To what extent do you believe that implementing Internet banking will allow your firm to develop technical expertise for future business developments?
21. To what extent do you believe that implementing Internet banking will allow your firm to develop managerial skill for future business developments?

Customer Demand

22. How much does ease of motivating customers to use Internet-based banking services affect the demand for your Internet banking services?
23. How much does customers' prior experience in using the Internet affect the demand for your Internet banking services?
24. How much does customers' perceived risk of the Internet affect the demand for your Internet banking services?
25. How much does customers' perceived usefulness of Internet banking affect the demand for your Internet banking services?
26. How much does customers' perceived ease of using Internet affect the demand for your Internet banking services? banking
27. How much does age of your firm's customers affect the demand for your Internet banking services?
28. How much does educational level of your firm's customers affect the demand for your Internet banking services?
29. How much does income level of your firm's customers affect the demand for your Internet banking services?
30. How much does the degree of financial sophistication of your firm's customers affect the demand for your Internet banking services?
31. How much does customers' lack the required hardware, software, or connectivity in using the Internet affect demand for your Internet banking services?
32. How much do Customers' lack experience and technical knowledge in using Internet affect demand for your Internet banking services?

Environmental Influences

33. How would you characterize your firm's competitive threat from other banks and credit unions?
34. How would you characterize the threat of losing market share to non-bank competitors (*e.g.* mortgage firms or credit card companies)
35. How would you characterize your firm's pressure to keep up with other financial institutions that have already adopted Internet banking?
36. How would you characterize the threat of not having 'first-mover' advantages in Internet banking services?
37. To what degree do you believe that the differences in government regulation or legal requirement will delay your implementation of Internet banking?
38. To what degree do you believe that the lack of legal control and recourse for business conducted on the Internet will delay your implementation of Internet banking?
39. To what degree do you believe that the potential liability from downtime, unauthorized access, or expired information will delay your implementation of Internet banking?
40. To what extent do you believe that Security of Internet banking transactions will delay your implementation of Internet banking?
41. To what extent do you believe that Lack of control over Internet technology (*e.g.* third party control over browsers) will delay your implementation of Internet banking?
42. To what extent do you believe that the setting of Internet standards (*e.g.* compatibility between system configurations) will delay your implementation of Internet banking?
43. To what extent do you believe that Immature programming and scripting languages will delay your implementation of Internet banking?

Operational Context

44. To what degree do you believe that it is important to influence customers to use Internet banking services (e.g. differential pricing policy)?
45. To what degree do you believe that it is important to re-define branch banking when Internet banking is offered?
46. To what degree do you believe that it is important to maintain face-to-face contact with customers in managing multiple service channels?
47. To what degree do you believe that it is important to decide what existing services can be put into Internet environment?
48. To what degree do you believe that it is important to make Internet banking as a distinct business entity (*i.e.,* not just an add-on service to the existing service portfolio)?
49. To what degree do you believe that it is important to differentiate, customize and personalize services offered through the Internet?
50. To what degree do you believe that it is important to align Internet banking with the firm's overall Electronic Commerce development?
51. To what degree do you believe that your firm's management support and commitment to Internet banking are sufficient (*e.g.* finance, human resources and technology)?
52. To what degree do you believe that your firm's upper management understands the technological development issues?
53. To what degree do you believe that it is prestigious to be a team member working on Internet banking development?
54. To what degree do you believe that Integration of the Internet into the existing IT infrastructure, including operating system and people represent a challenge to operations in Internet banking?
55. To what degree do you believe that Integration of Internet banking with the existing channels (*e.g.* communicability and interoperability of channel systems, and consistency of data) represent a challenge to operations in Internet banking?
56. To what degree do you believe that Definition of line of responsibility for development of Internet banking operation (*e.g.* marketing or IT department) represent a challenge to operations in Internet banking?

Appendix 3: Items Placement Matrix of Q-Sort Analysis

Labeled Category

Theoretical Category	STRATEGIC MOTIVATION				VALUATION OF INTERNET BANKING			CUSTOMER DEMAND				ENVIRONMENTAL INFLUENCE				OPERATIONAL FACTORS					OTHERS				
	Bus. Need	S. Fit	Goal Cong.	Strategic Issue (General)	Char. as Delivery Channel	Bus. Opp.	Perceived Value (General)	Cust. Behav.	Cust. Demog.	Tech Cap.of Cust.	Cust. Demand (General)	Market Comp.	Legal Const.	Tech Comp.	External Factor (General)	Channel Mgmt	Service & Product Devep.	Mgmt Support	Tech Context	Operl Factor (General)	Tech. Issues (General)	Misc.	N/A	Total	% of Hit
STRATEGIC MOTIVIATION																									
Business Need	5			25			14													2		4		50	60%
Strategic Fit		17		5			5													1		2		30	73%
Goal Congruence			4	10			5													1				20	70%
VALUATION OF INTERNET BANKING																									
Characteristics as Delivery Channel	1		1	3	4		24				1	4					11			2	5	2	2	60	47%
Business Opportunity		1		3		9	15										14					8		50	48%
CUSTOMER DEMAND																									
Customer Behavior								11			33						5			1				50	88%
Customer Demographics									11		25						4							40	90%
Technical Capabilities of Customer										3	15						2							20	90%
ENVIORNMENTAL INFLUENCE																									
Market Competition				4								32			4									40	90%
Legal Constraint													27		3									30	100%
Technical Complexity														7					11	1	21			40	18%
OPERATIONAL CONTEXT																									
Channel Management				3		1	3	1			3	1					7			3		6	2	30	10%
Service & Product Development	1	2		2		1	6										13			6		9		40	48%
Management Support				1			6											10		5		7	1	30	50%
Technical Context							2												9	14	4	1		30	77%
Total	7	20	5	56	4	11	80	12	11	3	77	37	27	7	7	0	56	10	20	36	30	39	5	560	560

Shaded cells are items that were placed within theoretical categories.

N/A : Items that could not be fitted into any theoretical categories.

Misc: Items that cannot be categorized by the judges.

Total Hit: 349

Overall Hit Ratio: 62%

Appendix 4: Analysis of the Items Placement Matrix

10 judges have participated in the Q-sort Analysis and examination of the Items Placement Matrix suggests some major changes to the survey, as summarized as follows.

Strategic Motivation

- Measurement items in "BUSINESS NEED" were too ambiguous because some of them were consistently targeted within the category of "PERCEIVED VALUE". However, this might indicate well for potential measurement consistency because they showed clustering, rather than a scattering of items. So items were reconstructed to specifically refer to the business need and its match with Internet banking.
- Placements in "STRATEGIC FIT" and "GOAL CONGRUENCE" were considered acceptable, so no change was recommended.

Valuation of Internet Banking

- Some judges identified question 11 as a technical issue. It might be due to the word "secured" because "security" is always recognized as a technical issue. It so was changed to "reliable" as a measure to reduce the possibility of confusion.
- Many measurement items clustered around the category of "SERVICE AND PRODUCT DEVELOPMENT". So, the following modifications were be made.
    1. Some measurement items were reworded to specifically refer to the perceived value of Internet banking. Any references to "services" were dropped, so as to avoid confusion with the category of "SERVICE AND PRODUCT DEVELOPMENT". For example, service channel will be reworded as delivery channel.
    2. Question 18 and 19 were mostly labeled as "SERVICE AND PRODUCT DEVELOPMENT" because they were referring to Internet banking services. These items so were moved to the category of "SERVICE AND PRODUCT DEVELOPMENT".

Customer Demand

A very high percentage of measurement items was placed within theoretical constructs, indicating a high degree of construct validity. So no change was recommended. (Remarks: items clustering around "SERVICE AND PRODUCT DEVELOPMENT" were all labeled by one particular judge)

Environment Influences

- Except those items in the "TECHNOLOGICAL COMPLEXITY", the majority of measurement items was placed within theoretical constructs. Therefore, only the 'TECHNICAL COMPLEXITY" needed to be reconstructed.
- Items in the "TECHNOLOGICAL COMPLEXITY" were too ambiguous because most of them were identified either as "TECHNICAL CONTEXT" (a dimension of "OPERATIONAL CONTEXT") or just as "TECHNOLOGICAL ISSUE" in general. They so were merged into the category of "TECHNICAL CONTEXT", becoming a dimension of "OPERATIONAL CONTEXT".

Operational Context

- There was scattering of measurement items in "CHANNEL MANAGEMENT" and no clustering around any particular category, indicating that they were too ambiguous and could fit in the same category. They were be eliminated or merged into other factor categories.
- There was also potential of measurement inconsistency in "SERVICE & PRODUCT DEVELOPMENT" because items were scattering around. However, examination of items placement shows that the scattering was mainly due to the question 48 and 50. These two items were dropped.
- Measurement items in "MANAGEMENT SUPPORT" also showed clustering around "PERCEIVED VALUE". Examination of the item placement indicated that the clustering was mainly formed by question 53. Confusion might be due to word of "prestigious". This item were be reworded.
- "TECHNICAL CONTEX" was be renamed as "TECHNICAL CHALLENGE" and included all items related to technical issue.

Section 1: FUNCTIONALITY OF INTERNET BANKING

This section asks about information on the type of banking functions you intend to provide through the Internet.

1. How would you rate your intention to add the following banking activities to your firm's Web site?

Please check the box or circle one number per row

	Already offered	*(1: Very Low ... 5: Very High)*				
• Corporation information	☐	1	2	3	4	5
• Press release	☐	1	2	3	4	5
• Recruitment form	☐	1	2	3	4	5
• Branch location	☐	1	2	3	4	5
• Advertisement	☐	1	2	3	4	5
• Offers announcement	☐	1	2	3	4	5
• Loans, investment and account application	☐	1	2	3	4	5
• E-mail & suggestion forms	☐	1	2	3	4	5
• Search engine	☐	1	2	3	4	5
• Hot links to other sites	☐	1	2	3	4	5
• Discussion groups	☐	1	2	3	4	5
• Calculator	☐	1	2	3	4	5
• Investment advisor	☐	1	2	3	4	5
• Software download	☐	1	2	3	4	5
• Balance inquiry	☐	1	2	3	4	5
• Statement request	☐	1	2	3	4	5
• Transaction history	☐	1	2	3	4	5
• Bill payment	☐	1	2	3	4	5
• Funds transfer	☐	1	2	3	4	5
• Stock & mutual fund trading	☐	1	2	3	4	5
• Electronic cash	☐	1	2	3	4	5
• Bill presentment	☐	1	2	3	4	5
• Smart card	☐	1	2	3	4	5
• Digital certificate	☐	1	2	3	4	5

Please check one box per row

	Your Firm	*The Banking Industry*	*Government*	*Financial Inter-mediaries*	*Customers*
2. Who most influences the type of services you expect to offer through Internet banking?	☐	☐	☐	☐	☐
3. Who most influences how you define the market for Internet banking services?	☐	☐	☐	☐	☐
4. Who is the strongest regulator of Internet banking activities in your firm's Web site?	☐	☐	☐	☐	☐

Section 2: STRATEGIC MOTIVATION

This section evaluates the degree to which Internet banking is perceived consistent with your firm's strategic vision.

2.1 Business Need

Definition: the degree to which Internet banking satisfies problems or opportunities associated with key business needs. Needs are drivers to strategic missions and may be generated from all kinds of stimuli ranging from the change of organizational policy to the change of environmental factors (*e.g.* evolution of IT, trends in the financial industry, demographic shift and competition structure).

5. Which of the following is the major business need of your firm? (*Please one box only)*
   - ☐ Improving name recognition
   - ☐ Re-defining customer relationship
   - ☐ Serving unique market segments (*e.g.* customers who have interests in technology or need global access to banking services)
   - ☐ Serving customers who cannot be reached by branch network
   - ☐ Developing cost-efficient delivery channels
   - ☐ Being innovation leader

6. To what extent do you believe that Internet banking enables the following business drivers for your firm?

Please circle one number per row (1: Very Little ..... 5: Very Much)

a. Improving name recognition	1	2	3	4	5
b. Re-defining customer relationship	1	2	3	4	5
c. Serving unique market segments (*e.g.* customers who have interests in technology or need global access to banking services)	1	2	3	4	5
d. Serving customers who cannot be reached by branch network ...	1	2	3	4	5
e. Developing cost-efficient delivery channels	1	2	3	4	5
f. Being innovation leader	1	2	3	4	5

2.2 Strategic Fit

Definition: the degree to which the strategic features associated with Internet banking support your firm's stated strategic mission.

7. Which of the following is the major strategic mission of your firm? (*Please one box only)*
   - ☐ Branding strategy: improving or maintaining your firm's brand image
   - ☐ Customer-oriented strategy: creating or improving customer relationship
   - ☐ Market-coverage strategy: widening the geographic-reach without having to extend the branch network
   - ☐ Cost-saving strategy: developing lower cost alternatives for services delivery and making your firm cost competitive
   - ☐ Technology adoption strategy: experimenting with the technology and assessing its future impact on business

8. To what extent do the following match your strategic expectations about Internet banking?

Please circle one number per row (1: Very Little ..... 5: Very Much)

a. Improving or maintaining brand image	1	2	3	4	5
b. Creating or improving customer relationship	1	2	3	4	5
c. Widening the geographic-reach to customers	1	2	3	4	5
d. Being cost competitive by developing lower cost delivery channels	1	2	3	4	5

e. Experimenting with technology and assessing its future impact on business 1 2 3 4 5

2.3 Goal Congruence

Definition: the degree to which Internet banking produces benefits that can achieve the declared organizational goals.

9. Which of the following is the major organizational goal of your firm? *(Please one box only)*
   - ☐ Being positioned as a distinctive and innovative organization and having a well-branded image
   - ☐ Creation or improvement of customer relationship
   - ☐ Widened market coverage and expanded accessibility to banking services
   - ☐ Having cost advantage by reducing transaction and branch operation cost
   - ☐ Development of expertise in technology-based service delivery

10. To what degree do you believe that Internet banking meets the following organizational goals?

Please circle one number per row (1: Very Little ..... 5: Very Much)

a. Being positioned as a distinctive and innovative organization and having a well-branded image	1	2	3	4	5
b. Creation or improvement of customer relationship	1	2	3	4	5
c. Widened market coverage and expanded accessibility to banking services	1	2	3	4	5
d. Having cost advantage by reducing transaction and branch operation cost	1	2	3	4	5
e. Development of expertise in technology-based service delivery	1	2	3	4	5

Please check one box per row

	Your Firm	*The Banking Industry*	*Government*	*Financial Inter-mediaries*	*Customers*
11. What most influences your Internet banking strategy?	☐	☐	☐	☐	☐
12. Your Internet banking strategy is most consistent with the needs of	☐	☐	☐	☐	☐
13. What constrains strategic innovation in Internet banking in your firm?	☐	☐	☐	☐	☐

Section 3: VALUATION OF INTERNET BANKING

This section evaluates the perceived value of delivery channel characteristics and business opportunities represented by Internet banking.

3.1 Perceived Efficiency as Delivery Channel

Definition: the degree to which the Internet is perceived as being an efficient delivery channel.

14. To what extent do you believe that ...

Please circle one number per row (1: Very Little ..... 5: Very Much)

a. banking transactions conducted over the Internet are highly reliable?	1	2	3	4	5
b. the Internet expands the accessibility to banking services?	1	2	3	4	5
c. the Internet is a convenient delivery channel for bank customers?	1	2	3	4	5
d. the Internet is a less-expensive delivery channel?	1	2	3	4	5

3.2 Perceived Significance as Delivery Channel

Definition: the degree to which the Internet is perceived as being a significant delivery channel.

15. To what extent do you believe that ...

Please circle one number per row (1: Very Little ... 5: Very Much)

a. the Internet will become the mainstream delivery channel?	1	2	3	4	5
b. Internet banking has migrated from a strategic advantage to a strategic necessity?	1	2	3	4	5
c. the Internet is an integral part of multiple-delivery system?	1	2	3	4	5

3.3 Business Opportunity

Definition: the degree to which Internet banking is perceived as being an opportunity for development of future business, managerial skill and technical "know-how".

16. To what extent do you believe that ...

Please circle one number per row (1: Very Little ... 5: Very Much)

a. Internet banking will lay the foundation for your firm's future business development in Electronic Commerce (*e.g.* bill presentment, E-cash, digital certificate, smart card etc.)?	1	2	3	4	5
b. implementing Internet banking will allow your firm to develop technical expertise for future business developments?	1	2	3	4	5
c. implementing Internet banking will allow your firm to develop managerial skill for future business developments?	1	2	3	4	5

Please check one box per row

	Your Firm	*The Banking Industry*	*Government*	*Financial Inter-mediaries*	*Customers*
17. From where do you realize the value for Internet banking?	☐	☐	☐	☐	☐
18. Where do you get ideas to improve your firm's Internet banking site?	☐	☐	☐	☐	☐
19. From where do you get feedback on Internet banking services?	☐	☐	☐	☐	☐

Section 4: CUSTOMER DEMAND

This section evaluates the degree to which customer demand is perceived significant for the Internet banking decision in your firm.

4.1 Customer Behavior

Definition: the degree to which customers' behavior and perception to the Internet influence their acceptance of Internet banking.

20. How much do the following affect the demand for your firm's Internet banking services?

Please circle one number per row (1: Very Little ... 5: Very Much)

a. Customers' prior experience in using the Internet	1	2	3	4	5
b. Customers' perceived risk of the Internet	1	2	3	4	5
c. Customers' perceived usefulness of Internet banking	1	2	3	4	5
d. Customers' perceived ease of using Internet banking	1	2	3	4	5

4.2 Customer Demographics

Definition: the importance of the demographics of existing and potential customers to the projection of customer demand.

21. How much do the following affect the demand for your firm's Internet banking services?

Please circle one number per row (1: Very Little .... 5: Very Much)

a. Age of your firm's customers	1	2	3	4	5
b. Educational level of your firm's customers	1	2	3	4	5
c. Income level of your firm's customers	1	2	3	4	5
d. The degree of financial sophistication of your firm's customers	1	2	3	4	5

4.3 Technical Capabilities of Customer

Definition: the degree to which customers' capabilities to use the Internet affect their demand for Internet banking.

22. How much do the following affect the demand for your firm's Internet banking services?

Please circle one number per row (1: Very Little .... 5: Very Much)

a. Customers lack the required hardware, software, or connectivity in using the Internet	1	2	3	4	5
b. Customers lack experience in using the Internet	1	2	3	4	5
c. Customers lack technical knowledge in using the Internet	1	2	3	4	5

Please check one box per row

	Your Firm	*The Banking Industry*	*Government*	*Financial Inter-mediaries*	*Customers*
23. Who decides what services will address customer demand?	☐	☐	☐	☐	☐
24. Who determines how to deploy Internet banking to meet customer demand of your firm?	☐	☐	☐	☐	☐
25. Who decides if your firm's Internet banking activities meet customers' demand?	☐	☐	☐	☐	☐

Section 5: ENVIRONMENTAL INFLUENCES

This section evaluates the degree to which the adoption decision (*i.e.* the timing and extent of adoption decision) is affected by the external environment.

5.1 Market Competition

Definition: the degree to which your firm's competitive pressure is critical to adoption decision.

Please circle one number per row (1: Very Little .... 5: Very Much)

26. How would you characterize your firm's competitive threat in Internet banking?					
a. Competitive threat from other banks and credit unions	1	2	3	4	5
b. Threat of losing market share to non-bank competitors (*e.g.* mortgage firms or credit card companies)	1	2	3	4	5
c. Pressure to keep up with other financial institutions that have already adopted Internet banking	1	2	3	4	5
d. Threat of not having 'first-mover' advantages in Internet banking services	1	2	3	4	5

5.2 Regulatory Constraints

Definition: the degree to which regulatory and legal constraints associated with Internet banking hinder adoption.

	Please circle one number per row (1: Very Little ... 5: Very Much)				
27. To what degree do you believe that the following legal or regulatory issues will delay your implementation of Internet banking?					
a. Differences in government regulation or legal requirement	1	2	3	4	5
b. Lack of legal control and recourse for business conducted on the Internet	1	2	3	4	5
c. Potential liability from downtime, unauthorized access or expired information	1	2	3	4	5

	Please check one box per row				
	Your Firm	*The Banking Industry*	*Government*	*Financial Inter-mediaries*	*Customers*
28. What is the most influential element in the external environment for Internet banking services?	☐	☐	☐	☐	☐
29. Who informs you how to best operate within the external environment?	☐	☐	☐	☐	☐
30. Where are your best indicators of external environmental problems?	☐	☐	☐	☐	☐

Section 6: OPERATIONAL CONTEXT

This section evaluates the degree to which the adoption decision is affected by operational issues collateral to implementing Internet banking.

6.1 Service and Product Development

Definition: the degree to which developing appropriate services and products on the Internet is perceived important to Internet banking implementation.

	Please circle one number per row (1: Very Little ..... 5: Very Much)				
31. To what degree do you believe that it is important to ...					
a. decide what existing services can be put into Internet environment?	1	2	3	4	5
b. differentiate, customize and personalize services and products offered through the Internet?	1	2	3	4	5
d. add non-banking services to make Internet banking successful?	1	2	3	4	5

6.2 Management Support

Definition: the degree to which the level of management support is perceived important to the implementation of Internet banking.

	Please circle one number per row (1: Very Little ..... 5: Very Much)				
32. To what degree do you believe that ...					
a. your firm's management support and commitment to Internet banking are sufficient (*e.g.* finance, human resources and technology)?	1	2	3	4	5
b. your firm's upper management understands the Internet banking development issues?	1	2	3	4	5
c. the team working on Internet banking development has a high organizational status?	1	2	3	4	5

6.3 Technical Challenge

Definition: the degree to which the technical complexity impacts the pace of Internet banking implementation.

	Please circle one number per row (1: Very Little ..... 5: Very Much)				
33. To what degree do you believe that the following technical issues represent a challenge to operations in Internet banking?					
a. Integration of the Internet into the existing IT infrastructure *(e.g.* communicability and interoperability of channel systems, and data consistency)	*1*	*2*	*3*	*4*	*5*
b. Security of Internet banking transactions	*1*	*2*	*3*	*4*	*5*
c. Lack of control over Internet technology (*e.g.* third party control over browsers)	*1*	*2*	*3*	*4*	*5*
d. The setting of Internet standards (*e.g.* compatibility between system configurations)	*1*	*2*	*3*	*4*	*5*
e. Immature programming and scripting languages	*1*	*2*	*3*	*4*	*5*

	Please check one box per row				
	Your Firm	*The Banking Industry*	*Government*	*Financial Inter-mediaries*	*Customers*
34. From where do you find out about the operational factors that affect Internet banking decision?	☐	☐	☐	☐	☐
35. Who is most influential in organizing Internet banking within your firm's Web site?	☐	☐	☐	☐	☐
36. Who judges the effectiveness of your firm's operations in Internet banking services?	☐	☐	☐	☐	☐

Section 7: BACKGROUND INFORMATION

	Please circle one number per row (1: Very Little ..... 5: Very Much)				
• How familiar are you with the development of Internet banking within your firm?	*1*	*2*	*3*	*4*	*5*

- What is the name of your firm: _____
- What is your position title: _____
- If you would like to receive the summarized report of the survey, please provide the following information

Contact name: _____ E-mail address: _____

Mail Address: _____

Please use the enclosed stamped envelope to return the completed survey or mail directly to
Dr. John Tillquist
Division of Management Information Systems
Faculty of Commerce and Business Administration
University of British Columbia, 2053 Main Mall, HA462
Vancouver, B.C. Canada V6T 1Z2

Again, we thank you very much for your time and effort to support this study.

Appendix 6: Procedures of Evaluating Significance of Discriminant Functions

Wilks' Lambda Test in this study was used in discriminant analysis to examine which of the discriminant functions should be retained. The testing procedure is a residualization approach, which has steps as follows.

1. All the discriminant functions are tested simultaneously: *the **null hypothesis** is that all discriminant functions are equal to 0, meaning that no discriminant function can describe group differences; and the **alternative** is that at least one is significant, meaning that there is at least one discriminant function that can describe group differences.*
2. If the null hypothesis is rejected (indicating that at least one discriminant function is significant), then the largest (*i.e.,* the first discriminant function because it explains most of the variance) discriminant function is removed and a test is made on the remaining functions (*i.e.,* the residual) to determine if they are significant.
3. At this stage, the null hypothesis is, only one (*i.e.,* the largest) function differs from 0[37]; the alternative is, more than one function is significant. If the null hypothesis is accepted, the procedure stops and it can be concluded that only one (*i.e.,* the largest) function is required to describe group differences. It is because when null hypothesis is accepted, it means that all the residual functions cannot describe any group differences.
4. If the null hypothesis is rejected again, a second residual is created by removing the first 2 functions. Similarly, the next null hypothesis is, only 2 functions are significant; the alternative hypothesis is, more than 2 functions are significant.
5. The testing procedure will continue until either the residual becomes insignificant (*i.e.,* null hypothesis is accepted) or one runs out of functions to test. It must be noted that in this procedure significance of any individual discriminant function cannot be determined. Only the retained functions as a whole can be proved significant.

[37] It is because the largest discriminant function has already been removed. The next null hypothesis is also that all discriminant functions are insignificant. If accepted, it means that only the removed largest discriminant function is significant.

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