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The adoption of virtual banking: an empirical study

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Abstract

Virtual banking is broadly defined in this paper as the provision of banking services via means other than traditional physical branches. Currently, virtual banking exists in the forms of ATM, phone banking, home banking and Internet banking. Understanding people's adoption intention of virtual banking can help financial institutions to formulate appropriate marketing strategies for new forms of banking. Theory of planned behavior (TPB) and innovation diffusion were used to study the adoption intention of virtual banking in a well-developed international financial city. The study finds that the relationships were found only partially explained by the TPB. Other results are interesting and useful for the strategic planning of IT in banking.

Keywords: Virtual banking; Innovation diffusion; Information technology; Banking

1. Introduction

Coupled with innovative business thinking, technology is rapidly changing the way personal financial services are designed and delivered (Freeman, 1996; Crane & Bodie, 1996). Banking is an information intensive business and information technology (IT) plays an increasingly significant role in it. A recent extreme case is the first fully fledged virtual bank, Security First Network Bank (Gandy, 1995). The bank was established in October 1995 in the US and has since then attracted much attention and speculation in both the financial and information technology communities.

In fact, some even asserted that "virtual banking got started with the Automatic teller machine (ATM) (Kass, 1994)". Others describe telephone banking and home banking as other forms of virtual banking (e.g. Talmor, 1995; Mahoney, 1994; Sraeel, 1995). A virtual bank can then be defined as a "non-branch bank", while the virtual banking is the provision of banking services through electronic media such as ATM, telephone, personal computers and/or Internet.

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Virtual banking so defined has been with us for some time. Previous studies have shown that the use of IT has helped banking organizations. For instance, a recent study on the US retail banking sector shows that the transaction cost of telephone banking is only 40% of the cost through physical branch (Talmor, 1995). However, there are other important issues that need to be tackled. For instance, to what extent will the retail bank customers adopt new forms of banking? What are the factors that affect customers' adoption intention? Are there any perception and adoption differences between different forms of banking? These issues are important in that their answers would help the practitioners plan and market new forms of banking in the competitive market.

The purpose of this research, as a result, was to investigate how different virtual banking forms are adopted or perceived and whether the theory of planned behavior (TPB) is capable of predicting the adoption intention of retail bank customers. The findings of this research may help both the bank management to formulate their marketing strategies to promote virtual banking and researchers in virtual banking studies and virtual organizations in general.

The paper is organized as follows. It first reviews relevant literature in banking and information technology, theories of innovation, diffusion and planned behavior. It then describes how this study was conducted, together with the research setting. Third, it reports the research findings. Finally, it concludes with a discussion and recommendation for both practitioners and researchers.

2. Background and literature review

2.1. IT and the evolution of banking

IT was primarily employed to automate the back-office of banks in the 1960s. This situation had been changed by a move of IT into the front office and thus the beginning of management information systems. Technology was deployed to extend the back-office (core process and support process) to the front office and beyond the branch (Llwellyn, 1995; Legg, 1994). This extension has made the banking industry enter a new era, where an explosion of IT applications has been seen throughout banking services, and the division between front and back-offices has become less relevant as integrated systems increasingly blur the line.

Although the IT implementation by the banks was previously directed internally, it has facilitated the introduction of changes in banking, the full effects of which are still being felt. The first of these was the expansion of existing products into new markets and that started the era of 'mass market' banking. Secondly, it opened up alternative distribution channels and the first credit cards started appearing – effectively by-passing the branch networks. Thirdly, it permitted early experiments with cash dispensers that evolved into ATMs. These developments thus provide a useful bridge into the new phase of IT in banks.

New banking delivery channels such as extensive use of ATMs, transborder fund transfers in banking, telephone banking have made banking services convenient to bank customers (Mitchell, 1995). This new era is an integration of systems which have no distinction between back-office and front-office, and there are intelligent elements within the domain of information systems (Oppenheim & Shao, 1994). Banking transactions through the Internet and its related products are developing and will provide enormous opportunities to banking industry (Jones, 1995). Eventually, virtual banks will become a reality such as Security First Network Bank in the US (Gandy, 1995).

With the convenience virtual banking provides, bank customers may now perform their banking transactions at the place and time of their choice. In addition, banks benefit from low operating cost through less staff and less physical branches. However, there are some concerns on virtual banking. Security is one of the most frequently quoted concerns, especially in the area of Internet Banking (Gandy, 1995; Wills, 1996; Tan, 1996). Furthermore, the decrease of cross-selling opportunities is another concern for virtual banking (Talmor, 1995). At a branch, tellers and bank staff can cross-sell other services to customers through face-to-face interaction. With the introduction of virtual banking, customers can now perform transactions by themselves. Consequently, tellers/bank staff do not interact with customers and the chance of cross-selling is thus reduced. Finally, as Internet banking is mainly conducted through computer networks, it seems it is only applicable for those technically competent customers (Wills, 1996).

2.2. Diffusion of innovation

A dominant part of the research in innovation diffusion literature has focused on the process by which adoption occurs or the demand aspect of diffusion (Brown, 1981; Rogers, 1995). This perspective asserts that the adoption of an innovation is primarily the outcome of a learning or communications process. As a result, a fundamental step in examining the process of diffusion is to identify factors related to the flow of information and of the characteristics of the information flows, information reception and the resistance to adoption. The resistance includes an individual's general propensity to adopt an innovation, or his innovativeness and the congruence between innovation and the social, economic and psychological characteristics of the potential adopter (Brown, 1981).

Virtual banking as a technological innovation in banking has not been studied rigorously in the perspective of diffusion, although there are studies on IT adoption in banking (e.g. Pennings and Hariant, 1992; Prendergast, 1993; Shao et al., 1996). The diffusion of virtual banking is defined as the process by which that virtual banking are "communicated through certain channels over time among the members of a social system (Rogers, 1995)." There are four key elements in this diffusion process: the virtual banking, channels of communications, time and people in the social system. The issue of virtual banking adoption is a complex one as adopting a particular technology depends on many factors.

2.3. Theory of planned behavior

The theory of planned behavior (TPB) assumes that "behavior is determined by intention to perform the behavior (Benham & Raymond, 1996)" (see Fig. 1). Intention is determined by three factors: attitude, subjective norms and perceived behavioral control. Each factor is in turn generated by a number of beliefs and associated evaluations.

Attitudes refer to how favorably or unfavorably one views a behavior. Subjective norms measure the influence of the social environment and are formed as one's "perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Aizen, 1975). Perceived behavioral control refers to the individual's perception of "... the presence or absence of requisite resources and opportunities (Aizen & Madden, 1996)" to engage in a behavior.

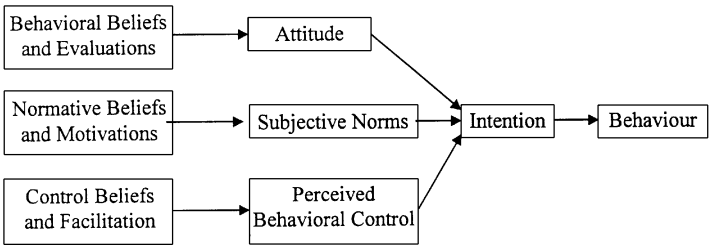

Fig. 1. Theory of planned behavior.

For attitude, behavioral beliefs referred to one's subjective probability that the behavior in question would result in a particular outcome and evaluations were one's implicit valuation or payoff associated with that outcome. For subjective norms, the normative beliefs pertained to the individual's perception of how referent groups would view the behavior and the evaluations were usually expressed as the individual's motivation to comply with these referent groups. For perceived behavioral control, control beliefs would include the individual's perception that he possessed the necessary skills, resources or opportunities to successfully perform the activity. While the evaluations, commonly referred to as facilitation, would indicate how important each skill, resource or opportunity was to being successful.

In sum, these studies and theories have laid a firm background for the study of virtual banking adoption.

3. Research model and hypotheses

3.1. Research model

In the virtual banking case, a behavioral belief is an individual's confidence that using virtual bank will make it faster and more convenient to complete his banking transactions. The associated evaluation will indicate on how important it is to that individual to have his banking transactions completed faster and more convenient. (Attitude factor.)

While normative beliefs is the individual's perception of his friends or colleagues view of his using virtual banking. The evaluations will be the importance placed on each referent group's opinion. (Subjective Norms factor.)

Control beliefs refer to knowing how to perform transactions via virtual banking and the facilitation will cover how critical that knowledge was to successfully using virtual banking to operate an account. (Perceived behavioral control factor.)

3.2. Hypotheses

In light of the above discussion, the following hypotheses were constructed for testing in this study:

H1. Attitude towards the use of virtual banking is dependent upon the behavioral beliefs of relative advantage, ease of use, compatibility, results demonstrability and perceived risk.

H2. Subjective norms about the use of virtual banking are dependent upon normative beliefs of image, visibility and critical mass.
H3. Perceived behavioral control about the use of virtual banking is dependent upon control beliefs of voluntariness, trialability, support and learning.
H4. Intention to use virtual banking is dependent upon attitudes towards the use of virtual banking, subjective norms about the use of virtual banking and perceived behavioral control about the use of virtual banking.

4. Research project

4.1. The research project

The purpose of the research project was to ascertain the adoption situation of various forms of virtual banking and the capability of TPB to predict virtual banking adoption. The study was conducted in late 1996. The target respondents of the questionnaire are professionals or those who have higher education level. Due to the limitation in time and manpower resources, convenience sampling method was used. A total of 200 questionnaires were sent out to a group of staff in several companies. The response rate is 59% with 118 valid responses. Although some of the answers in the returned questionnaires were missed out, they were treated as missing data and excluded from processing on that particular part, the whole questionnaire was still treated as valid sample.

4.2. The research setting: the retail banking in Hong Kong

Hong Kong is an international financial center. The small island is crowded with numerous domestic and foreign banks. By June 1996, there were 184 licensed banks in Hong Kong. Among them, 31 were incorporated in Hong Kong and 153 outside Hong Kong (HKMA, 1996). Major players in the retail banking market are: Hongkong Bank, Hang Seng Bank (a subsidiary of Hongkong and Shanghai Banking Group), Bank of China Group (which consists of 13 member banks), Standard Chartered Bank and Bank of East Asia, etc.

The retail banking sector is served by both domestic banks and foreign banks. By the end of 1995, there were 1649 branches in Hong Kong, equivalent to one branch for every 3825 Hong Kong citizens (Anon, 1996b).

4.2.1. Forms of technology-based retail banking services

Virtual Banking is quite new in the banking industry and are generally recognized as including ATM, Phone Banking, Home Banking, and Internet Banking. The following section is a brief description of these forms of virtual banking in Hong Kong.

Automatic teller machine (*ATM*): ATM was first introduced in Hong Kong by Standard Chartered Bank in 1979. ATM provides some basic banking services on a 24 hour basis. By using an ATM card and a personal password (PIN), customers can deposit or withdraw cash, transfer funds from one account to another, inquire about account balance and request for cheque books and account statement. The transactions are electronically recorded instantaneously (Ghose, 1987).

Table 1
No. of ATM of major banks in Hong Kong

Network	Hongkong bank		JETCO		
Bank	Hongkong Bank	Hang Seng Bank	Bank of East Asia Group	Bank of China	Standard Chartered Bank
No. of ATM	600	275	Over 70	400	200

(Source: *Hong Kong Economic Times*, 5 July 96).

ATM is now widely accepted by bank customers in Hong Kong. The ATM network of major banks in Hong Kong is listed in Table 1.

At present, ATM plays a crucial role in the retail banking business of Hong Kong. Hang Seng Bank claimed their number of transactions conducted via ATM is about 3 million per month (Anonymous, 1996) and Standard Chartered Bank claimed 40% of their daily transactions are processed by ATM (Carstairs, 1998).

Telephone banking: Telephone Banking (Phone Banking) allows customers to conduct transactions through telephones. Phone Banking services can be divided into two types: operator-attended and automated. Operator-attended ones can handle customers' sophisticated inquiries and provide services which are too complicated for a machine to perform. However, it is seldom operated 24 hours a day as the operating cost is high. On the other hand, fully automated ones can provide services round-the-clock as the services are provided via the voice response system.

Phone banking has been widely adopted by customers since it was first introduced in Hong Kong by Wing Hang Bank in 1989. Phone banking is very successful in Hong Kong because it brings convenience to customers and the scope of services provided is almost the same as that of the branches except for cash withdrawal. Moreover, the high ratio of telephone usage (68 telephones per 100 people or 1:1.47) (Anonymous, 1996) also contributes to the quick adoption of phone banking. Nowadays, phone banking is a necessity service for many retail banks in Hong Kong.

Customers benefit from phone banking as the telephone is available in Hong Kong: at home, at the office, on the street. Cellular phones are widely used in Hong Kong. The phone banking service is usually available beyond the normal business hours of branches.

Home banking: Home banking is defined as the conducting of transactions and accessing bank account information via personal computers (PC). Sometimes, it is called Electronic Banking. To use Home Banking, a PC, a modem and a telephone line are required. In addition, a specific banking application software has to be installed to perform banking functions.

The first home banking service was launched in Hong Kong in 1985 by Hong Kong Bank and Hang Seng Bank. The Hongkong Bank Group's "Hexagon" targets corporate customers who are frequent users and have many accounts operating for different business. Since then, several banks in Hong Kong have introduced the Home Banking services for their customers. All of them

run on the proprietary software developed by the respective banks. Customers can access their bank accounts and perform transactions via any PC with the software installed. However, the software are unique and not compatible with each other.

In 1996, Hang Seng Bank started to promote the Home Banking service to their personal customers. Citibank has launched a free-of-charge service to all their retail customers. Banks therefore consider that Home Banking is gradually being accepted by their retail customers.

Internet banking: Internet Banking is defined as the conducting of banking transactions through the Internet. The difference between Internet Banking and Home Banking is that no proprietary software has to be installed for accessing the banking service over the Internet. Banking services can be acquired through the public network of the Internet. Hence, a customer can access to his/her bank account through the Internet.

Full banking services on the Internet are still not available in Hong Kong. However, banks such as Wing Hang Bank, Dao Hang Bank and International Bank of Asia have set up their home pages on the Internet recently, but the services are only limited to product information and rates inquiry. Banks in Hong Kong are aware of the business opportunities created by the Internet, but most of them are in a wait-and-see mode and only a few of them are seriously considering it (Llwellyn, 1995).

Nevertheless, the future outlook of Internet Banking is very promising as the numbers of Internet users in Hong Kong is growing rapidly. Recent research conducted by SRH found that the number of current Internet users in Hong Kong reached 500 000 whereas the figure was only 280 000 at the beginning of 1996, a growth of 220 000 in 6 months. SRH projected that the no. of users would reach 1 million by 2000 which is equivalent to 1 per 6 Hong Kong residents (Anon, 1996a).

5. Research findings

This section reports the findings in two parts: virtual banking in the research setting and the analyses of theory of planned behavior.

5.1. Virtual banking adoption in Hong Kong

Among the 118 respondents, 115 (97.5%) of them have used the ATM services and 104 (88.1%) are current users. This is not surprising as ATM has been introduced in Hong Kong for 17 years. Phone Banking comes the second. 81 (68.6%) of the respondents have used it and 73 (61.9%) of them are still using it. Only less than 10 respondents had used the Home Banking services (see Fig. 2).

As ATM and Phone Banking are the most commonly used virtual banking services by the respondents, a more in-depth analysis of the usage pattern was conducted. The same could not be done for Home Banking and Internet Banking because the sample size was too small (7) and hence not representative enough.

On average, 11 transactions are performed through ATM in a month by the 104 respondents who are current users of ATM. Nearly half of the users (48.1%) use the ATM to process banking transactions 6–10 times in a month. The detailed ATM usage distribution is shown in Fig. 3.

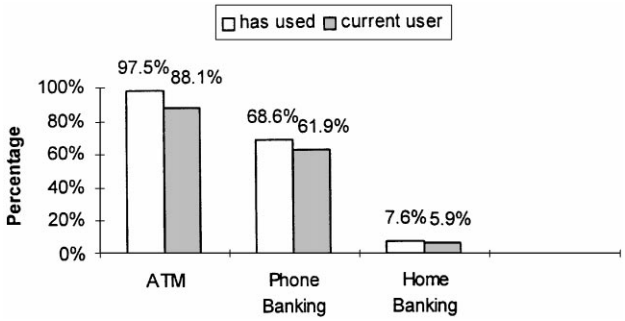

Fig. 2. Comparison of the usage of different forms of virtual banking.

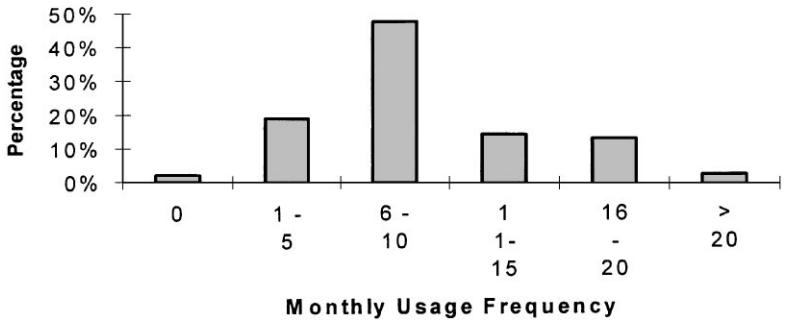

Fig. 3. ATM usage distribution of the respondents (N = 104).

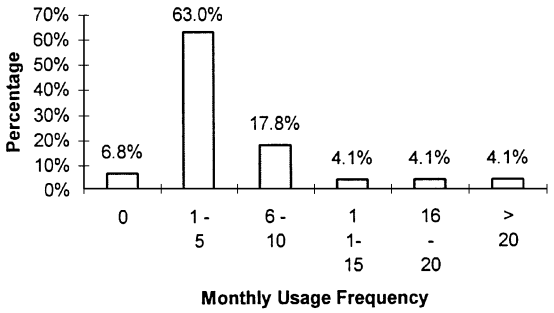

Fig. 4. Phone banking usage distribution of the respondents (N = 73).

The 73 Phone Banking service users use the telephone to conduct banking transaction about 6 times a month. Around 70% of them use the Phone Banking service less than 5 times a month. Fig. 4 shows the detailed breakdown of usage frequency.

Respondents were questioned as to whether they would consider using the virtual banking service that they were not currently using. Fig. 5 shows a summary of the result. It is worth noting that 63% of the 103 non-users of Home Banking said they would like to use it in the future. 56% of the 100 non-users of Internet Banking stated that they would also want to use it in the future.

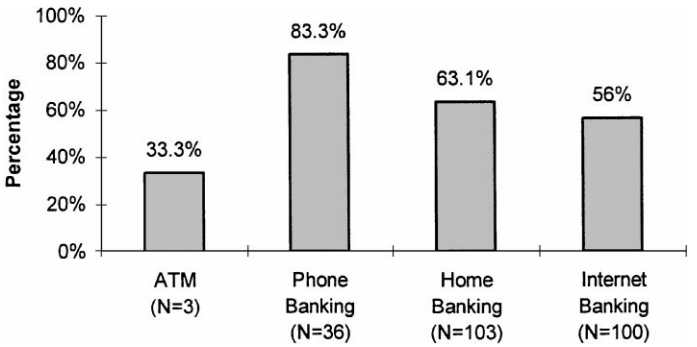

Fig. 5. Intention to use each form of virtual banking in the future.

5.2. Theory of planned behavior

5.2.1. Reliability test

Cronbach's Alpha was used to check the agreement among intention questions which were intended to measure the same attribute. 0.7 was chosen as the passing mark for the reliability test. Eight out of 15 attributes passed the reliability test for virtual banking in general.

First of all, among the five attributes of behavioral belief, four of them were reliable except for the perceived risk item. Perceived risk item was then dropped from the analysis. Secondly, for the three attributes of normative belief, both image and critical mass were proved reliable. Furthermore, as all the attributes of control belief had relative low Cronbach's alpha values, they were all dropped from the study and analysis on control belief could not be further proceeded. Finally, for the "caused by" construct, only attitude and perceived behavioral control were found reliable and subjective norms was then dropped.

5.2.2. Factor analysis

Subsequent to reliability test, a varimax factor analysis was performed on those reliable attributes to condense multiple questions into a single construct scale.

For behavioral belief, the 12 questions measuring relative advantage, compatibility, ease of use and result demonstrability loaded on two factors. Analysis of these two factors concluded that ease of use dominated the first factor whereas relative advantage dominated the second factor. One compatibility question and one result demonstrability question loaded on each factor. These two factors explained 60.6% of the variance.

Applying varimax factor analysis on the four questions measuring image and critical mass, the result was very clear cut. These four questions loaded on two factors. Critical mass heavily loaded on one factor while image heavily loaded on the other. The two factors explained 78% of the variance.

When using the same varimax factor analysis on the questions measuring attitude and perceived behavioral control ("caused by" construct), it was found that they loaded on one factor only. The four questions were almost equally loaded on the same factor and their factor score ranged from 0.77 to 0.87.

5.2.3. Hypotheses testing

The first hypothesis (H1) stated that attitude towards the use of virtual banking was dependent on the behavioral beliefs of relative advantage, ease of use, compatibility, result demonstrability and perceived risk. As it was unable to obtain a reliable measure of perceived risk and the hypothesis was re-written as "attitude towards the use of virtual banking would be dependent on the behavioral beliefs of relative advantage, ease of use, compatibility and result demonstrability".

Linear regression was used to test the revised hypothesis. It was found that both the factors were statistically significant. Factor 1 consisted of ease of use, compatibility and result demonstrability while ease of use played a dominated role. Factor 2 included relative advantage, compatibility and result demonstrability with relative advantage dominating. Moreover, Factor 1 had a larger influence on attitude because it had a greater beta value (0.641) while that of Factor 2 was only 0.397. The adjusted R square was 0.561 which is meant that 56.1% of the variance can be explained by this relationship.

The second hypothesis (H2) stated that subjective norms about the use of virtual banking were dependent upon normative beliefs of image, visibility and critical mass. Since a reliable visibility measure could not be obtained, the hypothesis was revised as "subjective norms about the use of virtual banking were dependent upon normative beliefs of image and critical mass". The result of the linear regression was showed below. It supported the hypothesis since both the critical mass and image were proved statistically significant. Factor 2 (i.e. image) showed a larger influence on the subjective norms (beta value = 0.525). Nevertheless, the explanation power of this relationship was low as indicated by the low adjusted R square value (0.29).

The third hypothesis (H3) states that perceived behavioral control about the use of virtual banking was dependent upon control beliefs of voluntariness, trialability, support and personal learning. Because no reliable attribute measures were obtained on this part, the hypothesis could not be tested in this study.

The fourth hypothesis (H4) proposed that intention to use virtual banking was dependent upon attitudes towards the use of virtual banking, subjective norms about the use of virtual banking and perceived behavioral control about the use of virtual banking. Owing to the absence of reliable measure on subjective norms, the hypothesis was amended to "Intention to use virtual banking was dependent upon attitudes towards the use of virtual banking and perceived behavioral control about the use of virtual banking".

The intention was a measure on current usage and future usage of four forms of virtual banking. The intention value was 3 (2 + 1) if the respondent claimed that he was currently using ATM and Phone Banking services and would use Internet Banking service in the future. Hence, this measure was a combination of actual behavior (current usage) and imaginary behavior (future usage).

The hypothesis was supported. The only factor loaded by attitude and perceived behavioral control was statistically significant as a determinant of the intention. However, the explanation power of this hypothesis is very low as indicated by the low adjusted R square value (0.056).

6. Conclusion

TPB was only partially applicable in predicting the adoption intention of virtual banking in the research setting. However, four major relationships of TPB were presented as the four hypotheses

and three of them were tested. The first hypothesis stated that attitude towards virtual banking was dependent on relative advantage, compatibility, ease of use, result demonstrability and perceived risk. Reliable measures on perceived risk could not be obtained and only the first four constructs were tested. The hypothesis was supported but the two factors found were not clear cut. One of them was a combination of ease of use, compatibility and result demonstrability whereas the other was a mixture of relative advantage, compatibility and result demonstrability. The explanation power of this relationship is 0.56.

The second hypothesis claimed that subjective norms about virtual banking were dependent on image, visibility and critical mass. Visibility was not used as no reliable measure was available. The hypothesis was also supported. However, the *R* square value was only 0.29, which meant that image and critical mass alone could not provide a powerful explanation of subjective norms.

The third hypothesis was that perceived behavioral control about virtual banking was dependent on voluntariness, trialability, support and organizational learning. However, this hypothesis could not be tested in this study due to an unavailable reliable measure.

The last hypothesis stated that intention to use virtual banking was determined by attitude, subjective norms and perceived behavioral control. Dependency on subjective norms could not be tested due to the absence of reliable measure. Dependency on the other two factors was founded statistically significant. Nevertheless, the low *R* square value of 0.056 indicated very low explanation power.

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