Library Hi Tech

Investigating factors affecting the acceptance of self-service technology in libraries: The moderating effect of gender

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Received 19 September 2014
Revised 30 October 2014
Accepted 1 December 2014

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Abstract

Purpose – The self-service technology (SST) launched outside libraries has received great attention in Taiwan. This automatic book stop (ABS), FastBook, has raised some interesting issues regarding users' behavior in the library context. The purpose of this paper is: first, to assess critical variables that contribute to users' acceptance of SST in the library context; second, to propose an integrated SST acceptance model in terms of technological and individual factors; and third, to further examine the gender differences among all the theoretical relationships proposed in this research model.

Design/methodology/approach – Based on a sound theoretical foundation, the authors proposed a research model to investigate users' intention to adopt FastBook, including both technological and individual factors. The survey methodology and structural equation modeling were used in this study.

Findings – The proposed model successfully accounted for about 92 percent of the total variance explained in attitude and 45 percent in behavioral intention (BI). Individuals' attitudes toward FastBook had a significant impact on their usage intention. All three technological characteristics (perceived ease of use, usefulness, and reachability) and one individual trait (self-efficacy) were confirmed as critical determinants of attitude. Note that the effect of self-efficacy on attitude was much stronger for male than for female users.

Originality/value – The SST launched outside libraries has received great popularity and extended the library service to readers in Taiwan. This research connected actual users' experience and the SST literature to provide a conceptual understanding of FastBook adopting process.

Keywords Information technology, Library services, Questionnaires, Qualitative research, Library facilities

Paper type Research paper

1. Introduction

Since the mid 1990s, with the rapid expansion of the internet and the availability of digital information to the general public, library use has been on the decline. Research has pointed out that both gate counts and circulation of traditional materials in university libraries are declining at many college libraries (Carlson, 2001). In contrast to this declining physical usage of libraries worldwide, the move toward e-books has been increasing among the younger generation because they tend to read books on computers or mobile devices such as pads or smart-phones. According to a survey of public libraries in Taiwan, while paper-based book borrowing grew < 1 percent per year, the digital items downloaded grew 8 percent with an average of 2.6 items checked out by each person (National Central Library Annual Report, 2012).

Library Hi Tech
Vol. 33 No. 1, 2015
pp. 114-133

0737-8831
DOI 10.1108/LHT-09-2014-0087

The shift to electronic resources has caused many scholars and librarians to worry about the loss of resources in physical libraries and to mourn the loss of a common library culture. Since the use of electronic resources is growing more rapidly than expected, some university boards or authorities are becoming skeptical about adding equipment/books and library buildings since they cost so much. Recent studies have pointed out that some libraries endeavored to enhance web-based library services in academic libraries (Becker *et al.*, 2013; Boateng and Liu, 2014). However, other libraries rely on self-service technologies (SSTs) to offer readers customized options, and hopefully to take the library to the next level of productivity, security, and service. For example, self-issue and return systems have been introduced to libraries and are popular with readers as they can issue and return books at the kiosk without the need to queue at the counter (Morris *et al.*, 2001).

In addition to self-issue and return systems inside the facility, some extended library SST has been introduced outside library locations. For example, FastBook, an automatic self-service book vending machine[1], has been introduced to serve people 24 hours a day in Taiwan. Originally from Sweden (called "Bokamaten" machines), this book vending machine (also called Library-a-Go-Go or GoLibrary) has received its popularity and attentions after its first introduction to the USA in 2008 for the Contra Costa County Library in California (Hildreth, 2008). It can accommodate up to 400 books, and allows book lovers to enjoy borrowing and returning books at their convenience. Readers can choose from the touch screen to complete book borrowing in as fast as 15 seconds through four steps: check identification, scan ISBN, select OK, and then take the receipt (see Appendix 1). FastBook is usually located in crowded areas such as hospitals, banks, and Mass Rapid Transit stations. This 24-hour automatic self-service book stop is a newly established library self-service system in Taiwan, attractive to readers and pedestrians, but the degree of its popularity and acceptance is as yet unknown. Therefore, there is a definite need to explore readers' attitudes toward and acceptance of this library SST and its determinants.

Past studies have also indicated that there are gender differences in technology acceptance (Ong and Lai, 2006; Venkatesh and Morris, 2000), as well as in SSTs (Elliott and Hall, 2005; Lee *et al.*, 2013). By examining the moderating effects of gender, this study provides better understanding of and insights into how gender influences the adoption of SST in the context of libraries.

Library SSTs such as FastBook have certainly made it easier and more convenient for readers to borrow books. However, there is very little known about what factors influence users' adopting intention for such technology, especially regarding the newly established ABS in Taiwan. This study extends the theoretical perspectives from views of the technological characteristics and individual traits, and integrates the SST literature into a unified framework to investigate the acceptance of FastBook. Accordingly, this current study has the following objectives: first, to assess some of the critical variables that contribute to users' acceptance of SST in the library context; second, to propose an integrated SST acceptance model in terms of technological and individual factors; and third, to further examine the gender difference among all proposed relationships in the research model. To the best of our knowledge, this is one of the first studies to investigate the acceptance of library SST.

2. Literature review

2.1 Overview of SSTs and the research model

SSTs refer to the technological interfaces that enable users to generate a service without the direct involvement of staff. SSTs have been widely applied in many

service contexts to provide consumers with an alternative way to co-produce services and co-create value with technology (Bitner *et al.*, 2000). Examples of SSTs include automated teller machines (ATMs), automated hotel checkout, self-scanning in libraries, and self-service kiosks at airports (Meuter *et al.*, 2000). Airline passengers can make a reservation and pay for tickets through the internet, or check in and pick up boarding passes at airport kiosks. Bank customers can make transactions through the internet, phone systems, ATMs, and mobile channels. By using SSTs, customers can participate as co-producers with a more flexible choice of time and space to suit their individual requirements.

With the introduction of SSTs, companies can provide multiple channels for customer service and offer many benefits for consumers. An easy and understandable service system may be attractive to consumers and can enhance customers' commitment to the service providers (Zeithaml *et al.*, 2002). Other advantages of SSTs include time and cost savings, convenience of location (Kauffman and Lally, 1994), perceived fun or enjoyment from using the technology (Dabholkar, 1994, 1996), and efficiency (Bitner *et al.*, 2000).

SSTs have also been established in libraries, such as self-issue and return systems, and self-service book vending machines. The self-issue and return systems which function as discharging and reclaiming library books are gaining popularity (Chang and Chang, 2009). Readers get a receipt from the self-service machine, while their borrower records are simultaneously updated. SST can modernize library services by reducing users' queuing time and library human resources. Another self-service platform outside library locations can even provide extension services 24 hours a day, all year round. This 24-hour automatic self-service book stop (ABS) (also called FastBook in Taiwan) is a newly developed library self-service system, which is rare but attractive to library readers. Like a vending machine but larger in volume, FastBook can provide basic library functions such as borrowing, returning, and updating records with an accommodation of up to 400 books. This service effectively presents the library to customers who are unable to get to a library.

The use of SSTs is in varying and novel contexts. Some studies have explored use intention across multiple contexts of SSTs. Lin and Hsieh (2011) constructed a scale to examine key factors of SST service quality, including functionality, enjoyment, security/privacy, assurance, design, convenience, and customization. Their investigation covered various industries and distribution methods, including banks, security firms, railways, airlines, rapid transit systems, kiosks, and the internet. Oyedele and Simpson (2007) examined the potential effects of locus of control, autonomy, self-efficacy, technology anxiety, and time pressure on the SST usage decision in a shopping store, a library, and a hotel situation, but no variable had a significant effect on SST usage in the library scenario. Liu (2012) examined the effect of forced use on satisfaction and BIs on typical interactive kiosks such as ATMs, vending machines, information query terminals, self-service washing machines, and subway tokens. The results confirmed the intermediate roles of technology anxiety and trust.

Other studies have focussed on a specific context of SSTs. Dabholkar and Bagozzi (2002) built an attitudinal model of SSTs regarding touch screens for ordering in a fast-food restaurant. The moderating effects of consumer traits and situational factors were under test, and the result confirmed the moderating effects of situational factors in the consumer use of SST delivery options. In the library context of using self-checkout machines, the research of Zhao *et al.* (2008) found that post-training self-efficacy has a positive impact on customer satisfaction but not on intention to reuse

SSTs. However, perceived ease (PE) of use influences intention to reuse SSTs positively. Chang and Chang (2009) confirmed the effects of all the variables in the TPB/technology acceptance model (TAM) integrated model on user intentions, including perceived usefulness (PU), ease of use, attitude, subjective norms, and perceived behavioral control. Lu *et al.* (2003) integrated individual differences into TAM in the study of mobile wireless internet acceptance.

Although the aforementioned research is useful in explaining the determinants of SST use intention, these efforts did not consider the simultaneous effects of technological (i.e. perceived useful, ease of use, and ubiquity) and individual factors (i.e. self-efficacy, novelty seeking (NS), and the need for interaction (NI) with people), nor did they explore the issue of FastBook usage. The introduction of SSTs in libraries opens up their potential popularity and extends the library services in Taiwan and elsewhere. Hence, our research should provide valuable insights into the study of SST use intentions in the library context (Figure 1).

2.2 Technological characteristics

An important and long-standing research question for information systems is how to accurately explain users' acceptance of new information technology (DeLone and McLean, 1992). Davis's TAM has been validated as one of the dominant theoretical underpinnings. The TAM is a widely accepted model adapted from the theory of reasoned action which focusses on two main beliefs regarding information technology:

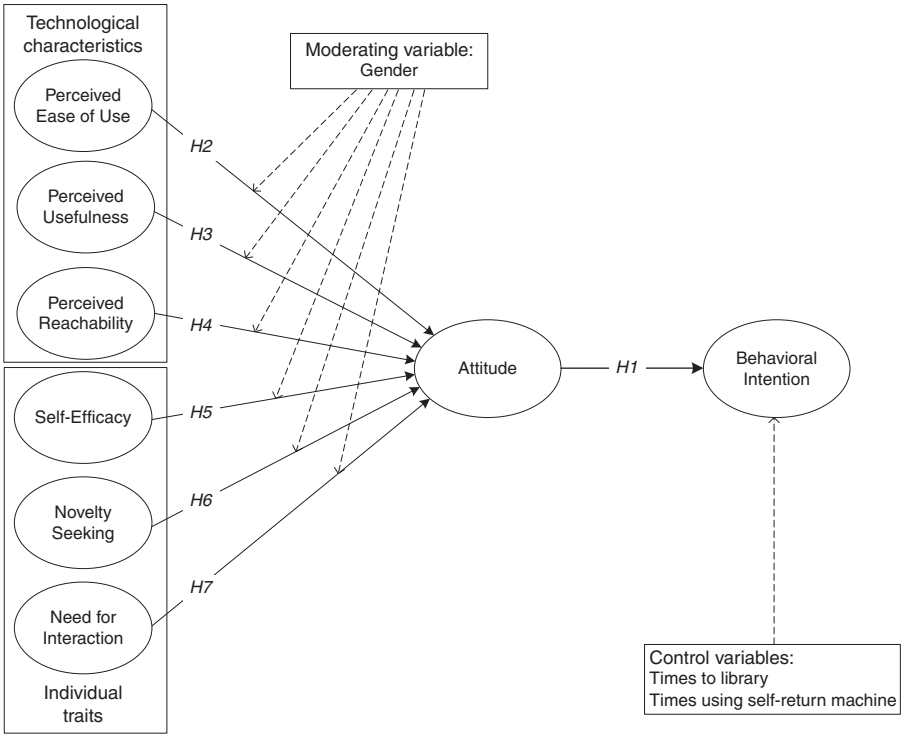

Figure 1.
Research framework

PE of use and PU. In TAM, PE of use and PU affect attitude toward usage, which in turn determines BI.

An attitude reflects the feelings of favorableness or unfavorableness regarding using the technology. According to the behavioral intention approach, BI is an adequate proxy of actual behavior (Allen *et al.*, 1998). Therefore, BI rather than actual behavior is adopted in the current study. Prior studies on the adoption of technology support attitudes as an antecedent of BIs (Dabholkar, 1994, 1996; Davis *et al.*, 1989). The relationship between attitude and behavior intentions has also been confirmed in the literature regarding the adoption of technology (Dabholkar, 1996; Taylor and Todd, 1995), e-book/e-textbook (Hsiao and Tang, 2014), digital libraries (Park *et al.*, 2009), and self-issue and return systems (Chang and Chang, 2009). Thus, this relationship is hypothesized as follows:

H1. Attitude positively influences BI.

2.2.1 Perceive ease of use and usefulness. Based on the TAM, this study proposed that PE of use and PU were critical to the effects of an individual's attitude toward using FastBook. PE of use reflects the extent to which an individual expects that the SSTs will be easy to learn and use (Davis and Wiedenbeck, 2001). An easy to understand and operate SST is sometimes attractive to consumers, because they would feel comfortable while using that technology (van Dolen *et al.*, 2007). Past research has found that some consumers prefer using SSTs over the traditional face-to-face service because they find the SST easy to use (Dabholkar, 1996; Meuter *et al.*, 2000).

PU reflects the extent to which a person believes that using SSTs will improve the way he or she could complete a given task (Davis *et al.*, 1989). In general, when consumers perceive a new technology as useful and functional, they will be more likely to adopt that new technology; this is especially true for young adults (Sun and Zhang, 2006; Venkatesh *et al.*, 2003). The influence of PU on SSTs is controversial. Dabholkar and Bagozzi (2002) indicated that PU is not appropriate for technology-based self-service systems, in which the consumer participates but does not own those devices. However, in the study of SSTs in the library context, PU is confirmed as having a direct influence on attitude to use self-issue and return systems (Chang and Chang, 2009). Thus, the current study verifies those relationships of TAM in the context of Fastbook with the following hypotheses:

H2. PE of use positively influences attitude.

H3. PU positively influences attitude.

2.2.2 Perceived reachability (PR). In addition to PU and ease to use, research also shows that other technical considerations related to the use of SSTs are necessary, including time and cost savings, greater control over service delivery, convenience of location (Kauffman and Lally, 1994) and fun or enjoyment from using the technology (Dabholkar, 1994, 1996). PR, referring to the extent to which an individual can reach the SSTs anytime at a convenient location, is emphasized as a key element of SST service (Childers *et al.*, 2001; Yang *et al.*, 2003). This concept assumes that users have the capability to connect with and reach all kinds of facilities and devices at convenient times and locations (Kim and Garrison, 2009).

Prior studies have claimed that this capability of geographical flexibility is a critical factor influencing the diffusion of new technology (Dholakia *et al.*, 2004; Looney *et al.*, 2004). Regarding the research interest in FastBook, a 24-hour self-service book stop

usually located in busy and crowded areas which people can easily access, we hypothesized that the characteristics of convenient time and location will foster a positive evaluation of FastBook:

H4. PR positively influences attitude.

2.3 Individual traits

Different consumer characteristics are important determinants of SST usage intention. Among consumer difference variables, personality traits have received greater interest than have demographic or psychographic factors (Dabholkar, 1996; Davis, 1989; Hirschman, 1980). Some researchers have asserted that the variation in individual traits is the heart of consumer attitude formation and BI for SST usage (Dabholkar and Bagozzi, 2002). In this study, we focus on three consumer traits that have direct relevance to SST usage, namely, self-efficacy, NS, and NI with service staff (Dabholkar, 1996; Hirschman, 1980).

2.3.1 Self-efficacy. Self-efficacy, one of the important traits of consumer differences, was introduced as a core concept in the social cognitive theory (Bedard *et al.*, 2003), which asserts that people are more likely to engage in a particular behavior if they believe that they have the capability to accomplish that behavior (Bandura, 1998). The concepts of self-efficacy, ability, and perceived behavioral control have often been confused. While ability refers to what an individual "can do," and perceived behavioral control focusses on the ability to perform a particular behavior, the concept of self-efficacy captures an individual's beliefs about his/her capabilities to perform given levels of attainment (Bandura, 1998).

Self-efficacy regulates people by influencing their motivation to persevere and to overcome difficulties, and then accomplish tasks successfully (Ellen *et al.*, 1991). It is considered as a key successful factor to perform a task, including computer and information system-related activities (Igbaria and Iivari, 1995), and SST (Dabholkar and Bagozzi, 2002). Consumers with low self-efficacy often regard a complex or new technology as a risk of failure, and will be more likely to avoid such perceived threats (Bandura, 1998). On the other hand, consumers with a higher level of self-efficacy will have more confidence in their ability to perform a task, and tend to be persistent in their efforts (Dabholkar and Bagozzi, 2002). It is believed that high-self-efficacy beliefs can reduce the resistance to technological innovation and IS acceptance (Ellen *et al.*, 1991).

Prior research has indicated that self-efficacy can foster attitudes toward the object of beliefs such as the internet (Ajzen and Sexton, 1999). People's level of internet self-efficacy is related to their beliefs about the web sites they use, which in turn reflect their perceived capability to use those sites to complete tasks (Eastin and LaRose, 2000). In the context of SST, the perceived ability to successfully complete tasks will also influence the technology usage decision (Dabholkar and Bagozzi, 2002). Compared with the traditional full service, the SST requires higher effort from customers. Therefore, according to the above research, it is reasonable to assume the following:

H5. Self-efficacy positively influences attitude.

2.3.2 NS. NS, another important personal trait capturing greater interest than demographic or psychographic factors, is regarded as the focal point of consumer attitude formation (Hirschman, 1980). Similar to the concept of arousal seeking (Mehrabian and Russell, 1974) or innovativeness, NS is defined as the desire to seek out new stimuli or to try out any new information technology (Hirschman, 1980). It is the

intrinsic motivation which drives people to explore new and different experiences (Holbrook and Hirschman, 1982).

Many studies have suggested that NS is an influential factor of attitude, including choices of traveling mode (Hsiao and Yang, 2010), technological products (Hirschman, 1980; Parasuraman, 2000) and SST (Dabholkar and Bagozzi, 2002). People who are identified as novelty-seekers dare to break traditional rules, take risks, pursue novel experiences apart from their routine life, and enjoy the stimulation of trying new ways to approach old problems (Hirschman, 1980; Midgley and Dowling, 1978). Such consumers tend to look favorably on technology and adopt new technology-based products, including SST (Dabholkar and Bagozzi, 2002; Hirschman, 1980), because they have stronger intrinsic motivation to use such products (Hirschman, 1980; Midgley and Dowling, 1978). According to the innate nature of intrinsic motivation, we treated "inherent NS" as an influential factor of attitude toward FastBook, a novel self-service device. Thus, we hypothesized:

H6. NS positively influences attitude.

2.3.3 NI with people. Prior research has found that the NI with a service staff member is a relevant factor for technology-based self-service (Cowles and Crosby, 1990; Curran and Meuter, 2005; Dabholkar, 1996). Recent research has found that some consumers may prefer using SST over person-to-person encounters if they find it easy to use, more convenient than the alternatives, or if it can help them avoid interaction with employees (Dabholkar, 1996; Meuter *et al.*, 2000).

In general, consumers may not be accustomed to using self-service machines, as they are used to having interpersonal contact with staff (Breakwell *et al.*, 1986). If people do not see any significant benefit in using the technology, they will continue to choose the traditional ways that they have always used (Zeithaml and Gilly, 1987). After all, the switching cost of learning new technology is not worthwhile for many people (Gatignon and Robertson, 1991). Those consumers who are not comfortable or confident with the technologies usually regard the use of technology service as a cause of anxiety and stress (Mick and Fournier, 1998). Others prefer to have interaction with people as they view the service encounter as an experience or opportunity to establish a certain degree of social relationship (Curran *et al.*, 2003). Apparently, consumers with a high NI with people would lack the intrinsic motivation to use technology-based self-service. Consistent with prior research, we therefore hypothesized that the NI with service staff will be negatively related to attitude toward the SST:

H7. NI with people negatively influences attitude.

2.4 Moderating effect of gender

Psychology research has studied gender differences in decision-making processes and found differences between women and men (Bem and Allen, 1974). For example, females usually engage in a greater amount of social activity than males (Wood and Karten, 1986) and weigh the opinions of others more highly than do men (Lee *et al.*, 2013).

Recently, more researchers have focussed on the study of gender differences in technology acceptance (Ong and Lai, 2006; Venkatesh and Morris, 2000). They found that males have higher levels of computer self-efficacy than females. In terms of PU, males weigh it to a greater degree compared to females. In contrast, females are

more strongly influenced by perceptions of ease of use, and show less favorable attitudes toward technology (Todman, 2000). They have also been revealed as experiencing higher discomfort with SST (Elliott and Hall, 2005). On the other hand, males are easily affected by attitude toward the adoption of a new technology (Venkatesh and Morris, 2000).

The above findings may suggest that there are also different effects of gender on the adoption and use of SST. Thus, we propose that all the relationships in the proposed hypotheses will be moderated by gender.

3. Research methodology

3.1 Procedure and subjects

Empirical data for this study were collected through a paper-based survey from a university in Taiwan. The questionnaire survey in the current study was administered during regular class time with the permission of the students and teachers by a trained instructor. Before the investigation, a two-minute brief introduction to FastBook was given in the class. Following the introduction, the students were presented with a questionnaire to complete.

In the context of library SST, the student subjects from the university can be viewed as the major target of library services. Prior research has indicated that student respondents were much more likely to be familiar with SSTs than were others, such as office workers or senior citizens (Dabholkar and Bagozzi, 2002; Dabholkar, 1996). Most participants in this study had had prior experiences of the library's self-checkout machines. This suggests that university students would place considerably high demands on library self-services to meet their needs.

In total, 413 out of 440 complete questionnaires were collected and used for subsequent analysis, with a high effective response rate of 93.9 percent. The participants ranged from 19 to 29 years old with an average age of 20.62 years and a standard deviation of 1.30 years. Male and female students made up approximately 40 and 60 percent of the sample, respectively. Students in the analysis had the experience of using self-checkout machines an average of 2.14 times, with a standard deviation of 0.48 times. Finally, respondents went to the library around 7.43 times on average, among which only 6.2 percent had not been to the library in the past half year.

3.2 Measurement development

In order to appropriately measure the constructs of interest, research items were drawn and modified from well-validated scales (see Appendix 2). The advantages of using existing scales are that they fulfill the face and content validity, thus providing a theoretical basis for the domain of assessment. All measures were translated into Chinese by the authors, and then back-translated into English by an independent translator. The discrepancies in the versions were compared and resolved to ensure consistency between the Chinese and the original English versions.

Items from TAM factors, PU and PE of use, were adopted from Davis (1989) and Davis *et al.* (1989). PU was measured using four items capturing aspects related to productivity and effectiveness, while the PE items assessed the concepts related to being clear to understand and requiring less effort. Three items of individual's attitudes (AT) were adopted from Fishbein and Ajzen (1975), capturing the aspects related to positive perceptions of using FastBook. Measures of PR were adapted from Palen (2002) and Parasuraman (2000), reflecting the accessibility

of FastBook anytime at a convenient location. NS, one of the individual traits, captured the aspects related to new ideas and the tendency for novelty and change experience. Three items were modified from two past studies of Mehrabian and Russell (1974) and Hsiao and Yang (2010). Items of NI with people were adopted from Dabholkar (1996). Finally, three items of BI modified from Venkatesh *et al.* (2003) reflected the likelihood of using FastBook. Note that the research items all used a seven-point Likert scale with anchors ranging from "strongly disagree" to "strongly agree."

The initial version of the survey instrument was modified through a pre-test with a 42-student sample. Based on the subjects' suggestions regarding any confusing items in the questionnaire and a low item-to-total correlation (< 0.5), some items were moderately re-worded. The Cronbach's α values ranged from 0.79 (NS) to 0.95 (PU). The above process helped to assure the content validity of the questionnaire. The refined instrument was then used to collect the research data.

3.3 Measurement assessment

Following a two-step structural equation modeling approach introduced by Anderson and Gerbing (1988), confirmatory factor analysis (CFA) using Amos Graphics 17.0 was employed for the measurement assessments and confirmation of structural relationships among the constructs of interest. The higher the value of the fit indices, the better model fit was suggested.

As the results show in Table I, a satisfactory fit to the data with χ^2 of 554.97 ($df = 247$, $p < 0.001$) and other goodness-of-fit indices (NFI = 0.91; IFI = 0.95; CFI = 0.95; RMSEA = 0.071) was obtained. The results suggest an adequate goodness-of-fit of our measurement model. In addition, internal consistency measures how consistently individuals responded to the items within a scale. Cronbach's was used to test the internal consistency reliability of each composite construct. As shown in Table I, Cronbach's α values for all constructs ranged from 0.83 (AT) to 0.95 (PU and BI), indicating the existence of reliability.

Based on a well-fitting measurement model, composite reliability (CR), measuring how consistently individuals respond to the items within a scale, supported the existence of construct reliability as well (CR ranging from 0.85 to 0.93). Average variance explained (AVE) for each construct in Table I all exceeded 0.5, indicating that the items explained more variance in the underlying construct than measurement error did (Fornell and Larcker, 1981). In Table II, the correlation matrix demonstrated significantly positive inter-item correlations among all constructs.

To further validate our measurement model, convergent and discriminant validity were then assessed. Convergence was statistically achieved in two ways. First, all factor loadings for indicators contained in the same construct were statistically significant with *t*-values ranging from 15.21 to 24.88, showing that every item explained each corresponding construct only. Next, both high values of CR and AVE provided supports that all the items were successfully converged and accounted for their underlying constructs. Discriminant validity is achieved if the square root of the average variance extracted for each construct is greater than the correlations between it and other constructs (Chin, 1998). As shown in Table II, the square roots of AVE were all greater than the off-diagonal elements in the corresponding rows and columns. Therefore, it can be concluded that the instrument had proper convergent and discriminant validity.

Indicators	Standardized loading	*t*-value	Cronbach's α	CR	AVE
PE1	0.90	22.85	0.93	0.93	0.83
PE2	0.92	24.01			
PE3	0.90	22.87			
PU1	0.88	22.03	0.95	0.93	0.78
PU2	0.92	24.03			
PU3	0.87	23.50			
PU4	0.86	23.87			
PR1	0.86	21.95	0.86	0.85	0.66
PR2	0.82	20.85			
PR3	0.76	16.97			
SE1	0.89	22.03	0.91	0.92	0.79
SE2	0.90	22.84			
SE3	0.87	21.48			
NS1	0.83	19.96	0.88	0.88	0.70
NS2	0.88	21.58			
NS3	0.81	19.54			
NI1	0.89	19.96	0.89	0.89	0.73
NI2	0.87	21.58			
NI3	0.79	19.54			
AT1	0.88	21.37	0.83	0.86	0.68
AT2	0.87	20.60			
AT3	0.71	15.21			
BI1	0.89	24.05	0.95	0.93	0.81
BI2	0.91	24.88			
BI3	0.90	24.87			

Notes: PU, Perceived usefulness; PE, perceived ease of use; PR, perceived reachability; SE, self-efficacy; NS, novelty seeking; NI, need for interaction; AT, attitudes toward 24-hour automatic self-service book stop; BI, behavioral intention

Table I. Standardized loadings and reliability

	Means	SD	PU	PE	PR	SE	NS	NI	AT	BI
PU	5.41	1.18	0.91							
PE	5.27	1.19	0.71*	0.88						
PR	5.29	1.08	0.71*	0.71*	0.81					
SE	5.23	1.16	0.70*	0.58*	0.66*	0.89				
NS	5.30	1.12	0.63*	0.59*	0.68*	0.64*	0.84			
NI	4.97	1.18	0.42*	0.37*	0.48*	0.43*	0.52*	0.85		
AT	5.39	1.11	0.80*	0.70*	0.73*	0.72*	0.63*	0.40*	0.82	
BI	5.08	1.21	0.52*	0.56*	0.64*	0.55*	0.52*	0.34*	0.60*	0.90

Notes: SD, Standard deviation. For constructs: PU, perceived usefulness; PE, perceived ease of use; PR, perceived reachability; SE, self-efficacy; NS, novelty seeking; NI, need for interaction; AT, attitudes toward 24-hour automatic self-service book stop; BI, behavioral intention. Coefficients on diagonal line are square roots of AVE. *Significant at the 0.01 overall

Table II. Latent construct correlation, criterion validity, and discriminant validity

4. Empirical results

4.1 Common method variance (CMV)

All the measures were self-reported by the same respondents; therefore, there is a potential problem of the occurrence of CMV. CFA was used as a test of CMV. If the fit

of the one-dimensional model is worse than that of the measurement model, this suggests that CMV does not appear to be a serious threat (Podsakoff *et al.*, 2003). The results show that the fit is considerably worse for the one-dimensional model than it is for the measurement model; therefore, the issue of CMV is of less concern in this study.

4.2 Measurement model assessment

Following the first step of measurement model testing, the next step was to analyze the structure model. To avoid making any improper inferences, times of visiting the library in the past six months and times of using the self-return machines were included as control variables. Controlling these variables can effectively reduce experimental errors as they could have some unpredictable influences on intention to use FastBook. The findings showed that there were no confounding effects of controlling the variables. Thus, practitioners need not be influenced by these control variables when applying the determinants identified in this study.

Our proposed model showed that the goodness-of-fit was acceptable ($\chi^2 = 789.64$, df = 289; NFI = 0.92; IFI = 0.95; CFI = 0.95; RMSEA = 0.065). *H1* tested the effect of attitude on BI, and *H2-H7* examined the effects of technological and personal factors on attitude. Five out of seven hypotheses were supported. The relationships from both NS and need for interpersonal interaction to attitude were not statistically supported.

The significance paths are shown below. First, all three technological characteristics have significant effects on attitude toward FastBook, namely PE of use ($\beta = 0.50$, $p < 0.000$), PU ($\beta = 0.11$, $p < 0.05$), and PR ($\beta = 0.28$, $p < 0.000$). Thus, *H2-H4* were supported.

H5-H7 investigated the links between individual traits and attitude. The positive influence of self-efficacy on attitude ($\beta = 0.16$) was supported under two-tail significant level at 0.01; however, the paths from NS and NI with people failed to influence attitude statistically ($\beta = 0.02$, -0.05, respectively). Thus, *H6* and *H7* were not supported.

Overall, the present study found that the proposed model accounted for 92 percent of the variance in AT, and 45 percent of the variance in BI regarding FastBook. The result is depicted in Table III.

To examine the moderating effect, subgroup analyses with AMOS 17 were performed according to the recommendation of Jöreskog and Sörbom (1996). We conducted the pairwise parameter comparisons using 0.05 as the significant level for differences between parameters. The test results of the moderating effects in Table IV indicated that the influence of self-efficacy on attitude for males is higher than for

Hypotheses	Path	Standardized coefficient	*t*-value	*p*-value	Remarks
H1	AT→BI	0.67***	14.20	< 0.000	Supported
H2	PE→AT	0.50***	8.30	< 0.000	Supported
H3	PU→AT	0.11*	2.21	0.027	Supported
H4	PR→AT	0.28***	3.96	< 0.000	Supported
H5	SE→AT	0.16**	2.92	0.003	Supported
H6	NS→AT	0.02	0.39	0.697	Not supported
H7	NI→AT	−0.05	−1.28	0.201	Not supported
Control variable					
Times to library		0.001	0.128	0.898	Not supported
Times using self-return machine		0.063	0.731	0.465	Not supported

Notes: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table III. Hypothesis testing results

females, but the influences of other factors on attitude have no significant differences between females and males. Therefore, we conclude that the gender difference effect exists only in the effect of self-efficacy on attitude.

5. Discussion

5.1 Summary of results

The present research aims to provide an empirical analysis based on a sound theory to explain factors influencing users' attitude toward and intention to use FastBook, a 24-hour automatic self-service book stop. The moderating effects of gender on the relationships of the proposed hypotheses were also investigated. The proposed model was found to have a good fit to the data. We also found that the proposed model successfully accounted for about 92 percent of the total variance explained in attitude and 45 percent in BI. Moreover, five out of seven hypotheses were supported.

Our results have provided insights into the relationships between attitude and its determinants, as well as three important results:

(1) a conceptual understanding of the FastBook adopting process was reached;

(2) four determinants from the roles of technological characteristics and individual traits were confirmed; and

(3) the moderating effect of gender difference was found to exist.

First, the theorized structure for adopting FastBook was validated by using samples of real library users, providing real users' experience to conceptually understand the whole adoption process of FastBook. Second, viewing usage intentions, individuals' attitudes toward FastBook were found to have a significant impact on BI. In the present study, all three technological characteristics and one individual trait, which were confirmed as critical determinants of attitude toward FastBook, have thus shed light on the way to enhance readers' positive attitudes. Specifically, the results show that PE of use, PU, and PR influence individuals' attitudes toward FastBook. This finding supports previous research on the TAM in that PE of use and PU serve to strengthen users' attitudes (Sun and Zhang, 2006; Venkatesh *et al.*, 2003; van Dolen *et al.*, 2007).

In addition to PU, ease of use has a stronger influence on attitudes, indicating that perception of ease of use plays a pivotal role in the user acceptance of FastBook as past research has asserted (van der Heijden, 2004). Furthermore, PR is confirmed as being an essential factor of attitude toward SST as well. Unlike our expectations, however, only one factor of personal traits (i.e. self-efficacy) had a significant effect on attitude

Paths	Male	Female	$\Delta\chi^2$	p-value	Significant
AT→BI (*H1*)	0.64***	0.69***	0.95	0.33	No
PE→AT (*H2*)	0.49***	0.48***	0.00	0.96	No
PU→AT (*H3*)	0.07	0.17	1.50	0.22	No
PR→AT (*H4*)	0.22*	0.29**	0.13	0.72	No
SE→AT (*H5*)	0.31***	0.07	3.73*	0.05	Yes
NS→AT (*H6*)	0.02	0.04	0.03	0.86	No
NI→AT (*H7*)	−0.03	−0.06	0.17	0.68	No

Notes: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table IV. Gender moderating effects: results of multiple group analysis

toward SST. Two other constructs, novelty seeking and the NI with people, were not identified as major determinants of attitude in this study.

Finally, there was only one significant difference (i.e. self-efficacy) between male and female users found in the context of library self-service machines with which students should be most familiar. Most notably, there was a gender difference in the effects of self-efficacy on attitude, with male users experiencing a much stronger effect than female users.

5.2 Implications

This study presents important contributions and implications for both academic researchers and practitioners. It can provide useful suggestions regarding the key factors leading to attitudes toward and use of SST, especially in times of rising labor costs. Apart from cost and labor reduction, organizations such as libraries need to consider how to enhance readers' usage of library resources. Therefore, it is especially important to widely establish FastBook, a 24-hour self-service book stop, to serve the above purposes.

For academic researchers, our findings may contribute to a comprehensive understanding of the adoption of SST in the context of library use. Second, results provide evidence to support the appropriate use of important technological elements to explain SST adoption. Moreover, we extended the TAM by investigating the impact of technological and individual influences on users' attitudes and adoption in the context of library SST. Additional variables such as PR and self-efficacy are suggested as being one of the focal determinants of attitude toward SST. In the end, the moderating effect of gender was identified in the relationship between self-efficacy and attitude toward SST. Overall, this research provides a connection between actual users' experience and the SST literature based on simultaneous considerations of additional technological and personal factors as well as gender difference.

Regarding practitioners and developers, this study identifies significant variables encouraging students' use of FastBook. First and most important of all, the easier the SST is to use, the more positive the attitude generated toward FastBook. Thus, SST providers should attempt to make SST easier to operate, or provide clear and simple directions (e.g. it is better to illustrate with figures). Apart from ease of use, our results also suggest that SST developers should make it more usable and useful to increase its usage. Rationally, readers would want to use FastBook only if they found it useful; that is, borrowing books from FastBook would increase their efficiency of reading and borrowing books. Therefore, the books provided by FastBook must be replaced frequently with new publications to meet readers' needs. Our findings also suggest that PR is critical if practitioners expect readers to give high evaluations of FastBook. Compared with a well-established library, FastBook is relatively economical and convenient as it is often located in a business hub. The flexibility of time and location offer the advantage of the SST to increase readers' positive attitudes, which will in turn affect the usage of FastBook.

One more finding that should be mentioned is that only one of the hypothesized individual differences, self-efficacy, was found to have a direct effect on attitude in this study. This finding offers an important insight into the promotion of FastBook, that is, user differences should not be ignored, and possible ways to enhance their knowledge of FastBook or training methods are necessary. Clear step-by-step instructions or self-paced tutorials might enhance readers' confidence in using the system. On the contrary, the other two personal traits, NS and the NI with people, had no significant

impact on attitude in the context of using a self-service book stop. The newly established FastBook might trigger readers' curiosity, but novelty is not a decisive motivation for using it. Therefore, the main appeal of using FastBook for readers should be its original purpose: borrowing and returning books on their own. Note that the NI with service staff did not hinder readers from using FastBook. Nevertheless, an SST combined with a service encounter would encourage readers to use FastBook. Finally, the moderating effect of gender difference suggests that practitioners can take an aggressive approach to strengthening female users' confidence and reducing their perceptions of the difficulties of using the SST. For example, facilities should provide an additional toll free number or video instruction on the touch screen. Understanding gender differences in the evaluation and adoption process of SSTs will enable practitioners to implement well-suited strategies to a certain gender group.

5.3 Limitations

Although the findings of this study provide meaningful implications for self-service book stops, some limitations regarding the model's external validity are addressed here. First, the issue of external validity is a concern in developing studies with student samples. Although student samples were considered as appropriate for the study of this particular SST, a broader range from diverse groups of respondents is suggested for future studies. Second, only four factors were recognized as important determinants of attitude. Other constructs can be used to explore readers' adoption of SSTs. Finally, we did not incorporate actual customer behavior in the proposed model. However, this is less of a concern for substantial empirical support for the causal relationship between intention and behavior (Taylor and Todd, 1995; Venkatesh and Morris, 2000).

In conclusion, the present study strengthens our conclusions with a sound theoretical base and fills the gap in the adoption of a self-service book stop. The empirical findings are supportive of the inclusion of technological and personal factors into the TAM model. Note that the moderating effect of gender should not be ignored. The proposed model presents an explication of how the different determinants influence users' adoption of FastBook, providing researchers and practitioners with an in-depth understanding of this novel self-service system.

Note

1. The first modern vending machine was introduced in London in 1880s to dispensing postcards (retrieval from Wikipedia). Later on, the vending machine is widespread worldwide and dispenses items such as snacks, beverages, alcohol, cigarettes, lottery tickets, cologne, consumer products, gold/gems, and books for public use.

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Further reading

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Appendix 1

Plate A1.
Fastbook – automatic book stop (ABS)

Appendix 2

Table A1. Research items of the constructs of interest

Construct	Source
Perceived ease of use (PE)	
PE_1. I find FastBook to be clear and understandable[a]	Davis (1989), Davis *et al.* (1989)
PE_2. I find that using FastBook does not require a lot of mental effort	
PE_3. I find FastBook to be easy to use	
PE4. I find it easy to use FastBook to checkout and return the books I want	
Perceived usefulness (PU)	
PU_1. Using FastBook will improve my performance in borrowing and returning books	Davis (1989), Davis *et al.* (1989)
PU_2. Using FastBook will increase my productivity in borrowing and returning books	
PU_3. Using FastBook will enhance my effectiveness in borrowing and returning books	
PU_4. I find FastBook to be useful in borrowing and returning books	
Perceived reachability (PR)	
PR_1. FastBook providing the accessibility of self-borrowing-and-returning books anytime is crucial	Adapted from Palen (2002), Parasuraman (2000)
PR_2. FastBook provides me anytime to borrow and to return books at convenient locations	
PR_3. I will use FastBook for my book-borrowing-and-returning purpose anytime	
Self-efficacy (SE)	
SE_1. I am confident that I could learn how to use FastBook	Adapted from Taylor and Todd (1995)
SE_2. I would feel comfortable using FastBook on my own	
SE_3. I would be able to use the FastBook device even if there was no one around to show me how to use it	
Novelty seeking (NS)	
NS_1. I am always seeking new ideas and experiences	Mehrabian and Russell (1974), Hsiao and Yang (2010)
NS_2. When things get boring I like to find some new and unfamiliar experiences	
NS_3. I like meeting consumers who have new ideas[a]	
NS_4. I like to experience novelty and change in my daily routine	
Need for interaction with people (NI)	
NI_1. Human contact in providing services makes the process enjoyable for me	Dabholkar (1996)
NI_2. I like interacting with the person who provides the service	
NI_3. It bothers me to use a machine when I could talk to a person instead	
Attitude (AT)	
AT_1. I think that using FastBook is a good idea	Fishbein and Ajzen (1975)
AT_2. I think using FastBook is beneficial to me	
AT_3. I have a positive perception of using FastBook	
Behavioral intention (BI)	
BI_1. I intend to use FastBook in the future	Venkatesh *et al.* (2003)
BI_2. I will always try to use FastBook in my daily life	
BI_3. I plan to use FastBook frequently	

Notes: [a]These items were dropped due to low item-to-total correlation. All items employ a seven-point Likert scale from "strongly disagree" to "strongly agree"

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