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Abstract

Background: *The major purpose of this research is to examine Contactless Technology (CT) users' post-adoption phenomena in the context of mobile apps (MA) run by a Quick Service Restaurant (QSR). It applies the Post-Adoption Model of Information System Continuance (PAMISC) to examine how QSR customers' technology anxiety (TA), confirmation of initial expectations, perceived usefulness (PU), and satisfaction with CT relate to their continued intention of use. Furthermore, the study investigates the relationship between customers' satisfaction with CT and their overall satisfaction with QSR.*

Methods: *To test the research model, we collected survey data from 245 users of MA provided by McDonald's restaurants in the US, which are analyzed through Partial Least Square analysis using SmartPLS 4.0.*

Results: *The theoretical relationships in the PAMISC hold true in the context of QSR's MA. Current QSR customers' TA is negatively associated with their perceived usefulness, but is not related to the degree of confirmation of using MA. Customers' continued intention of use and satisfaction with MA are positively related to overall satisfaction with QSR.*

Conclusion: *Our study is among the first to provide empirical/practical evidence of the PAMISC in the context of IT-enabled hospitality services. It also extends the model in two important ways. First, the study examines the role of TA, an important personal trait relevant to individuals' use of QSR technology. Second, it highlights customers' satisfaction with firm-provided technology to improve their overall satisfaction with the firm in the context of QSRs. For practitioners, it is important for QSR managers to understand the impact of TA on customers' adoption of MA, so that they can design their MA with simpler interfaces and more human aspects. Managers should also make sure that MA is well-designed to satisfy customers' needs, which will then lead to those customers' overall satisfaction with the QSR.*

Keywords: Contactless Technology, Mobile App, Quick Service Restaurant, Customer Satisfaction, Technology Anxiety.

Introduction

In the restaurant industry, information technologies (IT) have been frequently used for ordering food, either online (and mobile) or within restaurants in the forms of online order webpages, mobile apps, in-store kiosks, tablet-based menus, etc. (Li, Zhong, et al., 2021). Among restaurants that adopt food-ordering technologies, quick service restaurants (QSR)[1] have been a frontier of tech-based innovation in food ordering, logistics, and customer service to serve customers more efficiently, save operating costs, and generate higher revenue and profits (Khan, 2020). Among the tech-based innovations in customers' food-ordering methods offered by QSR, mobile apps (MA) and self-service kiosks (SSK) are becoming more popular because they provide easy and efficient ways of ordering food without in-person contact between customers and service clerks (Kim & Christodoulidou, 2013). Because of the COVID-19 lockdown, more people have used MA than SSK recently, since MA can be used for so-called "contactless" food ordering and curbside pick-up of pre-ordered food. In addition to restricting the spread of airborne infectious disease, the benefits of MA include labor cost-saving, promotions (e.g., electronic/mobile coupons on smartphones), efficiency in food ordering (e.g., shortened ordering times), and expanding into new markets by service providers (i.e., QSRs) (Eaton, 2020). While these benefits are important reasons to launch dedicated MA for QSR franchisers (e.g., McDonald's, Burger King, etc.), one of the most important reasons for QSR's launch of MA is to serve their customers better, which can possibly improve customers' overall satisfaction with restaurants by providing their customers with their own MA. Therefore, this study focuses on "MA created and offered to their own customers by QSR franchisers" (i.e., QSR MA) and examines how QSR MA makes their customers continue to use the MA and improve their satisfaction with contactless technology because the IT's impact on hospitality services has been considered an important topic in the hospitality field, and empirical findings regarding IT-driven service improvement and its impact on overall customer satisfaction have significant practical implications (Khatri, 2019; O'Connor & Murphy, 2004).

The literature has examined the impact of MA on customers' food-ordering processes, as well as the factors affecting users' intention of initial or continuous use. Quite a few empirical studies have identified various factors leading to user satisfaction and continuous intent to use MA (e.g., Akram et al., 2020; Alalwan, 2020; Cho et al., 2019). However, only a few empirical studies have examined the relationships among QSR customers' perceived usefulness (PU) of MA, confirmed expectations, satisfaction with MA, continued use intention, and eventually their satisfaction with the QSR itself using the theoretical framework of the Post-Adoption Model of Information System Continuance (PAMISC) (Bhattacherjee, 2001). Additionally, MA is a technology-enabled service that delegates some if not most food-ordering processes to customers. Some customers might appreciate ordering food without lining up in restaurants, saving time in food ordering, or customizing their food more easily, but others might have some negative reactions to this technology if they are not very familiar with using technology-enabled services or if they are more comfortable with ordering food from human service clerks. TA refers to a technology user's timidity concerning using technology products, which concept has been frequently applied in some empirical studies (Meuter et al., 2003). Studies found that TA is negatively related to users' adoption process of technology-enabled services such as the intention to re-use and frequency of future app usage (Meuter et al., 2003). We argue that while MA for a specific QSR is quite user-friendly, it is still important to investigate the effect of customers' TA on psychological processes in terms of their satisfaction with the technology and the QSR itself and on their continued use intention. Our literature review, however, identified that little empirical effort has been made to examine the effect of TA on current QSR MA users' beliefs about MA usefulness and users' confirmed expectations in the context of MA operated by a specific QSR franchiser. We believe that these research gaps (i.e., how MA technology released by a QSR franchise organization can improve overall satisfaction with the organization that provides the technology and how an individual's attitude toward technology can influence their technology-related beliefs) are important research topics because addressing these not only contributes to the theory of PAMISC and the bodies of knowledge on TA and IT-enabled hospitality technology (Beldona et al., 2018; Djelassi et al., 2018) but also provides QSR industry practitioners with valuable implications, which are summarized below. Therefore, our three research questions are: *(1) How do current users of QSR MA's PU and confirmed expectations while using the MA lead to their satisfaction with contactless technologies?, (2) How does their satisfaction with MA technology lead to their continuing intention to use the QSR MA and overall satisfaction with the organization that provides the technology?, and (3) How is their level of technology anxiety related to their level of PU of and confirmed expectation from the QSR MA?*

To answer these research questions, the PAMISC framework is adopted in this study. This framework was proposed by Bhattacherjee (2001), who not only examined how people get to confirm their initial expectations

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[1] The acronyms are used for either singular or plural words without adding '~s'.

from an Information Technology (IT) based on the Expectation-Confirmation Theory (ECT) (Oliver, 1980) and Technology Acceptance Model (TAM) (Davis, 1989), but also focused on how people decide to continue using the technology after such acceptance (Kim et al., 2009). This study extends the PAMISC (Bhattacherjee, 2001) in the context of QSR by 1) examining the role of TA in affecting their PU and confirmation and 2) investigating how users' satisfaction with contactless technology (MA) and continued use intention result in satisfaction with the QSR itself, while it also empirically validates a research model that hypothesizes the relationships among current QSR customers' PU, confirmed expectations (confirmation), satisfaction with MA, and continued use intention based on the PAMISC.

As theoretical contributions, the suggested research model contributes to the literature on the role of IT in the hospitality industry, which has been considered a very important topic in the hospitality field because our research can highlight the value of an IT-enabled food-ordering service in improving overall customer satisfaction of QSR restaurants, as well as the broad impact of IT on hospitality services (Khatri, 2019; O'Connor & Murphy, 2004). Our research model also contributes to the literature on the PAMISC and technology anxiety, as it extends the PAMISC with application to TA. For practitioners, this study offers distinctive and multifaceted insights into the drivers of user attitudes and technology evaluations regarding MA in the QSR franchisers by focusing specifically on MA created and offered by the franchisers, examining the role of TA in shaping use perceptions, linking satisfaction with the MA technology to overall satisfaction with the restaurant itself. In particular, the examination of TA's relationship with perceived usefulness and confirmation provides a novel understanding of how personal traits continue shaping technology beliefs after adoption. Also, the investigation into MA satisfaction's impact on overall QSR satisfaction gives important insights into customer-facing and contactless technology's role in hospitality service experiences. Therefore, this study provides QSR service providers (e.g., marketing managers, mobile app designers, customer service managers, etc.) with several practical implications as to how to develop and promote customer-facing contactless technologies to serve their customers better.

Literature Review and Hypothesis Development

The Literature Review on the Adoption of Mobile Apps

A substantial number of empirical studies have examined the initial or continuous adoption of and customer satisfaction with various kinds of online or mobile applications in the restaurant context. Those applications include mobile diet apps, online restaurant reservation services, online food ordering and delivery aggregators/applications (OFODA), mobile food ordering and delivery apps (MFODA), etc. To identify the current status of the literature on the roles of mobile apps (MA) for the restaurant industry and the research gaps that highlight this study, we reviewed 23 recently published empirical studies (i.e., since 2018) on the adoption and continuance of online or mobile applications for food ordering and delivery and summarized their theories, variables, and contexts in Appendix A. This literature review provided us with the following takeaways.

First, many more studies examined the phenomena regarding users' initial adoption intention of the MAs based on well-known technology acceptance models such as Technology Acceptance Model (TAM) (Davis, 1989), Theory of Planned Behavior (TPB) (Ajzen, 1991), and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), etc. than the phenomena regarding users' continuance intention. To list a few, Okumus et al. (2018) found that the intention to use MA was influenced by expected performance, expected endeavor of usage, social influence, and user innovativeness. Akram et al. (2020) found that the quality of a mobile website and the brand equity of the website are significantly associated with perceived usefulness (PU) and perceived ease of use (PEU), with digital coupon proneness acting as an accelerator by positively moderating the relationship between PEOU and PU on the one hand and MA use intention on the other hand. Chakraborty et al. (2022) found significant relationships among social, conditional, functional, and epistemic values and the intention of food delivery MA usage. It is noteworthy to mention that many studies put great emphasis on understanding the role of PU and PEU (e.g., Atulkar & Singh, 2021; Chakraborty, 2022; Su et al., 2022b; Wen et al., 2022) because they are two important factors that determine users' intention to use the specific technology/app and their future usage patterns (Prakash & Das, 2020).

Second, on the other hand, some studies investigated the phenomenon regarding the continuance intention of MAs for food ordering and delivery (Alalwan, 2020; Cho et al., 2019; Wang et al., 2019). Among them, only a few adopted the PAMISC model (Al Amin et al., 2021 in Appendix A), while the other studies applied the theory or models that are more suitable for initial adoption, such as Stimuli-Organism-Response model (Shah et al., 2022), TAM (Chakraborty, 2022), TPB (Fitriani et al., 2019; Wen et al., 2022), and UTAUT 2 (Alalwan, 2020; Ramos, 2022). To list a few, Wang et al. (2019) found that perceived price, quality of goods, and promotions are important factors impacting both electronic word-of-mouth and intention to reuse. Cho et al. (2019) found

that app design, reliability/trustworthiness, use convenience, and food choice options had a positive influence on continuous MA use intention. Analyzing survey data from a sample of MA users, Alalwan (2020) found that online reviews, online ratings, online tracking, PU, hedonic motivation, and price value led to continuous reuse intention and/or e-satisfaction. Al Amin et al. (2021) adopted the PAMISC and found that customers' confirmation and PU of food ordering MAs are significantly associated with their dinning attitudes, which influences their e-satisfaction with the Mas and continuance intention. Therefore, we believe that adopting and extending the PAMISC model for the continued adoption of MAs in the context of the restaurant (or food ordering and delivery) industry will address the research gap of the lack of effort to adopt the PAMISC model to investigate the antecedents and consequences of the use continuance intention of MAs.

Finally, substantial studies focus on mobile food ordering/delivery (i.e., aggregator) apps (e.g., UberEats or DoorDash) rather than a dedicated mobile app for a particular restaurant service provider or franchise (e.g., McDonald's), of which the purpose is to improve the way the restaurant serves their customers and possibly improve customer satisfaction. It means that extant studies have not yet considered the question of *how a mobile contactless food-ordering technology could affect customers' overall satisfaction with the restaurant that launches and services the technology.* In other words, very little effort has been dedicated to examining the relationship between the antecedents of continuance use intention and users' ultimate satisfaction with the QSR itself, which highlights the key contribution of this study.

PAMISC and Its Application to MA of QSR

Introduced by Bhattacherjee (2001), the Post-Adoption Model of Information System Continuance (PAMISC) is considered a good theoretical framework to explain "information systems continuance", or more specifically, what causes users to accept technology and the decision to use a technology continuously and this model has been adopted as a key theoretical framework for the studies investigating the use continuance of information technologies in various contexts (Fitriani et al., 2019; Kumar et al., 2018). Bhattacherjee (2001) stated that "*affect (in the form of user satisfaction), which is based on a user's direct experience with a technology, better predicts continuance than user attitude and perceived usefulness (PU) of the technology, which may be significantly influenced by second-hand information*" (p. 364). The model posits that users' confirmation, which is the extent to which a user confirms that their initial expectations have been met while using the technology, is positively related to the PU of technology (mobile apps (MA) for quick service restaurants (QSR) in this study); confirmation and PU are positively related to satisfaction with the technology, which is in turn positively related to users' continuance intention (Bhattacherjee, 2001).

The justifications for using the PAMISC rather than other models of acceptance are as follows. To start with, related models of acceptance such as the Expectation-Confirmation Theory (ECT) (Oliver, 1980), the Technology Acceptance Model (TAM) (Davis, 1989), and the UTAUT2 (Venkatesh et al., 2012) have focused primarily on how to encourage individuals to adopt the new technology, and the PAMISC further emphasizes how people come to accept the information technology and the adaptation of people's behavior after acceptance (Kim et al., 2009). In addition, the PAMISC was the first model to investigate discontinuance after the acceptance behavior; it, therefore, addressed the shortcomings of related models of acceptance that automatically assume that covarying relationships exist between acceptance and continuance (Bhattacherjee, 2001). In particular, the UTAUT2 is not adopted in this study because even though it extends the UTAUT in the consumer market context, it emphasizes the integration of hedonic motivation, price value, and habit, which are not the focus of this study. Furthermore, Okumus et al. (2018) already employed the UTAUT to examine individuals' acceptance of diet apps in food ordering, so it would undermine the innovativeness and importance of this study if the context is simply changed from diet apps to MAs.

The PAMISC is extended in this study in the context of QSR by examining the role of technology anxiety (TA) in affecting their PU and confirmation and investigating how users' satisfaction with MA and use continuance intention result in their satisfaction with the QSR itself. The reason for extending the PAMISC is that this framework has been theoretically extended to include more variables related to the core variables, which are perceived usefulness, confirmation, continuance intention, and satisfaction. In other words, the PAMISC can be used in various contexts to examine relationships among users' confirmation of initial expectation of IT products, PU, continuance intention, and satisfaction with IT products. Chung et al. (2018) used the PAMISC to examine the influence of augmented reality on attitudes and intentions regarding cultural heritage tourism destinations through confirmation and satisfaction. Lee et al. (2021) studied the continuous use of artificial intelligence (AI)-based voice supporting systems by using technology-related personal tendency (e.g., personal innovativeness), confirmation, satisfaction, and continuance intention. Li and Liu (2014) analyzed the satisfaction, continuance intention, and post-adoption behaviors of e-service users on online travel services with the PAMISC. Li, Lee, et al. (2021) applied the PAMISC in investigating the quality, confirmation, satisfaction, and continued use of chatbot services for Chinese online travel agencies. You et al. (2020) examined PU, confirmation, satisfaction, and purchase intention of organic food through social media based on the PAMISC.

These extant studies not only examined the post-adoption of new technologies, but also added the antecedents and consequences of confirmation to investigate post-adoption behaviors with new technologies better. This study similarly investigates the antecedents of TA and post-adoption of new technologies (MA for QSR) by including PU, confirmation, satisfaction with technology, and continuance intention, which explains the reasons for including the proposed variables in a single model. We, therefore, believe that the proposed variables have strong theoretical links in the PAMISC in the context of MA for QSR.

As Bhattacherjee (2001) proposed in the PAMISC, when users' initial expectation is confirmed, their perception of the usefulness of an information system (IS) could be higher, which leads to an increase in the PU of the IS. In addition, based on the baseline level of users' initial pre-adoption expectation, confirmation is assessed to determine whether users feel that performance meets or exceeds their initial pre-adoption expectation, and confirmation is then positively related to satisfaction (Bhattacherjee, 2001) because in the case of higher-than-expected performance of the IS, users should be affectively pleased with the use of the IS. Recent studies have empirically supported positive relationships among confirmation, PU, and satisfaction (e.g., Lee et al., 2021; Li & Liu, 2014; Li, Lee, et al., 2021). Although little research has examined these relationships in the context of MA in QSR, we believe that if users think that MA meets or exceeds their initial expectations, they will consider MA useful and be satisfied with MA technology.

Hypothesis 1a: Confirmation is positively related to PU.
Hypothesis 1b: Confirmation is positively related to satisfaction with MA.

Drawing on the PAMISC, PU is the primary motivator of technology acceptance, so PU experienced while using an IS should logically be associated with current users' continuance intention, and as their perceptions change, PU can enhance users' satisfaction (Bhattacherjee, 2001). Based on this rationale, users' satisfaction levels should increase while experiencing positive practicality from MA (Ho & Hsu, 2022), which is empirically supported in different contexts that PU positively influences satisfaction with mobile websites or apps and smart restaurants with facial recognition (Ho & Hsu, 2022; Wu & Cheng, 2018). In other words, the higher the PU, the more satisfied users are with the technology. Moreover, a positive relationship between PU and restaurant continuance intention has been validated in various extant research such as with mobile branded apps (Li & Fang, 2019), mobile instant messaging (Oghuma et al., 2016), and smartphone diet apps (Okumus et al., 2018). We therefore propose:

Hypothesis 2a: PU is positively associated with satisfaction with MA.
Hypothesis 2b: PU is positively associated with continuance intention.

These relationships (i.e., H1(a, b) and H2(a, b)) are examined in the context of MA in QSR for the following reasons. To start with, the proposed relationships may not necessarily have significant associations without validation; for example, Kanchanatanee et al. (2014) found that PU does not influence continuance intention in the context of e-marketing. Furthermore, this study focuses on the QSRs in the early stage of the COVID-19 lockdown, when people had adopted contactless food ordering and curbside pick-up of pre-ordered food for not only the restriction of the spread of airborne infectious disease, but also other benefits of MA such as labor cost-saving and efficiency in food ordering (Eaton, 2020). Therefore, it is a new research period that has not yet been examined much by extant studies that emphasized other aspects of MA (e.g., Akram et al., 2020; Alalwan, 2020; Cho et al., 2019), which underscores the importance of this study. Specifically, Akram et al. (2020) found that the quality of mobile websites and the brand equity of websites were significantly associated with PU and perceived ease of use (PEOU) in China in the year 2019. Alalwan (2020) conducted research in 2018 to investigate the relationships among online reviews, online ratings, online tracking, PU, hedonic motivation, and price value that led to continuous reuse intention and/or e-satisfaction in Jordan. Cho et al. (2019) discovered that app design, reliability/trustworthiness, use convenience, and food choice options had a positive influence on continuous MA use from 2017 to 2018 in China. We, therefore, argue that the relationships among confirmation, PU, satisfaction with MA, and continuance intention have research importance and should be empirically investigated in the context of MA in QSR.

Finally, numerous studies using PAMISC have empirically validated the relationship between users' technology satisfaction and their continuance intention, which corresponds to Bhattacherjee (2001) above. Several studies found a significant relationship between users' technology satisfaction and continued use intention (e.g., Al Amin et al., 2020). In the context of MA for QSR, we proposed that the given relationship should hold, as the positive affective status formed by users' confirming experience with MA should incline them to continue using MA for QSR. Therefore,

Hypothesis 3a: Satisfaction with MA is positively related to continued use intention of MA.

The Effect of Tech Anxiety (TA)

Technology anxiety (TA) is an important personality trait that affects the way individuals adopt and keep using technology-enabled products or services ("tech products" hereafter). In general, those with a high level of TA for a technology comment negatively against tech products, try to reduce the time spent using them, or even avoid visiting places where tech products are located. Research has also found that TA is negatively associated with users' adoption and use continuance (Chen et al., 2013; Deng et al., 2014; Kim & Forsythe, 2008; Kotrlik & Redmann, 2009). Several studies have found evidence of TA's negative effect on users' adoption and/or continued intention of use. For example, Suarez et al. (2019) found that TA has a significant negative association with restaurant customers' intention to adopt tablet-based menus in three different types of restaurants (midscale, quick service, and upscale restaurants). Meuter et al. (2003) found a negative relationship between TA and consumers' use and experience with various types of self-service technologies, including automated hotel checkout and self-service airline ticketing. These results indicating a negative association between TA and users' adoption are also observed among current users of technology-based services. For example, Kimes (2011) found that TA is negatively related to current users' behavioral intention for continued use of online food ordering. Li, Lee, et al. (2021) also found that TA is negatively correlated with three key variables in the post-adoption model of information system use continuance, namely confirmation, satisfaction with the technology, and continuance use intention in online travel agencies' chatbot services. We, therefore, propose that current mobile app (MA) users' TA will have a negative significant relationship with two key variables that eventually influence current users' continuance intention in the post-adoption model of IS continuance (PAMISC): PU and Confirmation.

First, users having a high level of TA are usually reluctant to try new tech products but are more willing to get human services (Meuter et al., 2003). In the context of quick service restaurant (QSR) customers, those with high TA have an alternative to MA such as ordering from human service clerks (or phone ordering in some countries), so they would not try to make use of nor perceive much usefulness or expected performance outcomes from MA. Research also found that the readiness for technology acceptance (the opposite of TA) is positively related to perceived usefulness (PU) in the context of self-service technologies in restaurants (Lin & Chang, 2011), which implies that technology anxiety will have a negative relationship with PU. Therefore,

Hypothesis 4a: TA is negatively related to PU of MA.

Second, the level of confirmation in the Post-Adoption Model of Information System Continuance (PAMISC) implies that a user's initial expectation of a tech product has been satisfied or exceeded while using that product. As QSR customers with a high level of TA tend to avoid using MA, they should have low initial expectations, so it is likely that they will not make good use of MA—or, even if they try to use it, they do so with limited functionality (probably with the least technical functions). Due to this limited use of MA, we expect that the level of confirmed initial expectation of MA should also be lower than those with low TA. Previous research has also found that the level of confirmation is negatively correlated with TA in the context of contactless technology (Li, Lee, et al., 2021). Therefore,

Hypothesis 4b: TA is negatively associated with confirmation of MA.

## *The Relationships among CT Satisfaction, Use Continuance, and Overall QSR Satisfaction*

We extend the Post-Adoption Model of Information System Continuance (PAMISC), by adding users' satisfaction with the service providers (i.e., restaurants providing mobile apps (MA)) itself as a dependent variable to examine whether users' satisfaction with MA and continued use intention of MA can influence their overall satisfaction with quick service restaurants (QSR). In other words, this section should answer the question "Will a new MA-based contactless technology improve overall satisfaction with restaurant chains?" To propose this hypothesis, we have reviewed extant studies on the relationship between users' *technology experience evaluation* and their *satisfaction with the technology provider* in the service industries. Overall findings from the literature indicate that customers' satisfaction with technologies can lead to satisfaction with a service provider because "*technology* satisfaction" influences trust in the service provider and in turn enhances "*overall* satisfaction with service providers" (Beldona et al., 2018; Djelassi et al., 2018; Zhang et al., 2020). In the context of MA users in a QSR, we argue that this relationship should hold because users' positive experience with satisfactory MA should improve their trust in QSR, which in turn positively affects their overall satisfaction with QSR. Therefore, we argue the following hypothesis.

Hypothesis 3b: Satisfaction with using MA is positively related to overall satisfaction with the restaurant (QSR).

We also argue that users' continuance intention with respect to contactless technology (i.e., MA) is positively related to their overall satisfaction with the service provider. The relationship between the continuance intention of technology use and users' satisfaction with the service provider could be bi-directional. A high level of continuance intention of MA (a part of the provider's service) can lead to overall satisfaction with the service provider. At the same time, when a customer has a high level of satisfaction with a QSR, then they will continue to use various methods of food ordering, including MA, kiosks, and human clerks, depending on their preferences for various ordering methods. However, in this study, we borrow General Systems Theory (GST), which posits that positive aspects of a part of a whole system should go beyond the individual parts and can affect users' positive reactions to the whole system (Von Bertalanffy, 1969). Based on this theory, we can speculate that providing the option of MA to their customers is a part of the whole services provided by QSR and argue that a user's higher intention to continuously use MA (a part of QSR service) can result in their overall satisfaction toward QSR.

Hypothesis 5: Continued use intention of MA is positively related to overall satisfaction with the restaurant (QSR).

In addition, eight control variables, namely, gender, age, education level (Edu), income, occupation, frequency of ordering food from McDonald's restaurants per month (AppUseFreq), frequency of using the QSR MA per month (McDUseFreq), and proportion of ordering food using MA out of all orders made from McDonald's restaurants (OrdAppPer), were included in the structural model analysis (for further details, see Appendix B.2). These control variables were selected by referring to the control variables used in previous studies investigating the continuance intention of mobile food apps (Al Amin et al., 2020; Ramos, 2022; Timur et al., 2023) and also by considering the specificity of the research context (e.g., a dedicated MA for a particular restaurant service provider or franchiser rather than so-called aggregator food-ordering apps). Figure 1 illustrates the overall research model.

Figure 1 – Research Model
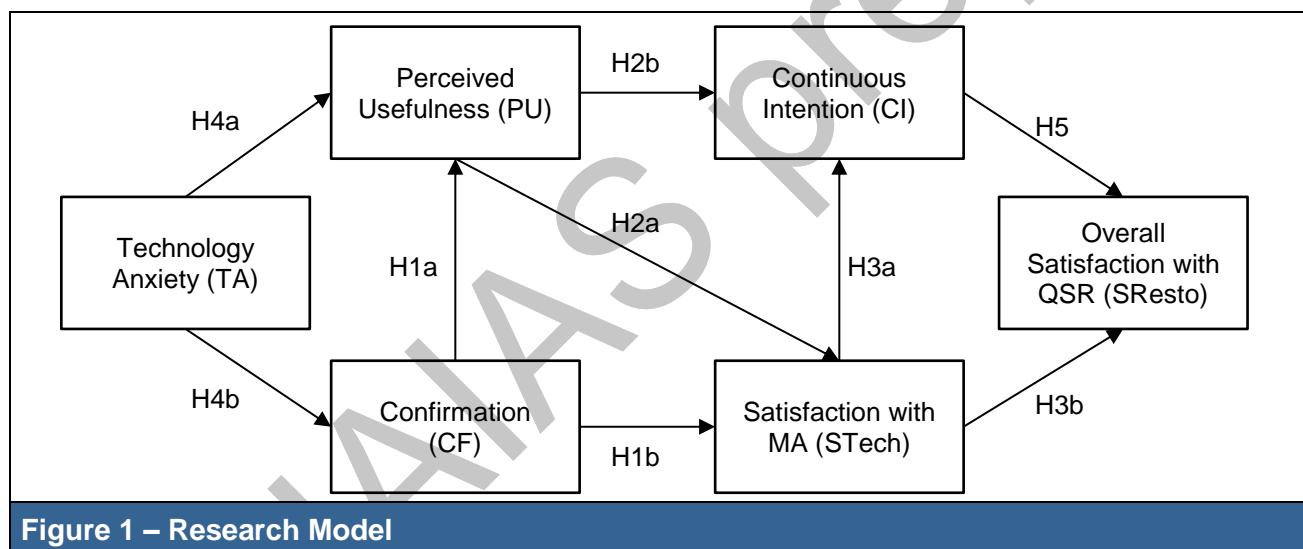
Research Methodology

Measurements

The items were adopted from extant studies and modified for the context of this study and measured with 7-point Likert scales. Technology anxiety was measured using Meuter et al.'s (2003) four items measure, including "I have difficulty understanding most technological matters." Three items of Bhattacherjee's (2001) scale were used to measure confirmation, including "My experience with using the My McD's App was better than what I expected." To assess perceived usefulness, three items from Venkatesh et al.'s (2012) measure were selected, including "I find the My McD's App useful when ordering food." We adopted Bhattacherjee's (2001) three items of satisfaction with technology, including the question "How would you describe your overall experience of using the My McD's App?" Use continuance intention was measured using Bhattacherjee's (2001) four items, including "I can see myself increasing my use of the My McD's App if possible." Finally, satisfaction with the restaurant was assessed by using Djelassi et al. (2018), including the statement "Thanks to the Mcdonald's mobile app, I have become (much more dissatisfied/much more satisfied)." The operational definitions and survey questions of all constructs are provided in Table 2 and Appendix B.1, respectively.

Table 2 – Operational Definitions of the Constructs		
Latent variable	**Operational definition**	**References**
Technology Anxiety	User's feeling of intimidation, unfamiliarity, and difficulty when using MA	Meuter et al. (2003)
Confirmation	User's perception of the congruence or discrepancy between their initial expectation from the use of MA and the actual performance of the device	Bhattacherjee (2001)
Perceived usefulness	User's perception of the expected benefits of MA performance	Bhattacherjee (2001)
Satisfaction with Tech	User's affect (a pleasurable or positive emotional state) with their prior use of MA	Bhattacherjee (2001)
Continuance Intention	The user's intention to continue using MA	Bhattacherjee (2001)
Satisfaction with Resto	Users' affect (a pleasurable or positive emotional state) with their prior experience of the restaurant	Djelassi et al. (2018)

Sampling and Data Collection

McDonald's restaurants in the U.S. were selected as the target sampling frame due to three major reasons for the balance between the external validity and internal validity of this study. To start with, the U.S. has the highest market share and highest number of McDonald's locations in the world; there are 14,146 locations in the U.S., which accounts for 37% of the total McDonald's restaurants globally in 2023 (Cook, 2023). Furthermore, McDonald's restaurants in the U.S. pervasively use mobile ordering apps since launching in 2015, and McDonald's restaurants in the U.S. were top-ranked in quick service restaurants (QSR) by downloads in 2022 with a staggering total of 4.2 million (Blacker, 2023; Houck, 2016). We, therefore, believe that the research results of this study can be generalized to some extent because of the top performance of McDonald's restaurants in the U.S. in terms of market share and pervasive use of mobile ordering apps. Additionally, only U.S. restaurants were selected to control for cultural differences and potential menu variations to increase the internal validity of this study.

For the data collection process, the data collection period and method are explained below. To start with, data was collected in May 2020 to diminish the influence of the COVID-19 pandemic lockdown. To be specific, even though statewide stay-at-home orders were issued from March to April 2020 in the U.S. (Mervosh et al., 2020), the pandemic was at a relatively early stage. The data on the daily number of confirmed COVID-19 cases can be used as support for this argument. For example, the daily number of confirmed COVID-19 cases was 28,134.14 on May 1st, 2020, whereas the number soared 28 times to 805,716 on January 16th, 2022 (Our World in Data, 2022). We therefore believe that the influence of the COVID-19 pandemic was relatively low during the data collection period. Furthermore, it is undeniable that mobile app (MA) was introduced to the mass market before the start of the COVID-19 pandemic and that the pandemic has accelerated MA use to an extent, as it is a safe contactless payment method. However, we argue that MA has become a new business norm, and restaurants should ensure its continued usage not only during but also after the pandemic. The reason is that it has been argued by Kumar and Shah (2021) that contactless MA has already happened in the food industry and that it will be sustained in the long term.

As to the data collection method, Amazon Mechanical Turk (MTurk) was used because MTurk is known to be as efficacious as other types of data collection (Lowry et al., 2016). With a screening question, the survey subjects were limited to Americans who have used McDonald's MA. For the sequence of the questionnaire, the personality variable (i.e., technology anxiety (TA)) was shown first, followed by the dependent variables of the model, and the other variables were shown at the end. Survey participants were given a reward of 0.75 USD.

A total of 245 samples were collected in this study after deleting biased and inattentive responses using reverse-coded items and time spent to complete all survey questions. In other words, if the reverse-coded items were answered consistently with the conventionally-coded ones and if the survey was completed significantly faster than the average number of seconds for completion, those responses were removed to improve the overall quality of the dataset. The required sample size for sufficient statistical power for studies that utilize survey data was calculated with the method introduced by Goodhue et al. (2012) and Hair Jr et al. (2011) –the "10-times rule," which suggests that the minimum number of questionnaires can be calculated

using 10X the number of proposed relationships. The number of proposed relationships in this study is 17, including nine relationships in the model and eight direct links between the control variables and the dependent variable. As our final sample size (N = 245) exceeds the calculated value (17 x 10 = 170), we conclude that our sample size is sufficient to test the proposed relationships (Hair Jr et al., 2017; Hair Jr et al., 2021).

Table 3 represents the demographic information that includes survey respondents' gender, age, education, monthly income level, and occupation. Specifically, females accounted for 32.7% and males for 67.3% of survey respondents. Survey respondents were between 20 to 29 years old (37.1%), 30 to 39 years old (37.1%), and 40 to 49 years old (14.3%). With respect to education, 36.3% of respondents have undergraduate degrees, and 47.8% have graduate degrees. As for monthly income level, 40.8% of the participants earn more than 4,000 USD per month, and 76.3% of survey participants have occupations other than student, employed, homemaker, or self-employed. For the representativeness of our sample, since the screening question limited the survey subjects to Americans who have previously used McDonald's MA, we found a statistic on McDonald's app users. In terms of age group, about 75% of McDonald's MA users are between 18 and 44 (Singer, 2023), which corresponds approximately to the sampled respondents.

Table 3 – Demographics of Survey Respondents			
Demographics	**Category**	**Frequency**	**Percent**
Gender	Male	80	32.7%
	Female	165	67.3%
Age	Less than 19	2	0.8%
	20-29	91	37.1%
	30-39	91	37.1%
	40-49	35	14.3%
	50-59	19	7.8%
	More than 60	7	2.9%
Education	Middle school degree or equivalent	5	2.0%
	High school degree	15	6.1%
	Vocational college degree	19	7.8%
	Undergraduate (University) degree	89	36.3%
	Graduate (University) degree	117	47.8%
Income level (Monthly)	Less than 500 USD	19	7.8%
	500-1,000 USD	28	11.4%
	1,000-2,000 USD	44	18.0%
	2,000-3,000 USD	29	11.8%
	3,000-4,000 USD	25	10.2%
	4,000-5,000 USD	32	13.1%
	5,000-7,000 USD	27	11.0%
	7,000-10,000 USD	28	11.4%
	More than 10,000 USD	13	5.3%
Occupation	Student	1	0.4%
	Employed	14	5.7%
	Homemaker	6	2.4%
	Self-employed	37	15.1%
	Others	187	76.3%

Results

The Partial Least Square (PLS) Structural Equation Modeling (PLS-SEM) technique is used to assess the measurement properties and test the hypotheses. The selection of PLS-SEM as the analysis tool for the current study is justified by several key factors that align with the exploratory nature and specific objectives of This study. First, the main purpose of the current study is exploratory in that it tests relationships among quick service restaurant (QSR) customers' personal traits, key variables in the Post-Adoption Model of Information System Continuance (PAMISC), and overall satisfaction improved by the QSR rather than to confirm an established theory with collected data (Hair Jr et al., 2021). Second, PLS-SEM is well-suited for analyzing complex relationships among variables, especially in situations where the relationships are not well-defined or established beforehand (Chanda et al., 2023; Qin & McAvoy, 1992). As the current study aims to explore the relationships among QSR customers' trait, key variables in the PAMISC, and the patrons' overall satisfaction with QSR, it requires an analysis method capable of handling potentially intricate relationships, which justifies

the selection of the PLS-SEM technique (Astrachan et al., 2014). Third, Some PLS-SEM Software such as SmartPLS 4.0, which is used in this study, offers the means to assess the goodness of fit of the model, which is a crucial aspect in validating the accuracy of the relationships among variables (Henseler & Sarstedt, 2013). By incorporating fit tests, PLS-SEM ensures that the model adequately captures the underlying dynamics of the data and accurately represents the relationships being investigated (Johnston et al., 2004). Finally, SmartPLS 4.0 was chosen because it offers a convenient way to test direct mediation, and mediation impacts among variables using PLS Algorithm and Bootstrapping analysis (Gutu et al., 2023).

Measurement Model Analysis

We conducted a confirmatory factor analysis (CFA) using SmartPLS 4.0 to establish an appropriate level of internal reliability (Cronbach's α > 0.7) and composite reliability (CR) > 0.7) (Fornell & Larcker 1981; Hair Jr et al., 2010). Convergent validity is ensured because the factor loadings of all variables are larger than 0.7 (Hair Jr et al., 2021), and all values of average variance extracted (AVE) are larger than 0.5 (Fornell & Larcker, 1981) (Table 4). All values of square roots of AVE on the diagonal cells were larger than the inter-construct correlations of their respective latent variables (Table 5) (Fornell & Larcker, 1981), and all values in the HTMT ratios are lower than 0.9 (Table 6). While 0.85 or lower for the value in the HTMT table is a stricter threshold value for discriminant validity, many studies use 0.90 as a criterion for acceptable discriminant validity if some latent variables are conceptually similar (Guzzo et al., 2022). Therefore, this study achieved adequate discriminant validity (Henseler et al., 2015).

For the model fit, the chi-square value, Standardized Root Mean Square Residual (SRMR), and Normed Model Fit Index (NFI) were checked. The chi-square values for saturated and estimated models were 545.77 and 585.56, respectively. SRMR values for both saturated (0.051) and estimated (0.068) models are below the maximum acceptable threshold value of 0.08. NFI values for the saturated and estimated models were 0.86 and 0.85, respectively, which are slightly lower than the minimum value for an acceptable model fit (0.9). However, SRMR has been considered a more preferred model fit measure for PLS analysis than NFI due to the NFI's major disadvantage (i.e., not penalized for model complexity) (Ringle et al., 2022). As our SRMR values are far below the maximum threshold value (0.08), we consider that our research model has a good fit between the model's implied correlation matrix and the observed correlation matrix (Henseler et al., 2014).

Table 4 – Reliability and Convergent Validity				
Latent variable	**Factor loadings**	**Cronbach's α**	**Composite reliability (CR)**	**Average variance Extracted (AVE)**
Technology anxiety (TA)	0.870	0.938	0.964	0.841
	0.925			
	0.927			
	0.944			
Perceived usefulness (PU)	0.886	0.86	0.861	0.781
	0.889			
	0.876			
Confirmation (CF)	0.903	0.836	0.843	0.753
	0.866			
	0.834			
Satisfaction with mobile app (STech)	0.878	0.862	0.862	0.783
	0.883			
	0.895			
Use continuance intention (CI)	0.870	0.888	0.891	0.748
	0.881			
	0.846			
	0.863			
Satisfaction with restaurant (SResto)	0.847	0.83	0.83	0.746
	0.863			
	0.881			

Table 5 – Construct Correlations and Discriminant Validity						
	TA	**PU**	**CF**	**STech**	**CI**	**SResto**
TA	*0.917*					
PU	-0.249	*0.884*				
CF	-0.101	0.764	*0.868*			
STech	-0.139	0.708	0.754	*0.885*		
CI	-0.070	0.754	0.745	0.696	*0.865*	
SResto	-0.015	0.676	0.734	0.726	0.730	*0.864*

Table 6 – Heterotrait-Monotrait (HTMT) Ratio						
	TA	**PU**	**CF**	**STech**	**CI**	**SResto**
TA						
PU	0.268					
CF	0.105	0.898				
STech	0.152	0.821	0.885			
CI	0.093	0.859	0.861	0.794		
SResto	0.062	0.800	0.878	0.859	0.849	

Common Method Bias Analysis

As our data collection used a self-reported survey with a cross-sectional dataset, there is a risk of common method bias (CMB). To address this issue, two tests were conducted. First, the approach suggested by Liang et al. (2007) was used, and the results indicated that the mean of the squared values of the substantive factor loadings (67.24%) was much greater than that of the squared values of the common method factor loadings (6.96%) (Table 7). This implies that CMB is no longer a significant concern of this study. Second, a full-collinearity test for CMB (Kock, 2015) indicated that all variance inflation factors (VIFs) are not larger than the threshold value of 3.3, except for VIFs of confirmation (3.35). However, Kock (2015) also recommended that the VIF threshold could be a bit higher than 3.3 in the case of analysis using PLS (Table 8). Therefore, we can conclude that CMB is not a serious concern with our data.

Table 7 – Results of Common Method Bias Test					
Latent variable	**Item**	**Substantive factor loading (R1)**	**R1²**	**Common method factor loading (R2)**	**R2²**
Technology anxiety (TA)	TA01	0.91	0.82	0.08	0.01
	TA02	0.91	0.83	-0.03	0.00
	TA03	0.92	0.84	-0.04	0.00
	TA04	0.94	0.88	-0.01	0.00
Perceived usefulness (PU)	PU01	-0.29	0.09	0.75	0.56
	PU02	0.07	0.00	0.60	0.36
	PU03	-0.12	0.01	0.54	0.29
Confirmation (CF)	CF01	0.72	0.52	0.19	0.04
	CF02	0.82	0.67	0.05	0.00
	CF03	1.07	1.15	-0.26	0.07
Satisfaction with mobile app (STech)	STech01	0.78	0.61	0.11	0.01
	STech02	0.96	0.92	-0.08	0.01
	STech03	0.92	0.84	-0.02	0.00
Use continuance intention (CI)	CI01	0.75	0.57	0.12	0.01
	CI02	0.82	0.67	0.07	0.00
	CI03	0.94	0.88	-0.09	0.01
	CI04	0.95	0.91	-0.09	0.01
Satisfaction with restaurant (SResto)	SResto01	0.80	0.64	0.05	0.00
	SResto02	0.90	0.81	-0.04	0.00
	SResto03	0.89	0.79	-0.01	0.00
Average			**67.24%**		**6.96%**

Table 8 – Results of Common Method Bias Test: Kock's (2015) Variance Inflation Factor Test	
Latent variable	**VIF**
TA	1.08
PU	3.11
CF	3.35
STech	2.72
CI	2.94

Structural Model Analysis

The PLS algorithm and bootstrapping technique with 5,000 data resampling were used to calculate the standardized path coefficient (β) and variance explained in the endogenous variables and test the significance of the hypothesized relationships. The results are presented in Figure 2 and Table 9.

Table 9 – Summary of Structural Model Results			
Hypothesis	**Path coefficient (β)**	**P-values**	**Results**
H1a: CF → PU	0.747	0	Supported
H1b: CF → STech	0.512	0	Supported
H2a: PU → STech	0.316	0	Supported
H2b: PU → CI	0.524	0	Supported
H3a: STech → CI	0.325	0	Supported
H4a: TA → PU	-0.173	0	Supported
H4b: TA → CF	-0.101	0.145	Not Supported
H3b: STech → SResto	0.429	0.001	Supported
H5: CI → SResto	0.429	0	Supported

*Note. N = 245. N.S. = Not Significant, *p<.05, **p<.01, ***p< .001.*
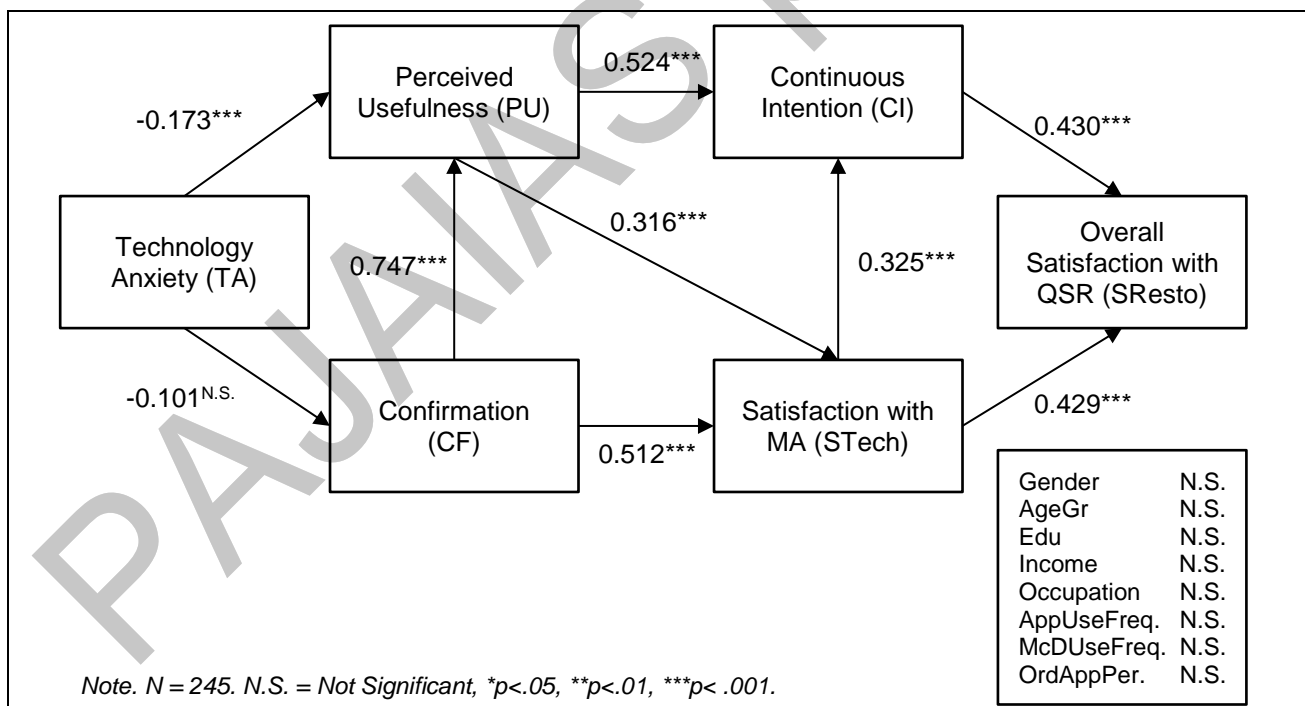
Figure 2 – Structural Model Results

Eight out of the nine hypotheses were supported except H4b, indicating that the negative association between TA and confirmation of MA was not significant (β = - 0.101, t-value = 1.458). In addition, none of the eight control variables, namely, gender, age, education level (Edu), income, occupation, frequency of ordering food from McDonald's restaurants per month (AppUseFreq), frequency of using the QSR MA per month (McDUseFreq), and proportion of ordering food using MA out of all orders made from McDonald's restaurants (OrdAppPer), were found to be significant. Overall, 63.3% of the variance in overall satisfaction with the QSR was explained by the structural model.

Discussion of Results

As hypothesized and suggested by the Post-Adoption Model of Information System Continuance (PAMISC), H1-H3a are supported, indicating that its theoretical relationships are validated in the context of MA provided by QSR. When users of a QSR MA find that using the app meets or exceeds their initial expectations, they perceive that it is useful and are satisfied with the technology.

One interesting finding is that TA has a significant negative relationship only with PU (H4a) and not with confirmation (H4b). Those with high anxiety about using a tech product might feel that the app is less useful, but having high technology anxiety might not impact the degree to which their use of the app meets their initial expectations of the tech product. The observed significant negative relationship between TA and PU of the MA (H4a) could be attributed to the impact of individuals' anxiety on their perceptions of the app's utility and practicality. Users with high levels of TA may approach the app with uncertainty and worry about using technology, which could influence their perceptions of the app's usefulness. As a result, they might be more inclined to focus on potential difficulties or challenges in using the app, leading them to rate its usefulness as low compared to users with lower TA.

In contrast, the absence of a significant relationship between TA and confirmation (H4b) suggests that TA does not significantly affect the degree to which users' initial expectations of the app are confirmed or validated through actual use. One possible explanation may be that individuals with high TA might not try to assess their initial expectations or ongoing confirmation while using the app because of a tendency to avoid using or even thinking about technology (Chen et al., 2013; Deng et al., 2014; Kim & Forsythe, 2008; Kotrlik & Redmann, 2009). Consequently, their TA may not substantially alter their expectation-confirmation process. Furthermore, confirmation is often associated with users' pre-existing beliefs and perceptions about the app's functionalities (Ault et al., 2017), which might be more stable and less influenced by momentary feelings of anxiety during their app usage. Users with high TA might interpret their app experiences based on their existing beliefs and expectations about technological tools rather than being significantly affected by their anxiety during usage, so TA is not significantly impactful in altering their degree of confirmation.

Regarding H3b and H5, this study aims to contribute to the MA field by proposing the research question of "How does a useful and satisfactory contactless technology improve QSR patrons' overall satisfaction with the restaurant?" Our results from H3b and H5 indicate that satisfactory contactless technology could not only increase QSR patrons' continued use of the app, but also improve overall satisfaction with the QSR chain itself. To explore our results further regarding the relationships among customers' satisfaction with the IT (MA), continuance intention of the IT (MA), and overall satisfaction with the restaurant franchiser, a post-hoc analysis for the mediating role of use continuance was conducted. As shown in Table 10, the t-statistics and confidence interval values of the indirect, direct, and total effects from the bootstrapping analysis indicate that the continuance intention of the IT (MA) partially mediates the relationship between customers' satisfaction with the IT (MA), and overall satisfaction with the restaurant franchiser. This result suggests that satisfaction with IT-enabled food-ordering solutions can be not only directly transferred to overall satisfaction with the restaurant service provider, but also indirectly transferred to customer satisfaction through their increased intention to continue using the IT.

Table 10 – Direct, Indirect, and Total Effects for the Mediating Role of Continuance Intention (ContInt) for the Relationship Between Customers' Satisfaction (SatTech) and Overall Satisfaction with the Restaurant Franchiser (SatResto)			
Indirect Effect **T-stat	[LCI, UCI]**	**Direct Effect** **T-stat	[LCI, UCI]**	**Total Effect** **T-stat	[LCI, UCI]**	**Result**
SatTech → ContInt → SatResto	SatTech → SatResto	SatTech → SatResto	
3.900 [0.068, 0.209]	3.377 [0.208, 0.666]	5.165 [0.360, 0.754]	Partial Mediation

* *Note*: T-stat: t-statistics / LCI (UCI): Lower (Upper) value of confidence interval

Discussion

Theoretical Contributions

Our study investigated the key relationships in the Post-Adoption Model of Information System Continuance (PAMISC) in the context of mobile apps (MA) for quick service restaurants (QSR) and extends the PAMISC with an important personal trait associated with individuals' technology use (i.e., technology anxiety) and one

of the key performance measures of quick service industry (i.e., customer satisfaction with QSR). Our findings contribute to the PAMISC, the technology anxiety (TA) literature, and the overall body of knowledge on IS impact on firms' customer service performance as follows.

First, a significant relationship between QSR customers' satisfaction with (or their continued use intention of) MA technology and their satisfaction with QSR (service provider) contributes to the literature on technology evaluation and its impact on users' satisfaction with service technology providers (e.g., Beldona et al., 2018; Djelassi et al., 2018). These findings provide important empirical evidence that satisfactory and well-facilitated customer-facing technology can actually improve overall satisfaction with the firm providing technology-enabled service. Furthermore, our findings in the context of dedicated mobile apps provided by specific restaurant service providers offer impactful new insights, as this emerging class of tailored, brand-specific food-ordering platforms has distinct features, capabilities, and branding compared to generalized multi-restaurant apps (Buhalis & Park, 2021). The findings of this study in terms of post-adoption phenomena for these customized apps can inform targeted improvement initiatives (Liu et al., 2017) and advance theoretical knowledge about how platform distinctions shape continuance intentions and satisfaction with the provider of the IT-enabled platform. In order words, our focus specifically on MAs created for individual QSR (service technology) providers offers multifaceted perspectives into post-adoption drivers, which has been unavailable in previous research on generalized food ordering apps (e.g., UberEats or DoorDash). The context-specific examination enriches the theoretical understanding of MA continuance and satisfaction formation within the understudied domain of QSR-provided platforms.

Second, even though TA has been examined with users' adoption and use continuance (Chen et al., 2013; Deng et al., 2014; Kim & Forsythe, 2008; Kotrlik & Redmann, 2009), the effect of TA on post-adoption usefulness beliefs and confirmation has been underexplored in the context of MA from a specific QSR franchiser. The findings of a significant (negative) relationship between TA and PU (i.e., a utilitarian assessment of contactless service technology) align with the extant studies that there is a negative relationship between TA and consumers' adoption, use, experience, and behavioral intention for technology-based services (Kimes, 2011; Li, Lee, et al., 2021; Meuter et al., 2003). Furthermore, the context-specific application of the PAMISC also enriches understanding of TA's role in shaping post-adoption beliefs and contributes to the literature on TA and IT adoption, as a non-significant relationship between TA and confirmation (i.e., the extent of user confirmation of their initially formed expectation of the contactless service technology) is found in this study. To be specific, these findings suggest that customers with high TA should have significantly lower PU or benefits from MA, but their TA does not strongly impact the degree of their post-use assessment of their initial expectations. This also means that the degree of technology users' confirmed expectations of MA varies insignificantly with users' technology anxiety in the case of MA for QSR, adding an intriguing dimension to the understanding of TA's role in shaping post-adoption assessment.

Finally, the findings with respect to relationships among the four core constructs of PAMISC (Bhattacherjee, 2001) of PU, confirmation, satisfaction with the technology, and use continuance intention all contribute to the IT adoption literature in the context of current MA users of QSRs. While quite a few studies have examined factors leading to user satisfaction and continuous intention to use MA for QSRs (Akram et al., 2020; Alalwan, 2020; Cho et al., 2019), there remained theoretical gaps regarding post-adoption phenomena of QSR's MA, as little research has investigated relationships among QSR customers' PU of MA, confirmed expectations, satisfaction with MA, continued use intention, and eventually their satisfaction with the QSR itself drawing on the PAMISC as identified in Appendix B.1. In other words, very little effort had been made to examine the relationship between the antecedents of continuance use intention and users' ultimate satisfaction with the QSR itself. Our study, therefore, provides significant contributions to the IT adoption literature within the context of current MA users in QSRs. By empirically validating the PAMISC, we address theoretical gaps and reveal that customers' confirmed initial expectations and utilitarian assessments significantly influence their satisfaction with MA, subsequently impacting both continued adoption and overall satisfaction with the QSR itself for consumer-facing contactless technologies in the service industries. This underscores the importance of considering use continuance of contactless technologies as a vital element in restaurant marketing strategies. Overall, this study fills theoretical voids concerning a specific QSR-provided MA users' post-adoption experiences and beliefs, significantly advancing knowledge regarding the theoretical perspectives of Post-Adoption Model of IS Continuance, Technology Anxiety, and the literature on the role of contactless technologies in the restaurant and hospitality industry.

Managerial Implications

Our study provides a number of important practical implications. First, it shows that TA matters when QSR customers consider using mobile food-ordering apps, a type of contactless technology. Based on this finding, MA designers should design their apps with less complicated user interfaces, or they could even apply more human aspects (e.g., voice-activated and conversational food-ordering interfaces using natural-language-

processing technologies) to the app in order to provide contactless technology to those with a higher TA level. If it is possible to make the app more human-like, the marketers or facilitators of MA should also promote this technology with newly added easy-to-use features to those who have a high level of TA to increase penetration of this contactless technology to consumers with different levels of anxiety about tech product use.

The Asia Pacific Region is home to numerous languages and dialects (Fam & Waller, 2003). To cater to a wider audience, MA developers should not only add multilingual support in their MA but also implement accurate voice recognition capabilities that understand and process diverse accents and languages. Such advancements can address the negative impact of TA on usefulness, which could in turn improve user interactions and make the app more user-friendly for a broader range of customers in the region, as it has been found that chatbot-based mobile customer services can mitigate the negative impact of TA on users' adoption process of the technology (Li, Lee, et al., 2021). Furthermore, acknowledging the rich diversity of cultures and customers within the Asia Pacific Region (Puri et al., 2023; Tsaur et al., 2020), the MA user interface can be specifically tailored to align with the unique preferences and sensibilities of customers across different countries. Tailoring the app's design elements, colors, and icons to align with regional preferences can create a more inviting and familiar experience for users by reducing TA and encouraging wider adoption of the app across diverse markets.

Second, it is found that both utilitarian (PU) and affective (satisfaction) assessments of MA are positively related to continuous adoption of the technology and overall satisfaction with the quick service provider. Based on the given findings, QSR managers need to assist their customers by making MA more useful and satisfying for their customers in order to facilitate continued adoption of contactless technology, which eventually helps improve overall satisfaction with QSR itself. Due to the pandemic, the role of contactless technologies (e.g., virtual collaboration tools, MA, etc.) has become more important (Wibowo et al., 2022). We believe a useful and satisfactory MA could not only increase current QSR customers' continued use of MA, but also lead customers to choose those QSR chains providing useful and satisfactory MA over other QSR chains that have inconvenient or unsatisfactory MA or other types of food-ordering methods. As such, our findings provide the important implication that service-oriented MA with customer-focusing designs could improve the overall performance of QSRs or other service providers, which helps the service organizations sustain their competitiveness (Gilsing et al., 2021). As QSRs strive to reduce service costs and improve customer experiences, properly designed MA could be one of the important tech-driven digital transformation initiatives (Ho & Hsu, 2022).

In the Asia Pacific Region, where the population density is often higher and the need for time-efficient and safe service is paramount (Webster, 2002), the adoption of contactless technologies like MA has accelerated. QSR managers in the region should be mindful of this trend and prioritize enhancing the usability and satisfaction of their MA offerings to capitalize on the growing demand for contactless food ordering. Moreover, the study suggests that a well-designed MA can potentially lead customers to choose QSR chains that offer a useful and satisfactory app over competitors with inconvenient or unsatisfactory MA or other ordering methods. In the highly competitive QSR market in the Asia Pacific Region (Baker & Friel, 2016), having a cutting-edge and customer-centred MA can provide a significant competitive advantage. QSR chains that invest in innovative, user-friendly, and effective MA platforms are likely to attract and retain a larger customer base, driving overall business success. Finally, a properly designed MA can be an important tech-driven digital transformation initiative. This is particularly relevant for QSRs in the Asia Pacific Region, where the adoption of digital technologies is rapidly transforming various industries (Sarwar et al., 2023). Embracing MA technologies not only improves customer experiences, but also allows QSRs to streamline operations, reduce service costs, and stay at the forefront of evolving market trends.

Limitations and Future Research Directions

Even with these theoretical contributions and practical implications, this study is not without its limitations. First, as it is exploratory in nature, the current study does not examine possible moderators or mediators other than the two variables extended from the PAMISC: TA and satisfaction with the QSR service provider. Possible moderating factors may include users' personal traits related to innovation adoption such as personal innovativeness, preference for QSR, health concerns, or time sensitivity when ordering food. Future research should include some of these variables in the proposed model as mediating or moderating factors to provide a deeper understanding of the phenomena related to the adoption and benefits of new contactless technologies in the QSR field.

Second, the data collection for all variables was done at the same time, which could have caused some issues with common method bias. Although we addressed this matter at the end of our measurement model testing, we admit that the relationships found in the current study can only be interpreted as correlational rather than causal. A future study may collect data in a longitudinal way whereby the independent and mediating variables are collected at different periods from dependent variables, so the findings can provide evidence of causality

among the variables. Furthermore, because we collected data during the pre-pandemic period, it might be difficult to generalize our findings to phenomena related to mobile app (MA) users for QSR during or after the pandemic. Just like many other social and economic phenomena before and after the pandemic, QSR customers' degrees of TA, confirmation of initial expectations of the technology, and their utilitarian (PU) and affective (satisfaction) assessments of MA during and after the pandemic should differ from those during the pre-pandemic era. We nevertheless think that investigating the relationships among key variables in the PAMISC, TA, and satisfaction with the service provider should still be important and contribute to academia and practitioners, but future research could empirically examine the same or a similar model with post-pandemic data to see how the findings differ from those of this study.

Third, the relationship between TA and confirmation is non-significant. The concept of confirmation in the original expectation-confirmation model entails the difference between users' after-use performance evaluation and their pre-use initial expectations (Bhattacherjee, 2001; Oliver, 1980). As such, the degree of confirmation contains dual concepts: initial expectations and post-use performance evaluation. These two concepts could be differently or separately related to customers' TA levels. For example, those with high TA could have a low level of initial expectation of MA, as well as a low level of confirmed performance evaluation of MA. On the other hand, those with low TA could have low/high initial expectations of MA but might better appreciate the functionality of MA, etc. Therefore, in order to address the insignificant relationship between TA and confirmation in the case of QSR MA, future research could take a longitudinal approach to measuring pre-use initial expectations at time 0 and post-use performance assessment at time 1 and validate their relationships with TA, which can provide more fine-grained results regarding the relationship between TA and confirmation.

Fourth, considering the unlimited number of users in the target population (users of dedicated QSR MA) and even those in the sampling frame (McDonald's MA users in the US), our sample size (N = 245) is relatively small, although it is sufficient for statistical analysis using the PLS-SEM technique (Hair Jr et al., 2017; Hair Jr et al., 2021). Additionally, our verification of sample representativeness against the target population (sampling frame) was limited to age group only because of the lack of available statistics regarding demographic information for users of dedicated QSR MA or McDonald's MA users in the US and the unique nature of hospitality research (Ali et al., 2021). Therefore, future research should collect data from larger samples as well as verify sample representativeness against the target population with multiple demographic information.

Conclusion

The current study aims to examine CT users' post-adoption perceptions and behaviors in the context of restaurant mobile apps (provided by a QSR franchise company) through the lens of PAMISC. To address the proposed research gap and questions, we first developed an integrated model of the PAMISC and TA in the context of IT-enabled restaurant services and tested it empirically with survey data (N = 245). The research findings supported the proposed relationships in the PAMISC although the negative impact of TA on confirmation of MA was not significant. More importantly, satisfaction with MA directly and indirectly (through continuance intention) improves overall satisfaction with QSR. Thus, this study is one of the first studies to integrate a PAMISC framework with restaurant customers' satisfaction and empirically test their relationships in the context of MAs launched by a specific QSR franchiser. Furthermore, our results theoretically extend the PAMISC model by exploring the role of TA on restaurant customers' use of QSR technology and discovering the positive impact of their satisfaction with restaurant-provided technology on overall satisfaction with the restaurant. Broadly, our research on the role of mobile apps in the QSR industry shed light on the existing bodies of knowledge in the Pacific Asia Journal of the Association for Information Systems (Jiang et al., 2019), specifically the topics of "Electronic and Mobile Business" and "IS Implementation, Adoption, and Diffusion", which demonstrate the relevance of this study to the most frequently studied topics in the journal. Practically, our study presents that TA plays a critical role in QSR customers' PU, which influences the satisfaction with the restaurant's mobile apps and overall satisfaction with the restaurant. Thus, restaurant managers and system developers need to reconsider their mobile apps and facilitate continued adoption and use of contactless technologies by reducing complicated technology interfaces and providing more human aspects and technology support. Based on these critical research findings and implications, we discussed some limitations and future research directions in the IS literature.

Acknowledgement

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Appendix A

Table A – Literature Review on Mobile App Adoption and Continuance in the Hospitality Industry						
Authors (Year)	**Context***	**Dependent Variables**	**Moderating or Mediating Variables****	**Independent variables****	**Theory used*****	**Research methods******
Kapoor & Vij (2018)	OFODA	Conversion	None	Visual design, Information design, Navigation design, Collaboration design	App attributes	Survey -> SEM
Okumus et al. (2018)	Mobile diet apps	Use intention	Personal innovativeness (Mod)	Performance expectancy, Effort expectancy, Social influences, Facilitating conditions, Personal innovativeness	UTAUT	Survey -> PLS
Cho et al. (2019)	MFODA	Continuance intention	Perceived value, Attitudes (Med), Household size (Mod)	Convenience, Design, Trustworthiness, Price, Various food choices	App attributes and perceived value	Survey -> SEM
Palau-Saumell et al. (2019)	Mobile apps for restaurant reservations	Actual use	Behavioral intention (Med)	Performance expectancy, Effort expectancy, Social influences, Facilitating conditions, Hedonic motivation, Price value, Habit	UTAUT2	Survey -> SEM
Wang et al. (2019)	Mobile catering apps	Word of mouth Reuse intention	User satisfaction, Perceived value (Med)	Information quality, System quality, Service quality, Product quality, Perceived promotions, Perceived price	ISSM	Survey -> PLS
Akram et al. (2020)	Fast food mobile commerce	Use intention	PU (Med), PEU (Med), Digital coupons proneness (as Med and Mod)	Mobile website quality (website service quality, website information quality, website system quality), Website brand equity (brand image, brand perceived quality, brand association, brand loyalty)	Extended TAM, S-O-R theory, and acquisition-transaction utility theory	Survey -> SEM
Alalwan (2020)	MFODA	Continuance intention	Habit, e-satisfaction (Med)	Performance expectancy, Effort expectancy, Social influences, Facilitating conditions, Hedonic motivation, Price value, Online review, Online rating, Online tracking	UTAUT2	Survey -> SEM
Al Amin et al. (2021)	MFODA	Continuance intention	Dining attitude, e-satisfaction (Med)	Expectation confirmation, PU	PAMISC	Survey -> PLS
Atulkar & Singh (2021)	MFODA	Customer conversions	None	Psychological attributes (PU, PEU, perceived incentives, perceived price) and Technological attributes (visual design, perceived information, customer relationship management, order management system)	TAM	Survey -> PLS
Chotigo & Kadono (2021)	MFODA	Actual use	Use intention (Med), Age, Gender, Experience (Mod)	Performance expectancy, Effort expectancy, Social influences, Facilitating conditions, Hedonic motivation, Price value, Habit	UTAUT2	Survey -> SEM

Table A – Literature Review on Mobile App Adoption and Continuance in the Hospitality Industry						
Authors (Year)	**Context***	**Dependent Variables**	**Moderating or Mediating Variables****	**Independent variables****	**Theory used*****	**Research methods******
Taylor (2021)	MFODA	Use intention	Productivity orientation, Fear of missing out (Mod)	Performance expectancy, Effort expectancy, Social influences, Facilitating conditions, Hedonic motivation, Risk perceptions, Trust	UTAUT2	Survey -> Multiple regression
Bao & Zhu (2022)	MFODA	Reuse intention	Perceived value, Satisfaction (Med)	Information quality, PEU, Convenience, Food choices, Informational social influence, Normative social influence	E-commerce success model and social influence	Survey -> PLS
Chakraborty et al. (2022)	MFODA	Use intention	Visibility (Med)	Functional, Social, Conditional, & Epistemic values	Theory of consumption values	Survey -> SEM
Chakraborty (2022)	OFODA	Use intention	Visibility (Mod)	Trialability, PU, PEU, Hedonic motivation, Purchase intention	TAM, UTAUT2, Diffusion of Innovation	Survey -> SEM
Francioni et al. (2022)	OFODA	Continuance intention	Gender (Mod)	Perceived healthiness, Quarantine procedures, Perceived hygiene, PEU, Attitude	Not specified	Survey -> SEM
Kao & L'Huillier (2022)	Mobile commerce	Use of mobile commerce	Use intention (Med), Attitude (Mod)	Attitude, Subjective norms, Perceived behavioral control	TPB	Survey -> SEM
Ramos (2022)	MFODA	Continuance intention	NA	Effort expectancy, Performance expectancy, Food and beverage quality, Price saving orientation	UTAUT2	Survey -> Multiple regression
Shah et al. (2022)	MFODA	Continuous purchase intention	Cognitive, Affective, and Behavioral engagement (Med)	Mobile online reviews, Food quality, Restaurant reputation, Service quality, System quality	S-O-R theory	Survey -> SEM
Su et al. (2022b)	MFODA	Loyalty towards MFDAs	Customer's trust (Med)	PU, PEU, Interface quality, Interaction quality, Information quality, Personalization	TAM, service quality, and the personalization-privacy theory	Survey -> SEM
Su et al. (2022a)	MFODA	Loyalty toward MFDSs	Perceived value (Med)	Functional quality (a second-order, multidimensional construct with ease of use, app design, responsiveness, privacy and security, information quality, personalization)	Gronroos's service quality model	Survey -> PLS

Table A – Literature Review on Mobile App Adoption and Continuance in the Hospitality Industry						
Authors (Year)	**Context***	**Dependent Variables**	**Moderating or Mediating Variables***	**Independent variables***	**Theory used***	**Research methods****
Wen et al. (2022)	MFODA	Continuance intention	Attitude, Perceived behavioral control, Trust (Med)	Subjective norms, Perceived innovativeness, Hedonic and Utilitarian motivations, PU, PEU, Food safety risk perception	TAM and TPB	Survey -> PLS
Anbumathi et al. (2023)	OFODA	Brand love	Brand image (Med)	App design factors, Service quality factors, Personality factors, Social influence factors	Brand attachment theory	Survey -> PLS
Gani et al. (2023)	OFODA	Actual use	PU, Use intention (Med), Trust (Mod)	Information attributes (attitude toward information, information availability, information credibility, information quality, and need for information), Food service attributes (delivery time, menu visualization, price-related value, and reputation)	Information adoption model (IAM)	Survey -> PLS

* OFODA: Online Food Ordering and Delivery Aggregators/Applications, MFODA: Mobile Food Ordering and Delivery apps

** MED: Mediating variable, MOD: Moderating variable, PU: Perceived usefulness, PEU: Perceived ease of use

*** ISSM: Information Systems Success Model, S-O-R: Stimulus–Organism–Response Theory, PAMISC: Post Adoption Model of Information System Continuance, TAM: Technology Acceptance Model, TPB: Theory of Planned Behavior, UTAUT: Unified Theory of Acceptance and Use of Technology, UTAUT2: Consumer Acceptance and Use of Information Technology

**** SEM: Structural Equation Modelling, PLS: Partial Least Squared

Appendix B

Table B.1 – Measurement Items		
Variables	**Selected Questions**	**References**
Technology Anxiety (4 Items)	• I have difficulty understanding most technological matters. • Technological terminology sounds like confusing jargon to me. • I have avoided technology because it is unfamiliar to me. • I hesitate to use technology for fear of making mistakes I cannot correct.	Meuter et al. (2003); Thatcher & Perrewé (2002)
Confirmation (3 items)	• My experience with using the My McD's App was better than what I expected. • The service level provided by the My McD's App was better than what I expected. • Overall, most of my expectations about using the My McD's App were confirmed.	Bhattacherjee (2001); Hong et al. (2006)
Perceived Usefulness (3 items)	• I find the My McD's App useful when ordering food. • Using the My McD's App increases my efficiency in the food ordering process. • If I use the My McD's App, I will increase my chances of getting better deals for the price of my food.	Bhattacherjee (2001)
Satisfaction with Technology (3 items)	• How would you describe your overall experience of using the My McD's App? • Very dissatisfied / Very satisfied. • Very displeased / Very pleased. • Absolutely terrible / Absolutely delighted.	Bhattacherjee (2001); Hong et al. (2006)
Use Continuance Intention (4 items)	• My intentions are to continue using the My McD's App over other alternative means of food ordering methods. • All things considered; I expect to continue to use the My McD's App in the future. • I can see myself increasing my use of the My McD's App if possible. • It is likely that I will frequently use the My McD's App in the future.	Bhattacherjee (2001)
Improved Satisfaction with the Restaurant (3 items)	• Thanks to the McDonalds' mobile app, I have become… • Much more dissatisfied / Much more satisfied • Much more displeased / Much more pleased • Much more terrified / Much more delighted • … with McDonald's restaurants than before I used the My McD's App.	Bhattacherjee (2001); Djelassi et al. (2018); Hong et al. (2006)

Table B.2 – Control Variables	
Items	**Questions**
Gender	What is your gender? Male / Female

Age Group	What is your age group?
	    in my 10's
	    in my 20's
	    in my 30's
	    in my 40's
	    in my 50's
	    in my 60's (and over)

Education	What is your level of education?
	    Middle school degree or equivalent
	    High school degree
	    Vocational college degree
	    Undergraduate (University) degree
	    Graduate (University) degree

Occupation	What is your occupation?
	    Student
	    Employed
	    Homemaker
	    Self-employed
	    Others

Income level	What is your income per month (in USD)?
	    $500(-)
	    $500~$1,000
	    $1,000~$2,000
	    $2,000~$3,000
	    $3,000~$4,000
	    $4,000~$5,000
	    $5,000~$7000
	    $7,000~$100,000
	    $100,000~

Frequency of ordering food from McDonald's (McDUseFreq)	Please indicate the frequency that you eat (order) any food or drink items in any McDonald's restaurants per month: _____ times/month
App order percentage (OrdAppPer)	Please indicate the proportions of food ordering with Mobile Apps you use when you order, visit, or eat in a McDonald's restaurant. _____ % (out of all your food ordering methods in any McDonald's restaurants
App use frequency (AppUseFreq)	Please indicate the frequency that you use the My McD's App per month: _____ times/month

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