Journal of Advanced Research in Technology and Innovation Management

Journal homepage:
https://karyailham.com.my/index.php/jartim
ISSN: 2811-4744

Investigating the Roles of Technological and Consumer Characteristics on Behavioural Intention to Adopt Self-Service Checkout Kiosks

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ARTICLE INFO

Article history:
Received 7 December 2024
Received in revised form 11 January 2025
Accepted 5 February 2025
Available online 31 March 2025

Keywords:
Self-service checkout kiosks; smart retailing; diffusion of innovation; PLS-SEM

ABSTRACT

The post-pandemic era causes retailers to rethink the business operation model to reduce human forces, and people are more reliant on smart retail technologies. Despite the trend being favourable to retail digitalisation, the geographical discrepancy and inconsistent diffusion of self-service checkout kiosks indicated that the insights from developed countries are less explainable in the adoption process in Malaysia. Therefore, the present study aims to investigate the roles of technological and consumer characteristics on the behavioural intention to adopt self-service checkout kiosks. The in-field survey was conducted in Klang Valley, and the researchers finally obtained 237 valid responses for PLS-SEM analysis. The findings indicate that perceived advantage, security, and consumer innovativeness significantly influence the behavioural intention to adopt self-service checkout kiosks. The perceived complexity is insignificant in relation to the intention. The present study suggests better insights that may help researchers establish a smart retail model to explain consumer behaviours better. Also, the findings provide retailers with adoption strategies for the successful implementation of self-service checkout kiosks in retail stores. Future research recommendations could help researchers refine the literature on smart retailing, technology adoption, consumer behaviour and the diffusion of innovation theory.

1. Introduction

The adoption of self-service checkout kiosks has been incrementally growing in Malaysia [1]. In fact, the tech-enabled standalone counter is designed to reshape service flow, especially making payments for in-store shoppers for their selected grocery items. Self-service checkout kiosk is an integral part of smart retailing [2,3]. It extends the internet connectivity with front-end service encounters, and the technology itself is equipped with several physical instruments such as an interactive touchscreen display, barcode scanner, receipt printer, bagging space and payment processing terminal [4] that can realise the checkout process without human assistance in retail stores [5] and endow more feeling of empowerments to consumers [6].

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https://doi.org/10.37934/jartim.14.1.2029

Establishing self-service checkout counters is a critical shopping solution to meet the megatrends of the post-pandemic era, emphasizing contactless devices to reduce the public concern of high infection risk [7]. Under these circumstances, adopting self-service checkout kiosks is a significant shift toward redefining the service model in the retail sector. The adoption behaviour provides win-win solutions for both parties, enhancing consumers' in-store shopping experiences and optimising retailers' operational efficiencies [8].

Although a self-service checkout kiosk has great advantages, adopting the technology also presents challenges in Malaysia. In particular, a limited number of empirical studies to explain consumer behaviours on self-service checkout kiosk adoptions [3,8], especially since the diffusion of smart retailing in Malaysia is at the nascent level and much of its knowledge gaps in the literature are still underexplored in this emerging market [3]. Severely, the existing number of self-service checkout kiosks is being reckoned due to a lack of understanding of consumer behaviours towards the particular retail technology [10]. It is unclear which technological characteristics determine the users' adoption of the technology.

When considering the existence of self-service checkout kiosks subjected to optimising the checkout experience, it is crucial to understand how consumers perceive the advantages of these devices to replace traditional human-served cashiers and which impacts consumers' intended technology adoption. The distinctive advantages consumers perceive over traditional cashiers would lead them to choose self-service checkout kiosks rather than cashiers to complete their in-store shopping process. Moreover, the perceived complexity is vital in determining the extent of technology adoption, especially in emerging markets where consumers have yet to thoroughly learn about checkout devices across the social system.

Self-service checkout kiosks in daily operations involve highly intensive transactions throughout the back-end financial gateways, arousing the issue of security perceptions with self-service checkout kiosks that determine the users from using them [11]. In addition, each country has its demographic composition, and the results of smart retailing studies in developed countries are less transferable to developing countries, such as Malaysia, presenting geographical gaps in the emerging market [12]. Apart from the technological characteristics, the consumer characteristic, namely consumer innovativeness, was identified as an important driver in determining Malaysian fintech-related retail technology adoptions [13]. Thus, previous researchers have suggested that consumer innovativeness should be re-conceptualised to predict how consumer characteristics, especially consumer innovativeness, influence individuals' technology adoptions [13].

From the discussions above, the existing issues, such as the lack of diffusion studies about self-service checkout kiosks in Malaysia, the security perception is important to the adoption of fintech-related retail technologies, and the empirical study includes the characteristic, apart from technological perspectives (e.g. consumer innovativeness) are imperative to understand Malaysian consumer behavioural intention to adopt self-service checkout kiosks. In order to address these issues, the present study aims to investigate the roles of technological (perceived advantage, complexity, and security) and consumer characteristics (consumer innovativeness) to determine consumers' behavioural intention to adopt self-service checkout kiosks, and the research are contextualised in the Malaysian grocery retail sector.

2. Literature Review

Self-service checkout kiosks are equipped with a range of features, including the ability to process financial exchange without employee assistance, offer several digital payment methods, track consumers' historical shopping records, and integrate with other types of smart retail

technologies to deliver consistent and personalised shopping experiences across channels under a retail brand. Accordingly, the present study sheds light on the predictors of and resistance to the behavioural intention to adopt self-service checkout kiosks, and this section discusses the particulars of each variable.

2.1 Perceived Advantage

Origin from the diffusion of the innovation theory [14], the perceived advantage in this study is defined as the extent to which consumers believe that adopting self-service checkout kiosks to make payment for their grocery items would be better than human-served cashiers. In other words, if the consumers subjectively identify the retail technology is better than its predecessor, consumers will be more attracted to adopt the technology.

Chronologically, perceived advantage plays a crucial role when persuading technological adoption. Jaganathan *et al.,* [15] conducted an empirical study in Malaysia about consumer adoption of smart retailing and found that local shoppers need positive differentiations to accommodate the changing retail environment. As an integral part of smart retailing, the distinctive positive advantage of self-service checkout kiosks over cashiers is that they provide efficient checkout experiences. Therefore, it will raise advantages in consumers' state of mind when making an adoption decision. Similarly, the advanced retail solution arouses a greater expectation towards the newer device if compared with the status quo [16]. For that reason, the researchers postulated that the perceived advantage is in relation to the behavioural intention to adopt the particular technology. This leads to the first hypothesis, as stated below:

H1: Perceived advantage positively and significantly influences behavioural intention to adopt self-service checkout kiosks.

2.2 Perceived Complexity

Similar to the perceived advantage, the perceived complexity is also derived from the diffusion of innovation theory [14]. In this study, perceived complexity refers to the extent to which consumers perceive that the self-service checkout kiosk is relatively hard to understand and use. The intrinsic of perceived complexity is similar to perceived ease of use [17] and effort expectancy [18], in which consumers perceive the level of easiness to approach a new technology. Being less or free from substantial efforts to formulate concrete knowledge towards a new behaviour could encourage people to engage in technology [19]. Previous scholars have also identified a lower perceived complexity as the key to successful service innovations in marketplaces [19].

As per Chouk and Mani [20], perceived complexity is identified as an innovation characteristic. It is a barrier that adds to the uncertainty of smart services and forces consumers to resist change. Previous scholars have ascertained that Malaysians would gauge the level of simplicity of a financial service innovation when deciding to interact with or stay away from it [21,22]. Hence, perceived complexity is expected to hinder behavioural intention to adopt self-service checkout kiosks. The argument above supported the adverse impact of perceived complexity on the adoption decision. Thus, the second relationship is postulated as the following statement:

H2: Perceived complexity negatively and significantly influences behavioural intention to adopt self-service checkout kiosks.

2.3 Perceived Security

In this study, perceived security refers to consumers' sense of security towards self-service checkout kiosks. Obviously, the fintech products are always cannot get rid of answering security questions by consumers. A higher level of technology security could raise the adoption rate of fintech-related retail technologies [13]. Zaman *et al.,* [22] contended that the sense of security determines the diffusion of retail technologies that serve financial transactions. By executing a robust security and transparent data management policy, it is beneficial to build solid trust towards a fintech-related retail technology in the end market [22].

Rahman *et al.,* [13] emphasise that perceived security is crucial to representing an organisation's ability to develop consumers' products and services securely. They conducted an empirical study of cashless payment in Malaysia and found that perceived security is the most important variable influencing local consumers' adoption behaviours, and this is essential to heighten retailers' prosperity. The higher the sense of security, the less likely consumers are to fear unauthorised access to their personal data by third parties, which in turn quickens the adoption of self-service checkout kiosks. Thus, the third relationship is proposed below:

H3: Perceived security positively and significantly influences behavioural intention to adopt self-service checkout kiosks.

2.4 Consumer Innovativeness

Apart from the technological characteristics, the consumer characteristic is another perspective to investigate the adoption of self-service checkout kiosks. Consumer innovativeness is related to consumers' predisposition to adopt less familiar behavioural patterns in their daily lives [23]. The present study interprets consumer innovativeness as the extent of consumers' likelihood to search, evaluate and try novel products and services—this definition of consumer innovativeness aligned with the concept of "innate innovativeness" [22,23]. It received wide attention from marketing researchers during their empirical studies about technology adoption and consumer behaviours [25].

Rogers [14] proposed that consumers in a social system will fall into one of the five adopter categories based on their level of innovativeness in adopting a product or service. Innovative users tend to be more proactively seeking information and independently evaluating technologies [25]. The high curiosity to explore less familiar innovations may put their position ahead of low-innovation social members, such as the late majority and laggards. Rahman *et al.,* [13] ascertained that innovativeness encourages Malaysians to adopt cashless payment. As an extension of the fintech-related study, the researchers also postulate that consumer innovativeness has a positive impact on the intention to adopt self-service checkout kiosks. By following this argument, the last hypothesis from the perspective of consumer characteristics is stated in the sentence below:

H4: Consumer innovativeness positively and significantly influences behavioural intention to adopt self-service checkout kiosks.

3. Research Methodology

The present study aims to investigate the roles of technological and consumer characteristics in influencing the behavioural intention to adopt self-service checkout kiosks. This study was

conducted in Klang Valley, the most prosperous area in this country, to reach the users of self-service checkout kiosks and examine their decision to adopt the specific technology. By following the purposive sampling technique, the researchers obtained 237 valid responses during the mall intercept from 29 March until 10 April 2024. The research instrument was a self-administered questionnaire, which contains three sections. Since the endogenous variable of this study is the behavioural intention to adopt self-service checkout kiosks, the consumers who had a particular usage experience are selected as the study's sample.

Section one includes the introduction of self-service checkout kiosks and screening questions that can ensure the respondents who are 18 or above have that particular usage experience in the last six months. Section two consists of variable items, including perceived advantage [19], complexity [19], security [26], consumer innovativeness [23], and behavioural intention to adopt self-service checkout kiosks [12]. All variable items were measured using a 7-point Likert scale. The partial least squares structural equation modelling (PLS-SEM) algorithm was utilised during the path relationship analysis process [27]. The PLS-SEM statistical algorithm is suitable for testing the theoretical integration model and is flexible to accept large or small samples [27]. The SmartPLS 4.1.0 statistical package was used for analysing path relationships.

4. Results and Analysis

4.1 Measurement Model

According to Hair *et al.,* [27], the loadings value should be 0.708 or above. In this study, all variable items fulfil this criterion, except CIN 1. Hair *et al.,* [27] also suggest that factor loadings below 0.708 are acceptable. However, those items should reach at least 0.4, and the average variance extracted (AVE) from that particular latent variable is 0.5 or higher [27]. Therefore, the variable items meet the essence of individual item reliability.

Table 1
Results of the measurement model

Latent variables	Items	Loadings	Composite reliability	Average variance extracted
Perceived advantage	PA1	0.735	0.900	0.692
	PA2	0.825		
	PA3	0.887		
	PA4	0.874		
Perceived complexity	PCX1	0.879	0.968	0.883
	PCX2	0.965		
	PCX3	0.944		
	PCX4	0.969		
Perceived security	PSR1	0.908	0.921	0.795
	PSR2	0.913		
	PSR3	0.852		
Consumer innovativeness	CIN1	0.636	0.885	0.661
	CIN2	0.838		
	CIN3	0.881		
	CIN4	0.873		
Behavioural intention to adopt self-service checkout kiosks	BITA1	0.862	0.935	0.782
	BITA2	0.898		
	BITA3	0.899		
	BITA4	0.879		

Sarstedt *et al.,* [28] suggested that the composite reliability (rho_c) is the most important metric for testing the internal consistency in PLS-SEM. The values ranged between 0.885 and 0.968, which achieved a satisfactory level [27]. In terms of convergent validity, Hair et al. suggested that good convergent validity arises when the construct is relatively higher to capture the variance in the indicator. Therefore, the threshold of AVE should be at least 0.5 or above. In the study, the AVEs of the variables range from 0.661 to 0.883, which far exceeds the bottom line recommended by previous scholars [27,28].

The last criterion when evaluating the measurement model step is discriminant validity. The heterotrait-monotrait ratio (HTMT) is the latest alternative to cross-loadings and the Fornell Larcker scale, as the two prior criteria do not perform well in detecting the issue of discriminant validity [27,29]. The threshold below 0.85 is suggested to identify if a model achieves a satisfactory discriminant validity level [27]. The HTMT result validated that this model has reached the suggested value by Hair *et al.,* [27].

Table 2
Heterotrait-monotrait ratio (HTMT)

	BITA	CIN	PA	PCX	PSR
BITA					
CIN	0.526				
PA	0.692	0.41			
PCX	0.047	0.22	0.093		
PSR	0.618	0.375	0.466	0.079	

4.2 Structural Model

In order to ensure the robustness of structural model analysis, 10,000 subsamples were chosen during the bootstrapping process [27]. Table X shows that perceived advantage positively influences behavioural intention to adopt self-service checkout kiosks (β= 0.407, t= 7.025, p<0.001), thus supporting H1. Inversely, the influence of perceived complexity does not significantly impact the adoption tendency (β= -0.048, t= 0.880, p= 0.189), rejecting H2. However, the relationship between perceived security and behavioural intention (β = 0.306, t = 5.242, p<0.001), as well as the relationship between consumer innovativeness and behavioural intention (β= 0.233, t= 4.632, p<0.001) are positive and significant, thus supporting H3 and H4.

Table 3
Hypothesis testing

Relationships	Path coefficients	Std. errors	t-values	p-values	f^2
H1: PA -> BITA	0.407	0.058	7.025	0.000	0.272
H2: PCX -> BITA	-0.048	0.054	0.880	0.189	0.005
H3: PSR -> BITA	0.306	0.058	5.242	0.000	0.158
H4: CIN -> BITA	0.233	0.050	4.632	0.000	0.089

The effect size is considered small (0.02), medium (0.15) and large (0.35) to define a related exogenous variable's influence on an endogenous variable [30]. Perceived advantage (f^2= 0.272) and security (f^2= 0.158) signify a medium level of effect sizes, while consumer innovativeness indicates a small effect size (f^2= 0.089). Perceived complexity presents a trivial effect size (f^2= 0.005), thereby still being translated into substantively vital findings [31]. Four exogenous variables strongly explain the variance of behavioural intention to adopt self-service checkout kiosks (adjusted-r^2= 0.53).

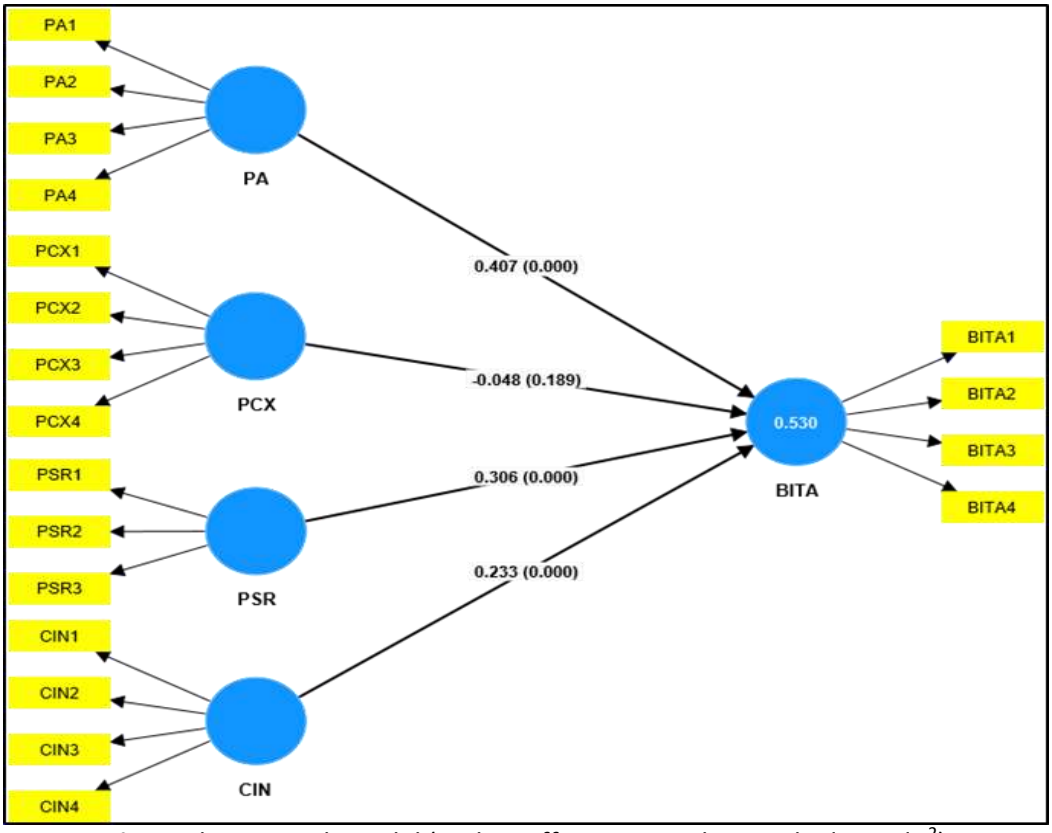

Fig. 1. The research model (path coefficients, p-values and adjusted r^2)

5. Discussion

In this study, the authors provide researchers and business practitioners with insights related to consumer behaviours and how to interact with smart retail technologies, especially self-service checkout kiosks. In terms of academics, the authors demonstrate an extended DOI model for the significant influence of technological characteristics on consumers' behavioural intention to adopt (use) self-service checkout kiosks, which has been under researched by previous scholars in developing countries. In particular, the extended DOI model integrates another technological characteristic, namely perceived security, which is highly related to fintech-retail technologies that can drive or inhibit consumers' intention to adopt self-service checkout kiosks in grocery shopping checkouts. Moreover, since the adoption of smart retail technology not limited by technological characteristics, the authors decided to incorporate the perspective of consumer characteristics, namely consumer innovativeness, to better understand individual differences in the consumers' adoption process. The authors also provide business practitioners with practical implications for maintaining their organisations' competitiveness by continuously keeping track of technological and consumer characteristics compositions that can determine their strategies and efforts of smart retail investments.

First, the result supported the role of perceived advantage as one of the important technological characteristics that determine consumers' adoption decisions (H1). Indeed, after several evolutions of self-service checkout kiosks, the technology is already integrated as a subsect of smart retailing and highly related to the features of Retail 4.0, such as connecting offline and online in real-time scenarios, personalised service experiences with several digital payment channels, and the shopping data are integrated to the back-end system that can allow retailers to serve consumers in next trips consistently. The retailers should emphasise self-service checkout

kiosks as an integral part of smart retailing and personalised shopping experiences over traditional cashiers in their marketing campaigns to promote the technology.

Second, the influence of perceived complexity is rejected due to the insignificant result of H2. The plausible explanation is that the self-service checkout kiosk is an extension of traditional human-served checkout counters. Thus, consumers may be familiar with the new checkout devices in grocery stores. Therefore, Malaysian consumers tremendously ignore the influence of perceived complexity on their adoption decisions towards self-service checkout kiosks. Hence, the retailers should engage with their consumers during the self-service checkout kiosk developments to ensure the system design meets the consumers' shopping habits, understanding, and preferences.

Third, this study has confirmed the importance of perceived security to the adoption process (H3). As per Rahman *et al.,* [13], Malaysian consumers are highly concerned about system security when an innovative service is integrated into their daily lives. They expect service providers to do more on system security, especially the services involving their personal assets. Retailers should explicitly state the security assurance and make a transparent data management policy to consumers when using self-service checkout kiosks.

Fourth, the study ascertains that individual differences exist among Malaysian consumers when determining the adoption process of smart retail technology. The group of highly innovative consumers is the primary focus of retailers to accelerate the diffusion of self-service checkout counters. Malaysia is a highly collectivist country [32]. The influence of surrounding people may be more important than the messages provided by marketers. Therefore, high-innovative consumers can be posited as opinion leaders who can make the process of technology adoption efficient and effective in the local marketplace.

6. Conclusion and Future Recommendation

The study is a milestone in terms of examining consumer behaviours towards self-service checkout kiosks and smart retailing. Most consumers expect retail service providers to proactively offer payment devices with relatively advantageous features, friendliness system designs and high security. Consumers with high innovativeness could be the easier cluster to reach by retailers to promote the new behavioural pattern.

Although the current study is one of the initiatives to understand self-service checkout kiosks, there are some challenges that need to be addressed in order to delve into the deep knowledge of smart retailing. Initially, this study was conducted in Klang Valley. The discrepancies between rural and urban areas exist in Malaysia, and subsequent works could focus on comparing consumers from both areas. In addition, researchers can replicate this model to investigate the adoption process from the two perspectives (technological and consumer) in neighbouring countries located in the ASEAN region, such as Thailand, Singapore, and Indonesia. Additional variables from the consumer characteristics, such as age, income level, or technology familiarity, are required to increase the variance of behavioural intention to adopt self-service checkout kiosks. Other contextual factors, such as the number of items and retailers' reputation, could be the moderators of this model.

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