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Information Management

Exploring user behaviours on mobile technologies combined with payment functions during the COVID-19 pandemic

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**Exploring user behaviours on mobile technologies
combined with payment functions during the
COVID-19 pandemic**

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Abstract

With the extensive spread of smart mobile devices, mobile technologies and services have revolutionised and pervaded significantly in most aspects of human life, such as social communication, commerce, entertainment, etc. Various industries have integrated services and products with mobile financial transaction technologies, facilitating the payment services combined with various mobile applications. The wide adoption of mobile transactions has increased the efficiency of transaction processes, met the expectations of customers and the requirements of enterprises, and supported the social-economic development in different scenarios, especially under the pandemic situation. Understanding mobile device users' perceptions and behaviours on mobile technologies combining payment functions under the COVID-19 pandemic situation has reinforced the need to embark on a deeper investigation of customer behaviours during the pandemic.

For these reasons, this study contributes to the advancement of knowledge and implementation methods for a better understanding of the determinants of customers' behavioural intentions of using mobile technologies combined with payment functions in a total of seven separate studies. The investigation begins with a systematic literature review on mobile payment studies presented in chapter two. This research is augmented by investigating users' continuance usage intention of mobile payments under the COVID-19 pandemic in chapter three. The fourth chapter analyses the determinants of continuance usage intention of food delivery apps during the pandemic. Chapters five and six present two theoretical development studies about the Unified Theory of Acceptance and Use of Technology (UTAUT) and UTAUT2, respectively. The seventh chapter investigates customers' psychological shopping processes via live-streaming shopping apps during the pandemic lockdown period.

In epistemological terms, this study involved conjoint positivist and interpretivist research in behavioural information systems research. A qualitative research method was applied in chapters two, five and six, and a quantitative research method was implemented in the third, fourth and seventh chapters. The main theoretical foundations applied and validated in three empirical studies were UTAUT and UTAUT2.

Specifically, chapter three integrates UTAUT with Mental Accounting Theory, the fourth chapter combines UTAUT with the Expectancy Confirmation Model, and chapter seven integrates UTAUT2 with the Stimulus-Organism-Response framework and Flow theory.

This study found that performance expectancy, social influence, and trust significantly affect users' behavioural intentions in all three empirical studies. Customers' mental cognitions, such as perceived benefits, satisfaction, flow and perceived value, positively formulate users' behavioural intention in the three studies, respectively. Hedonic motivation and flow significantly influence users' behavioural intention when mobile technologies contain payment and entertainment features.

Moreover, this study contributes several theoretical and practical implications. This study facilitates the advancement of knowledge of mobile technologies adoption through three verified theoretical frameworks and two proposed developed theoretical models and appropriate measurement methods. Meanwhile, this study supports relevant stakeholders in mobile technologies, enterprises, policymakers, service providers, and marketing departments with valuable findings and discussions for comprehensively understanding the determinants of customers' behaviours on mobile technologies combined payment function.

Keywords: mobile technologies combined payment function; mobile payment; food delivery apps, live-streaming shopping apps, customer behaviours; Unified Theory of Acceptance and Use of Technology (UTAUT); UTAUT2; Mental Accounting Theory (MAT); Expectancy Confirmation Model (ECM); Stimulus-Organism-Response framework (SOR); Flow theory

Publications

List of publications resulting from this dissertation.

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Zhao, Y. and Bacao, F. (2021) 'How Does the Pandemic Facilitate Mobile Payment? An Investigation on Users' Perspective under the COVID-19 Pandemic', *International Journal of Environmental Research and Public Health*, 18(3):1016. DOI: <https://doi.org/10.3390/ijerph18031016>

Zhao, Y. and Bacao, F. (2020) 'What factors determining customer continuingly using food delivery apps during 2019 novel coronavirus pandemic period?', *International Journal of Hospitality Management*, Elsevier, 2020, Aug, 91, 102683. DOI: <https://doi.org/10.1016/j.ijhm.2020.102683>

Zhao, Y. and Bacao, F. (2020) 'A comprehensive model integrating UTAUT and ECM with espoused cultural values for investigating users' continuance intention of using mobile payment', *2020 3rd International Conference on Big Data Technologies*. September 2020, 155–161. DOI: <https://doi.org/10.1145/3422713.3422754>

Zhao, Y. and Bacao, F. (2020) 'Theoretical Development: Extending the Flow Theory with Variables from the UTAUT2 Model', *2020 IEEE 6th International Conference on Computer and Communications (ICCC)*, Chengdu, China, 2020, 2427-2431, DOI: <https://doi.org/10.1109/ICCC51575.2020.9345049>

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1. Chapter 1 - Introduction

1.1. Introduction

With the significant development of information technology, smart mobile devices have been adopted ubiquitously. Various mobile applications and services have developed sharply, revolutionising the telecommunication industry (Baptista and Oliveira, 2016). Since mobile devices involved financial transaction functions, the global business climate had changed dramatically from traditional social commerce to online commerce towards mobile commerce. According to a WorldPay report, mobile payments accounted for 22% of the global points of sale spending in 2019, and this percentage will increase to 29.6% in 2023 (WorldPay, 2020). The wide adoption of mobile payment has facilitated financial transactions for paying goods, services, and bills anywhere, anytime and for anyone (Di Pietro *et al.*, 2015). Mobile payment, as an innovative contactless financial transaction technology, has been widely applied in various business industries such as banking, catering, entertainment.

Meanwhile, mobile device users' consumption habits have significantly changed. Especially since the COVID-19 pandemic broke out in December of 2019, maintaining social distance and lockdown measures have been applied globally. Contactless payments have been adopted significantly. For example, in the catering industry, 41.6 % of residents preferred mobile delivery services to purchase food and daily supplies during the COVID-19 pandemic in China (Meituan research institute, 2020). Investigating the determinants of customer behaviours on mobile technologies combining payment functions has aroused increasing attention from both academic and practical aspects. Although some previous studies facilitated the understanding of user's adoption intention and actual usage of mobile payments in different contexts (Di Pietro *et al.*, 2015; Ramos-de-Luna *et al.*, 2016; Liébana-Cabanillas *et al.*, 2018; Cao and Niu, 2019), the determinant variation and theoretical evidence of mobile payment adoption were still insufficient (Dahlberg *et al.*, 2015). Previous research has been especially sparse considering users' perceptions and behavioural intention of using mobile applications with

payment functions corresponding to specific environmental conditions. Thus, investigating customer behaviours is essential for relevant stakeholders to understand technology's performance to develop better marketing and business strategies to optimise users' experience and meet customers' requirements opportunely. Furthermore, the main motivational factors for the current research are listed as follow.

- 1) Despite some previous studies having investigated various specific antecedents of mobile payment technology adoption, the research scenarios were insufficient because of the variation of cultural backgrounds (Baptista and Oliveira, 2015), which indicates the necessity for exploring the new constructs and novel interactions of variables to contribute knowledge advancement.
- 2) Previous studies on mobile payment adoption's variation and theoretical evidence of different perspectives in a specific situation were limited (Dahlberg *et al.*, 2015). Especially under emergency conditions, namely the COVID-19 pandemic, investigating the factors affecting users' continuance intention of using mobile payments can support new insights into how emergency conditions affect users' perceptions and behaviours.
- 3) Payment functions have been integrated into various mobile technologies. Food delivery apps (FDAs), as emerging catering service mobile applications, facilitate customers' dining experiences anytime and anywhere. FDAs met customers' daily requirements and widened catering enterprises' operational range, especially during the COVID-19 pandemic. Therefore, investigating customers' continuance usage intention of FDAs under the COVID-19 scenario is valuable for knowledge advancement in new technology usage under an emergency environment.
- 4) The theoretical frameworks applied in previous mobile payment technology adoption studies were insufficient to explain users' behaviours from technological and mental perceptions conjointly (Marinkovic *et al.*, 2020). For example, as the engagement cognition, flow reflects the customer's immersive experience (Hossain and Zhou, 2018). Thus, theoretical frameworks require adjustment and modification to comprehensively analyse users' technological perceptions and mental cognitions in various environmental backgrounds and involve cultural moderating effects to relevant theoretical development.

- 5) Live-streaming shopping apps (LSSAs), as a relatively new emerging mobile commerce technology combining social entertainment and e-commerce features, have rarely been explored in previous studies. Different ages and gender play a role in customers' psychological shopping processes via LSSAs under specific environmental conditions (such as the pandemic lockdown situation). These factors should be investigated to bring new insights into explaining customer behaviours on mobile payment technology.

1.2. Adoption models

Myriad adoption models have previously been implemented in new technology adoption literature, such as the Diffusion of Innovations theory (DOI) (Rogers, 2003), Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), Theory of Planned Behaviour (TPB) (Ajzen, 1991), Technology Acceptance Model (TAM) (Davis, 1989) and Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh *et al.*, 2003). wherein TAM and UTAUT are probably the most widely applied and validated models evident in many empirical studies on consumer behaviour on adopting new technologies (Kim, Mirusmonov and Lee, 2010; Koenig-Lewis *et al.*, 2015). Specifically, Venkatesh *et al.* (2003) proposed UTAUT to investigate users' behavioural intention to use new information technology systems to reflect social cognition theory. UTAUT incorporated four fundamental determinants, performance expectancy, effort expectancy, social influences, and facilitating conditions as an extension of the TAM model, which has been modified with different external variables or integrated with other theoretical frameworks to explore users adopting new technologies in various contexts (Oliveira *et al.*, 2014; Khalilzadeh, Ozturk and Bilgihan, 2017; Marinkovic *et al.*, 2020). Di Pietro *et al.* (2015) integrated TAM, DOI and UTAUT to investigate the determinants of mobile payment adoption. Moreover, UTAUT2, an advanced version of UTAUT, designed by Venkatesh, Thong and Xu (2012), overcame the weaknesses of UTAUT by including additional variables and moderators to predict users' motivation and behaviour on information technology. UTAUT2 has also been revised by extending or subtracting variables or models to accurately analyse users' adoption intention of information technology in various particular

situations. For example, excluding price value and adding privacy to investigate mobile payment adoption (Morosan and DeFranco, 2016), adding culture moderators to predict mobile banking adoption (Baptista and Oliveira, 2015), and integrating the theory with the DOI model to investigate mobile payment adoption (Oliveira, 2016).

1.3. Research foci

The principal foci of this paper are summarised and presented in Figure 1.1. as follows:

- understanding the main determinants of customers' continuance usage intentions of mobile payment and food delivery apps under the COVID-19 pandemic;
- developing an adoption framework with theoretical support; investigating customers of different ages and genders' psychological shopping processes via live-streaming shopping apps during the pandemic lockdown period,

Meanwhile, the study's target is to focus on individual levels of behaviour on mobile technologies combined payment function.

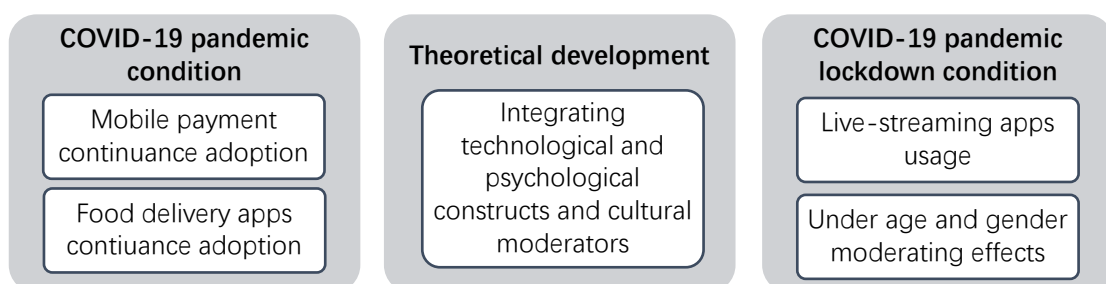


Figure 1.1. Research focuses

Mobile technologies combining payment functions interact information communication with electronic financial transactions (Dahlberg *et al.* 2015), which are embedded in various services to support customers' financial transaction requirements, such as mobile banking, food delivery apps, and live-streaming shopping apps. This thesis proposes a specific adoption model in each chapter to investigate customer behaviours on

mobile technologies combining payment functions in different patterns, scenarios, and samples to contribute relevant knowledge advancement. A total of six separate studies are presented in Figure 1.2. Wherein four cover the mobile payments arena, one investigates the food delivery apps aspect, and one delves into the live-streaming shopping apps field. Specifically, UTAUT (Venkatesh *et al.*, 2003) was integrated with different frameworks and theories for specific scenarios, such as the Mental Accounting Theory (MAT) (Thaler, 1985), Expectancy Confirmation Model (ECM) (Bhattacharjee, 2001), Hofstede’s Cultural Values (Hofstede, 1980), and the Task-Technology Fit model (TTF) (Goodhue and Thompson, 1995). UTAUT2 (Venkatesh *et al.*, 2012) was combined with Flow theory (Csikszentmihalyi, 1975), and the Stimulus-Organism-Response framework (SOR) (Mehrabian and Russell, 1974).

Mobile payments	<ul style="list-style-type: none"> • Systematic literature review of mobile payments' adoption • Continuance usage under the COVID-19 pandemic (UTAUT + MAT) • Theoretical development of UTAUT (UTAUT + ECM+culture moderator) • Theoretical development of UTAUT2 (UTAUT 2+Flow theory)
Food delivery apps	<ul style="list-style-type: none"> • Continuance usage under the COVID-19 pandemic (UTAUT + ECM+TTF)
Live-streaming shopping apps	<ul style="list-style-type: none"> • Shopping intention under age and gender moderating effects (UTAUT2 + SOR + Flow theory)

Figure 1.2. List of studies and theoretical frameworks

1.4. Main objectives

This study aimed to understand the main determinants of customer behaviours on mobile technologies with combined payment functions, including continuance usage intentions of mobile payment and food delivery apps during the COVID-19 pandemic, users’ psychological processes, moderated by age and gender, of shopping via live-streaming shopping apps during the pandemic lockdown period. Each research

objective was addressed in different studies and are presented in separate chapters.

The second chapter consists of a systematic literature review of mobile payment adoption studies, which generated the main determinants of mobile payment adoption, identified the popular theoretical frameworks applied in previous studies, and summarised the obstacles in mobile payment adoption studies. This chapter provides a general theoretical foundation and research guidance for supporting the remaining studies in the following chapters.

The third chapter investigates the main determinants of mobile device users' intention to continuously use mobile payments under the COVID-19 pandemic by integrating the UTAUT and MAT theoretical models with additional perceived benefits, security, and trust constructs. Mobile payments provide individuals with a contactless transaction method under the highly contagious COVID-19 pandemic condition. The determinants of technology adoption under emergencies have barely been explored heretofore; this chapter explores how the pandemic has influenced individual use behaviour.

The fourth chapter researches individuals' continuance usage intention of food delivery apps under the COVID-19 pandemic. As a specific emerging online-to-offline mobile technology with payment functions, food delivery apps have been widely adopted. These apps provide two-way beneficial catering delivery services in rescuing catering enterprises and satisfying customers' technological and mental expectations during the COVID-19 pandemic. A comprehensive model integrating UTAUT, ECM and TTF with the trust factor was proposed in this chapter to support understanding of customers' behaviours.

The fifth chapter develops a theoretical framework by integrating UTAUT and ECM with the trust construct and Hofstede's cultural values to contribute towards theoretical development. This chapter aims to build up an adoption model under the cultural moderating effects to analyse users' behavioural intention from technological and mental perceptions conjointly to understand individual behaviours of technology usage comprehensively.

The sixth chapter presents a theoretical development of UTAUT2 by combining a new mediator, flow theory, and an additional variable,

satisfaction, to explore the main antecedents of using mobile technology. Flow, as a mediating variable, represents an individual's immersive experience and engagement with a particular technology, which is influenced by the user's technological perceptions, towards affecting their mental cognition and adoption intention. The proposed adoption model contributes a theoretical foundation for relevant study to predict the main drivers of technology adoption from a users' perspective.

The seventh chapter proposes a modified Stimulus-Organism-Response framework, which extends stimulus based on UTAUT2 and trust, a proposed organism based on flow theory. It assumes perceived values and behavioural intention as responses to investigate customers' psychological shopping processes via live-streaming apps under the moderating effects of age and gender during the pandemic lockdown period. This chapter provides a new insight that an individual's psychological process of using an emerging entertainment mobile payment technology under a specific environmental condition is moderated by gender.

As a concluding chapter, the eighth chapter summarises the principal findings of the previous chapters and generates the most important contributions of this study.

1.5. Methods

This study involved positivist and interpretivist research in behavioural information systems research conjointly. Specifically, chapters two, five and six applied interpretivism qualitative research methods, which aimed to gain in-depth insights and empathetic understanding of the state-of-the-art knowledge from previous studies and theoretical developments based on the weaknesses of the adoption model in previous studies. On the other hand, chapters three, four and seven broached positivism, which aimed to discover human behaviours in information system research. These chapters were conducted using a quantitative research method. Moreover, this study applied the observation method in the interpretivist research to summarise the subjective discoveries and implemented an online survey method in the positivist research to generate the objective phenomenon of human behaviours in information systems. A structural approach was applied in the positivist research,

including identifying the research topic, constructing the research model, proposing hypotheses and validating the research model by collected data. The theoretical frameworks and the quantitative approach in the positivist research are presented as follows.

Chapter three integrates UTAUT (Venkatesh *et al.*, 2003) with Mental Accounting Theory (MAT) (Thaler, 1985) to establish the theoretical framework. MAT explained that personal desires affect cognitive processes towards bearing on psychological processes for valuing a specific technology which should be considered in the voluntary usage environment (Alghamdi, 2018). For the data collection, a cross-sectional online survey with a five-point Likert scale measurement for all constructs' indicators was applied to collect data through the most popular Chinese mobile social media platform, WeChat, in a three-week period during the COVID-19 pandemic, from 11 March 2020 to 31 March 2020. A total of 739 valid data was accepted for evaluating the theoretical framework using a covariance-based structural equation modelling technique through a two-step approach (Anderson and Gerbing, 1988), including validating the measurement model and testing the structural model.

Chapter four combines UTAUT (Venkatesh *et al.*, 2003) with the Confirmation Model (ECM) (Bhattacharjee, 2001) and Task-Technology Fit model (TTF) (Goodhue and Thompson, 1995) to propose the theoretical framework. ECM explained users' satisfaction and continuance behaviour of information systems via three dimensions, performance expectancy, confirmation and satisfaction (Bhattacharjee, 2001). TTF presented the degree of fitness between tasks and technology to assist in performing individual daily tasks and utilising technology (Goodhue and Thompson, 1995). Equivalent data collection and validation methods were applied in this chapter to understand the determinants of customers using food delivery apps during the COVID-19 pandemic. Data collection was conducted in China from 23 March 2020 to 12 April 2020. A total number of 532 valid answers were accepted to validate the theoretical framework.

Chapter seven integrates UTAUT2 (Venkatesh *et al.*, 2012) with the Stimulus-Organism-Response framework (SOR) (Mehrabian and Russell, 1974) and Flow theory (Csikszentmihalyi, 1975) to investigate individuals' psychological process of shopping via live-streaming shopping apps

during the COVID-19 pandemic lockdown period. A seven-point Likert scale cross-sectional online survey was applied in China from 9 August 2020 to 6 September 2020 through Wenjuan.com (a Chinese online survey platform) and WeChat. A total of 374 valid answers were applied for assessing the theoretical model. Moreover, to distinguish the moderating effects of age and gender, a multi-group analysis was implemented to evaluate the path coefficients across each age and gender subsample.

1.6. Research Path

This research consists of six interrelated studies associated with mobile technologies that combine payment functions, namely mobile payment, food delivery apps and live-streaming shopping apps, addressed from the second to the seventh chapters separately. Two of them have already been published in Q1 and Q2 international journals with a double-blinded review process. Another two were published in international conference proceedings with a double-blinded review process and indexed in Scopus. The remaining two studies are under review. The majority of the chapters were published in international journals and qualified international conference proceedings with a double-blinded review process to guarantee the quality of the research. The summary of the current stage of each study is presented in Table 1.1. The final chapter at the end of this dissertation summarises the main conclusions of each study.

Table 1.1. Current stages of studies

Chapter	Study name	Current stage
2	Systematic Literature Review: user perspective on mobile payment adoption	Under review
3	How does the pandemic facilitate mobile payment? An investigation on users' perspectives under the COVID-19 pandemic	Published in the International Journal of Environmental Research and Public Health (Q2)
4	What factors have determined customers' continuous use of food delivery apps during the 2019 novel Coronavirus pandemic?	Published in the International Journal of Hospitality Management (Q1)
5	A comprehensive model integrating UTAUT and ECM with espoused cultural values for investigating users' continuance intention of using mobile payment	Published in conference proceeding of the 2020 3rd International Conference on Big Data Technologies
6	Theoretical Development: Extending the Flow Theory with Variables from the UTAUT2 Model	Published in conference proceeding of the 2020 IEEE 6th International Conference on Computer and Communications
7	How does gender moderate customer intentions of shopping via live-streaming apps during the COVID-19 pandemic lockdown period	Under review

2. Chapter 2 - Systematic Literature Review: user perspectives on mobile payment adoption

2.1. Introduction

Mobile payment (M-payment) was defined by Dahlberg *et al.* (2008) as 'the payment method for goods, services, and bills with a mobile device by taking advantage of wireless and other communication technologies. With the increasing compatibility of M-payment services and ubiquitous coverage of internet-based communication networks, financial transactions via mobile devices are leading us to move towards a cashless world, which will be worth more than £3.5 trillion by 2023, following a growth of 33.8% CAGR between 2017-2023 (Merchantsavvy, 2019). M-payments supported users' daily transactions and protected the development of the social economy during the pandemic, especially in 2020, despite the global economy suffering seriously because of the COVID-19 pandemic. For example, the number of transactions made by mobile payments was 22.4 million in the first quarter of 2020 in China, up 187% from the year 2019 (China Banking and Insurance News, 2020). The percentage of M-payment users in China had increased from 73.5% in June 2019 to 85.3% in March 2020 and reached 86.0% in June 2020 (CNNIC, 2020). As an efficient cashless transaction pattern, M-payment plays a vital role in various industries, such as banking, e-commerce, hospitality, and entertainment. It provides two-way benefits for both consumers and merchants by providing fast, safe and convenient financial transactions. This phenomenon became even more prevalent during the Covid-19 lockdowns, which were decreed by governments worldwide.

Despite various previous research focusing on mobile payment adoption in various scenarios (Slade *et al.* 2013; Koenig-Lewis *et al.*, 2015; Oliveira *et al.*, 2016; Lu *et al.*, 2017; Park *et al.*, 2018), a comprehensive systematic literature review on mobile payment adoption had not been sufficiently analysed. This scenario required an investigation to understand users' behaviours on M-payment better to support relevant knowledge extraction. The purpose of this paper is to systematically

review the existing literature related to M-payment adoption from the user perspective. 'M-payment' mentioned in this study includes relevant terms such as 'mobile banking', 'mobile wallet' and 'mobile transfer' since they consist of payment services via mobile devices. (Donner and Tellez, 2008; Albuquerque *et al.*, 2014). The relevant literature was categorised in the field of information system management. As a theoretical review foundation, the systematic literature review method was implemented to examine and analyse the relevant works of literature to achieve the following research targets.

- Demonstrate the general distribution of relevant M-payment adoption literature.
- Summarise the insights from previous literature about the different perspectives of factors involved in M-payment adoption.
- Evaluate the theoretical frameworks implemented in previous M-payment adoption literature.
- Summarise the obstacles mentioned in the previous M-payment adoption works of literature limitation sections.

This study provides a guideline for systematic review implementation, summarises and discusses essential elements and frameworks for M-payment adoption, and proposes a comprehensive model for future relevant investigations. This paper provides practical evidence to comprehensively understand customers' attitudes and behaviours on adopting M-payments for better business strategy and management for relevant stakeholders in M-payment services.

This study presents the following sections for the systematic literature review; section 2 illustrates the systematic literature review process. Sections 3 and 4 present the findings and results. Finally, section 5 concludes with the implications, limitations and recommendations for future research.

2.2. Methodology

2.2.1. Systematic Literature Review

As a replicable, scientific and transparent literature review method, a systematic literature review minimises the bias and random error to generate selected literature to focus on a specific topic or solve a particular research question (Kitchenham and Charters, 2007; Fu *et al.*, 2018). The systematic literature review process was grouped by Brereton *et al.* (2007) into three main phases, planning the review, conducting the review and reporting the review, which has been further divided into five steps, including (i) formulating research questions, (ii) identifying studies, (iii) selecting and evaluating studies, (iv) analysing and synthesising, and (v) presenting the results (Kitchenham and Charters, 2007). Regarding the third step, selecting and evaluating studies, applying the filtering of works of literature repeatedly in the systematic literature review process to answer research questions clearly was suggested (Brereton *et al.*, 2007). This five-step systematic literature review process had been widely implemented in different fields, such as cloud computing integration with the supply chain (Novais, Maqueira and Ortiz-Bas, 2019). This chapter revises the five-step systematic literature review to systematically investigate the previous literature related to mobile payment adoption from the user's perspective.

2.2.2. Formulating research questions

The first step is identifying the research questions as guidance for building literature search strategies (Kitchenham and Charters, 2007; Novais, Maqueira and Ortiz-Bas, 2019). Based on the research purpose, the research questions were formulated as follows:

- What is the trend in previous literature on users adopting mobile payment? (Year, region and key terms)
- What are the key determinants of mobile payment adoption in previous studies?
- What are the theoretical foundations underpinned in previous literature to investigate customers adopting mobile payments?

- What are the obstacles in previous research related to users' mobile payment adoption?

2.2.3. Identifying relevant studies

The second stage of the systematic literature review involves searching and locating relevant pieces of literature to answer the main research questions (Kitchenham and Charters, 2007; Ahmed *et al.*, 2019). In pursuing this target, the relevant studies' location and collection processes implement keyword-based searches in the leading bibliographic databases (Brereton *et al.*, 2007; Kitchenham and Charters, 2007). According to the review questions, three sets of keywords were established and connected with Boolean Logic as a search strategy:

'Consumer' OR 'User' OR 'Customer'
AND
'Mobile Payment' OR 'Mobile Banking' OR 'Mobile transfer'
AND
'Adoption' OR 'Acceptance'

The target scientific databases consisted of two easily-accessed datasets, Web of Science and Science Direct. The target literature included peer-reviewed journal articles and conference proceedings written in English and published between 2009 and 2020. Specifically, there were 615 papers from the Web of Science and 268 from ScienceDirect. VOSviewer initially analysed the brief performance of identified literature to visualise the networks of key items. The keywords were connected by association strength, the key items' minimum occurrence was set as 20. As shown in Figure 2.1, the Web of Science's network demonstrated four clusters, with the most valued items, 'technology adoption model', 'usefulness', 'social influence'. Likewise, Figure 2.2 presents the network visualisation of ScienceDirect with two clusters, and the key items summarised as 'intention', 'social', 'information' and 'development'. A VOSviewer visualisation analysis identified the relationships of mentioned keywords to discern the relevant literature targets better.

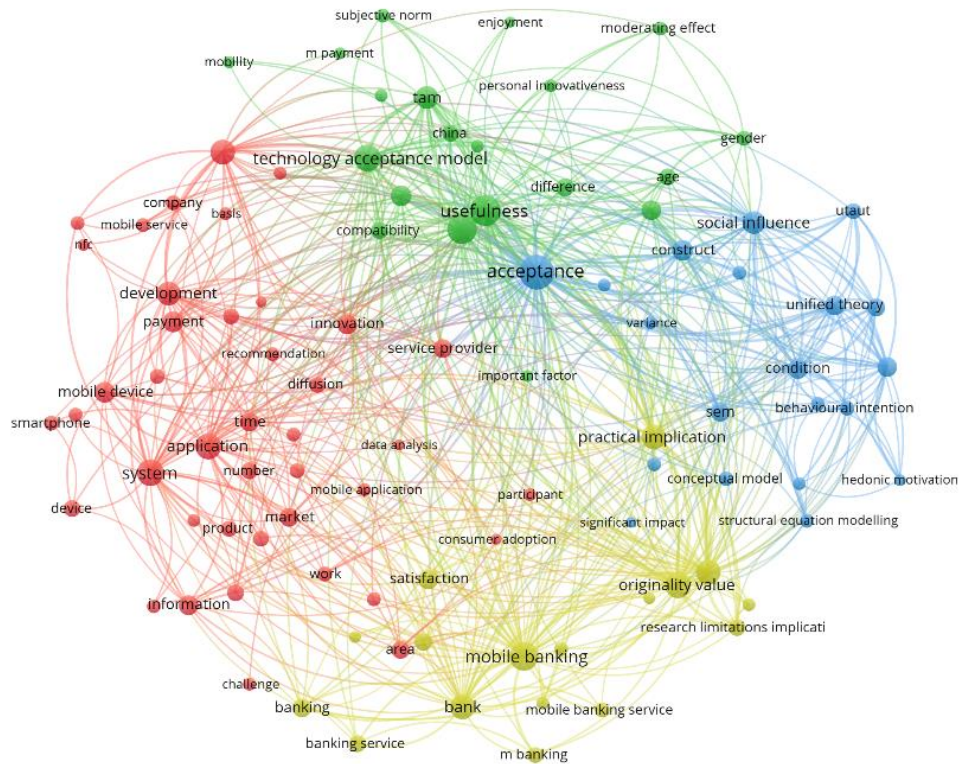


Figure 2.1. Network visualisation of key terms from 615 relevant studies in the Web of Science

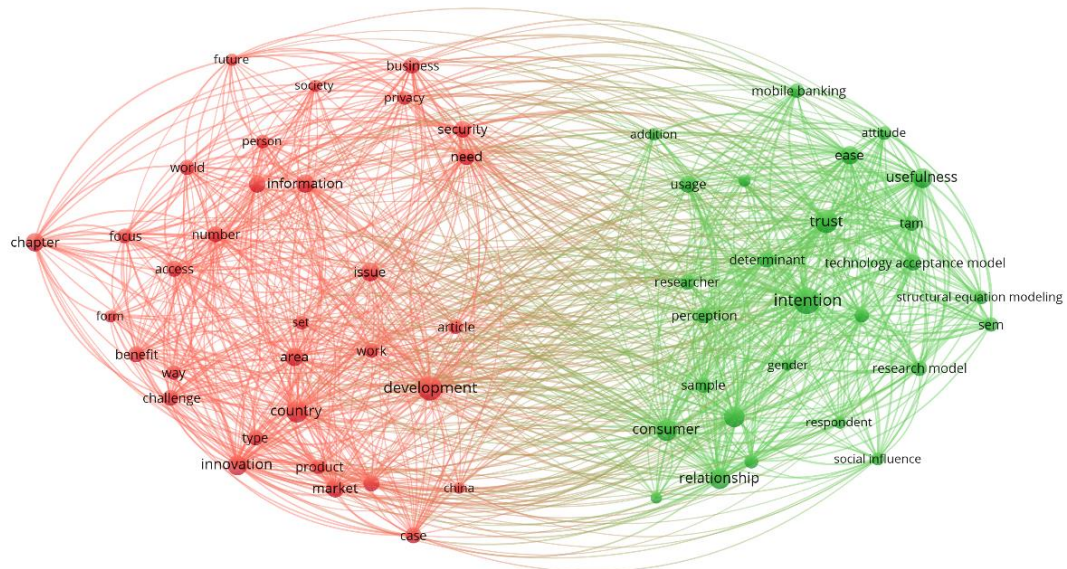


Figure 2.2. Network visualisation of key terms from 268 relevant studies in ScienceDirect

2.2.4. Selecting studies

Even after an initial examination of the titles and abstracts of the papers containing the key terms, many of them were not qualified within the scope of the research (Brereton *et al.*, 2007; Kitchenham and Charters, 2007). Thus, after fully accessing the studies, inclusion and exclusion criteria were applied to scan and assess relevant literature from titles and abstracts to full texts to select relevant articles, as shown in Figure 2.3. In turn, 58 papers were initially selected from 2009 to 2019, and 3 extra papers were selected in 2020 for in-depth analysis.



Figure 2.3. overview of the selected studies

2.2.5. Data extraction and synthesis

The information, including author(s) and year of publication (Studies), title, theoretical basis (Theo. basis), target location (Loc.), sample size (No.), key outcomes and obstacles, were extracted from selected 61 works of literature and tabulated in table 2.1 to match the research dimension for answering the research questions. (Brereton *et al.*, 2007; Kitchenham and Charters, 2007; Duran and Mussbacher, 2019).

Table 2.1. basic information of selected studies

Studies	Title	Theo. basis	Key Factors	Loc.	No.	Key outcomes	Obstacles
(Marinković <i>et al.</i> , 2020)	The moderating effects of gender on customer satisfaction and continuance intention in mobile commerce: a UTAUT-based perspective	UTAUT	Performance expectation; Effort expectation; Social influence; Satisfaction Perceived trust; Involvement; Continuance intentions	Serbia	402	Performance expectancy was found to be the strongest predictor of satisfaction, and comparative value was identified as the primary driver of continuance intention. In addition, significant differences in attitudes between women and men were confirmed in the case of three out of ten effects.	trust and privacy protection; data collection method
(Flavián, Guinalíu, and Lu, 2020)	Mobile payments adoption – introducing mindfulness to better understand consumer behavior	TAM	Mindfulness; Perceived usefulness; Perceived ease of use; Subjective norms; Attitude;	United States and Spain	794	This study integrated mindfulness as a major factor and found mindfulness, perceived ease of use, perceived usefulness, subjective norms and attitude have significant influence on mobile payment use intention	Location
(Hassan and Wood, 2020)	Does country culture influence consumers' perceptions toward mobile banking? A comparison between Egypt and the United States	TAM	Perceived usefulness; Perceived ease of use; Perceived risk; Trust; Social influence.	Egypt and the United States	617	Perceived usefulness and trust have a significant influence on usage intention in all groups. Social influence presented different effects. Country culture (both primary and secondary) can, to some degree, influence consumers' perceptions and intentions toward mobile banking.	Sample size
(Abrahão <i>et al.</i> , 2016)	Intention of adoption of mobile payment: An analysis in the light of the Unified Theory of Acceptance and Use of Technology (UTAUT)	UTAUT	Performance expectation; Effort expectation; Social influence; Perceived risk; Perceived Cost.	Brazil	605	Performance expectation, effort expectation, and social influence have significantly positive impacts, and perceived risk has a significant negative impact on mobile payment adoption. The factor perceived cost does not have a significant negative impact on mobile payment adoption.	Region; financial
(Al-jabri, 2012)	Mobile Banking Adoption: Application of Diffusion of Innovation Theory	DOI	Relative Advantage; Compatibility; Complexity; Observability; Perceived risk; Trialability.	Saudi Arabia	330	Relative advantage, compatibility, observability have significant positive effects, and trialability has significant negative effects on mobile banking adoption. Complexity has insignificant positive effects, and Perceived Risk has insignificant negative effects on mobile banking adoption.	Region; age; use experience; sample size
(Anthony and Mutalemwa, 2014)	Factors influencing the Use of Mobile Payments in Tanzania: Insights from Zantel's Z-pesa Service	TAM	Perceived usefulness; Perceived ease of use; Perceived mobility; Perceived cost; Perceived trust; Perceived expressiveness; Perceived support.	Tanzania	120	This paper investigated the factors influencing the intention to use mobile payment. Usefulness is impacted by other factors continuing effect use intention, the poorly perceived usefulness, no ease of use, and lack of trust affect users adopting mobile payment in Tanzania.	Server; sample size; language;

Studies	Title	Theo. basis	Key Factors	Loc.	No.	Key outcomes	Obstacles
(Baptista and Oliveira, 2015)	Understanding mobile banking: The unified theory of acceptance and use of technology combined with cultural moderators	UTAUT2	Performance expectancy; Effort expectancy; Social influence; Facilitating conditions; Hedonic motivation; Price value. Hofstede's cultural moderators.	Mozambique.	252	This study integrated UTAUT2 and Hofstede's cultural values and found that Individualism/collectivism, Uncertainty avoidance, Long/short term, Power distance have positively moderating influences on acceptance of mobile banking.	Culture; region; server
(Boonritomachai and Pitchayadejana, 2018)	Determinants affecting mobile banking adoption by generation Y based on the Unified Theory of Acceptance and Use of Technology Model modified by the Technology Acceptance Model concept	UTAUT; TAM	Performance expectancy; Effort expectancy; Social influence; Facilitating conditions; Security; Self-efficacy; Hedonic motivation	Thailand	480	This study combined ATM and UTAUT to determine the mediating effect of hedonic motivation being impacted by facilitating conditions, security, and self-efficacy, which conjointly affected behavioural intention on mobile banking adoption.	Age
(Cao and Niu, 2019)	Integrating context-awareness and UTAUT to explain Alipay user adoption	UTAUT	Performance Expectancy; Effect Expectancy; Social Influence; Perceived Risk; Ubiquity; Context; User Adoption.	China	614	This study integrated context-awareness and UTAUT and stated that performance expectancy mediated ubiquity and user adoption. Content has an insignificant positive impact on performance expectancy; effect expectancy.	Security
(Chawla and Joshi, 2019)	Scale Development and Validation for Measuring the Adoption of Mobile Banking Services	TAM	Ease of use; Attitude; Lifestyle; Convenience; Efficiency; Trust	India	283	The study integrated TAM with attitude, lifestyle, trust, convenience and efficiency, and found that trust, attitude, and lifestyle significantly impacted behaviour intention.	Age; region; sample size; culture
(Chen and Li, 2017)	Understanding Continuance Intention of Mobile Payment Services: An Empirical Study	IT continuance theory	Post perceived usefulness; Disconfirmation of pre-perceived usefulness; Post perceived risk; Disconfirmation of pre-perceived risk; Trust and Satisfaction.	China	243	Satisfaction had positive impacts on trust and continuance intention. Pre-perceived usefulness positively affected satisfaction and post-perceived usefulness. Pre-perceived risk negatively impacted user satisfaction and positively affected post-perceived risk. Trust had a positive impact on post-perceived usefulness and a negative impact on post-perceived risk.	Habit; region
(Cocosi and Trabelsi, 2016)	An integrated value-risk investigation of contactless mobile payments adoption	Theory of perceived value-risk	Utilitarian; Enjoyment; Social; Perceived risk (time; social; psychological and privacy); Perceived value;	Canada	289	This study integrated value-risk perception as a significant factor in adopting NFC payments with smartphones in Canada. The results also presented that utilitarian and enjoyment values had a positive impact on user motivators. Psychological and privacy risks had the most negative impact.	User experience
(Daştan and Gürler, 2016)	Factors Affecting the Adoption of Mobile Payment Systems: An Empirical Analysis	TAM	Perceived Reputation; Environmental Risk; Perceived Trust; Perceived Usefulness; Perceived Ease of Use; Perceived Mobility; Attitude.	Turkey	225	Perceived Trust, Perceived Mobility and Attitude had positive effects on the adoption intention. Perceived trust was positively related to perceived reputation and negatively related to environmental risk. However, perceived usefulness and perceived ease of use do not affect adoption intention.	Sample size; region
(Kerviler, Demoulin and Zidda, 2016)	Adoption of in-store mobile payment: Are perceived risk and convenience the only drivers?	Theory of perceived value	Perceived benefit (utilitarian, hedonic, and social); Perceived risks; Experience; Spillover effects	French	363	This paper measured perceived benefits from utilitarian and hedonic, and social aspects. Financial and privacy risks were key drivers for the French consumer adopting mobile payment. Perceived	Enjoyment

Studies	Title	Theo. basis	Key Factors	Loc.	No.	Key outcomes	Obstacles
						risk has a significant negative impact on the intention of adoption.	
(Di Pietro et al., 2015)	The Integrated Model on Mobile Payment Acceptance (IMMPA): An empirical application to public transport	TAM; DOI; UTAUT	Usefulness; Ease of use; Security; Attitude; Compatibility; Users' behaviour	Italy	439	Usefulness, Ease of use and Security have a positive effect on usage intention. Usefulness is simultaneously influenced by Ease of use, towards influencing Compatibility and Attitude on adopting mobile services.	Age; use experience; culture; region
(Gu, Lee and Suh, 2009)	Determinants of behavioural intention to mobile banking.	TAM	Social Influence; System Quality; Facilitating Conditions; Self-efficacy; Familiarity with Bank; Situational Normality; Structural Assurances; Calculative-based Trust; Perceived Usefulness; Perceived Ease of Use; Trust.	South Korea	910	This paper applied Trust-associated TAM and found that trust and ease of use affected perceived usefulness. Self-efficacy had the strongest impact on perceived ease-of-use, which in turn affected behavioural intention through perceived usefulness. Trust as a strong indicator could increase behavioural intention.	User experience; Sample size
(Haider et al., 2018)	Exploring Gender Effects in Intention to Islamic Mobile Banking Adoption: an empirical study	ATM	Perceived financial cost; Perceived usefulness; Social norms; Perceived credibility; Perceived self-expressiveness; Gender	Pakistan	243	Male intention was significantly impacted by perceived usefulness and perceived self-expressiveness. Female intention was significantly impacted by perceived credibility. However, with perceived financial cost and social norms, no significant gender differences existed.	Region; Age
(Hamidi and Safareeyeh, 2019)	A model to analyse the effect of mobile banking adoption on customer interaction and satisfaction: A case study of m-banking in Iran	CRM	Interaction; Affective commitment; Satisfaction; Trust; Loyalty; Profitability; Involvement; Number of visits; Willingness to re-visit	Iran	243	User's satisfaction and profitability were the most significant indicators for user interaction.	Sample size
(Zhu, Lan and Chang, 2017)	Understanding the Intention to Continue Use of a Mobile Payment Provider: An Examination of Alipay Wallet in China	ELM	Source credibility; Perceived usefulness; Perceived integration; Trust; Subjective norm; Competitors' marketing efforts	China	332	Source credibility, perceived usefulness, and perceived integration were internal factors determining continuance intention through trust. Competitors' marketing efforts and subjective norms, as two external factors, negatively and positively impacted continuance intention, respectively.	Trust
(Hossain and Zhou, 2018)	Impact of m-payments on purchase intention and customer satisfaction: perceived flow as a mediator	SOR	Usefulness; Emotion; Security; Perceived flow; Customer satisfaction	China	350	Satisfaction has the most significant positive impact on mobile payment adoption. Perceived flow, as a mediator, affected satisfaction, consequently influenced purchase intention.	Enjoyment
(Jenkins and Ophoff, 2016)	Factors influencing the intention to adopt NFC mobile payments – A South African perspective	TAM	Security concerns; Privacy concerns; Trust concerns; Perceived risk; Perceived value; Social influence; Perceived ease of use; Perceived financial resources.	South Africa	331	Social influence had the most significant influence on perceived value. Security and privacy concerns had significant positive influences on perceived risk but negative impacts on adoption.	Age; Sample Size

Studies	Title	Theo. basis	Key Factors	Loc.	No.	Key outcomes	Obstacles
(Johnson, et al., 2018)	Limitations to the rapid adoption of M-payment services: Understanding the impact of privacy risk on M-Payment services	DOI	Perceived ease of use; Relative advantage; Visibility; Perceived security; Privacy risk; Ubiquity; Trialability.	USA	270	Ease of use, relative advantage, visibility, and perceived security had positive effects on adoption intention. Ubiquity and trialability positively influenced security, while concern over privacy risks negatively influences perceptions of security.	Sample size
(Kaitawarn, 2015)	Factor influencing the acceptance and use of M-payment in Thailand: a case study of AIS mPAY rabbit	UTAUT	Personal factors; Performance expectancy; Effort expectancy; Social influence; Facilitating condition; Attitude; Switching cost; Convenience; Privacy.	Thailand	222	Convenience and attitude are the most significant determinants of adoption intention. Privacy of personal information and the switching cost were also negative effects of usage intention.	Region
(Kapoor, Dwivedi and Williams, 2013)	Role of innovation attributes in explaining the adoption intention for the interbank mobile payment service in an Indian context	TAM	Relative Advantage; Compatibility; Complexity; Trialability; Observability; Cost.	India	323	This paper added Cost indicator to TAM and found that relative advantage, compatibility, complexity and trialability had significant positive effects on users' adoption intention. However, observability had a poor impact on behavioural intention.	Culture; region
(Khalilzadeh, Ozturk and Bilgihan, 2017)	Security-related factors in extended UTAUT model for NFC based mobile payment in the restaurant industry	UTAUT	Facilitating condition; Self-efficacy; Attitude; security; Trust; Utilitarian; Performance expectancy; Effort expectancy; Social influence; Hedonic; Risk.	USA	412	Security and trust positively impacted customers' adoption intention, while perceived risk had a negative effect. Effort expectancy, hedonic and utilitarian performance expectancy and attitude had direct and indirect impacts on adoption intention, respectively.	Sample size; industry; culture; use experience
(Kim, Mirusmonov and Lee, 2010)	An empirical examination of factors influencing the intention to use mobile payment	TAM	Innovativeness; M-payment Knowledge; MPS characteristics; Mobility; Reachability; Compatibility; Convenience; Perceived Usefulness; Perceived Ease of Use.	South Korea	269	Perceived ease of use and perceived usefulness were the most significant indicators of usage intention. Perceived ease of use had insignificant effects on Individual differences, convenience, and reachability. Compatibility has insignificant effects on perceived usefulness and perceived ease of use. Furthermore, M-payment knowledge had a greater effect on perceived ease of use than personal innovativeness.	Actual usage
(Koenig-Lewis et al., 2015)	Enjoyment and social influence: predicting mobile payment adoption	TAM; UTAUT	Perceived usefulness; Perceived ease of use; Perceived risk; Perceived enjoyment; Social influence.	France	316	This study combined TAM and UTAUT and found that perceived ease of use had no significant effects on perceived usefulness and intention to use. Meanwhile, perceived enjoyment had significant effects on perceived ease of use and usefulness. Social influence reduces perceived risk.	Age; gender; use experience; culture; region
(Kongarachapatara, 2018)	Factors Affecting Adoption versus Behavioural Intention to Use QR Code Payment Application	TAM	Perceived Usefulness; Perceived Ease of Use; Perceived Credibility; Behavioural Intention; Perceived Self-Efficacy	Thailand	275	This study added the self-efficacy indicator to TAM to illustrate that perceived usefulness, ease of use, and credibility significantly positively affected behavioural intention. Ease of use was affected by perceived self-efficacy when adopting QR payment.	Sample size; culture

Studies	Title	Theo. basis	Key Factors	Loc.	No.	Key outcomes	Obstacles
(Lee and Wong, 2016)	Determinants of Mobile Commerce Customer Loyalty in Malaysia	E-S-QUAL model	Efficiency; System availability; Fulfilment; Privacy; Satisfaction; Trust; Commitment.	Malaysia	214	Efficiency had the strongest influence on satisfaction, which in turn affected customer loyalty. Commitment had a stronger influence on customer loyalty than satisfaction and trust.	Region; Culture; Enjoyment
(Liéban a-Cabaniilas and Lara-Rubio, 2017)	Predictive and explanatory modelling regarding the adoption of mobile payment systems	TAM	Perceived usefulness; Perceived Ease of Use; Perceived security; Comparability; Subjective norms; Individual mobility.	Spain	191	Perceived usefulness and perceived security had the most significant impacts on adopting a mobile payment system. Perceived security, comparability, subjective norms, and individual mobility positively impacted perceived usefulness and ease of use.	Region,
(Liéban a-Cabaniilas et al., 2018a)	Predicting the determinants of mobile payment acceptance: A hybrid SEM-neural network approach	TAM	Perceived usefulness; Perceived ease of use; Trust; Mobility; Customisation; Customer involvement.	Serbia	224	This paper explored determinants of users adopting mobile payment through TAM and neural network analysis and found that perceived usefulness and security had the most significant effects on acceptance intention.	Region; server; age; gender; use experience
(Liéban a-Cabaniilas et al., 2018b)	To use or not to use, that is the question: Analysis of the determining factors for using NFC mobile payment systems in public transportation	TAM	Convenience; Effort expectancy; Perceived trust; Service quality; Social value; Satisfaction; Perceived risk.	Malaga	180	Satisfaction, service quality, effort expectancy, and perceived risk were determining factors of the continuance intention of using NFC mobile payment systems in public transportation.	Region; culture; server; age; gender; use experience
(Liéban a-Cabaniilas et al. 2017)	Intention to use new mobile payment systems: A comparative analysis of SMS and NFC payments	TAM	Subjective norms, Perceived ease of use, Perceived usefulness, Attitude, Perceived security.	Spain	287	This paper proposed Mobile Payment Acceptance Model in New Electronic Environments and identified the attitude, connected usefulness and ease of use, had the most significant effect on adoption intention. Perceived security had a significant impact on the intention of adoption.	server, age, gender, use experience
(Liéban a-Cabaniilas, Sánchez-Fernández and Muñoz-Leiva, 2014a)	Antecedents of the adoption of the new mobile payment systems: The moderating effect of age	TAM, TRA, UTAUT	External influences; Social influence; Subjective Norms; Trust; Risk; Ease of use; Attitude; Usefulness.	Spain	2012	This paper involved the attitude variable into the TAM adoption model to investigate the different ages adopting mobile payment. The results show that younger people easily adopt new techniques than older age users. Usefulness and external influence, based on social image and subjective norms, significantly impact adoption intention. However, risk has a negative impact.	Sample size, server
(Liéban a-Cabaniilas, Sánchez-Fernández and Muñoz-Leiva, 2014b)	The moderating effect of experience in the adoption of mobile payment tools in Virtual Social Networks: The m-Payment Acceptance Model in Virtual Social Networks (MPAM-VSN)	TRA; TAM; UTAUT	External influences; Ease of use; Usefulness; Attitude; Trust; Risk.	Spain	2012	This study proposed a behavioural model (named MPAM-VSN) and found that previous experience reduced associated risk, improving the perception of usefulness and encouraging use, which positively affected intention of usage.	Sample size, age, gender, use experience
(Lu et al., 2017)	How do post-usage factors and espoused cultural values impact mobile payment continuation?	TAM; UTAUT; ECM	Social influence; Privacy; Mobility; Privacy protection; Usefulness; Satisfaction.	China	724	Privacy protection and social influence beliefs had significant impacts on continuous usage intentions. Satisfaction, indicated by mobility, had a positive impact on intention. Uncertainty avoidance affected perceived social influence	culture

Studies	Title	Theo. basis	Key Factors	Loc.	No.	Key outcomes	Obstacles
						and mobility. Power distance served as an antecedent of perceived privacy protection.	
(Morosan and DeFranco, 2016)	It's about time: Revisiting UTAUT2 to examine consumers' intentions to use NFC mobile payments in hotels	UTAUT2	Performance expectancy; Effort expectancy; Social influence; Facilitating condition; Hedonic motivation; Habit; Privacy; Perceived security.	USA	794	Performance expectancy, hedonic motivations, habit, and social influences impacted intentions to use NFC mobile payment in an American hotel.	Region, server
(Mun, Khalid and Nadarajah, 2017)	Millennials' Perception of Mobile Payment Services in Malaysia	TAM	Perceived Usefulness; Perceived Ease of Use; Social Influence; Perceived Credibility.	Malaysia	300	Usefulness had the most significant positive impact on consumer intentions to use mobile payment services in Malaysia, followed by ease of use, social influence and credibility.	Competitive
(Muñoz-Leiva et al., 2017)	Determinants of intention to use the mobile banking apps: An extension of the classic TAM model	TAM	Perceived Usefulness; Perceived Ease of Use; Perceived Risk; Perceived Trust; Social Influence; Attitude.	Spain	103	Attitude significantly determined the intention of adopting mobile banking. Usefulness and risk had positive and negative effects on mobile banking app adoption, respectively.	Actual use, sample size, loyalty
(Oliveira et al., 2014)	Extending the understanding of mobile banking adoption: When UTAUT meets TTF and ITM	UTAUT; TTF; ITM	Performance expectancy; Effort expectancy; Social influence; Facilitating conditions; Technology characteristics; Task characteristics; Task technology fit; Firm reputation; Personal propensity to try; Structural assurances.	Portugal	194	Facilitating conditions and behavioural intentions directly affected mobile banking adoption in Portugal. Initial trust, performance expectancy, technology characteristics, and task technology fit had total effects on behavioural intention.	Server, use experience
(Oliveira et al., 2016)	Mobile payment: Understanding the determinants of customer adoption and intention to recommend the technology	UTAUT; DOI	Performance expectancy; Effort expectancy; Social influence; Facilitating conditions; Hedonic motivation; Price value; Innovativeness; Compatibility; Perceived technology security.	Portugal	301	This study combined UTAUT2, DOI and PTS. It illustrated that compatibility, perceived technology security, performance expectations, innovativeness, and social influence have significant direct and indirect effects on the adoption and recommendation of mobile payment.	Trust, risk, age, culture,
(Pal, Vanijja and Papasratorn, 2015)	An Empirical Analysis towards the Adoption of NFC Mobile Payment System by the End User	TAM	Personal Innovativeness; NFC Payment Knowledge; User Mobility; Reachability; Compatibility; User Convenience; Perceived ease of Use; Perceived Usefulness	Thailand	270	perceived ease of use was the most significant indicator effect on intention of adoption. Experience positively affected ease of use; however, use mobility had a negative impact on ease of use.	Trust, security, financial, policy, gender

Studies	Title	Theo. basis	Key Factors	Loc.	No.	Key outcomes	Obstacles
(Park et al., 2018)	Examining the role of anxiety and social influence in multi-benefits of mobile payment service	ATM; MAT	Technology anxiety; Social influence; Convenience benefit; Economic benefit; Information security benefit; Enjoyment benefit; Experiential benefit; Social benefit; Attitudes.	USA	361	This study integrated TAM and MAT and found that convenience, enjoyment, economic benefits, and attitudes positively impacted adoption intention. In contrast, experiential benefit was a negative determinant.	Culture, region, sample size, age, gender, trust, use experience
(Pham and Ho, 2015)	The effects of product-related, personal-related factors and attractiveness of alternatives on consumer adoption of NFC-based mobile payments	TAM; DOI	Perceived ease of use; Compatibility; Perceived risk; Trialability; perceived cost; Additional values of NFC mobile payments; Attractiveness of alternatives; Innovativeness in new technologies; Absorptive capacity, Trust.	China	402	This paper combined the TAM and DOI frameworks with personal-related factors to investigate NFC mobile payment adoption. Usefulness was the most significant antecedent of adoption Intention. Perceived risk had a significant negative impact on adoption.	sample size, culture,
(Ramos de Luna et al., 2018)	Mobile payment is not all the same: The adoption of mobile payment systems depending on the technology applied	TAM;	Perceived ease of use; Perceived usefulness; Subject norms; Perceived Security. Attitude, Intention of use.	Spain	168	As the essential factor, attitude and usefulness positively impacted users' intention to adopt mobile payment. Meanwhile, ease of use and perceived security had a great impact on intention to use.	Sample size, region age, gender, use experience
(Ramos de Luna et al., 2016)	Determinants of the intention to use NFC technology as a payment system: an acceptance model approach	TAM	Perceived compatibility; Perceived usefulness; Subjective norms; Perceived ease of use; Personal innovation in IT; Individual mobility; Perceived security; Attitude.	Spain	191	Attitude, subjective norms and innovation were essential determinants of the adoption intention of NFC mobile payment.	Use experience, server, security, culture, Region
(Riskianto et al., 2017)	The Moderation Effect of Age on Adopting E-Payment Technology	TAM	Perceived Ease of Use; Perceived Usefulness; Attitude.	Indonesia	532	This study found that adoption intention was moderated by age. Perceived ease of use and perceived Usefulness were the most significant antecedents of mobile payment adoption.	Sample size, age
(Shankar and Datta, 2018)	Factors Affecting Mobile Payment Adoption Intention: An Indian Perspective	TAM	Perceived ease of use; Perceived usefulness; Personal innovativeness; Self-efficacy; Subjective norm; Trust.	India	381	Perceived ease of use, perceived usefulness, trust and self-efficacy had a significant impact on adoption intention. Personal innovativeness and self-efficacy had significant impacts on perceived ease of use. Personal innovativeness and subjective norm had a significant impact on perceived usefulness.	Age, sample size, culture
(Shao et al., 2018)	Antecedents of trust and continuance intention in mobile payment platforms: The moderating effect of gender	DOI	Mobility; Customisation; Security; Reputation; Trust; Perceived; Risk; Gender.	China	740	Security was the most significant antecedent of customers' trust, followed by platform reputation, mobility and customisation. Customers' trust, in turn, is negatively associated with perceived risk and positively associated with continuance intention.	Age, region, use experience, trust

Studies	Title	Theo. basis	Key Factors	Loc.	No.	Key outcomes	Obstacles
(Sharma and Sharma, 2019)	Examining the role of trust and quality dimensions in the actual usage of mobile banking services: An empirical investigation	IS success model	Service quality; Information quality; System quality; Trust; Intention to use; Satisfaction.	Omani	227	Satisfaction mediated the relationship between service quality, information quality and trust with intention, which had the most significant effect on actual usage.	Sample size, culture, actual adoption
(Shin, 2009)	Towards an understanding of the consumer acceptance of mobile wallet	UTAUT	Perceived usefulness; Perceived ease of use; Attitude; Social influence; Perceived security; Trust; Self-efficacy.	USA	296	Perceived usefulness and ease of use were key elements of attitude on adopting mobile wallets. Attitudes and intentions are influenced by perceived security and trust.	Sample size, security, social
(Siyal et al., 2019)	Predicting Mobile Banking Acceptance and Loyalty in Chinese Bank Customers	TAM	Resistance to change; Perceived risk; Awareness of service; Perceived benefit; Perceived Usefulness; Perceived ease of use; Attitude.	China	200	This paper explained mobile banking adoption connected with the loyalty factor. Resistance to change, perceived risk and low awareness of services, and perceived benefits had significant impacts on loyalty, in turn influencing adoption intention.	Age, region, sample size, user experience
(Slade et al., 2015)	Exploring consumer adoption of proximity mobile payments	UTAUT	Performance expectancy; Effort expectancy; Social influence; Facilitating conditions; Habit; Price value; Hedonic motivation; Perceived risk; Trust in provider.	UK	244	This research implemented UTAUT2 with trust and risk constructs and found that performance expectancy remained the strongest predictor, followed by habit, hedonic motivation, and social influence.	Personal innovativeness
(Sripalawat, Thongmak and Ngramyarn, 2011)	M-banking in metropolitan Bangkok and a comparison with other countries	TAM; TPB	Device barrier; Perceived risk; Lack of information; Perceived financial Cost; Subjective norm; Perceived usefulness; Perceived ease of use; Self-efficacy.	Thailand	195	Perceived usefulness and lack of information were two main factors of M-banking adoption. This paper recommended attractiveness of alternatives, convenience, context, compatibility, expressiveness, mobility, privacy, speed of transaction, system quality, technology anxiety, and trialability should be explored in future research.	Region, rural
(Theodorou et al., 2010)	Predicting the Adoption of Mobile Transactions: An Exploratory Investigation in Greece	TAM, TRA	M-transactions execution; Perceived usefulness; Perceived ease of use, Familiarity with technology.	Greece	392	Perceived usefulness and familiarity are the most significant variables of adoption intention. Familiarity had a significant impact on perceived usefulness.	Trust, financial
(Ting et al., 2016)	Intention to Use Mobile Payment System: A Case of Developing Market by Ethnicity	TPB	Perceived usefulness; Perceived ease of use; Trust; Perceived safety; Interpersonal influence; External influence; Self-efficacy; Facilitating condition; Attitude; Subjective norm; Perceived behavioural control.	Malaysia	311	Attitude, subjective norm, and perceived behavioural control positively affected mobile payment adoption by implementing the TPB framework in the Malaysian market. Meanwhile, belief also had a positive effect on the intention to use mobile payment systems	Region, sample size

Studies	Title	Theo. basis	Key Factors	Loc.	No.	Key outcomes	Obstacles
(Wu, Liu and Huang, 2016)	Exploring User Acceptance of Innovative Mobile Payment Service in Emerging Market: The Moderating effect of diffusion stages of WeChat Payment in China	Consumer Response System Model	Positive emotion; Perceived risk; Perceived usefulness; Diffusion stages.	China	484	Positive emotion has a strong negative impact on perceived risk and a positive impact on perceived usefulness. positive emotion and perceived risk have significant positive and negative impacts on acceptance intention at the market introduction stage rather than market growth.	Region, user emotion
(Yan et al., 2009)	Factors that affect mobile telephone users to use mobile payment solutions.	TAM; TPB	Perceived usefulness; Perceived ease of use; Trust; Peer influence; Perceived price level.	Malaysia	120	Trust and peer influence were the most significant antecedents of mobile payment adoption.	server
(Zhou, 2013)	An empirical examination of continuance intention of mobile payment services	IS success model; Flow theory	System quality; Information quality; Service quality; Trust; Flow; Satisfaction.	China	195	Service quality had significant effects on trust, flow and satisfaction of mobile payment continuance adoption. Trust affected flow, in turn, affected Satisfaction.	region
(Zhou, Lu and Wang, 2010)	Integrating TTF and UTAUT to explain mobile banking user adoption	TTF; UTAUT	Task characteristics; Technology characteristics; Task technology fit; Performance expectancy; Effort expectancy; Social influence; Facilitating conditions.	China	250	Performance expectancy, task technology fit, social influence, and facilitating conditions significantly affected users' adoption intention of M-banking.	region

TAM- technology acceptance model; UTAUT-Unified Theory of Acceptance and Use of Technology; TPB-Theory of planned behaviour; MAT- Mental Accounting Theory; DOI-Diffusion of innovation, TTF-Task technology fit model; SOR- Stimulus-Organism-Response framework; ELM- Elaboration likelihood model; ECM-expectancy confirmation model; E-S-QUAL model-Efficiency, system availability, fulfillment, and privacy dimensions on service quality. CRM-customer relationship management; TRA-Theory of Reasoned Action

2.3. Reporting and results

This stage of the current study consists of summarising and reporting the results (Brereton *et al.*, 2007; Kitchenham and Charters, 2007). The first part presents a descriptive analysis of the 61 selected papers. The distributions of basic information of previous works of literature were analysed and visualised by MS Excel and VOSviewer software. Specifically, publication years, target regions and key terms of selected studies were summarised and analysed for better understanding the relevant research trend.

2.3.1. Distribution of publication years

The publication years' distribution of select studies is summarised in Table 2.2. The result shows that the previous studies related to mobile

payment adoption from a user’s perspective have a continually growing trend. From the publication years’ distribution, it can be concluded that mobile payment adoption on an individual level has become a popular topic and has gained increasing attention from various researchers.

Table 2.2. Publication years of selected studies

Years	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
No. of Studies	3	3	1	1	2	4	7	11	10	11	5	3

2.3.2. Distribution of target regions

The 27 countries involved in the selected 61 papers are summarised and formulated to a graphic heat map presented in figure 2.5. The colour of each county, from green to red, represents the number of articles from low to high—the top 10 target countries with the number of works of literature are presented in Table 2.3. Specifically, previous research has paid more attention to Asian and European areas. Five of 10 countries are located in Asia, and 3 of them are located in Europe. At the top of the list was China, with 10 papers, which is not surprising considering China represents the largest amount of payment transactions. Spain was the second target region, explaining the increasing attention on mobile payments in the European area. The following list of target countries, Thailand, the USA and Malaysia, provides an appropriate context for the current study.

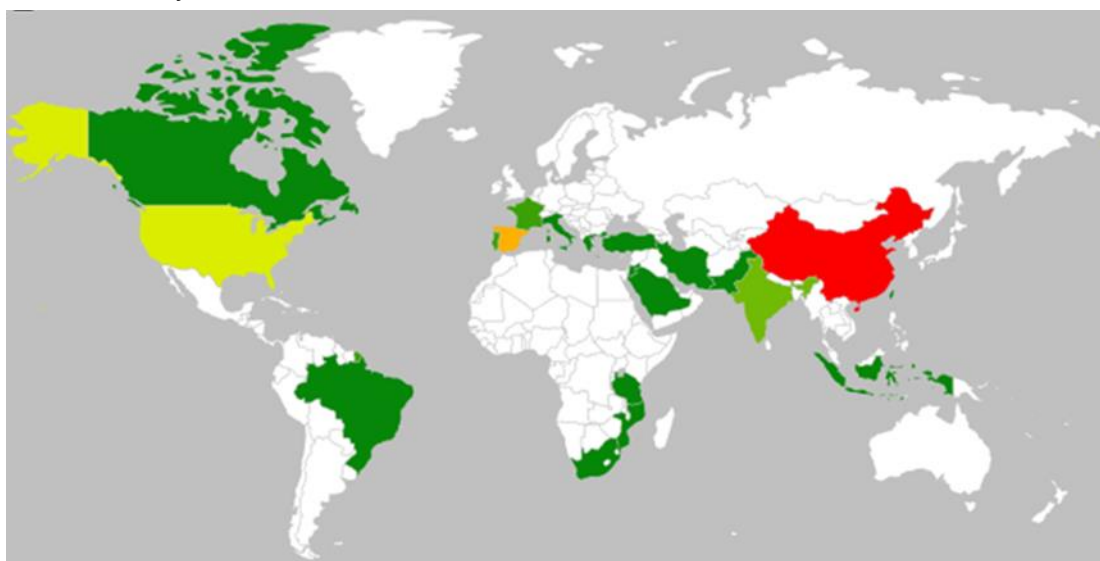


Figure 2.4. Target regions distribution

Table 2.3. Top 10 target countries with number of relevant studies

Regions	No. of studies
China	10
Spain	8
USA	7
Thailand	5
Malaysia	4
India	3
France	2
Portugal	2
South Korea	2
Brazil	1

2.3.3. Distribution of key terms

The titles and abstracts of the selected 61 works were extracted and saved as a .ris (Research Information System) file and analysed by VOSviewer. The network visualisation of key terms associated with strength has been segmented into 2 clusters in figure 2.6, wherein the red cluster on the left involves the terms of adoption factors. The terms 'Adoption', 'Factor', 'Mobile payment' and 'Intention' are the most recurring terms linked with key factors of user's payment adoption terms, such as 'Usefulness', 'Ease of Use', 'Trust' and 'Risk' as prevalent adoption factors. Furthermore, the green cluster on the right consists of the technique aspect related to the research targets. For example, the terms 'Technology' and 'Model' as two main terms with the highest occurrence are connected to adoption technique terms, such as 'Technology Acceptance Model' and 'Unified theory'(UTAUT) to analyse the target terms, like 'Customer' 'Acceptance' and 'Mobile banking'.

The overlay visualisation of key terms is presented in figure 2.7. In this overlay visualisation, the colour of a node represents the influence strength of the node. The nodes with the highest values, such as 'SEM' and 'Consumer' as the key analysis tool and key research target, had the highest overlay values with a high impact on other nodes.

The density visualisation of key terms is presented in figure 2.8. The colours of nodes in the density visualisation indicate how nodes were

distributed in the two-dimensional space underlying the visualisation. The density visualisation allows one to immediately identify dense areas where many nodes are located close to each other (van Eck and Waltman, 2014). According to each node's density visualisations, the most powerful nodes collected were 'Adoption', 'Intention', 'Factor' and 'Technology' with high-density values.

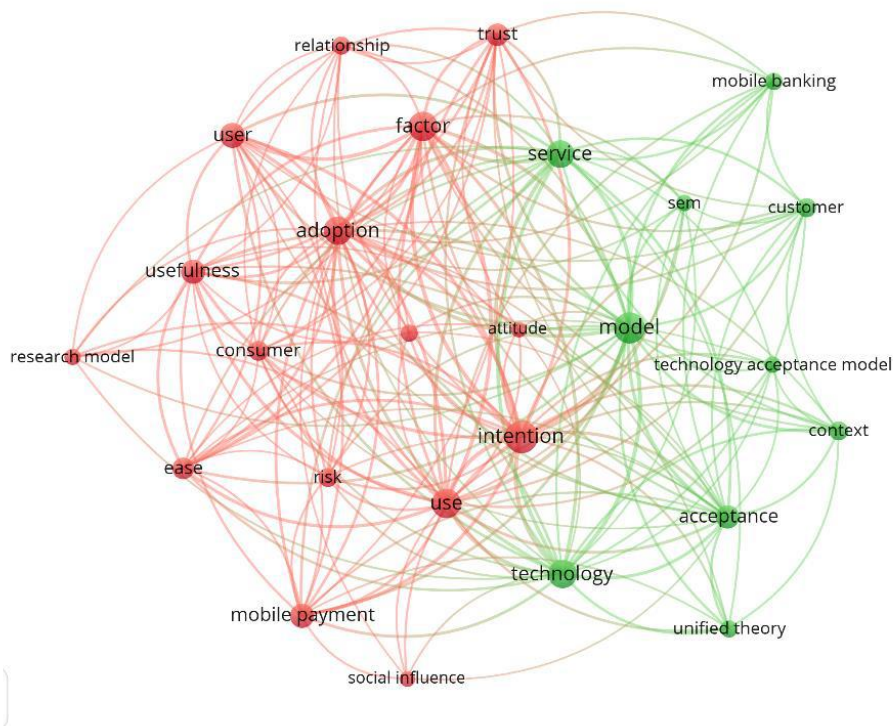


Figure 2.5. Network visualisation of selected studies

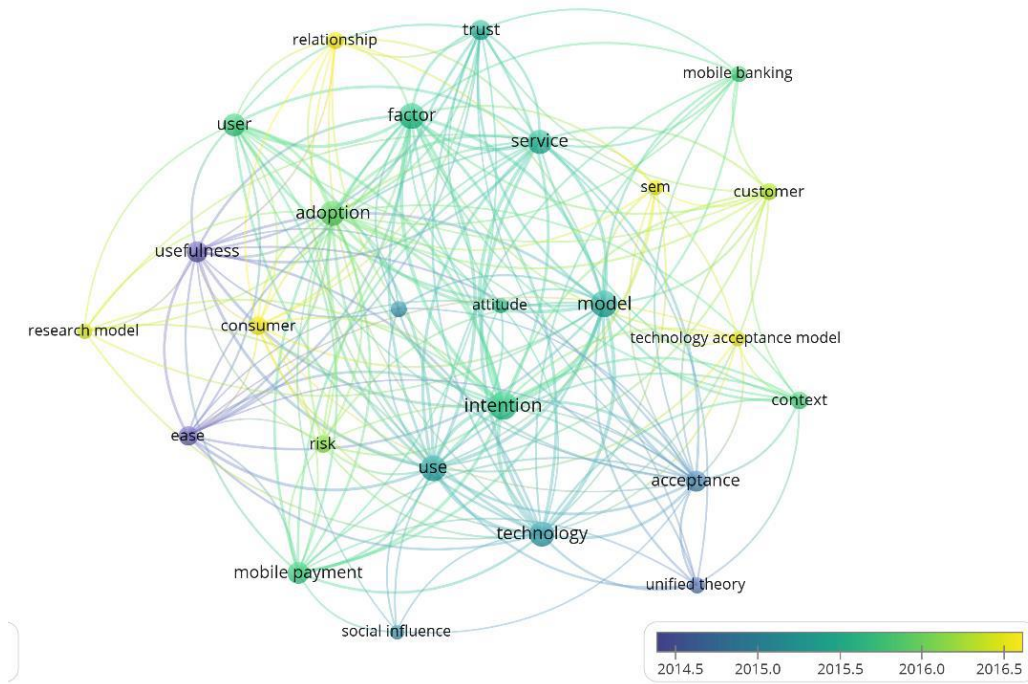


Figure 2.6. Overlay visualisation of selected studies

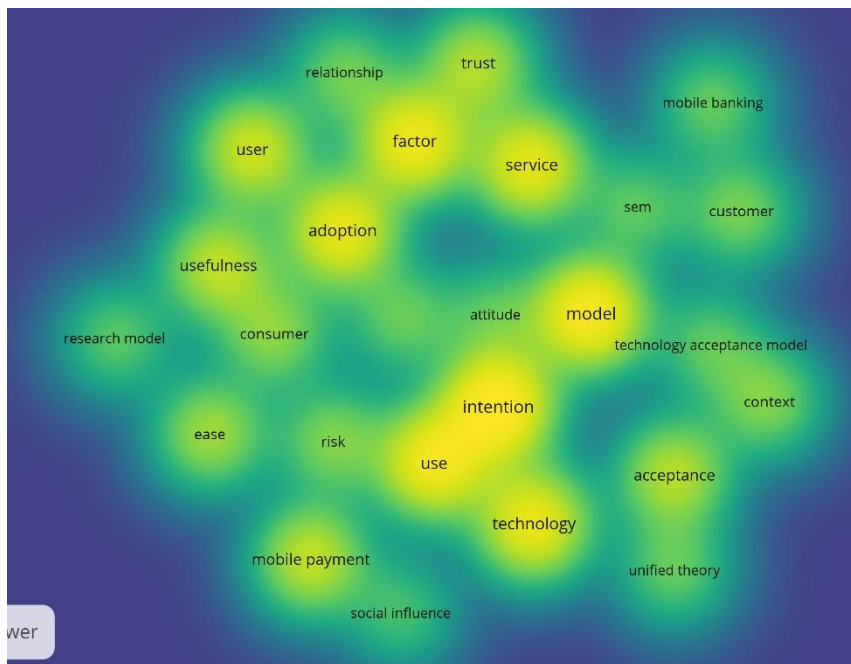


Figure 2.7. Density visualisation of selected studies

2.4. Discussion

Thematic analysis was applied to answer the research questions. First, this section addresses and discusses the determinants of mobile payment adoption. The second part discusses the theoretical frameworks applied in the previous studies. The third part summarises the obstacles in the previous works of literature.

2.4.1. Different factors involved in previous studies

According to the results from the selected 61 pieces of literature, the most prevalent factors with the highest occurrence are summarised as follows, Perceived Usefulness and Perceived Ease of Use (Cao and Niu, 2019; Di Pietro *et al.*, 2015; Chen and Li, 2017), Social influence (Lu *et al.*, 2017), Trust (Chawla and Joshi, 2019; Chen and Li, 2017), Perceived Risk (Daştan and Gürler, 2016; Chen and Li, 2017) and Security (Di Pietro *et al.*, 2015; Hossain and Zhou, 2018).

2.4.1.1. Perceived Usefulness

Perceived usefulness is defined as the degree to which a user implements a technology that will provide benefits to enhance the performance of certain activities. It is also referred to as 'performance expectancy' in UTAUT and 'Relative Advantage' in DOI (Davis, 1989; Venkatesh *et al.*, 2012; Al-jabri, 2012 Alalwan, Dwivedi and Rana, 2017). Perceived usefulness was confirmed to have a significant influence on determining behavioural intention to adopt mobile payments and in shaping the attitude of actual usage (Gu, Lee and Suh, 2009; Di Pietro *et al.*, 2015; Pham and Ho, 2015; Zhu, Lan and Chang, 2017; Riskinanto, Kelana and Hilmawan, 2017; Haider *et al.*, 2018; Liébana-Cabanillas, Molinillo and Ruiz-Montañez, 2018; Hassan and Wood, 2020; Flavián, Guinaliu, and Lu, 2020). Mun, Khalid and Nadarajah (2017) presented perceived usefulness as having the most significant impact on users adopting mobile payment and other mobile applications consisting of payment functions, such as mobile banking (Sripalawat, Thongmak and Ngramyarn, 2011). Meanwhile, the interaction between perceived usefulness and other variables directly or indirectly impacted the user's

behavioural intention. For example, Suh and Han (2002) indicated that perceived usefulness affected trust in internet banking adoption. On the other hand, the effect of perceived usefulness was also impacted by other factors, such as personal emotion (Wu, Liu and Huang, 2016), familiarity (Theodora *et al.*, 2010), trust and perceived ease of use (Alalwan, Dwivedi and Rana, 2017). Di Pietro *et al.* (2015) found that perceived usefulness was simultaneously influenced by the ease of use, conjointly determining mobile payment adoption. Furthermore, gender and age had moderating effects on perceived usefulness when users adopted mobile payments. Haider *et al.* (2018) indicated that perceived usefulness had a more significant impact on males' intention to adopt mobile banking in Pakistan. They found that male Pakistanis perceived usefulness and self-expressiveness were significantly impacted by their desire for personality, value and status. However, there were some disagreements on the influence of perceived usefulness on behavioural intention. Daştan and Gürler (2016) presented that perceived usefulness had an insignificant effect on mobile payment system users. Accordingly, perceived usefulness had different levels of effects on users' behavioural intention. In order to analyse perceived usefulness efficiently, it is necessary to address the interaction between perceived usefulness and other factors in the proposed model, such as interactions with attitude, perceived trust, self-efficacy (Khalilzadeh, Ozturk and Bilgihan, 2017; Liébana-Cabanillas, Ramos de Luna and Montoro-Ríosa, 2017; Muñoz-Leiva, Climent-Climent and Liébana-Cabanillas, 2017; Flavián, Guinaliu, and Lu, 2020).

2.4.1.2. *Perceived Ease of use*

David (1989) defined perceived ease of use forms an attitude, which develops users' intention to adopt a particular technology, in turn causing actual usage (Alalwan, Dwivedi and Rana, 2017; Muñoz-Leiva, Climent-Climent and Liébana-Cabanillas, 2017). This perception is defined by Venkatesh *et al.* (2012) as 'the degree of ease associated with consumers' use of technology, which is referred to as 'effort expectancy' in UTAUT. Ramos de Luna *et al.* (2018) found that perceived ease of use was one of the most significant predictors of usage intention; it even had a greater influence than perceived usefulness (Pal, Vanijja and Papasratorn, 2015). Meanwhile, perceived ease of use has been

modified to interact with other factors in adoption models to investigate the influence of perceived ease of use on mobile payment adoption. Alalwan, Dwivedi and Rana (2017) claimed that perceived ease of use affected Jordanian customers' perceived usefulness and behavioural intention toward adopting mobile banking. Moreover, perceived ease of use was impacted by individual differences, perceived convenience, and reachability (Kim, Mirusmonov and Lee, 2010). Perceived ease of use also interacted with other variables. Pal, Vanijja and Papasratorn (2015) illustrated that user experience positively affected perceived ease of use. However, use mobility negatively impacted perceived ease of use when users adopted NFC mobile payments in Thailand. Kongarchapatara (2018) found that perceived ease of use was significantly moderated by perceived self-efficacy when individuals used mobile payments. However, some studies found an insignificant connection between perceived ease of use and behavioural intention. For example, Koenig-Lewis *et al.* (2015) combined TAM and the UTAUT and illustrated that perceived ease of use had both insignificant effects on perceived usefulness and intention of using mobile payments in France. Daştan and Gürler (2016) described that perceived usefulness and ease of use had insignificant effects on adopting mobile payment systems in Turkey. User internal and external perceptions determined and measured perceived ease of use (Shin, 2009; Pal, Vanijja and Papasratorn, 2015; Ramos-de-Luna, Montoro-Ríos and Liébana-Cabanillas, 2016; Riskinanto, Kelana and Hilmawan, 2017).

2.4.1.3. *Social influence*

Social influence in the consumer context is defined as 'the extent to which consumers perceive influence from important others (e.g., family and friends) who believe they should use a particular technology (Venkatesh *et al.*, 2012, p. 159). The same as 'Subjective norm', social influence describes an individual's perception to perform a recommended behaviour based on the pressures from his/her peers, family, society, and culture (Zhu, Lan and Chang, 2017; Liébana-Cabanillas and Lara-Rubio, 2017). Social influence was found as a significant factor influencing mobile payments adoption (Liébana-Cabanillas, Sánchez-Fernández and Muñoz-Leiva, 2014; Jenkins and Ophoff, 2016; Lu *et al.*, 2017; Mun, Khalid and Nadarajah, 2017). Zhou, Lu and Wang (2010) found that social influence had a considerable role in users' successfully adopting

mobile banking in China. Moreover, regarding the factors' interaction aspect, Shin (2009) presented that social influence and perceived security were additional antecedents of attitude and intention of using mobile wallets. Meanwhile, Shin (2009) found that social influence was moderated by age and that social influence had a significantly stronger influence on younger people than older people. Koenig-Lewis *et al.* (2015) found that social influence has an insignificant variation on different gender customers when they adopt mobile payments. The measurement of social influence was recommended to interact with other variables, such as personally relevant factors, trust, security and cultural moderators (Zhou, Lu and Wang, 2010; Abrahão, Moriguchi and Andrade, 2016; Cocosila and Trabelsi, 2016; Kerviler, Demoulin and Zidda, 2016; Lu *et al.*, 2017; Haider *et al.*, 2018; Cao and Niu, 2019).

2.4.1.4. Trust

Trust is defined as users' subjective belief and willingness that a service provider can fulfil their obligations towards expecting a positive outcome regarding the service provider's future behaviour, which also played a crucial role in uncertain mobile financial transactions (Gu, Lee and Suh, 2009; Zhou, 2013; Zhu, Lan and Chang, 2017). As a unitary construct, the effect of trust has gained increasing attention on users' behavioural analysis (Zhou, Lu and Wang, 2010). Researchers such as Zhou (2013) proposed a trust-based adoption model and verified that service quality had a significant impact on trust towards affected flow, which in turn determined satisfaction in the mobile payments adoption context. Moreover, earlier research has proven that trust is one of the essential determinants in mobile payments adoption and continuance of usage (Alalwan, Baabdullah, Rana, Tamilmani and Dwivedi, 2018; Khalilzadeh, Ozturk and Bilgihan, 2017). Furthermore, as a multi-dimensional variable, trust had various interactions with other variables (Zhu, Lan and Chang, 2017). For example, trust positively interacted with perceived usefulness, consequently determining users' adoption intention on mobile payments (Gu, Lee and Suh, 2009; Chen and Li, 2017). Meanwhile, Daştan and Gürler (2016) confirmed that trust was associated with environmental risk and firm reputation, negatively affecting mobile payment systems, respectively. Shao *et al.* (2018) found that security positively influenced trust, and it was negatively associated with perceived risk on continuance

using mobile payments in China. Therefore, trust integrates external influence with personal feelings and has been measured by three items, flexibility, mobility and efficiency, affecting users' behavioural intention to adopt mobile payments.

2.4.1.5. *Perceived Risk*

Perceived risk was identified by Cocosila and Trabelsi (2016) as an obvious obstacle to adopting new technology. Perceived risk's negative influence on the behavioural intention added a solid power to predict users' behaviours on adopting mobile payments (Daştan and Gürler, 2016; Kerviler, Demoulin and Zidda, 2016; Chen and Li, 2017; Khalilzadeh, Ozturk and Bilgihan, 2017). Slade *et al.* (2015) found that perceived risk had a strong negative effect on the behavioural intention of mobile payment users. Moreover, the measurement of perceived risk was grouped into four independent variables, time risk, social risk, psychological risk and privacy risk. Psychological and privacy risks had the most negative impacts on users' adoption intention (Cocosila and Trabelsi, 2016). Moreover, perceived risk always interacts with trust, forming a salient foundation for evaluating users' mental perceptions of mobile payments. Investigators such as Daştan and Gürler (2016) found perceived risk had significantly negative effects on trust and the adoption intention of mobile payments. Likewise, Pham and Ho (2015) determined that perceived risk was a strong predictor of users' behavioural intention, which was negatively associated with performance expectancy. As a significant negative antecedent of behavioural intention, perceived risk should be measured by interacting with other factors, trust, flow, security, etc. (Cocosila and Trabelsi, 2016; Muñoz-Leiva, Climent-Climent and Liébana-Cabanillas, 2017; Shao *et al.*, 2018).

2.4.1.6. *Security*

Perceived security is defined as the degree to which a customer believes that using a particular technology will be secure (Shin, 2009). Security is a critical factor that leads users to adopt mobile payments (Zhu, Lan and Chang, 2017; Di Pietro *et al.*, 2015; Hossain and Zhou, 2018). Liébana-Cabanillas and Lara-Rubio (2017) found that perceived security had a significant positive impact on mobile payment adoption in Spain.

Meanwhile, security had a significantly negative interaction with perceived risk (Jenkins and Ophoff, 2016). Johnson *et al.* (2018) discovered that ubiquity and trialability positively influenced perceived security, while privacy risks negatively influenced security. Therefore, security not only directly affects users' behavioural adoption but also its interactions with other variables, such as trust, perceived risk, attitude, social influence, determining users adopting mobile payments conjointly (Shao *et al.*, 2018).

2.4.1.7. Other factors

According to the different mobile payment adoption scenarios, various factors were selected or modified to be applied in several different theoretical frameworks to investigate the antecedents of users' behaviours (Baptista and Oliveira, 2015; Pham and Ho, 2015). The following factors have attracted increasing focus in previous studies, which provided insight for further research.

Hedonic motivation is defined as 'the fun or pleasure derived from using a technology (Venkatesh *et al.*, 2012, p. 161). As a primary variable in UTAUT2, hedonic motivation complimented consumers' experience, and it was demonstrated as the second strongest predictor of behavioural intention in UTAUT2 (Venkatesh *et al.*, 2012). Moreover, hedonic motivation had significant interactions with other variables. Slade *et al.* (2015) associated hedonic motivation with perceived enjoyment in mobile payments adoption, which was formulated by consumers' innovativeness and novelty-seeking. Hedonic motivation was significantly influenced by self-efficacy, facilitating condition and security, affecting perceived ease of use and usefulness (Koenig-Lewis *et al.*, 2015). Despite Boonsiritomachai and Pitchayadejanant's (2018) finding that hedonic motivation is negatively associated with transaction system security, mobile payment applications increasingly involve entertainment functions, which indicate the importance of considering hedonic motivation as one of the antecedents when customers adopt mobile payment technologies with entertainment feature.

Habit was defined by Venkatesh *et al.* (2012) as 'the tendency to automatically use a technology as a result of learned behaviour'. Previous literature has shown that habit significantly impacted

behavioural intention, sometimes even higher than performance expectancy (Chawla and Joshi, 2019). Habitual responses may cause users to bypass a cognitive process. For example, mobile payment systems have developed slower in countries with well-established credit systems, mainly in European countries and the United States. However, they have developed faster in nations with less developed credit systems, such as those in Asia and Africa (Okazaki, 2006; Ghezzi *et al.*, 2010; Kapoor, Dwivedi and Williams, 2013; Nickerson, 2013). Despite traditional payment methods being available for a long time before mobile payments, mobile payments have become a new popular trend in the current global business environment. Individuals from different regions with different cultural backgrounds have developed assorted transaction habits using traditional payment methods, including mobile payments (Slade *et al.*, 2015; Chen and Li, 2017). Therefore, considering habit to correspond with the culture and payment development for future mobile payments adoption studies is necessary based on the transactional environment.

Cultural characteristics have significantly impacted users' adoption propensity by affecting constructs of social influence, attitude, usefulness, and behavioural intention. (Khalilzadeh, Ozturk and Bilgihan, 2017). Cultural influence is an antecedent of perceived social influence and mobility, and perceived privacy protection (Lu *et al.*, 2017). Likewise, cultural values were considered moderators in formulating users' adoption intention of mobile banking (Baptista and Oliveira, 2015). However, cultural factors are primarily mentioned in limitations or recommendations in previous studies (Pham and Ho, 2015; Ramos-de-Luna, Montoro-Ríos and Liébana-Cabanillas, 2016; Park *et al.*, 2018; Shankar and Datta, 2018). Thus, cultural influence should be considered a moderator or antecedent to interact with other variables to investigate mobile payments adoption. For example, culture may formulate individual consumption or payment habits when users adopt mobile payment technology.

2.4.2. Theoretical frameworks applied in previous studies

Various theoretical frameworks were implemented in the selected studies to investigate new technology adoption, such as the Diffusion of Innovations Theory (DOI) (Rogers, 2003), Theory of Reasoned Action

(TRA) (Fishbein and Ajzen, 1975), Theory of Planned Behaviour (TPB) (Ajzen, 1991), Technology Acceptance Model (TAM) (Davis, 1989) and Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh *et al.*, 2003). Kim, Mirusmonov and Lee (2010) and Koenig-Lewis *et al.* (2015) summarised that TAM and UTAUT were probably the most widely adopted and validated models in various empirical studies concerning consumers' adoption of new technologies, which is in accordance with the results displayed in table 2.1 showing that TAM, UTAUT and UTAUT2 were the three most applied theoretical foundations in the 61 previously selected studies. Moreover, most theoretical models have been modified with additional variables for various situations. Furthermore, the comprehensive models combined with different theoretical frameworks have become a new orientation for new technology adoption. Therefore, the two main adoption models TAM and UTAUT and comprehensive models, are critically discussed in the following three parts.

2.4.2.1. Technology acceptance model (TAM)

TAM was the most extensively applied in the information systems field to analyse new technology adoption (Abrahão, Moriguchi and Andrade, 2016). Specifically, perceived usefulness and ease of use were two main factors influencing users' decisions to accept and actually use a technology (Davis, 1989). Moreover, in the studies related to mobile payments, many articles extended TAM with different constructs (Gu, Lee and Suh, 2009; Anthony and Mutalemwa, 2014; Riskinanto, Kelana and Hilmawan, 2017; Flavián, Guinaliu, and Lu, 2020; Hassan and Wood, 2020). However, TAM has limited ability or flexibility in explaining the adoption of new ICT for general consumers (Jung, 2014). Therefore, many researchers recommend that TAM be extended or incorporated with additional variables to strengthen the explanatory power of TAM. For example, Chawla and Joshi (2019) extended TAM with trust, convenience and efficiency as additional factors to analyse users adopting mobile banking in India. Daştan and Gürler (2016) extended TAM with perceived reputation, environmental risk, trust, perceived mobility, and attitude. They found that perceived trust, perceived mobility and attitude had positive effects on mobile payment service adoption in Turkey. Gu, Lee and Suh (2009) proposed trust-associated with TAM to

investigate users' adoption intention of mobile banking in South Korea and discerned that trust was a strong indicator and the interaction between trust and perceived ease of use had a positive impact on perceived usefulness. Therefore, TAM has been widely applied and modified with other indicators such as trust and social influence to optimise model performance as the most classical adoption model.

2.4.3.2 Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT, proposed by Venkatesh *et al.* (2003), as an extension of the TAM model, has been developed to incorporate four determinants: performance expectancy, effort expectancy, social influences, and facilitating conditions. Wherein the first two determinants are similar to perceived usefulness and perceived ease of use in TAM (Kongarchapatara, 2018). Abrahão, Moriguchi and Andrade (2016) applied UTAUT and found that performance expectation, effort expectation and social influence had significant positive impacts on mobile payment adoption in southern Brazil. Meanwhile, they involved perceived risk and perceived cost as additional factors to improve the UTAUT model performance. Many researchers have modified and extended the UTAUT model with other variables to investigate mobile payments adoption. Kaitawarn (2015) extended the UTAUT model with attitude, switching cost, convenience and privacy and personal factors to investigate mobile payments adoption in Thailand. Khalilzadeh, Ozturk and Bilgihan (2017) extended UTAUT and found the negative impact of perceived risk and positive influences of security and trust, respectively, on customers' usage intention on mobile payments in restaurants.

Moreover, the moderators have been involved in UTAUT for different research purposes. Wu, Tao, and Yang (2008) included education as a moderator to investigate users adopting 3G mobile telecommunication. Shin (2009) applied social influence and self-efficacy constructs as moderators in UTAUT to analyse mobile wallet adoption in the U.S. Khalilzadeh, Ozturk and Bilgihan (2017) integrated UTAUT with the security moderator and validated the model in different countries to determine the model explained roughly 70% of the variance in behavioural intention. In addition, UTAUT2, as an advanced version of UTAUT, involved additional variables and moderators in predicting behavioural intention and actual usage, wherein age, gender, and

previous experience were original moderators (Venkatesh, Thong and Xu, 2012). Baptista and Oliveira (2015) extended UTAUT2 with Hofstede's cultural moderators and confirmed the model's performance by investigating customers' adoption intention of mobile banking in Mozambique. Therefore, UTAUT and UTAUT2, as advanced adoption models, achieved a better performance in explaining users' behaviour. Moreover, the additional variables, such as personal factors, perceived risk, trust and security, also significantly improved the performances of UTAUT and UTAUT2. (Baptista and Oliveira, 2015; Koenig-Lewis *et al.*, 2015; Morosan and DeFranco, 2016; Khalilzadeh, Ozturk and Bilgihan, 2017; Marinković *et al.*, 2020).

2.4.3.3 *Comprehensive models*

A comprehensive model is generated by one adoption model integrated with another adoption model or theory to analyse users' behaviours on mobile payments adoption. According to the summary of selected studies in table 2.1, comprehensive models have been applied widely (Morosan and DeFranco, 2016; Liébana-Cabanillas, Ramos de Luna and Montoro-Riosa, 2017; Liébana-Cabanillas, Molinillo and Ruiz-Montañez, 2018; Hamidi and Safareeyeh, 2019). To be more specific, TAM and UTAUT, as basic adoption frameworks, have been broadly integrated with other theoretical frameworks, such as DOI (Pham and Ho, 2015; Di Pietro *et al.*, 2015; Oliveira *et al.*, 2016), TRA (Theodora *et al.*, 2010 Liébana-Cabanillas, Sánchez-Fernández and Muñoz-Leiva, 2014) TPB (Yan *et al.*, 2009 Sripalawat, Thongmak and Ngramyarn, 2011), TTF (Zhou, Lu and Wang, 2010; Oliveira *et al.*, 2014), etc. The comprehensive models performed better in terms of explanatory power than a single model in mobile payments adoption (Pal, Vanijja and Papasratorn, 2015). Yan *et al.* (2009) integrated the TAM and TPB models with extra variables, peer influence and perceived price level to explain mobile phone users adopting mobile payments in Malaysia. Lu *et al.* (2017) integrated TAM, UTAUT and ECM and found privacy protection and social influence beliefs had significant impacts on users' continuous usage intentions. Oliveira *et al.* (2016) generated UTAUT2 models with DOI variables, innovativeness, compatibility and perceived technology security to investigate the determinants of users adopting and recommending mobile payment systems in Portugal. Sripalawat, Thongmak and Ngramyarn

(2011) combined TAM and TPB and found that perceived usefulness and lack of information were two main factors affecting mobile banking adoption in Thailand. Theodora *et al.* (2010) extended TAM with TRA and analysed the adoption of mobile transactions in Greece. Zhou, Lu and Wang (2010) integrated TTF and UTAUT and affirmed that task characteristics and technology characteristics determined performance expectancy towards affected individual performance and actual utilisation of mobile banking in China. Therefore, as an efficient analysis model, a comprehensive model combines different models, factors or moderators to optimise the model's performance, which has been highly suggested for future research in particular situations.

2.4.4. Obstacles in previous studies

Based on the different research purposes, target regions, sample sizes and theoretical frameworks in the selected literature, the obstacles were collected from the limitation section in previous studies and summarised in three dimensions, including internal, external and implemental aspects. The obstacles were collected and summarised by the quotation management software ATLAS. Ti v7. Each dimension was divided and identified as specific obstacles, such as internal obstacles including 'habit' (Chen and Li, 2017), 'age' (Al-jabri, 2012), 'user experience' (Siyal *et al.*, 2019), 'loyalty' (Muñoz-Leiva, Climent-Climent and Liébana-Cabanillas, 2017), etc. External obstacles consisting of 'policy' (Pal, Vanijja and Papsatorn, 2015) and 'culture' (Park *et al.*, 2018). Implemental obstacles contemplating factors such as 'language' and 'sample size' (Anthony and Mutalemwa, 2014). Specifically, a total of 101 quotations were quoted as 'obstacles' from the 61 selected studies' full-text review, which are summarised and sorted by occurrences in figure 2.9, and the relationship network of obstacles is presented in figure 2.10. The most mentioned obstacles, such as region limitation, sample size, age limitation and cultural limitation, are highly recommended by previous researchers for future studies on technology adoption (Riskinanto, Kelana and Hilmawan, 2017; Ramos de Luna *et al.*, 2018; Shao *et al.*, 2018).

Name	Grounded	Density
Obstacles	101	3
Regional limitation	27	1
Sample size limitatio...	22	3
Age limitation	19	2
Culture limitation	18	1
Trust issues	16	1
User experience	16	1
Habit	12	1
Server quilty	10	1
Gender	8	2
Security	5	1
Countinuance adopti...	4	1
Enjoyment	3	0
Financial Considerati...	3	1
personal innovativen...	1	1
Policy	1	1
Loyalty	1	1
language	1	1
User Emotion	1	1
Rural area~	1	1
competitive	1	1

Figure 2.8. Summary of obstacles with occurrences from selected papers

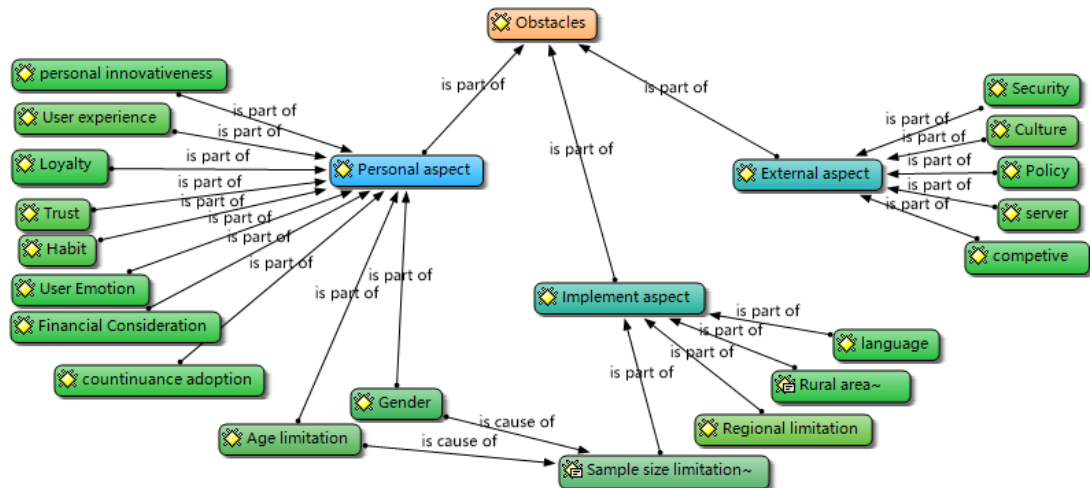


Figure 2.9. Relationship network between obstacles from selected studies

2.4.4.1 User internal obstacles

Internal obstacles were generated by users' internal determinants and empirical application limitations, consisting of habit, loyalty, personal innovativeness, trust issues, emotion, financial consideration, continuance adoption, age limitation, gender and user experience by ATLAS. Ti v7. Specifically, the result presents that 'Age limitation', 'Trust', 'Use experience' and 'Habit' were the most mentioned limitations in previous studies. Specifically, age limitation was suggested 19 times in the selected papers (Al-jabri, 2012; Shao *et al.*, 2018; Siyal *et al.*, 2019). Previous researchers suggested that customers' age should be considered moderators to be incorporated into a theoretical model to explain the behavioural differences in various scenarios (Shao *et al.*, 2018). Meanwhile, use experience was suggested as a moderator to apply in exploring post-adoption or continuing usage of mobile payment (Chen and Li, 2017; Zhu, Lan and Chang, 2017). Meanwhile, consumption experience may change users' payments habit towards affecting their adoption intention (Al-jabri, 2012; Baptista and Oliveira, 2015).

2.4.4.2. External obstacles

External obstacles were summarised by external antecedents of mobile payment adoption and were divided into competitive, culture limitation, policy, security, server quality by ATLAS. Ti v7. Wherein, the cultural obstacle was most mentioned with 18 quotations in previous studies. Kapoor, Dwivedi and Williams (2013) investigated users adopting interbank mobile payments in India and suggested integrating cultural and region factors with the TAM adoption model for better model performance. Baptista and Oliveira (2015) suggested that an adoption model should involve a broader range of samples in different countries, environments with different cultural backgrounds for future mobile payment adoption research.

2.4.4.3. Implemental obstacles

Implemental obstacles were defined as the empirical barriers and limitations during the research implementation process, including

language, location and sample size. Regional limitation was the main obstacle mentioned in previous works of literature. According to the variety of transaction method situations in different regions, mobile payments developed faster in nations with immature credit systems than in countries with mature credit card or check payment systems (Ghezzi *et al.*, 2010; Kapoor, Dwivedi and Williams, 2013; Nickerson, 2013). Thus, cross-regions and cross-culture comparisons were most highlighted and recommended in previous research on investigating mobile payments adoption (Koenig-Lewis *et al.*, 2015; Baptista and Oliveira, 2015; Di Pietro *et al.*, 2015; Junadi and Sfenrianto, 2015; Hamidi and Chavoshi, 2018; Shankar and Datta, 2018; Sharma and Sharma, 2019).

2.5. Conclusion

2.5.1. Implications

This paper followed the systematic literature review process to review previous studies related to mobile payments adoption from a users' perspective. This paper was organised in a five-step systematic literature review process to answer the research questions about the distribution and trend of the relevant literature, factors and adoption models applied in research, and the obstacles mentioned in previous studies. A total of 61 studies was selected, the data was visualised and extracted by VOSviewers, statistically analysed by Excel, and qualitatively analysed by ATLAS. Ti. The results of this paper indicate that previous mobile payment adoption studies mainly focused on Asian and European countries with an increasing trend worldwide. The prevalent factors were analysed and summarised from previous studies, including perceived usefulness, perceived ease of use, social influence, trust, perceived risk, security, hedonic motivation, culture and habit. Moreover, the interactions between factors require more attention in future research. Furthermore, this paper also found out that comprehensive models had higher performance than using a single adoption model. The internal, external and implemental obstacles were summarised from previous studies to indicate that future research should consider specific backgrounds and scenarios for particular research purposes. The reviewing process in this paper contributed a theoretical framework for relevant researchers to

investigate new technology adoption with other assorted attributes such as databases, research purposes, target populations, etc. This paper also provided a new theoretical insight for mobile payment adoption research by selecting appropriate variables and adoption models by a systematic summary from previous mobile payments adoption studies. Meanwhile, this paper also provided relevant stakeholders in the mobile payment milieu practical support by elucidating a general summary of mobile payment trends and consumers' performance on mobile payment adoption in different regions and scenarios for better decision making in relevant business marketing and strategy management.

2.5.2 limitations and recommendations

According to the systematic review processes and results, the basic steps in the systematic review process were recommended to be applied in new technology adoption research in information technology and information management aspects. However, some modifications for the review processes and practices can be improved for better review performance. These refinements include increasing the literature range to overcome access limitations and the insufficient number of more recent relevant studies. This paper only focused on mobile payments adoption from the users' perspective. Future research is recommended to involve other stakeholders in the mobile payments industry, like, service provider, merchant or organisational perspectives.

3. Chapter 3 - How does the pandemic facilitate mobile payments? An investigation on users' perspectives under the COVID-19 pandemic

3.1. Introduction

With the increasingly widespread popularity of mobile devices, our daily lives have changed significantly, especially in terms of financial transactions. Mobile payment (M-payment) has been dramatically adopted in various industries in recent years. M-payments accounted for 22% of the global points of sale spending in 2019, and this percentage will increase to 29.6% in 2023 (Worldpay, 2020). Moreover, China's overwhelming adoption of M-payments (Alipay and Wechat Pay) at the point of sale by using Quick Response (QR) codes drove nearly half (48%) of the point-of-sale payments in 2019 (Worldpay, 2020). Various previous studies have facilitated the understanding of adoption intentions of M-payment in different contexts (Di Pietro *et al.*, 2015; Liébana-Cabanillas *et al.*, 2018; Cao and Niu, 2019). However, there are still deficiencies of determinant variation and theoretical evidence of different perspectives in emergency conditions (Dahlberg *et al.*, 2015).

The 2019 novel coronavirus (COVID-19) broke out in December of 2019 and has dramatically expanded globally. As of 7 December 2020, there were 66,243,918 confirmed cases of COVID-19 and 1,528,984 deaths worldwide, reported by the World Health Organisation (WHO, 2020a). Due to the high risk of COVID-19 transmission, reducing contact among people and maintaining social distancing was highly recommended by the WHO (2020b) and Tang *et al.* (2020). In this sense, the contactless characteristic of M-payments can potentially contribute to users' mental and physical expectations to support their transaction processes and protect their safety. The adoption of M-payments in China has significantly increased during the COVID-19 pandemic. According to a report from China banking and insurance news (2020), during the COVID-19 pandemic, the number of transactions made by M-payments

was 22.4 million in the first quarter of 2020 in China, up 187% from the previous year (2019).

Meanwhile, based on the CNNIC (2020) report comparing the smartphone users who used M-payments from 2019 to 2020, this percentage increased from 73.5% in June 2019 to 85.3% in March 2020 and reached 86.0% in June 2020 in China, which indicates that M-payments contribute to maintaining individual and organisational transactions during emergency situations. Furthermore, users' payment habits and business models have changed from traditional face-to-face transactions to contactless M-payment transactions during the pandemic, which in turn efficiently supports the survival of various businesses and maintains the development of the social economy under an emergency situation. Therefore, what factors influence users' intentions to adopt M-payment during the pandemic? It becomes dramatically valuable to understand customers' behaviours under the pandemic for relevant researchers and stakeholders to comprehensively investigate information technology adoption under an emergency situation to develop business strategies correspondingly.

Traditional adoption models (e.g., Technology Acceptance Model (TAM) and the Unified Theories of Acceptance and Use of Technology (UTAUT)) evaluate users' intentions determined by technological perceptions with an obvious limitation of influence from users' mental perceptions (Venkatesh *et al.*, 2012; El-Haddadeh *et al.*, 2019). Notably, based on the recommendations of governments and the WHO (2020b) regarding restrictions of direct and indirect contacts among people under the pandemic situation, the contactless feature of M-payments potentially influenced users' attitudes regarding the benefits of using M-payments for daily transactions, which indicates that environmental conditions affect users' mental process with regard to adopting M-payments (Gupta and Kim, 2010). Thus, this paper involved mental accounting theory (MAT) in explaining customers' psychological cognitions of the benefits of using M-payments under a pandemic situation. In order to fill the gap of the limited integration of technological and mental perceptions on technology adoption, this study incorporates MAT with UTAUT to comprehensively investigate the antecedents of M-payment adoption from users' perspectives. Specifically, perceived benefits are considered an essential

factor in terms of users' expectations and will help determine their decisions (Park *et al.*, 2018).

Meanwhile, due to the influence of the pandemic, perceived security and trust are also considered additional antecedents of users' adoption intentions of M-payments (Gao *et al.*, 2015; Khalilzadeh *et al.*, 2017). Perceived security is the most significant determinant of trust, positively affecting users' intentions of using M-payments (Shao *et al.*, 2018). Therefore, this study proposes a new adoption model, including perceived benefits, performance expectancy, effort expectancy, social influence, perceived security, trust and behavioural intention, to investigate users adopting M-payments during the COVID-19 pandemic in the following sections: Section 2 provides the theoretical backgrounds of the utilisation of M-payments during the COVID-19 pandemic, MAT and UTAUT; Section 3 delves into the development of hypotheses and the research model; Section 4 covers the research methodology and data demonstration; Section 5 probes the data analysis; Section 6 deals with a discussion of the findings; Section 7 explores the theoretical and practical implications; Section 8 outlines the limitations and future research recommendations; Section 9 contains the study's conclusions.

3.2. Theoretical Background

3.2.1. M-Payment and its utilisation under the COVID-19 pandemic

M-payments, as an information interaction electronic financial transaction method for paying goods, services and bills by mobile devices (Dahlberg *et al.*, 2015), consists of three leading contactless technologies, including Short Message Service (SMS), Near Field Communication (NFC) and Quick Response (QR) codes (Di Pietro *et al.*, 2015). Due to the convenient, open and secure features of M-payments, a new business climate has been formulated by the wide adoption of M-payments, as financial transactions can take place anywhere, anytime and be conducted by anyone, which has established colossal market potential in various contexts, especially under pandemic situations (Cocosila and Trabelsi, 2016; Ramos de Luna *et al.*, 2018). Many researchers have

investigated various factors affecting M-payment adoption by reviewing theoretical frameworks and variables, supporting that relevant knowledge and understanding of users' adoption intentions of M-payments is determined by technological and mental perceptions, as shown in Table 3.1. However, few studies have analysed the adoption intentions determined by mental and technological factors conjointly under an emergency situation.

Table 3.1. Literature reviews related to M-payment adoption

Studies	Theoretical frameworks	Factors
Khalilzadeh et al., 2017	UTAUT	<ul style="list-style-type: none"> ● Risk ● Security ● Trust ● Performance Expectancy (Hedonic and Utilitarian) ● Social Influence ● Effort Expectancy ● Self-Efficacy ● Facilitating Conditions
Shankar and Datta, 2018	TAM	<ul style="list-style-type: none"> ● Perceived ease of use ● Perceived usefulness ● Trust ● Self-efficacy ● Subjective norms ● Personal innovativeness
Park et al., 2018	Mental accounting theory	<ul style="list-style-type: none"> ● Technology anxiety ● Social influences. ● Multidimensional benefits (Convenient; Economic; Information security; Enjoyment; Experiential; Social) ● Attitudes towards using.
Ramos de Luna et al., 2018	TAM	<ul style="list-style-type: none"> ● Perceived ease of use ● Perceived usefulness ● Subjective norms ● Attitude ● Perceived security
Hsiao, 2019	Expectancy-value theory, Task-technology fit	<ul style="list-style-type: none"> ● Characteristics ● Capability ● Task-technology fit ● Utilisation ● Benefits

UTAUT: Unified Theory of Acceptance and Use of Technology; TAM: Mental Accounting Theory

Thus, as the typical characteristic of M-payment, the contactless feature provides mental and physical support to protect and maintain users' experience in transactions (Zhou, 2013). Moreover, due to the restrictions imposed by the Chinese Government to avoid direct contact and maintain social distancing during the COVID-19 pandemic, M-payments have been widely adopted for their contactless feature and trustworthy performance. Users' positive cognitions and feelings of safety when using M-payments as the primary payment method have been formulated, reducing the virus transmission risk, protecting personal safety, and supporting the social economy (China banking and insurance news, 2020).

3.2.2. Mental Accounting Theory (MAT)

Mental accounting theory (MAT), proposed by Thaler (1985), is defined as the set of individuals' cognitive operations to categorise, organise and evaluate the consequences of their decision-making in financial activities (Thaler, 1985). Specifically, MAT explains that personal desires influence the cognitive processes of individuals, and their psychological processes for valuing a specific technology should be taken into consideration in the environment of voluntary usage (Alghamdi *et al.*, 2018). Accordingly, based on the normative principle of fungibility at the point of purchase, mental accounting is engaged, and decision-making is based on evaluating the perceived benefits of the purchase activity (Prelec and Lowenstein, 1998). Concretely, in the technology adoption aspect, a consumer's adoption decision is based on the perceived benefits of utilisation of technology (Gupta and Kim, 2010). Moreover, MAT can also be incorporated into an adoption model to complementarily explain customers' intentions of technology adoption (Kerviler *et al.*, 2016). Cheng and Huang (2013) incorporated MAT into TAM to investigate the mental factors affecting customers' intentions of adopting high-speed railway mobile ticketing services. Park *et al.* (2018) proposed that the perceived multidimensional benefits of M-payment services are influenced by social influence and technology anxiety, which indicates that users' willingness of using M-payments is significant determined by the external environment and internal technological perception.

Furthermore, MAT provides a theoretical basis to explain consumers' decisions under conditions of risk and uncertainty (Gupta and Kim, 2010). Combined with the disaster of COVID-19, customers' psychological processes of adopting M-payments are significantly influenced by the contactless feature of M-payments, which is appropriately adapted to the environmental situation, public restriction and users' requirements. Therefore, MAT is appropriate to apply for explaining users' mental cognitions of using M-payment under the COVID-19 pandemic.

3.2.3. Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT was developed by Venkatesh *et al.* (2003). It consists of performance expectancy, effort expectancy, social influence and facilitating conditions as determinants of behavioural intentions to use a new technology system (Venkatesh *et al.*, 2003). UTAUT has been applied in various technology adoption contexts. It has been revised with additional variables to explain users' behavioural intentions (Cao and Niu, 2019). For example, Khalilzadeh *et al.* (2017) integrated security-related factors with the UTAUT model and validated that security and trust strongly affect customers' adoption intentions of NFC M-payments in the restaurant industry. Marinković *et al.* (2020) modified the UTAUT model with extra variables (perceived trust and satisfaction) to evaluate customers' usage intentions of M-commerce. Moreover, UTAUT has also been integrated with other models to evaluate users' behavioural intentions (Oliveira *et al.*, 2014; Di Pietro *et al.*, 2015). Di Pietro *et al.* (2015) integrated TAM, DOI and UTAUT to verify M-payment adoption intentions. Oliveira *et al.* (2014) integrated UTAUT with the initial trust model and task–technology fit model to investigate users' behavioural intentions of adopting mobile banking in Portugal. However, UTAUT focuses on technological expectations rather than mental expectations, which weakly explains users' expectations determining their intention of technology (El-Haddadeh *et al.*, 2019). Thus, it is necessary to integrate UTAUT with MAT to explain users' technological and mental perceptions complementarily on usage intention of M-payments during the COVID-19 pandemic. The development of hypotheses and research models is illustrated in the following section.

3.3. Development of Hypotheses and Research Model

3.3.1. Revisiting the MAT

3.3.1.1. *Perceived Benefits (PBs)*

According to MAT, when consumers perform a particular behaviour, they tend to evaluate a possible beneficial outcome (Thaler, 1985). Perceived benefits represent users' perceptions of the functional benefits of M-payment services, which determine their decisions of adoption (Park *et al.*, 2018). Perceived benefits support a better understanding of users' mental perceptions of adoption intentions in various technologies, such as online shopping (Forsythe *et al.*, 2006) and mobile banking (Siyal *et al.*, 2019). Meanwhile, perceived benefits have been identified as multidimensional benefits, including utilitarian, hedonic and social values, which are determined by social influence and technology uncertainty (Kerviler *et al.*, 2016; Park *et al.*, 2018). However, few studies focus on the perceived benefits of technology characteristics corresponding to a particular condition. Specifically, in a pandemic situation, social distancing is an efficient way to decrease COVID-19 transmission risk among people (WHO, 2020b; Wilder-Smith and Freedman, 2020). Compared with traditional payments, the contactless characteristic of M-payments supports users in maintaining social distancing to avoid direct and indirect contacts from cash or point of sale terminals during a transaction process. This aspect allows users to formulate their opinions on the perceived mental and physical benefits of personal safety and provides convenience and utility when using M-payment technology as a financial transaction method in the COVID-2019 pandemic. Thus, perceived benefits are considered a mental factor influencing the users' adoption intentions of M-payments during the COVID-19 pandemic, expressed as the following hypothesis.

H1: *Perceived benefits positively affect the behavioural intention to adopt M-payments during the COVID-19 pandemic.*

3.3.2. Revisiting UTAUT

3.3.2.1. Performance Expectancy (PE)

Performance expectancy is defined as an individual's perception in terms of the use of an information system facilitating the completion of a task and work performance (Venkatesh *et al.*, 2003). Performance has been conceptualised by using attributes related to the system's efficiency, speed and accuracy in task completion (Venkatesh *et al.*, 2012).

Especially during the COVID-19 pandemic, users show more concern toward payment efficiency and accuracy. Concretely, in the M-payment adoption aspect, performance expectancy has significantly positive effects on users' adoption intentions in various contexts (Di Pietro *et al.*, 2015; Pham and Ho, 2015; Mun *et al.*, 2017; Liébana-Cabanillas *et al.*, 2018). Therefore, when users perceive M-payments as a useful way to accomplish their transactions during the pandemic, they will choose M-payment instead of traditional payment. Accordingly, this paper proposes the following hypothesis.

H2: *Performance expectancy positively affects the behavioural intention to adopt M-payments during the COVID-19 pandemic.*

3.3.2.2. Effort Expectancy (EE)

According to UTAUT, effort expectancy is referred to as "the degree of ease associated with the use of the system" (Venkatesh *et al.*, 2003, p.450). Effort expectancy influences users' attitudes toward adopting M-payments (Ramos de Luna *et al.*, 2018), revealing an even greater influence than performance expectancy (Pal, Vanijja and Papasratorn, 2015). Specifically, Liébana-Cabanillas *et al.* (2018) found that effort expectancy is the most significant factor affecting users' intentions of using NFC M-payment systems in public transportation. Moreover, effort expectancy has also been verified to positively impact performance expectancy in various technology adoption contexts (Ramos de Luna *et al.*, 2018; Alalwan *et al.*, 2017; Di Pietro *et al.*, 2015). Therefore, the following hypotheses are proposed.

H3: *Effort expectancy positively affects the behavioural intention to adopt M-payments during the COVID-19 pandemic.*

H4: *Effort expectancy positively affects the performance expectancy to adopt M-payments during the COVID-19 pandemic.*

3.3.2.3. *Social Influence (SI)*

In terms of UTAUT, the definition of social influence is “the degree to which an individual perceives that important others believe he or she should use the new system” (Venkatesh *et al.*, 2003, p.451). Slade *et al.* (2015) explained that it is an underlying assumption that users prefer to consult their social network to reduce any anxiety arising from uncertainty. Especially during the COVID-19 pandemic, recommendations and suggestions from important, relevant people are more important for individuals’ decisions and actions. From previous studies, social influence has been widely tested in the different contexts of its impact on usage intention of mobile technologies (Slade *et al.*, 2015; Kerviler *et al.*, 2016; Khalilzadeh *et al.*, 2017; Jenkins and Ophoff, 2016; Mun *et al.*, 2017). Morosan and DeFranco (2016) presented that social influence significantly affects the intention to use M-payments; Kerviler *et al.* (2016) illustrated that social influence plays a considerable role in explaining users’ intentions to use M-payments. Moreover, as a determinant for formulating users’ attitudes, social influence significantly affects the perceived multi-benefits of users regarding using M-payment services (Park *et al.*, 2014). Thus, relevant hypotheses are proposed as follows.

H5: *Social influence positively affects the behavioural intention to adopt M-payments during the COVID-19 pandemic.*

H6: *Social influence positively affects the perceived benefits of adopting M-payments during the COVID-19 pandemic.*

3.3.2.4. *Trust (TR)*

Trust is defined as users’ willingness to expect a positive outcome of a technology’s future performance and a subjective belief that the service provider will fulfil their obligations (Gefen, 2000). Meanwhile, the COVID-19 pandemic has brought uncertainty and social pressure to individuals’ daily transaction processes. Trust in M-payment platforms can increase the likelihood of users using them to make contactless M-payments

rather than traditional payments (Zhu *et al.*, 2017; Marinković *et al.*, 2020). Zhu *et al.* (2017) validated that trust has the most significant effect on the behavioural intention to use M-payments. Meanwhile, many studies have also verified the effect of trust significantly determining users' usage intentions of M-payments (Zhou, 2013; Gao *et al.*, 2015; Zhu *et al.*, 2017; Shao *et al.*, 2018). Zhou (2013) modified a trust-based adoption model and found that trust has significant direct and indirect impacts on the behavioural intention to use M-payments. Moreover, trust has also been validated as an additional variable of UTAUT, which positively influences performance expectancy, consequently affecting user behavioural intentions to use M-payments (Khalilzadeh *et al.*, 2017). Similar results have been supported by other studies (Alalwan *et al.*, 2017), including trust against perceived risk and uncertainty when adopting new technology (Khalilzadeh *et al.*, 2017; Shao *et al.*, 2018). Moreover, perceived risk combines uncertainty with the seriousness of the potential outcome (Kerviler *et al.*, 2016), which negatively influences the perceived multidimensional benefits (Park *et al.*, 2018). Thus, it can be summarised that trust positively impacts perceived benefits, which has also been supported by Khalilzadeh *et al.* (2017). Therefore, this study proposes the following hypotheses.

H7: *Trust has a positive effect on the behavioural intention to adopt M-payments during the COVID-19 pandemic.*

H8: *Trust has a positive effect on performance expectancy to adopt M-payments during the COVID-19 pandemic.*

H9: *Trust has a positive effect on perceived benefits to adopting M-payments during the COVID-19 pandemic.*

3.3.2.5. Perceived Security (PS)

Perceived security is defined as “the degree to which a customer believes that using a particular M-payment procedure will be secure” (Shin, 2009, p. 1346). In terms of conducting a financial transaction, lack of security—perception of security against the risk associated with mobile transactions—is one of the most frequent reasons for users refusing to adopt M-payments (George and Sunny, 2018). Previous studies have proved that perceived security is an essential factor determining whether users will adopt M-payments (Di Pietro *et al.*, 2015; Hossain and Zhou,

2018; Liébana-Cabanillas *et al.*, 2018). Johnson *et al.* (2018) found that perceived security has the most significant positive impact on users' intention to adopt M-payments. Moreover, perceived security significantly increases users' trust by protecting users from transactional uncertainties and risks (Xin *et al.*, 2013; Khalilzadeh *et al.*, 2017). Shao *et al.* (2018) verified that security is the most significant antecedent of customers' trust towards affecting usage of M-payments in both male and female groups. Therefore, perception of M-payments' perceived security, considered an extra variable of UTAUT, is a crucial guarantee for establishing users' trust in using M-payment under a pandemic. Accordingly, this study proposes the following hypotheses.

H10: *Perceived security positively affects the behavioural intention to adopt M-payments during the COVID-19 pandemic.*

H11: *Perceived security has a positive effect on trust to adopt M-payments during the COVID-19 pandemic.*

3.3.3. Research Model

Based on the above hypotheses, all measurement items were adapted from previous studies (Venkatesh *et al.*, 2012; Kerviler *et al.*, 2016; Khalilzadeh *et al.*, 2017; Park *et al.*, 2018; Shankar and Datta, 2018; Shao *et al.*, 2018; Cao and Niu, 2019; Tang *et al.*, 2020) and have been reasonably modified to correspond to the research purposes to explain the mental and technological factors affecting users' behavioural intentions with regard to adopting M-payments under the COVID-19 pandemic. Specifically, users' adoption intention of M-payment under the COVID-19 pandemic is conjointly determined by the variables from the revised UTAUT model (for explaining users' technological perceptions) and perceived benefits (as the variable of MAT, representing users' mental cognitions and psychological acceptance of using M-payment under pandemic conditions). The questionnaire is presented in Appendix A with Chinese translation. Moreover, this study revises the UTAUT model, integrating performance expectancy, effort expectancy and social influence with additional variables, perceived security, trust and perceived benefits from MAT to establish a research model, depicted in Figure 3.1, with the proposed hypotheses relations.

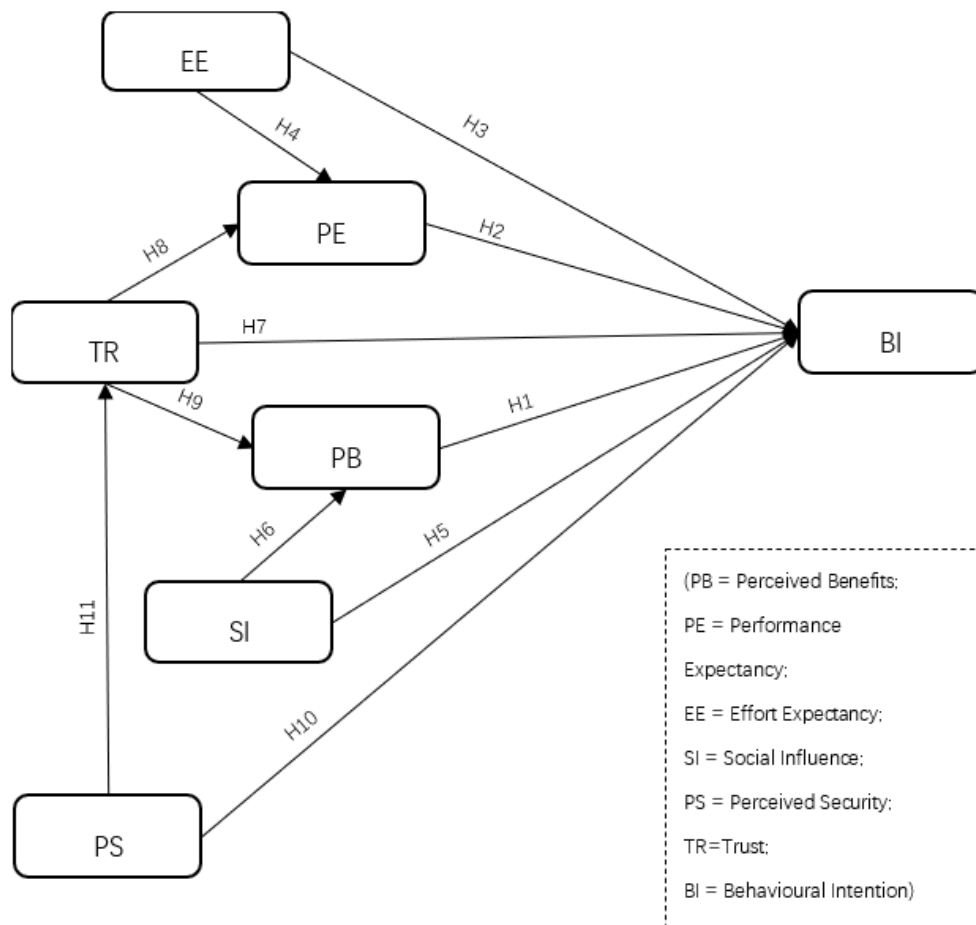


Figure 3.1. Research model with proposed hypotheses relations.

3.4. Methodology

3.4.1. Measurement

In order to validate the proposed conceptual model and examine the research hypotheses, an online questionnaire survey was designed and applied to data collection. Specifically, the questionnaire consisted of two parts. The first part contained respondents' demographic data with close-ended questions consisting of gender, age, education, occupation and M-payment experience. The second part was developed by implementing constructs and items from previous hypotheses, consisting of 27 measurement items as indicators to explain perceived benefits, performance expectancy, effort expectancy, social influence, trust, perceived security and behavioural intention. In order to reduce confusion and save time for the participants (Babakus and Mangold, 1992;

Bouranta *et al.*, 2009), a five-point Likert scale (from 1 to 5, representing “strongly disagree” to “strongly agree”) was applied to represent the items of each construct.

The main survey target of this research was smartphone users who used or intended to use M-payment services in China during the COVID-19 pandemic. In order to avoid the impact of culture and language differences, the questionnaire was translated into the Chinese language by a professional translator and then reverse translated into English, followed by confirmation of the translation equivalence. The questionnaire data were collected from a Chinese social media platform, named WeChat, over a three-week period during the height of the COVID-19 pandemic in China, from 11 March 2020 to 31 March 2020.

3.4.2. Data Demographic Characteristics

According to the N: q rule proposed by Jackson (2003), an ideal sample size-to-parameters ratio would be higher than 20:1 (samples: variables) (Jackson, 2003); therefore, the sample size of this study should be larger than 140. This study dispatched a total of 1000 online questionnaires via WeChat; 864 data were collected on 1 April. After removing the answers with missing values, a total of 739 valid questionnaires were accepted, achieving a final response rate of 73.9%. According to the guideline from Ryans (1974), the Kolmogorov–Smirnov test was applied to verify the sample's nonresponse bias by comparing the groups between males and females. The demographic distribution of the sample was 45.74% male and 54.26% female; 53.86% of participants were in the age bracket between 21 and 30; 61.71% of participants held bachelor's or college degrees (this group is more active on social media and so more likely to respond to the questionnaire); employees and students were the two main groups of participants, with percentages of 43.03% and 23.68%, respectively; 56.16% of total responses used M-payments at least one time per day and 93.78% at least one time per one week during the COVID-19 pandemic, which is in accordance with a report from Ipsos (2020) expressing that the penetration rate of M-payments among mobile Internet users in China (those who have used M-payments in the last three months) is 96.9% (Ipsos, 2020). The reason for this high rate of adoption of M-payments during the pandemic can be summarised as follows. Firstly, based on the restrictions by the Chinese Government

(China banking and insurance news, 2020), due to daily transactions using contact being restricted during the COVID-19 pandemic, people tended to complete the transactions in a contactless way. Secondly, according to the suggestions and recommendations by the government and WHO (2020b), avoiding contact among people is an efficient way to reduce the transmission risk of COVID-19. Thus, M-payments have been widely adopted by customers and retailers for general transactions. Thirdly, M-payment apps were applied to track users' health statuses during the pandemic, such as Alipay Health Code with a colour code (green, yellow or red) being assigned to indicate users' health statuses. Therefore, M-payments were dramatically adopted by smartphone users in China not only to support daily transactions but also to confirm their health statuses during the COVID-19 pandemic. Specific sample demographics are listed in Table 3.2.

Table 3.2. Demographic distribution of the sample.

Measures	Items	N	%
Gender	Male	338	45.74%
	Female	401	54.26%
Age	<21	170	23.00%
	21–30	398	53.86%
	31–40	80	10.83%
	41–50	29	3.92%
	>50	62	8.39%
Education	High school and lower	66	8.93%
	Bachelor or college	456	61.71%
	Master	194	26.25%
	PhD and above	18	2.44%
	Other	5	0.68%
Occupation	Student	175	23.68%
	Employee	318	43.03%
	Public Servant	47	6.36%
	Retiree	47	6.36%
	Unemployed	6	0.81%
	Freelancer	65	8.80%
	Other	81	10.96%
Experience	At least 1 time per 1 day	415	56.16%
	At least 1 time per 1 week	278	37.62%
	At least 1 time per 2 weeks	37	5.01%
	At least 1 time per 1 month	7	0.95%
	Never use during the COVID-19 pandemic	2	0.27%

3.5. Data Analysis

The covariance-based structural equation modelling (CBSEM) technique was conducted for quantitative data analysis. SPSS 17 and AMOS 22 were applied in this study through the two-step approach suggested by Anderson and Gerbing (1988), including validating the measurement

model and testing the structural model. The maximum likelihood estimation was conducted in the model assessment.

3.5.1. Measurement Model

A measurement model aims to assess fitness between indicators and latent variables. Exploratory factor analysis (EFA) was applied to examine the construct reliability, and a standard method factor analysis, confirmatory factor analysis (CFA), was applied to assess the convergent and discriminant validity of the measurement model. All seven hypothesised latent constructs in the CFA model were allowed to covary and were determined by related measurement items as reflective indicators.

Construct reliability was tested by Cronbach’s alpha. As presented in Table 3.3, all Cronbach’s alpha values of the latent variables are in the range of 0.807 to 0.897, all exceeding the 0.70 limits suggested by Nunnally and Bernstein (1994), which means that construct reliability has been demonstrated.

Table 3.3. Item loadings and Cronbach’s alpha of structures.

Factors	Items	Loadings	Cronbach’s Alpha
Performance Expectancy (PE)	PE1	0.810	0.888
	PE2	0.850	
	PE3	0.792	
	PE4	0.812	
Effort Expectancy (EE)	EE1	0.813	0.897
	EE2	0.854	
	EE3	0.806	
	EE4	0.843	
Social Influence (SI)	SI1	0.805	0.894
	SI2	0.829	
	SI3	0.805	
	SI4	0.854	
Perceived benefits (PBs)	PB1	0.719	0.807
	PB2	0.828	
	PB3	0.751	
Perceived Security (PS)	PS1	0.773	0.848
	PS2	0.850	
	PS3	0.800	

Trust (TR)	TR1	0.771	0.878
	TR2	0.714	
	TR3	0.794	
	TR4	0.801	
	TR5	0.769	
Behavioural Intention (BI)	BI1	0.829	0.877
	BI2	0.799	
	BI3	0.777	
	BI4	0.797	

Table 3.4. Descriptive statistics and correlation among constructs.

	CR	AVE	MSV	TR	PE	EE	SI	PB	PS	BI
TR	0.879	0.594	0.487	0.770						
PE	0.859	0.670	0.442	0.532	0.818					
EE	0.898	0.688	0.165	0.280	0.582	0.829				
SI	0.894	0.678	0.496	0.594	0.630	0.406	0.823			
PB	0.811	0.589	0.361	0.463	0.459	0.256	0.506	0.767		
PS	0.850	0.653	0.387	0.619	0.379	0.184	0.497	0.388	0.808	
BI	0.877	0.641	0.496	0.698	0.665	0.271	0.704	0.601	0.622	0.801

CR = Composite reliability; AVE = average variance extracted; MSV = maximum shared squared variance.

Meanwhile, the following criteria (the ratio of chi-square to degrees of freedom (X^2/df) < 3, comparative fit index (CFI) > 0.9, goodness of fit index (GFI) > 0.9, adjusted goodness of fit index (AGFI) > 0.9, normalised fit index (NFI) > 0.9, Tucker–Lewis index (TLI) > 0.9, and root mean square error of approximation (RMSEA) < 0.05) were applied to evaluate the fitness of the model. Table 3.5 shows that all the model-fit indices of the measurement model ($X^2/df = 1.832$, CFI = 0.979, GFI = 0.948, AGFI = 0.935, NFI = 0.959, TLI = 0.979, RMSEA = 0.034), respectively, exceeded the common acceptance levels, which demonstrates a qualified fitness of the measurement model.

Table 3.5. Model-fit indices of the measurement model and structural model.

	X^2/df	CFI	GFI	AGFI	NFI	TLI	RMSEA
Recommended Value	<3	>0.9	>0.9	>0.9	>0.9	>0.9	<0.08
Measurement Model	1.832	0.979	0.948	0.935	0.959	0.979	0.034
Structural Model	2.369	0.965	0.933	0.918	0.942	0.961	0.043

Further, this study examined the potential common method bias by Harman’s one-factor test in SPSS (Podsakoff *et al.*, (2003). The results show that the largest variance explained by an individual factor is 40.99% (<50%). The result confirms that none of the factors can individually explain the majority of the variance. Moreover, a CFA was applied to

assess the fitness of a single-factor model (all items as the indicators of one factor) (Malhotra *et al.*, 2006). The results of the model fit present a poor fitness, which include $\chi^2/df = 15.999(>3)$, CFI = 0.603 (<0.9), GFI = 0.566 (<0.9), AGFI = 0.485 (<0.9), NFI = 0.588 (<0.9), TLI = 0.569 (<0.9) and RMSEA = 0.143 (>0.08). Therefore, both tests confirm that no common method bias appeared in this study.

The assessment results of the measurement model validate the construct reliability and convergent and discriminant validity of constructs satisfactorily. The constructs can be used to test the structural model.

3.5.2. Structural Model

The maximum likelihood estimation method and bootstrapping technique (500 samples and 95% significance level) were applied for assessing the structural model. Firstly, the model fit of the structural model was evaluated similarly to the measurement model. The results were presented in Table 3.5, which confirms the qualified goodness of fit of the structural model.

Secondly, the variance (R^2) of endogenous variables was assessed to evaluate the explanatory power of the structural model. As shown in Table 3.6 and Figure 3.2, the explained variances of performance expectancy ($R^2 = 0.48$), perceived benefits ($R^2 = 0.28$), trust ($R^2 = 0.44$) and behavioural intention ($R^2 = 0.71$) all exceed the recommended minimum value, 0.1 (Falk and Miller, 1992). Thus, the structural model substantially explains the dependent variable.

Table 3.6. Hypotheses testing results.

Hypotheses	Relations	Estimate	T and p	Decisions
H1: Perceived benefits positively affect the behavioural intention to adopt M-payments during the COVID-19 pandemic.	PB → BI	0.283	5.591 ***	Supported
H2: Performance expectancy positively affects the behavioural intention to adopt M-payments during the COVID-19 pandemic.	PE → BI	0.426	8.059 ***	Supported
H3: Effort expectancy positively affects the behavioural intention to adopt M-payments during the COVID-19 pandemic.	EE → BI	-0.209	-4.712 ***	Rejected
H4: Effort expectancy positively affects the performance expectancy to adopt M-payments during the COVID-19 pandemic.	EE → PE	0.470	13.35 ***	Supported
H5: Social influence positively affects the behavioural intention to adopt M-payments during the COVID-19 pandemic.	SI → BI	0.277	6.416 ***	Supported

H6: Social influence positively affects the perceived benefits of adopting M-payments during the COVID-19 pandemic.	SI → PB	0.272	8.057 ***	Supported
H7: Trust has a positive effect on the behavioural intention to adopt M-payments during the COVID-19 pandemic.	TR → BI	0.234	4.254 ***	Supported
H8: Trust has a positive effect on performance expectancy to adopt M-payments during the COVID-19 pandemic.	TR → PE	0.401	11.242 ***	Supported
H9: Trust has a positive effect on perceived benefits to adopting M-payments during the COVID-19 pandemic.	TR → PB	0.233	6.306 ***	Supported
H10: Perceived security positively affects the behavioural intention to adopt M-payments during the COVID-19 pandemic.	PS → BI	0.221	4.493 ***	Supported
H11: Perceived security has a positive effect on trust to adopt M-payments during the COVID-19 pandemic.	PS → TR	0.586	14.664 ***	Supported

PB = Perceived benefit; PE = performance expectancy; EE = effort expectancy; SI = social influence; PS = perceived security; TR = trust; BI = behavioural intention; ***: $p < 0.001$.

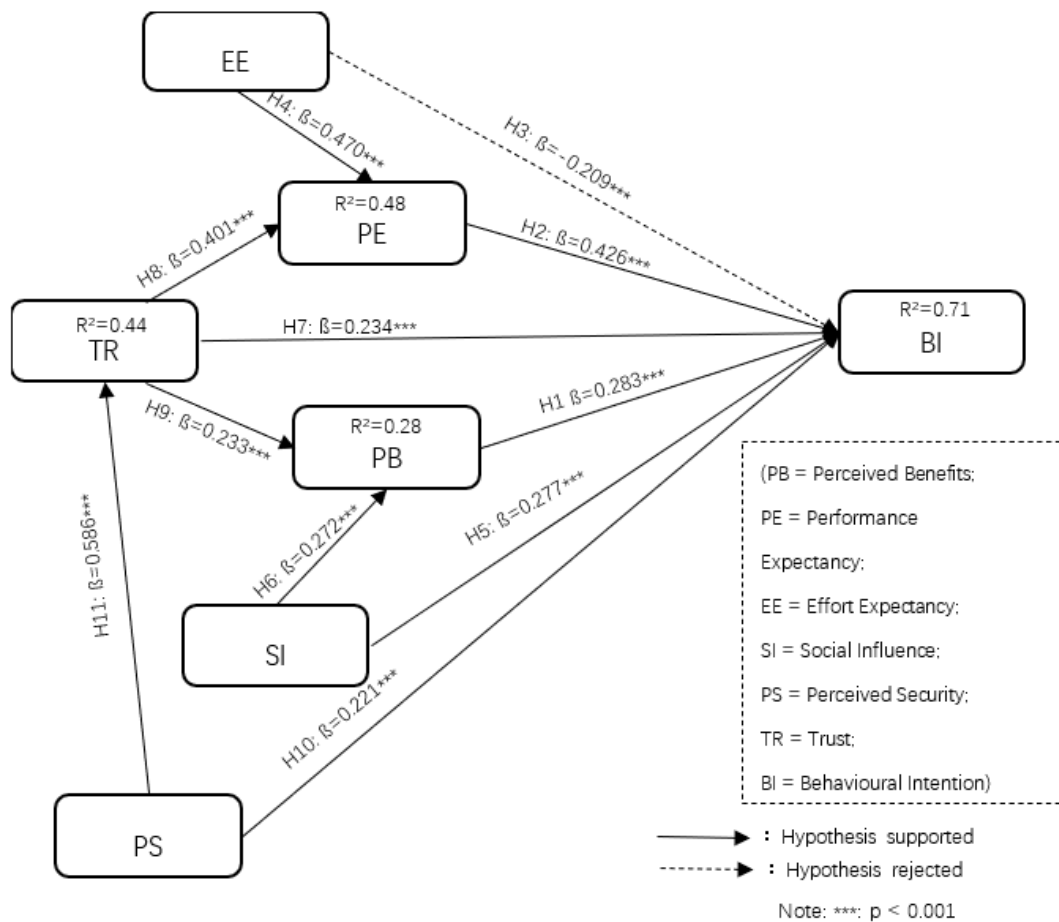


Figure 3.2. Hypotheses testing results.

Moreover, the results of hypotheses testing show that behavioural intention of adopting M-payments during the COVID-19 pandemic is the most significantly determined by performance expectancy ($\beta = 0.426$; $p < 0.001$), followed by, perceived benefits ($\beta = 0.283$; $p < 0.001$), social influence ($\beta = 0.277$; $p < 0.001$), trust ($\beta = 0.234$; $p < 0.001$) and perceived security ($\beta = 0.221$; $p < 0.001$). Thus, hypotheses H1, H2, H5, H7 and H10 are validated, respectively. However, the results show that effort expectancy ($\beta = -0.209$; $p < 0.001$) has a negative effect on behavioural intention; therefore, H3 was rejected. Moreover, both effort expectancy ($\beta = 0.470$; $p < 0.001$) and trust ($\beta = 0.401$; $p < 0.001$) are statistically significant in terms of explaining the performance expectancy. Thus, hypotheses H4 and H8 are confirmed. Meanwhile, the results illustrate that the perceived benefits are significantly influenced by social influence ($\beta = 0.272$, $p < 0.001$) and trust ($\beta = 0.233$, $p < 0.001$), respectively. Therefore, hypotheses H6 and H9 are confirmed. In addition, H11 is also accepted by the result of perceived security ($\beta = 0.586$; $p < 0.001$), significantly determining trust.

3.6. Discussion

Based on the data analysis results, ten of the eleven hypotheses were confirmed in this study, demonstrating that the current study exhibits an appropriate adoption model to explain antecedents of users' adoption intentions of M-payments under the pandemic.

Specifically, performance expectancy had the most significant positive impact on users' adoption intentions of M-payments during the COVID-19 pandemic (H2), which corresponds to the vast majority of previous studies (Morosan and DeFranco, 2016; Chopdar and Sivakumar, 2019). It can be confirmed that the utility and practicability of M-payment technology can improve users' payment efficiency in emergency situations. Primarily, M-payments provided a fast payment process without any direct or indirect contacts among people, significantly influencing users' adoption intentions during the pandemic. Users will feel M-payment is a more practical and reliable method than traditional payments to support their transactions under the pandemic.

Meanwhile, performance expectancy is significantly determined by effort expectancy (H4) and trust (H8), which is in accordance with findings from

previous studies (Gu *et al.*, 2009; Di Pietro *et al.*, 2015; Alalwan *et al.*, 2017). This study initially validated the effects of effort expectancy and trust on performance expectancy under the pandemic, which explains the absence of a confirmation of the simplicity and trustworthiness influencing the perceived functional utility when using M-payments under an emergency situation. Accordingly, the results support that the accessibility and operability of the technology's interface and function are positively formulating users' performance expectancy; meanwhile, the reliability and trustworthiness of the technology's services are essential in shaping the high utilisation of the technology under an emergency situation.

Moreover, the second largest significant effect on users' behavioural intentions to adopt M-payments during the COVID-19 pandemic is caused by perceived benefit (H1). This result illustrates that perceived benefits correspond with individuals' mental expectations related to the contributions of M-payments under the pandemic. Specifically, perceived benefits, such as M-payment's efficiency, not only influence users' perceived technological perceptions, convenience and utility (Kerviler *et al.*, 2016; Park *et al.*, 2018) but also increase perceived safety benefits by M-payment's contactless characteristic. Concretely, users' mental expectations are satisfied by perceiving more reliability and safety of using a contactless payment method to reduce contacts among people and maintain social distancing to decrease COVID-19 transmission risk (Wilder-Smith and Freedman, 2020 and WHO, 2020b). Thus, perceived benefits reflect users' mental cognitions of the technology's features which can overcome a particular environmental issue, which in turn significantly influences users' adoption intentions.

Meanwhile, under the condition of the COVID-19 pandemic, perceived benefits such as mental expectations are significantly influenced by social influence (H6) and trust (H9). The effects of social pressure and the opinions of important, relevant people play a substantial and pivotal role in influencing an individual's mental expectations, affecting his/her behavioural intention (Park *et al.*, 2018). When users receive recommendations from their close friends or families indicating that M-payments are beneficial for protecting their personal safety by avoiding contact with people during a transaction process to reduce the infection risk of COVID-19, they tend to consider M-payments as a helpful and

valuable payment method. Moreover, trust was analysed and found to have a significant effect on perceived benefits in this study. The contactless advantage of M-payments potentially determines the reputation and trustworthiness of M-payments in optimising users' experiences and supporting their safety during the COVID-19 pandemic, which emphasises users' perceived benefits towards adopting M-payments during the emergency situation.

Furthermore, social influence as the third most crucial factor has a statistically significant impact on behavioural intention (H5), which means the opinions, recommendations and support from close relationships of users are essential in the formulation of users' behavioural intentions to adopt M-payments during the COVID-19 pandemic. This result is supported by previous studies in normal situations (Slade *et al.*, 2015; Jenkins and Ophoff, 2016; Mun *et al.*, 2017). Especially under the pandemic, people rely more on the support and recommendations of significant people in their lives—their family and close friends more easily influence their behaviours. Accordingly, the reputation of M-payments and the word-of-mouth effect are considered crucial for attracting users' adoption intentions of M-payments to formulate a new payment habit by the influence of the pandemic.

In addition, this study confirms Hypotheses 7 and 10—trust and perceived security have statistically significant effects on explaining users' behavioural intentions of using M-payments during the COVID-19 pandemic. Specifically, consumers have developed trust in M-payment platforms through their reliable performance and mature legal framework protection, and so they worry less about financial risks to reap more benefits from the service (Zhu *et al.*, 2017). Thereby, users' adoption intentions are influenced by technological and privacy security and users' trust from technological and mental perspectives (Zhou, 2013; Johnson *et al.*, 2018; Shao *et al.*, 2018). Moreover, Hypothesis 11 also proved that perceived security is significantly associated with trust. In this sense, users' perceived security perceptions could reduce uncertainty and crucially guarantee M-payments' performance to improve users' trust in M-payment platforms (Khalilzadeh *et al.*, 2017). It demonstrates that trust and perceived security have a significant association, and both factors conjointly determine users' adoption intentions of M-payments under the pandemic.

Furthermore, M-payments involve sensitive and personal data; therefore, it is necessary to ensure the reliability and credibility of M-payment platforms for securing transactions and protecting personal information (Oliveira *et al.*, 2016). Moreover, based on the security, trustworthiness and reliability of M-payment platforms, users can accept the records of their transaction times and locations during the pandemic to be utilised by governments and health institutions to track contacts among payment processes, for monitoring, updating and reporting the pandemic transmission status. Accordingly, users can clearly and opportunely be made aware of the virus infection situation among them, which positively influences their intentions to use M-payments during the COVID-19 pandemic to reduce the infection risk.

However, Hypothesis 3 was rejected in this study, which means the easiness of understanding and handling M-payment systems does not directly impact a user's behavioural intentions to adopt M-payments during the COVID-19 pandemic. Similar results are supported by previous M-payment studies (Yuan *et al.*, 2016; Liébana-Cabanillas *et al.*, 2018). The main reason for this result is because users have become accustomed to smartphone functions and become more skilful through their previous utilisation of various applications on smartphones (Chopdar and Sivakumar, 2019). Meanwhile, under the COVID-19 pandemic, user behaviour is determined more by other perceptions related to personal safety, such as reliability, utility, security, trustworthiness and benefits, which can provide multidimensional supports for protecting transaction processes during a pandemic. Thus, the easiness of using M-payments is a less critical or surmountable factor determining users' adoption intentions during the pandemic.

3.7. Theoretical and Practical Implications

3.7.1. Theoretical Implications

This study contributes three main theoretical implications. First, this study was empirical and examined the factors affecting users' adoption intentions of M-payments under the pandemic situation, which is absent from evaluations of previous studies. Consequently, the study dramatically enriched the literature on technology adoption during a

pandemic. Specifically, this study illustrates a worthwhile direction to understand users' adoption intentions by not only examining users' perceptions from technological perspectives but also assessing users' mental expectations. Moreover, users' technological and mental perceptions of technology are significantly influenced by emergency situations. Therefore, this study provides a future insight for relevant research to analyse new technology adoption from technological and mental perspectives conjointly and corresponding with the specific situation, especially for emergency situations.

Second, this study integrated the UTAUT model with perceived benefits from MAT and two extra variables, perceived security and trust, which significantly contribute to the emerging literature's theoretical development and framework coordination on information technology adoption. Simultaneously, this study demonstrates a substantial contribution to the theoretical expansion of UTAUT and MAT by initially proposing and verifying new causal paths ($PB \rightarrow BI$, $SI \rightarrow PB$, $TR \rightarrow PB$, $TR \rightarrow PE$, $TR \rightarrow BI$ and $PS \rightarrow BI$) and rejecting the path $EE \rightarrow BI$ for investigating the interactions of variables in the new comprehensive model. Therefore, the integrative research approach presented in this study can serve as a beneficial and valuable reference to modify and evaluate new adoption models for investigating novel technology adoption.

Third, this study initially focused on technology characteristics corresponding to the pandemic situation as a potential antecedent determining users' mental and technological perceptions. Specifically, the contactless feature of M-payments avoids contacts during transaction processes and maintains social distancing, which improves the perceived multidimensional benefits of the users and optimises their experience of using M-payments under the pandemic situation. Meanwhile, based on the disaster status of the COVID-19 pandemic, effort expectancy became less important than other variables for determining whether users would adopt M-payments. Thus, it is essential to consider whether a particular technology's features can influence users' interpretations of the perceived mental and technological benefits corresponding to particular situations or conditions to explain technology adoption in an emergency situation comprehensively.

3.7.2. Practical Implications

Moreover, four main practical implications are demonstrated in this study. First, the current research enhances the existing knowledge of the adoption intention of M-payments in an emergency situation and enriches the understanding of how a pandemic changes users' payment habits. It suggests that a pandemic might bring suffering to people or society. Furthermore, it can also facilitate the development of new technology that can bring benefits to individuals, organisations and society to survive in the emergency situation, which is valuable for relevant stakeholders to consider the pandemic scenario to establish appropriate business strategies.

Second, this study could be valuable to start-up companies, policymakers, government bodies and private service providers interested in M-payment services. M-payments have become increasingly popular and provide useful services for efficient transaction processes, particularly in emergency conditions. In the context of a pandemic, M-payments can increase personal safety perception and maintain the stable development of business. Based on the findings of this study, as well as providing an easy-to-use operating application, relevant stakeholders should initially recognise the importance of M-payments in formulating users' perceived benefits and design system attributes accordingly under the pandemic situation. Meanwhile, M-payment service providers should guarantee transactions' compatibility, efficiency, and security to meet customers' requirements and match their lifestyles. In addition, enhancing the publics' impression of M-payments and stimulating a positive word-of-mouth social effect would improve the technology providers' reputation in different situations.

Third, this study supports new technology providers with a comprehensive understanding of customer adoption intentions, which is determined by conjoint technological and psychological perceptions. Consequently, relevant stakeholders should focus on taking advantage of the features of technology (such as the contactless characteristic of M-payments) corresponding to its benefit to a particular situation (such as avoiding direct or indirect contacts to decrease COVID-19 transmission risk) in terms of maintaining service quality, reliability and efficiency to

meet consumers' physical and mental concerns and optimise their experience, thereby increasing acceptance among the target population.

Finally, the findings and results of this study could be applied as references for other online-to-offline (O2O) service industries in a pandemic situation. Relevant businesses could utilise the results to develop appropriate strategies that combine the benefits of technology characteristics with users' technological perceptions and mental expectations to expand markets to adapt to different emergency situations and build better customer bases.

3.8. Limitations and Future Research

There are several limitations inherent in this study that need to be acknowledged. Firstly, the data collection was restricted to China during a particular period of the COVID-19 pandemic; the results may not be generalised to different countries and various situations. Future studies should replicate this model, collect data from different nationalities, and consider specific benefits corresponding to particular situations. Furthermore, the research model can be examined through cross-cultural studies to understand the variations in different cultural backgrounds better.

Secondly, there were limited variables and interactions of the variables analysed in this study—e.g., the variables selected in this study were mainly from a technology adoption aspect. Future research can put more effort into integrating the relations between variables, such as social influence affecting perceived security (Khalilzadeh *et al.*, 2017) and use technological indicators with the variables from a health and risk aspect. Meanwhile, in order to gain a deeper understanding of the mental and technological factors affecting adoption intentions with regard to novel technology, future research can incorporate research models with other variables, such as a cultural moderator, satisfaction, etc., which are also recommended in previous studies (Baptista and Oliveira, 2015; Hassan and Wood, 2020; Hossain and Zhou, 2018; Hamidi and Safareeyeh, 2019).

Thirdly, as the data collection period was limited, and that data were homogeneously distributed and collected through WeChat (a mobile social media application in China), in this study, the data collection

process is recommended to chronically and integrally cover the users from different areas (urban and rural areas) over a different period of using M-payment in various patterns (online and offline surveys).

Finally, there was no distinction between the types of M-payment patterns (such as SMS, NFC and QR), M-payment platforms (such as Apple pay, Samsung pay, WeChat pay, and Alipay) and patterns of the electronic transaction (such as electronic transaction via computer, electronic transaction via mobile device). Therefore, a future study can focus on distinguishing the different payment methods or payment platforms of M-payment techniques in accordance with specific research objectives.

3.9. Conclusion

In conclusion, we proposed a theoretical adoption model integrating UTAUT with perceived benefits from MAT and two additional variables, trust and perceived security, to appropriately explain the mental and technological factors affecting users' behavioural intentions of adopting M-payments during the COVID-19 pandemic. This research model provided extensive explanatory power when explaining that users' payment habits have changed due to the influence of the pandemic and that adoption intentions of M-payments were determined by technology perceptions and mental expectations conjointly. Performance expectancy, perceived benefits, social influence, trust and perceived security are significant in facilitating users' adoption intentions of M-payments during the COVID-19 pandemic. Specifically, the contactless characteristic of the M-payment technique is beneficial in maintaining social distancing and protecting personal safety under a pandemic. This study also explored new causal relationships and found that perceived benefits are significantly determined by social influence and trust. Moreover, performance expectancy is influenced by effort expectancy and trust towards explaining users' behavioural intentions of using M-payments during the COVID-19 pandemic.

Furthermore, this study provides several significant theoretical and practical contributions on investigating novel technology adoption in a particular situation, which contributes to the knowledge and understanding of the extension of the UTAUT application, explaining that users' payment habits have changed because of the pandemic and

adoption intention of M-payments is determined by users' technological perceptions and mental expectations. In addition, this study recommends that researchers and relevant stakeholders focus on a particular characteristic of M-payments that corresponds with the pandemic, which can influence the user's perceived mental and technological benefits. Understanding users' behaviours is an efficient way to analyse new technology adoption and develop an appropriate strategy for optimising users' experiences.

4. Chapter 4 - What factors have determined customers' continuous use of food delivery apps during the 2019 novel Coronavirus pandemic?

4.1. Introduction

Mobile devices have been widely adopted, and their use has sharply increased worldwide. According to a report from the Global Association of Mobile Operators, global mobile phone users exceeded 5.1 billion in 2020; among them, over 1.2 billion users are accounted for in China (GSMA, 2020). Meanwhile, various mobile services are significantly developed and implemented in different industries. Food delivery apps (FDAs) as online-to-offline mobile services have recently gained popularity offering two-way benefits for catering enterprises and customers by providing convenient and efficient online order and offline delivery services. Statista Reports (2019) illustrated that FDAs revenue in China (38.4 billion US dollars (USD)) generated more than one-third of global FDAs revenue (95.4 billion USD) in 2018. Moreover, global FDAs revenue increased to 107.4 billion USD in 2019 (Statista Reports, 2019) and are expected to exceed 164.5 billion USD by 2024, expanding at a CAGR of 11.4% during 2019-2024 (Imarc, 2020).

Meanwhile, the 2019 novel coronavirus (COVID-2019) erupted as a serious global pandemic from the end of 2019 and reached the whole of China in February 2020, then progressively expanded worldwide (Tang *et al.*, 2020). According to a report from the World Health Organisation (WHO), until 21 May 2020, there were a total of 4,904,413 globally confirmed cases of COVID-19 infections and 323,412 deaths (WHO, 2020a). During the COVID-19 crisis, wearing a mask in public, social distancing, self-isolating, and other self-protection actions have been highly recommended by the WHO (2020b) to avoid direct and indirect contacts among people to reduce the risk of the COVID-19 transmission

(Wilder-Smith and Freedman, 2020; Tang *et al.*, 2020). Moreover, because fewer customers intend to use public services, the traditional catering industry has suffered dramatically during the COVID-19 pandemic. According to the data of iiMedia Research (2020), in China, the revenue of the catering industry was 419.4 billion yuan (59.2 billion USD) from January to February 2020, which decreased 43.1% year on year. 95.0% of the interviewed catering businesses' stores' revenue decreased significantly during the COVID-19 epidemic period (iiMedia Research, 2020).

On the other hand, despite the negative influence of the COVID-19 significantly affecting the supply and demand of the catering industry, it has changed the consumption habits of residents and accelerated the transformation of catering enterprises from traditional in-store service to online-to-offline service for surviving in the pandemic situation and maintaining sustainable development. According to a report from the Meituan research institute (2020), there were 71.7% of 15263 participants using FDAs from the end of February to the beginning of March 2020, and 41.6% of residents preferred using online-to-offline delivery services to purchase daily supplies during the COVID-19 pandemic period in China. Likewise, iiMedia Research (2020) illustrated that 78% of responded Chinese traditional catering enterprises transferred their business to third-party FDAs (Ele.me, Meituan Waimai and Baidu Waimai). Compared to before the COVID-19 pandemic outbreak, the catering enterprises registered on FDAs have dramatically increased 63.1% in China, and 70% of the surveyed restaurants will continue to operate and increase investment in FDAs after the COVID-19 epidemic. Moreover, according to the business registration data from Tianyancha (2020), there were 106,000 new enterprise registrations related to food delivery services from January to May 2020, up 766% from the same period in 2019. The Chinese online food delivery market's estimated scale will exceed 91.8 billion USD in 2020 (iiMedia Research, 2020). Therefore, during the COVID-19 pandemic, the "internet + restaurant" modes of FDAs not only met the requirements of catering enterprises but also satisfied customers' demands on convenient and efficient food supplies and personal safety concerns (Liu and Wang, 2016).

Accordingly, factors motivating users to use FDAs continuously under the COVID-19 pandemic situation are essential for relevant stakeholders to

understand customers' requirements and expectations. In terms of FDA adoption, customers consider performance expectancy as the main determinator to adopt a relevant service (Yeo *et al.*, 2017; Roh and Park, 2019). Moreover, easiness and quality of service, convenience, social influence and satisfaction are also considerable antecedents of intention to adopt FDAs (Yeo *et al.*, 2017; Cho *et al.*, 2019; Correa *et al.*, 2019; Ray *et al.*, 2019; Roh and Park, 2019). Meanwhile, in terms of continuance usage of information technology, performance expectancy, effort expectance, social influence, and satisfaction are essential for formulating users' continuance usage intention (Gao *et al.*, 2015; Yuan *et al.*, 2016; Alghamdi *et al.*, 2018; Chopdar and Sivakumar, 2019; Marinković *et al.*, 2020). Furthermore, in order to evaluate factors affecting users' continuance intention of using information technology, Chong (2013) extended the Expectancy Confirmation Model (ECM), and Marinković *et al.* (2020) modified the Unified Theory of Use and Acceptance of Technology model (UTAUT), they found that trust also has a significant impact on users' continuance usage intention.

Meanwhile, Yuan *et al.* (2016) combined ECM with the Technology Acceptance Model (TAM) and the Task-Technology Fit model to explain that users' continuance usage intention is determined by perceived task-technology fit and confirmation. However, few prior investigations have focused on factors affecting FDAs' continuance usage, especially under pandemic conditions. Consequently, the purposes of this study are to fulfil the gap of factors determining users' intention to use FDAs during the COVID-19 period continuously and support FDA relevant stakeholders to understand customers' perceptions and behaviours for efficiently developing business strategies better. Therefore, this paper attempts to establish a comprehensive model integrating variables from ECM, UTAUT and the Task-Technology Fit model, including performance expectancy, effort expectancy, social influence, trust, perceived task-technology fit, confirmation and satisfaction, to investigate the factors affecting users' continuance usage intention of FDAs during the COVID-19 pandemic.

4.2. Theoretical background and hypotheses

development

4.2.1. Food delivery apps (FDAs)

FDAs, as an emerging online-to-offline mobile technology, provide a channel between catering enterprises and customers by integrating online order and offline delivery services. FDAs can be categorised into two patterns (Ray *et al.*, 2019). First, the restaurants themselves, such as KFC, Domino's and Pizzahut etc. Second, the third-party intermediary platforms, such as Uber Eats, Zomato, Ele.me Meituan Waimai and Baidu Waimai, are more popular and have been widely adopted in China (Roh and Park, 2019). Moreover, to adapt and overcome the COVID-19 pandemic, the contactless delivery process is applied in China, which delivers food to the gates of customers without direct contact.

Meanwhile, FDAs also involve daily supplies delivery service for customers. These additional services establish multi-way benefits in efficiently maintaining social distancing during the COVID-19 pandemic, enriching service range and reducing the spatio-temporal interval of sales and consumptions processes (Liu and Wang, 2016). Therefore, the quality of FDA services significantly impacts users' perceptions. Several previous studies have focused on various factors affecting users' intentions to adopt FDAs. Yeo *et al.* (2017) emphasised post-usage usefulness and perceived convenience motivation as significantly affecting customers' behavioural intentions to adopt online food delivery services.

Moreover, Roh and Park (2019) modified TAM with the moral obligation moderator and found that usefulness, compatibility, and subjective norms are significant determiners in the intention of online food delivery service adoption. He *et al.* (2018) illustrated that satisfaction is associated with food quality and service efficiency, significantly affecting online food delivery service adoption. Meanwhile, Elvandari *et al.* (2018) found that order conformity, quality of delivery, food quality and costs are the most significant attributes affecting the intention of using online food delivery services. Furthermore, Ray *et al.* (2019) implemented the uses and gratifications theory and validated that customer experience, ease-of-use,

and technological characteristics significantly impacted behavioural intention to use FDAs. Likewise, Cho *et al.* (2019) associated multi-dimensional perceived values with attitude to investigate the continuance intention of FDAs. They presented that trustworthiness has the most significant positive effect on perceived value towards formulating users' attitudes to continue using FDAs.

Therefore, according to previous relevant research and characteristics of FDAs associated with the current situation of the COVID-19 outbreak, this study focuses on technological and mental factors affecting customers' continuance intentions of using FDAs in China by integrating variables from UTAUT, ECM and the Task-Technology Fit model, including performance expectancy (Mun *et al.*, 2017; Yeo *et al.*, 2017; Roh and Park, 2019), effort expectancy (Ray *et al.*, 2019), social influence (Roh and Park, 2019) from UTAUT, satisfaction (He *et al.*, 2018) and confirmation (Yeo *et al.*, 2017) from ECM, perceived technology task fit (Elvandari *et al.*, 2018) from the Task-Technology Fit model and trust (Cho *et al.*, 2019). Furthermore, the following parts introduce the theoretical foundations that contribute to the conceptualisation of the research model.

4.2.2. Theoretical foundations

4.2.2.1. *Unified Theory of Use and Acceptance of Technology (UTAUT)*

UTAUT, as a reflection of social cognition theory, is an extension of the technology acceptance model developed by Venkatesh *et al.* (2003) for predicting users' behavioural intention to use new technology systems. Specifically, the UTAUT model has been modified with other variables and widely implemented on mobile technology adoption. For example, Khalilzadeh *et al.* (2017) modified UTAUT to verify that trust is associated with security and risk and significantly affects customers' intentions to use mobile payment technology. Min *et al.* (2008) combined UTAUT with satisfaction to analyse mobile commerce adoption in China. Moreover, UTAUT has also been integrated with other models for investigating mobile technology adoption. For example, Zhou *et al.* (2010) integrated the Task-Technology Fit model with UTAUT and found that performance expectancy, task-technology fit, social influence, and facilitating

conditions significantly affected mobile banking adoption in China. Afterwards, Oliveira *et al.* (2014) integrated UTAUT with the Task-Technology Fit model and the Initial Trust Model (ITM). They validated that initial trust, performance expectancy, technology characteristics, and task-technology fit are significant predictors to formulate users' intention to adopt mobile banking. Furthermore, several studies implemented UTAUT to investigate users' continuance intention of mobile technology (Chopdar and Sivakumar, 2019; Marinković *et al.*, 2020). Therefore, UTAUT as an advanced technology adoption model can be applied by associating additional variables or integrating with other models to efficiently explain the factors determining users' continuance intention of using FDAs during the COVID-19 pandemic.

4.2.2.2. *Expectancy Confirmation Model (ECM)*

ECM was proposed by Bhattacharjee (2001) and is rooted in the expectation–confirmation theory (ECT) (Oliver, 1980). It consists of three dimensions, including performance expectancy, confirmation and satisfaction for evaluating continuance usage intention of information systems. ECM has been widely implemented in various continuance adoptions of mobile technology. Authors such as Hung *et al.* (2012) modified ECM with the trust factor and proved that consumers' satisfaction and trust significantly impacted continuance usage intention of mobile shopping. Chong (2013) extended ECM with perceived ease of use, perceived enjoyment, trust and perceived cost to analyse Chinese consumers' satisfaction and continuance usage intentions of m-commerce.

Moreover, ECM can also be integrated with other adoption models to investigate the continuance usage intention of a technology. Such as, ECM integrating with TAM explains consumers' continuance usage intentions of various mobile technologies, m-shopping (Shang and Wu, 2017). Mobile Learning System (Alshurideh *et al.*, 2020). Likewise, Yuan *et al.* (2016) integrated ECM, TAM and the Task-Technology Fit model to explain the significant effects of satisfaction, perceived usefulness, perceived task-technology fit and perceived risk on users' continuance usage intentions of mobile banking.

4.2.2.3. *Task-Technology Fit model*

The Task-Technology Fit model was proposed by Goodhue and Thompson (1995) as the degree of fitness between tasks and technology to assist in the performance of individual daily tasks and the utilisation of technology. On the technology adoption aspect, technology characteristics and functions determine the performance of individual tasks and meet individual requirements (Goodhue and Thompson, 1995). Specifically, in this study, customers' continuance intention of using FDAs during the COVID-19 crisis period is determined on features of FDAs (fast, convenient and contactless food supply services), which fit users' efficient food supply requirements and maintain social distancing demand under the pandemic condition. Moreover, the Task-Technology Fit model has been implemented by various previous studies to analyse users' behavioural intentions of adopting mobile technology in different contexts, such as mobile commerce in the insurance industry (Lee *et al.*, 2007) and mobile information systems (Junglas *et al.*, 2008). Meanwhile, the Task-Technology Fit model has also been integrated with other models to explain technology adoption better. For example, the Task-Technology Fit model combines with UTAUT to analyse mobile banking adoption (Zhou *et al.*, 2010); the Task-Technology Fit model integrates with the DeLone & McLean model to explain mobile banking adoption (Tam and Oliveira, 2016). Moreover, Yuan *et al.* (2016) incorporated the Task-Technology Fit model with ECM and TAM to measure the factors affecting the continuance usage of mobile banking.

4.2.2.4. *Discussion of theoretical frameworks*

According to previous descriptions, the UTAUT model focuses on predicting users' initial adoption of new information technologies from users' technological expectations rather than mental expectations, which weakly explain users' mental perceptions determining continuance usage intention (Venkatesh *et al.*, 2011). Accordingly, based on the summary of previous studies related to continuance intention of using information technology (shown in Table 4.1.), this study integrates the trust, confirmation and satisfaction variables as mental perceptions with technological perceptions to analyse users' continuance intention to use FDAs during the COVID-19 pandemic. Specifically, trust is considered

users' general belief in technology, measured against perceived risk and uncertainty, and positively reflects perceived security when adopting new technology (Khalilzadeh *et al.*, 2017; Shao *et al.*, 2018). Moreover, confirmation and satisfaction extracted from ECM can efficiently describe users' expectations on continuously using information technology (Yuan *et al.*, 2016; Almazroa and Gulliver, 2018). Moreover, compared to UTAUT, the Task-Technology Fit model focuses more on the relationships among task and technology characteristics, utilisation and performance impact (Yuan *et al.*, 2016). Notably, the contactless feature and convenience of FDAs significantly contribute to users perceived technological and mental benefits of using FDAs under COVID-19 pandemic conditions. Therefore, UTAUT, ECM and the Task-Technology Fit model have good complementarities to evaluate the factors affecting users' continuance intention of using FDAs during the COVID-19 pandemic.

Table 4.1. Summary of studies related to continuance intention of using information technology

Relevant studies	Theoretical frameworks	Variables
Hung <i>et al.</i> , 2012	ECM	<ul style="list-style-type: none"> ● Perceived usefulness ● Confirmation ● Satisfaction
Yuan <i>et al.</i> , 2016	ECM Task-Technology Fit model TAM	<ul style="list-style-type: none"> ● Perceived technology-task fit ● Perceived ease of use ● Perceived usefulness ● Confirmation ● Perceived risk ● Satisfaction
Alghamdi <i>et al.</i> , 2018	UTT ECM	<ul style="list-style-type: none"> ● Performance expectancy ● Effort expectancy ● Social influence ● Facilitating conditions ● Satisfaction ● Confirmation ● Technology readiness ● Uncertainty Avoidance
Liébana-Cabanillas <i>et al.</i> , 2018	UTAUT DOI	<ul style="list-style-type: none"> ● Satisfaction ● Service quality ● Effort expectancy ● Perceived risk ● Convenience ● Social value
Alshurideh <i>et al.</i> , 2020	ECM TAM	<ul style="list-style-type: none"> ● Perceived ease of use ● Perceived usefulness ● Social influence ● Confirmation ● Satisfaction ● Continuance intention
Marinković <i>et al.</i> , 2020	UTAUT	<ul style="list-style-type: none"> ● Performance expectancy ● Effort expectancy ● Social influence ● Satisfaction ● Perceived trust ● Perceived compatibility ● Customer involvement ● Epistemic value

Tam et al., 2020	ECM UTAUT2	●	Comparative value
		●	Confirmation
		●	Satisfaction
		●	Performance expectancy
		●	Effort expectancy
		●	Social influence
		●	Facilitating conditions
		●	Hedonic motivation
		●	Price value
		●	Habit
Wang et al., 2020	UTAUT2 TAM	●	Performance expectancy
		●	Effort expectancy
		●	Hedonic motivation
		●	Social influence
		●	Attitude

4.2.3. Development of hypotheses

4.2.3.1. Revisiting the UTAUT model

Performance expectancy (PE)

According to UTAUT, performance expectancy (PE) is defined as the degree to which the user believes that using a particular technology will facilitate his or her performance in a certain activity (Venkatesh *et al.*, 2003). PE is a significant predictor to determine a user's intention to adopt new technology. Concretely related to this study, users perceived the higher utility from FDAs, and the greater intention to continue using them (Mun *et al.*, 2017; Yeo *et al.*, 2017; Roh and Park, 2019). Meanwhile, previous investigations have validated that PE has a significantly positive effect on user's continuance usage of various mobile technologies, such as mobile internet (Zhou, 2011a), mobile instant messaging and social networking apps (Lai and Shi, 2015), mobile banking (Yuan *et al.*, 2016) and mobile shopping applications (Chopdar and Sivakumar, 2019). Moreover, PE also significantly affects consumers' satisfaction towards affecting the continuance intention of using mobile technology (Tam *et al.*, 2018). In terms of UTAUT, studies by Marinković *et al.* (2020) and Chong (2013) verified that PE is a significant predictor affecting the satisfaction of users' continuance usage of mobile commerce. Furthermore, the ECM posits that PE significantly influences the satisfaction and continuance intention of using mobile technology (Yuan *et al.*, 2016; Susanto *et al.*, 2016). Accordingly, PE is considered a significant variable of UTAUT and ECM positively affecting users'

continuance intention and satisfaction. Therefore, the following hypotheses are proposed:

H1: Performance expectancy (PE) positively affects continuance intention (CI) of using FDAs during the COVID-19 pandemic.

H2: Performance expectancy (PE) positively affects satisfaction (SA) towards continuously using FDAs during the COVID-19 pandemic.

Effort expectancy (EE)

Effort expectancy (EE) as a fundamental variable of UTAUT is defined as the degree of ease associated with users' utilisation of a certain technology (Venkatesh *et al.*, 2003). EE positively affects users' continuance usage intention of using mobile apps (Kang, 2014; Fang and Fang, 2016) and has also been proved on FDAs (Ray *et al.*, 2019). Specifically, in this study, EE refers to users' perceived easiness of using FDAs generating higher continuance intentions to use them during the COVID-19 pandemic. Moreover, EE has been involved in previous studies by applying UTAUT to explain the continuance usage of information technology (Venkatesh *et al.*, 2011). However, some studies found that EE has an insignificantly direct effect on the continuance intention of mobile technologies, such as mobile banking (Yuan *et al.*, 2016) and mobile shopping applications (Chopdar and Sivakumar, 2019). Because users become increasingly familiar with mobile technology after their initial adoption, EE will no longer determine their intention.

On the other hand, EE is validated as a significant indirect effect on technology's continuance usage by affecting other variables, such as PE and satisfaction. Specifically, EE significantly affected the PE of users' continuance intention of using mobile technology by implementing an ECM-based model (Yuan *et al.*, 2016). Previous research has verified similar results in various aspects, like information systems (Kim and Malhotra, 2005), mobile Internet (Shin *et al.*, 2010). Meanwhile, Marinković *et al.* (2020) applied a UTAUT-based model and validated that EE significantly impacted satisfaction towards continuance usage of mobile commerce. Similar results are supported by Yeh and Li (2009), Agrebi and Jallais (2015) and Shang and Wu (2017). Therefore, this study proposes the following hypotheses:

H3: Effort expectancy (EE) positively affects the continuance intention (CI) of using FDAs during the COVID-19 pandemic.

H4: Effort expectancy (EE) positively affects performance expectancy (PE) towards continuously using FDAs during the COVID-19 pandemic.

H5: Effort expectancy (EE) positively affects satisfaction (SA) towards continuously using FDAs during the COVID-19 pandemic.

Social Influence (SI)

According to UTAUT, social influence (SI) is defined as the degree that users gain willingness from others' (e.g. families, friends and colleagues) encouragement that they should use a certain technology (Venkatesh *et al.*, 2003). Related to this study, SI has been validated as significantly determining users' intention to use an online-to-offline delivery service (Roh and Park, 2019). Moreover, from the continuance intention of using a mobile technology aspect, SI as an important variable in UTAUT has a significant impact on users' intentions to continue using mobile technologies (Lai and Shi, 2015). This angle has been supported in various aspects, such as mobile social network sites (Zhou and Li, 2014), shopping apps (Chopdar and Sivakumar, 2019) and mobile payment systems (Zhu *et al.*, 2017). Furthermore, SI not only directly determines users' continuance intention but also indirectly formulates users' intention to continuously use mobile technology by affecting their satisfaction (Hsiao *et al.*, 2016). Marinković *et al.* (2020) revised UTAUT to confirm that SI significantly affects users' satisfaction towards continuance intention of using mobile technology. Therefore, the following hypotheses are proposed in this study:

H6: Social influence (SI) positively affects continuance intention (CI) of using FDAs during the COVID-19 pandemic.

H7: Social influence (SI) positively affects satisfaction (SA) towards continuously using FDAs during the COVID-19 pandemic.

Trust (TR)

Trust (TR) is defined as a state of individual faith regarding intentions, and prospective actions will follow the appropriate behaviour of integrity

and ability (Gefen, 2000; Grazioli and Jarvenpaa, 2000). According to this study which focuses on continuance intention of using FDAs during the COVID-19 pandemic, trustworthiness can significantly formulate users' mental expectation to believe FDAs can provide reliable service (Cho *et al.*, 2019), which means users perceived the higher accumulation of trustworthiness from FDAs, and the higher willingness to continually use FDAs. Moreover, trust has been validated as an additional UTAUT variable, representing personal mental perceptions reflecting users' perceived security against uncertainty and risk, which has a significant influence in formulating users' behavioural intention (Khalilzadeh *et al.*, 2017; Shao *et al.*, 2018). Meanwhile, trust has been confirmed as a crucial predictor determining users' continuance usage intention towards mobile technology (Hung *et al.*, 2012; Zhou, 2013; Gao *et al.*, 2015). Furthermore, trust was demonstrated as a significant positive antecedent of satisfaction of mobile technology adoption, such as mobile banking (Liébana-Cabanillas *et al.*, 2016), mobile websites (Zhou, 2011b) and mobile commerce platforms (Gefen *et al.*, 2000; Jarvenpaa *et al.*, 2003). Likewise, in continuance usage studies, trust is also positively associated with satisfaction towards formulating users' continuance intention of using mobile technology (Chen and Li, 2017). Moreover, the positive influence of trust is not only on continuance intention but also on satisfaction to explain users' behaviour in continuance usage of mobile technology (Dlodlo, 2014). Accordingly, this study involves trust as an extra UTAUT variable and proposes the following hypotheses:

H8: Trust (TR) positively affects continuance intention (CI) of using FDAs during the COVID-19 pandemic.

H9: Trust (TR) positively affects satisfaction (SA) towards continuously using FDAs during the COVID-19 pandemic.

4.2.3.2. *Revisiting the Task-Technology Fit model*

Perceived task-technology fit (TTF)

The Perceived Task-Technology Fit (TTF) is a crucial factor summarised from the task-technology fit model, affecting users' technology adoption. Goodhue and Thompson (1995) argued that the higher fitness between the performance of a technology and users' tasks and requirements, the

higher the probability of adopting the technology. In the ongoing COVID-19 pandemic context, TTF represents the characteristics and advantages of FDAs that users can conveniently order food or daily supplies anytime at any self-isolation location via FDAs; meanwhile, contactless offline delivery is monitored and managed by FDA platforms to ensure the quality and efficiency of the service. Therefore, TTF significantly formulates users' technological and mental expectations towards continuously using FDAs during the COVID-19 pandemic. TTF associated with ECM has a significantly positive effect on continuance intention towards mobile banking usage (Yuan *et al.*, 2016). This result is per previous studies in information systems (Larsen *et al.*, 2009) and Web learning systems (Lin, 2012). In addition, TTF has also been confirmed to have a significant impact on PE in technology adoption. Zhou *et al.* (2010) and Oliveira *et al.* (2014) integrated TTF with UTAUT and observed that TTF was a significant predictor in determining the PE of mobile banking adoption. TTF has been verified to have a significantly positive effect on PE determining users' continuance usage intention of mobile technology (Yuan *et al.*, 2016). Thus, this study assumes the following hypotheses:

H10: Perceived task-technology fit (TTF) positively affects continuance intention (CI) of using FDAs during the COVID-19 pandemic.

H11: Perceived task-technology fit (TTF) positively affects Performance expectancy (PE) towards continuously using FDAs during the COVID-19 pandemic.

4.2.3.3. *Revisiting the ECM model*

Confirmation (COF)

Confirmation (COF) is defined as the degree of users' perceptions of an information system is congruent with their prior expectations and actual performances (Bhattacharjee, 2001). In terms of ECM, Bhattacharjee (2001) illustrated that COF is a vital factor in predicting PE and satisfaction, determining users' continuance intention of using the information system. This study refers to COF as the degree of users' confirmations of their initial expectations of FDAs, which affect PE and satisfaction towards continuance usage of FDAs during the COVID-19

pandemic. Lee and Kwon (2011) validated that COF had a significant positive effect on PE and satisfaction towards users' continuance intention of using web-based services. Similar results have been verified by applying ECM in various mobile technologies' continuance usage contexts as well, like, mobile banking (Yuan *et al.*, 2016) and mobile learning systems (Alshurideh *et al.*, 2020). Therefore, the following hypotheses are proposed in this study:

H12: Confirmation (COF) positively affects satisfaction (SA) towards continuously using FDAs during the COVID-19 pandemic.

H13: Confirmation (COF) positively affects Performance expectancy (PE) towards continuously using FDAs during the COVID-19 pandemic.

Satisfaction (SA)

Satisfaction (SA) is defined as cumulative feelings when individual prior emotion is coupled with surrounding disconfirmed expectations (Oliver 1980). According to ECM, satisfaction refers to an overall emotion-based evaluation of an IS (Yuan *et al.*, 2016). Users will be satisfied if perceived service performance exceeds their expectations, which leads to positive action towards continuance usage of FDAs. For example, Gao *et al.* (2015) found the significant influence of satisfaction towards users' continuance usage intention of mobile purchases. Moreover, satisfaction as an extra variable of UTAUT positively formulated users' continuance intentions of using information technology (Alghamdi *et al.*, 2018). Similar findings are supported by other studies of different mobile technologies' continuance usage intention, such as mobile banking (Liébana-Cabanillas *et al.*, 2017; Susanto *et al.*, 2016; Yuan *et al.*, 2016), mobile apps (Hsiao, Chang, and Tang 2016; Tam, Santos, and Oliveira 2018), mobile payment (Cao *et al.*, 2018; Dlodlo, 2014) and mobile commerce (Marinković *et al.*, 2020). Therefore, satisfaction as a complementary variable of UTAUT and ECM has been proposed in the following hypothesis:

H14: Satisfaction (SA) positively affects continuance intention (CI) of using mobile payment during the COVID-19 pandemic.

4.2.4. Research model

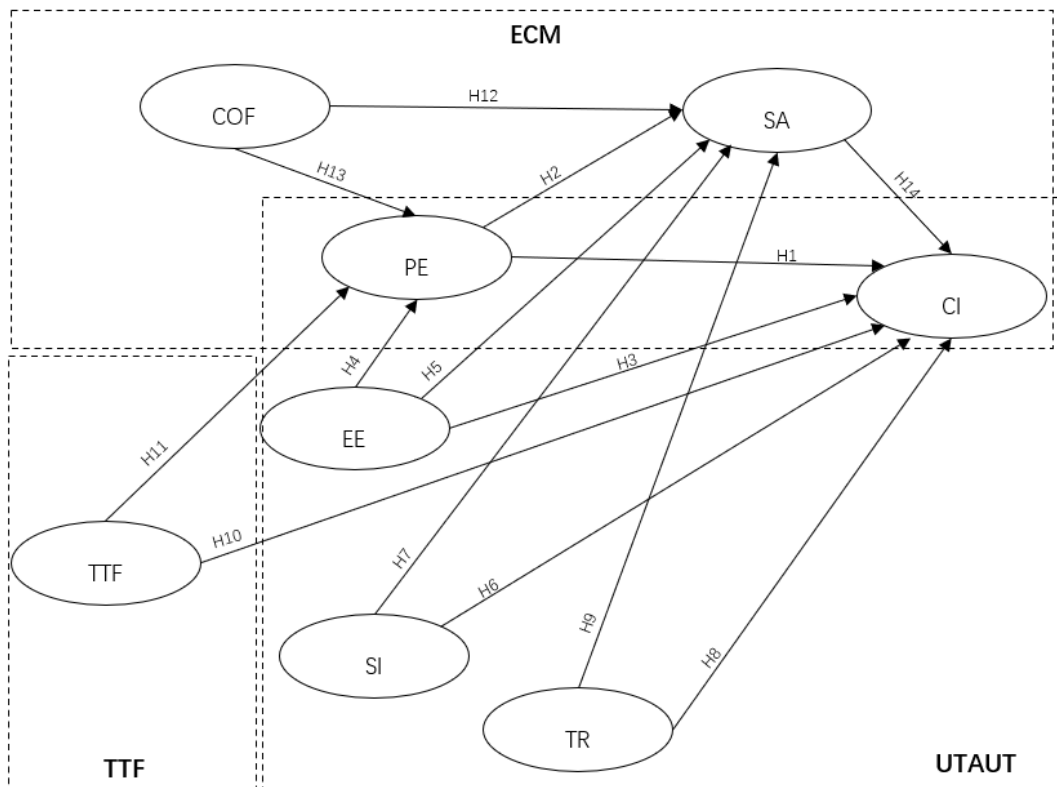
According to previous literature and the proposed hypotheses, the research model integrates variables from UTAUT, ECM and the Task-Technology Fit model and presents the hypotheses paths in Figure 4.1.

Figure 4.1. Research model

4.3. Methodology

4.3.1. Questionnaire development

A questionnaire survey was applied to collect data to validate the conceptual model and examine the research hypotheses. The questionnaire consisted of two parts. The first part concentrated on the demographic information of respondents using close-ended questions,



(COF=Confirmation; SA=Satisfaction; PE=Performance Expectancy; EE=Effort Expectancy; SI=Social Influence; TR=Trust; CI=Continuance Intention; TTF=Perceived Task-technology fit.)

including gender, age, education, occupation and frequency of using FDAs during the COVID-19 pandemic. The second part comprised of

constructs and items referred from pre-validated literature, consisting of 32 measurement items as indicators of variables, including performance expectancy (PE), effort expectancy (EE), social influence (SI), trust (TR), perceived task-technology fit (TTF), confirmation (COF), satisfaction (SA) and continuance intention (CI) of using FDAs, and the scale items and their references are listed in Appendix B with Chinese translation.

According to the large number of measurement items, a five-point scale appears to be less confusing and less time consuming for participants to increase the response rate (Babakus and Mangold, 1992; Bouranta, 2009). Thus, all indicators corresponding to the survey constructs were measured using a five-point Likert scale, ranging from strongly disagree = "1" to strongly agree = "5".

The main survey target of this research focused on smartphone users who adopted FDAs during the ongoing COVID-19 virus period in China. The questionnaire was translated into the Chinese language by a professional translator to avoid the impact of culture and language differences. The questionnaire was then reversely translated into English to confirm the translation equivalence. The questionnaire data were collected through an online survey and inquiry through Wechat (a Chinese social media platform) over a 3-week period, from 23 March 2020 to 12 April 2020.

4.3.2. Data collection and demographic distribution

During the data collection period, a total of 900 questionnaires were distributed, and 713 data were collected on 13 April 2020. After scrutinising the questionnaire and removing answers with missing values, a total number of 532 valid responses were accepted, achieving a final response rate of 59.1%. The valid data were mainly collected from the Henan province, which is the third-largest population province, consisting of 6.9% of the total population in China. The sample distribution of the male and female respondent groups was compared using the Kolmogorov–Smirnov (K–S) test, and no statistical difference between them was verified (Ryans, 1974), which indicates a sample with no existing non-response bias. The demographic distribution of the sample consists of 49.62% male and 50.38% female respondents; the most significant proportion of age range is between 21 to 30 with 53.57%, which is in line with a report from Chyxx (2019) that the proportion of

FDAs users are between 19 to 35 years of age was 73.9%; there are 71.80% participants with bachelor's or college degrees because this group is more active on social media and achieve a high response rate. Meanwhile, their working and study pressures accelerate their experience of ordering food through FDAs (DCCI, 2016); employee and student are the two main groups of respondents with the percentages of 43.05% and 31.58%, respectively; there are 45.68% of total responses using FDAs at least once every three days. The specific demographic distribution is listed in Table 4.2.

Table 4.2. Demographic distribution of participates

Measure	Item	N	%
Gender	Male	264	49.62%
	Female	268	50.38%
Age	<21	158	29.70%
	21-30	285	53.57%
	31-40	62	11.65%
	41-50	12	2.26%
	>50	15	2.82%
Education	High school and lower	32	6.02%
	Bachelor's or college	382	71.80%
	Master's	107	20.11%
	PhD and above	9	1.69%
	other	2	0.38%
Occupation	Student	168	31.58%
	Employee	229	43.05%
	Public Servant	30	5.64%
	Retiree	10	1.88%
	Unemployed	5	0.94%
	Freelancer	38	7.14%
	Other	52	9.77%
Usage Frequency	At least 1 time every 3 days	243	45.68%
	At least 1 time per 1 week	208	39.10%
	At least 1 time every 2 weeks	66	12.41%
	At least 1 time per 1 month	11	2.07%
	Never used during the pandemic	4	0.75%

4.4. Data analysis

The data analysis followed the two-step approach by Anderson and Gerbing (1988) by using SPSS 19 and AMOS 22 software. The first step assessed the reliability and validity of the measurement model. It was followed by examining the structural model and testing the research hypotheses. The maximum likelihood approach was implemented as the model estimation method in this study.

4.4.1. Measurement model

The reliability and validity of the measurement model were assessed by exploratory factor analysis (EFA) via SPSS and confirmatory factor analysis (CFA) through AMOS. Construct reliability represents the internal consistency of survey items and was measured by Cronbach's alpha (CA). The results in Table 4.3 reveal that all CAs are in the range of 0.848 to 0.888 and all exceed 0.70 (Nunnally and Bernstein, 1994), demonstrating eligible construct reliability. Furthermore, CFA is employed to evaluate the convergent and discriminant validity of each dimension. Specifically, convergent validity refers to the high theoretical correlations of the scale items where a factor's loadings exceed 0.7 (Henseler *et al.*, 2014). Table 4.3 confirms that all the loadings are qualified.

Moreover, the complemented convergent validity is assessed by Composite Reliability (CR) and Average Variance Extracted (AVE) criteria. The CR value of 0.70 or above is deemed acceptable, and an AVE value suggested higher than the threshold of 0.5 (Fornell and Larcker, 1981). As shown in Table 4.3, the CR values of all variables range from 0.838 to 0.889. All constructs have AVE values in the range of 0.582 to 0.666. Thus, the convergent validity of the measurement model has been confirmed.

In addition, discriminant validity is defined as the extent to which the indicator does not reflect other variables (Lee *et al.*, 2007). The square root of the AVE of each latent construct should be higher than any two pairs of its inter-construct correlation to confirm the discriminant validity. Meanwhile, the values of the average variance extracted (AVE) of each variable should be greater than its maximum shared squared variance (MSV) (Hair *et al.*, 2010). The results of the variables' MSV and square

roots of AVE and correlations shown in Table 4.4 confirm the measurement model's qualified convergent validity and discriminant validity.

Moreover, the model-fit was examined by the following measures: the ratio of chi-square to degrees-of-freedom (X^2/df), comparative fit index (CFI), the goodness of fit index (GFI), adjusted goodness-of-fit index (AGFI), normalised fit index (NFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA) and standardised root mean square residual (SRMR). All the model-fit indices of measurement model ($X^2/df=1.207$, $CFI=0.992$, $GFI=0.942$, $AGFI=0.929$, $NFI=0.953$, $TLI=0.990$, $RMSEA=0.020$, $SRMR=0.240$) respectively exceed the common acceptance levels (shown in Table 4.5), which demonstrates a reasonable fitness of the measurement model.

Further, this study implemented two tests to examine the potential common method bias. First, Harman's one-factor test (Podsakoff *et al.*, 2003) was conducted by implementing EFA in SPSS. The results present that the largest variance explained by individual factors is 44% (< 50%). Therefore, the result confirms that none of the factors can individually explain the majority of the variance. Second, a CFA was applied to assess the fitness of a single-factor model (all items as the indicators of one factor) (Malhotra *et al.*, 2006). The results of model-fit present a poor fitness ($\chi^2/df = 6.449(>3)$, $CFI = 0.764 (<0.9)$, $GFI = 0.668 (<0.9)$, $AGFI = 0.622 (<0.9)$, $NFI = 0.733 (<0.9)$, $TLI = 0.765 (<0.9)$, $RMSEA = 0.101 (>0.08)$, $SRMS=0.0713 (>0.05)$). Therefore, both tests confirm that no common method bias appeared in this study.

Table 4.3. The factor loadings, Cronbach's alphas (CA), Composite Reliability (CR) and Average Variance Extracted (AVE)

Variables	Items	Loading	CA	CR	AVE
Performance expectancy (PE)	PE1	0.84	0.881	0.838	0.634
	PE2	0.832			
	PE3	0.784			
	PE4	0.771			
Effort expectancy (EE)	EE1	0.845	0.883	0.883	0.654
	EE2	0.845			
	EE3	0.771			
	EE4	0.77			
Social influence (SI)	SI1	0.807	0.860	0.862	0.609
	SI2	0.77			
	SI3	0.732			

	SI4	0.81			
Trust (TR)	TR1	0.737	0.852	0.852	0.591
	TR2	0.788			
	TR3	0.762			
	TR4	0.787			
Perceived task-technology fit (TTF)	TTF1	0.824	0.880	0.880	0.647
	TTF2	0.801			
	TTF3	0.796			
	TTF4	0.797			
Confirmation (COF)	COF1	0.78	0.848	0.848	0.582
	COF3	0.769			
	COF2	0.76			
	COF4	0.741			
Satisfaction (SA)	SA1	0.808	0.848	0.850	0.586
	SA2	0.777			
	SA3	0.719			
	SA4	0.755			
Continuance intention (CI)	CI1	0.842	0.888	0.889	0.666
	CI2	0.82			
	CI3	0.814			
	CI4	0.788			

Table 4.4. Descriptive statistics and correlation among constructs.

	MSV	CI	PE	EE	SI	TR	TTF	COF	SA
CI	0.610	0.816							
PE	0.612	0.781	0.796						
EE	0.429	0.421	0.544	0.809					
SI	0.551	0.697	0.666	0.622	0.780				
TR	0.575	0.758	0.700	0.549	0.742	0.769			
TTF	0.612	0.781	0.782	0.530	0.642	0.699	0.805		
COF	0.575	0.625	0.709	0.655	0.677	0.671	0.658	0.921	
SA	0.581	0.762	0.726	0.587	0.699	0.714	0.659	0.758	0.765

Table 4.5. Models fit indices of the measurement model and structural model

	X ² /DF	CFI	GFI	AGFI	NFI	TLI	RMSEA	SRMR
RECOMMEND VALUE	<3	>0.9	>0.9	>0.9	>0.9	>0.9	<0.08	<0.05
MEASUREMENT MODEL	1.207	0.992	0.942	0.929	0.953	0.990	0.020	0.0240
STRUCTURAL MODEL	1.235	0.990	0.940	0.9228	0.952	0.989	0.021	0.0265

4.4.2. Structural model

According to the previous hypotheses, the structural equation model was developed, and the maximum likelihood estimation method and bootstrapping technique (500 samples and 95% significance level) were applied based on the absence of normality of the variables in this study. The overall goodness of fit of the structural model was comparably assessed, as was the previous CFA of the measurement model. The model-fit results are shown in Table 4.5, demonstrating the adequate fitness between the hypothesised structural model and the observed data. Furthermore, in order to evaluate the explanatory power and predictive accuracy of the structural model, the R^2 (also known as squared multiple correlations or coefficient of determination) of endogenous variables were calculated to show that the degree of their portion of the variance is explained by related exogenous variables (Hair *et al.*, 2010). As shown in Table 4.6 and Figure 4.2, the explained variances of performance expectancy, satisfaction and continuance intention are $R^2=0.70$, $R^2=0.69$ and $R^2=0.78$, respectively, which confirm the structural model substantially explains the dependent variable. Moreover, the hypotheses' testing shows that the continuance intention of using FDAs during the ongoing COVID-19 pandemic is positively determined by performance expectancy ($\beta=0.228$, $p<0.001$), social influence ($\beta=0.163$, $p=0.011$), trust ($\beta=0.271$, $p<0.001$), perceived task-technology fit ($\beta=0.309$, $p<0.001$) and satisfaction ($\beta=0.341$, $p<0.001$) directly. Thus, hypotheses H1, H6, H8, H10 and H14 are respectively validated. Moreover, the results illustrate that satisfaction is significantly influenced by performance expectancy ($\beta=0.210$, $p<0.001$), social influence ($\beta=0.141$, $p=0.023$), trust ($\beta=0.223$, $P=0.003$), confirmation ($\beta=0.339$, $p<0.001$) respectively. Therefore, hypotheses H2, H7, H9 and H12 are confirmed. Moreover, perceived task-technology fit ($\beta=0.536$, $p<0.001$) and confirmation ($\beta=0.389$, $p<0.001$) are verified and have significant effects on performance expectancy, which support H11 and H13. However, effort expectancy was found to have a negative influence on continuance intention ($\beta=-0.267$, $p<0.001$), and an insignificant impact on performance expectancy ($\beta=0.038$, $p=0.466$) and satisfaction ($\beta=0.041$, $p=0.399$). Therefore, the results reject hypotheses H3, H4 and H5.

Table 4.6. Summary of hypotheses testing.

Hypotheses	Relations	Estimate	S.E.	T-values	P-values	Decisions
H1	PE→CI	0.228	0.066	3.444	***	Supported
H2	PE→SA	0.210	0.052	4.027	***	Supported
H3	EE→CI	-0.267	0.048	-5.57	***	Rejected
H4	EE→PE	0.038	0.052	0.729	0.466	Rejected
H5	EE→SA	0.041	0.049	0.844	0.399	Rejected
H6	SI→CI	0.163	0.064	2.55	0.011	Supported
H7	SI→SA	0.141	0.062	2.278	0.023	Supported
H8	TR→CI	0.271	0.081	3.333	***	Supported
H9	TR→SA	0.223	0.074	3.022	0.003	Supported
H10	TTF→CI	0.309	0.063	4.907	***	Supported
H11	TTF→PE	0.536	0.051	10.564	***	Supported
H12	COF→SA	0.339	0.073	4.61	***	Supported
H13	COF→PE	0.389	0.071	5.442	***	Supported
H14	SA→CI	0.341	0.070	4.836	***	Supported

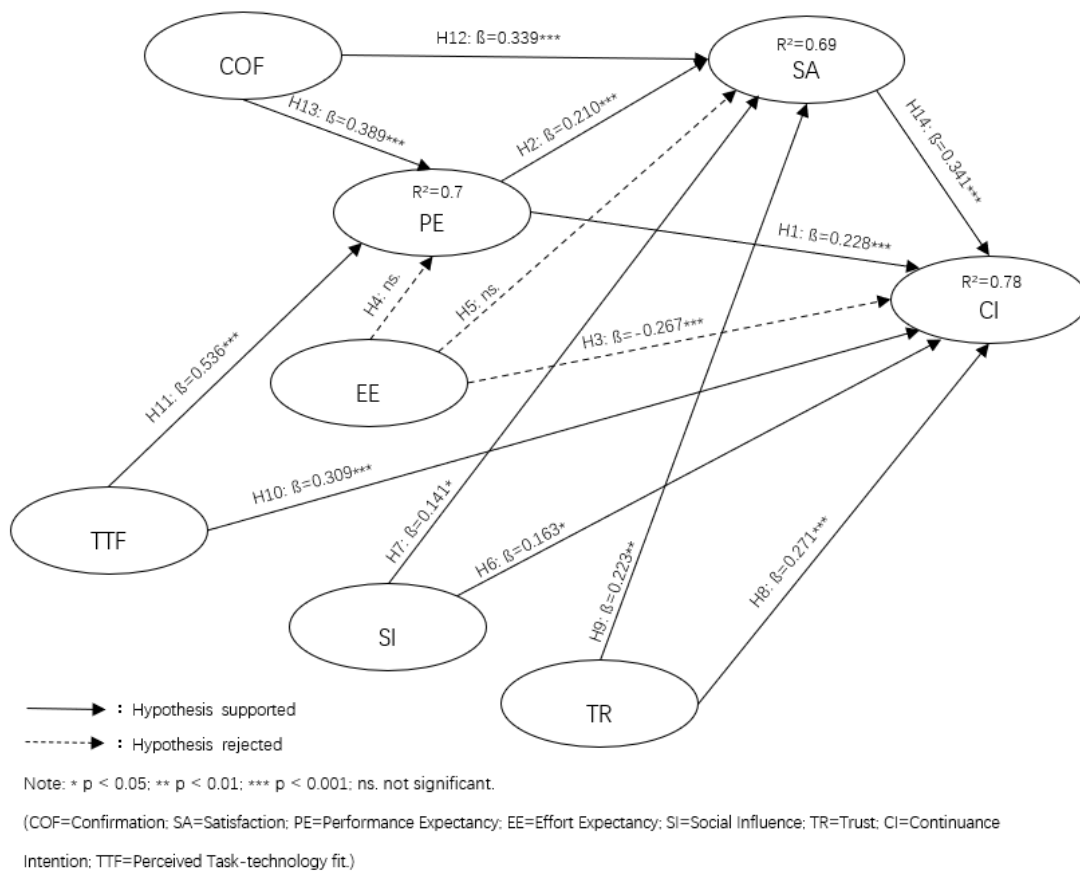


Figure 4.2. Hypotheses testing results

4.5. Discussion

According to the path analysis, it can be concluded that four of the five variables (PE, SI, TR, TTF and SA) emerged as statistically significant antecedents of continuance usage intention of FDAs during the COVID-19 pandemic. Wherein satisfaction has the most substantial influence on continuance intention. This result confirms previous studies related to the continuance adoption of mobile technologies and services (Dlodlo, 2014; Gao *et al.*, 2015; Yuan *et al.*, 2016; Cao and Niu, 2019; Marinković *et al.*, 2020). Furthermore, it has reconfirmed that satisfaction is an important determinant for users' re-purchase intentions in an FDA service context (Elvandari *et al.*, 2018). Therefore, monitoring and improving users' satisfaction by providing a high quality of service to meet customers' requirements are essential and appropriate approaches for FDAs providers to retain customers during the COVID-19 pandemic, as well as sustainably maintaining the future development of FDAs by satisfying customers' technological and mental expectations.

TTF is the second most crucial indicator affecting CI. This study initially integrates the Task-Technology Fit model with UTAUT and ECM to verify the TTF plays an essential role not only in determining users' premier behaviour intention of adopting technology (Zhou *et al.*, 2010) but in explaining users' continuance intention (Larsen *et al.*, 2009; Lin, 2012; Yuan *et al.*, 2016). Moreover, previous literature related to FDAs adoption has focused on users' perceptions or technologies' characteristics (Cho *et al.*, 2019; Ray *et al.*, 2019; Roh and Park, 2019), which is insufficient on analysing the fitness between users' perception and technology characteristics. TTF is significantly determined by technological characteristics (Oliveira *et al.*, 2014). Specifically, based on the FDAs' features, strict monitoring of the service processes and additional functions, such as daily necessities delivery. Contactless delivery significantly formulates customers' intention to use FDAs under the COVID-19 epidemic situation. Compared to the results from Oliveira *et al.* (2014) that TTF has no significant effect on behavioural intention, this study proves that when technology's characteristic is beneficial to a particular situation, the customers will take advantage of relevant features to acquire higher usage intention. Thus, the stakeholders of FDAs, as well as other new technologies, should analyse how technology's specific

characteristics can meet users' requirements in particular contexts to increase customers' usage intention.

Meanwhile, TTF also significantly determine PE (Zhou *et al.*, 2010; Oliveira *et al.*, 2014; Yuan *et al.*, 2016). It indicates that when FDAs' specific characteristics or functions meet customers' requirements of accessing food supplies or daily necessities under a safe environment during the pandemic period, customers will feel FDAs are useful and compatible. This study replenishes findings from Roh and Park (2019) that TTF is another antecedent of PE towards using FDAs. Therefore, the stakeholders of FDAs should insist on the user-centred principle to improve the services or functions to optimise users' perceived usefulness and better meet users' requirements, thereby maintaining users' continuance usage.

Moreover, not only TTF but also COF significantly impact PE, synchronously COF significantly determines SA. Similar results have been supported in previous studies (Lee and Kwon, 2011; Yuan *et al.*, 2016; Alshurideh *et al.*, 2020). COF reflects users' expectations formulated by their previous experience. Ray *et al.* (2019) illustrated that experience directly affects customers' intention of using FDAs. This study supplements their findings with mediating variables PE and SA, which explains the technological and mental effects of COF on customers' continuance intention of using FDAs. Thus, FDA providers should comprehend users' expectations to improve the efficiency and reliability of online order and delivery services based on users' requirements and particular situations (e.g., the COVID-19 pandemic) to preferably meet customers' technological and practical expectations for formulating a beneficial inspiration of technology and improving users' experience to maintain customers' continuance usage intention.

Furthermore, PE is determined by TTF and COF and simultaneously plays a vital predictor role in influencing SA and CI positively. Yuan *et al.* (2016) supported similar results. Moreover, other researchers have validated these findings in various contexts, respectively (Zhou, 2011b; Lai and Shi, 2015; Chopdar and Sivakumar, 2019; Susanto *et al.*, 2016; Marinković *et al.*; 2020). These findings indicate that the quality and serviceability of FDAs affect users' perceived satisfaction and continuance intention of FDAs' usage during the COVID-19 pandemic. Therefore, FDA providers should guarantee the performance and

usability of FDAs appropriate to users' expectancy in pandemic conditions, providing accurate and opportune stability ordering and delivery services with safety and quality assurance.

Additionally, this study proposes that TR, as the additional variable of UTAUT, has a significant influence on CI, consistent with previous findings (Dlodlo, 2014; Shao *et al.*, 2018). Meanwhile, this study originally integrates TR with the ECM model. The results confirm that TR significantly formulates SA on users' continuance intention (Zhou, 2013; Dlodlo, 2014; Zhou, 2011b; Liébana-Cabanillas *et al.*, 2016). These results confirm that TR significantly impacts users' behaviour on adopting FDAs (Cho *et al.*, 2019). It can be concluded that the reliability, promptness and personalisation of FDA service determine customers' trust in using FDAs during the COVID-19 pandemic. Thus, FDA providers should improve personalised services and monitor online ordering, production and delivery processes to ensure service quality and reliability to increase customers' trust.

Similarly, SI has also been validated to be the determinant of SA and CI, which efficiently combines UTAUT with ECM to explain users' continuance usage intention of FDAs, which is supported by previous studies in various contexts of technology adoption respectively (Roh and Park, 2019; Zhou and Li, 2014; Lai and Shi, 2015; Hsiao *et al.*, 2016; Zhu, Lan and Chang; 2017; Chopdar and Sivakumar; 2019; Marinković *et al.*, 2020). Regarding the significant role of SI, FDA providers and catering enterprises need to create appropriate marketing through social networks. Social marketing should be applied to promote the benefits of FDAs related to the pandemic situation to establish a reliable reputation of FDAs for increasing customers' satisfaction and continuance usage intention.

However, the influence of EE does not have a strong influence on PE, SI and CI. These results are against previous findings (Fang and Fang, 2016; Kim and Malhotra, 2005; Marinković *et al.*, 2020) but consistent with results from Yuan *et al.* (2016) and Chopdar and Sivakumar (2019). Because users gained enough experience from their previous usage of FDAs, the recognition and familiarity of FDAs will increase by their usage experience. Therefore, users' ease will no longer determine users' satisfaction and continuance intention after their initial adoption of FDAs. Meanwhile, during the COVID-19 pandemic, other FDA features, such as

safety, reliability and efficiency, as more critical determinants can provide more benefits for users, directly influencing their satisfaction and continuance usage intention more.

4.6. Theoretical and practical implications

This study contributes various theoretical implications. First, this study applied an empirical study and examined the factors affecting users' continuance usage intention of FDAs during the COVID-19 pandemic. Consequently, the study dramatically enriched the literature of technology continuance usage in an emergency situation, especially during a pandemic. Second, UTAUT, ECM and the Task-Technology Fit model are initially integrated to form a comprehensive model in this study. Simultaneously, the proposed model highly explains technological and mental factors affecting users' continuance intention of using FDAs during the COVID-19 pandemic. Specifically, TTF, as the extension of the boundary of the UTAUT, efficiently explains the technology characteristic that significantly formulates users' perceptions and behaviours.

Meanwhile, the proposed variables of the revised UTAUT model, as the extension of boundaries of the ECM model, complementarily explain users' technological perceptions, not only determining users' continuance usage intention but also affecting users' satisfaction. Moreover, ECM analyses users' continuance intention mainly from mental aspects, which is complementary with UTAUT and the Task-Technology Fit model. Thus, the proposed comprehensive model can significantly contribute to the emerging literature on information technology's continuance usage. Third, this study not only focuses on perspectives of users' perceptions but also emphasises the effect of specific technology's characteristics can appropriately optimise users' technological and mental expectations in a particular situation (e.g., the contactless function of FDAs increases users' perceived fitness between technology and their requirements, thereby optimises users' perceptions towards determining their continuance usage intention of FDAs under the COVID-19 pandemic). Therefore, future researches may pay more attention to the specific feature or function of technology, which can adapt to a particular situation, as an antecedent of users' perceptions and behaviours. Meanwhile, integrating users' technological and mental perceptions is an

efficient pattern to explain users' continuance usage intentions of technologies in various contexts.

Moreover, four main practical implications have been demonstrated in this study. First, the current research enhances the existing knowledge and benefits of FDAs, especially in the emergency COVID-19 pandemic context. The results indicate that the benefits of the contactless delivery function of FDAs formulate users' perceptions and behaviour, together with technological and mental factors jointly affecting users' intention to use FDAs in China continuingly under the COVID-19 pandemic condition. Second, this study supports FDAs providers and catering business owners with a fundamental understanding of customer's continuance intention as driven by satisfaction, perceived task-technology fit, trust, performance expectancy, confirmation and social influence. Notably, satisfaction, as the most significant determinant of customers' continuance usage intention, has significantly been determined by their mental and technological perception.

Meanwhile, the sense of the fitness between a technology's features and users' requirements also plays an essential role to formulate customers' perceptions and behaviour. Consequently, relevant stakeholders should focus on taking advantage of the technology's particular characteristic or function and maintaining service quality, reliability, and efficiency to optimise users' experience and achieve higher customers' satisfaction, thereby increasing continuance acceptance among their target population particular situation and future development. Third, this study could be valuable for start-up companies, policymakers, government bodies, and private service providers interested in the catering industry. FDAs have become increasingly popular and gradually useful platforms for the survival of the foodservice industry in a particular emergency (the COVID-19 pandemic), as well as continuously developing after crises. This popularity is determined by customers' increasing willingness to enjoy food at home as well as self-protection during the pandemic period, which has also formulated new consumption habits for continuance usage. Finally, the findings of this study could be applied as references for other online-to-offline service industries, such as online real estate services and the online hospitality industry. Relevant businesses could utilise the findings from this study to develop appropriate strategies by integrating specific technology features with customers' technological and

mental perceptions for expanding their market and building a better sustainable customer base not only in crises situations but also for future development.

4.7. Limitations and future research

This section summarises three main limitations of the current study and provides relevant recommendations for future research. First, this study mainly focuses on users of FDAs in China, and the results of this study may not be generalisable to different cultures, regions and countries. Therefore, future research is recommended to pay attention to different regions or countries. Moreover, comparisons across cultures are also highly encouraged. Second, this study only conducts a short-term reflection of users' perception towards continuance usage intention of FDAs, especially in a particular situation (the COVID-19 pandemic context). According to the spatio-temporal dynamics of an individual's behaviour and intention, future research can apply longitudinal and experimental methods to explore users' perceptions in different situations, investigate causality over time, and make comparisons to more comprehensively explain users' continuance usage intentions of technology. Third, the current study does not distinguish the different FDA platforms such as Ele.me, Meituan waimai, Baidu Waimai, and Uber eats. Meanwhile, the study focuses on the customers' perspectives towards FDAs only. Consequently, the research model can be generalised to distinguish the different FDA platforms, different stakeholders, e.g., business owners, service providers, and other contexts of the online-to-offline service industry, such as online real estate platforms and online-to-offline hospitality services.

4.8. Conclusion

In conclusion, at the nascent stage of FDA development, an increasing number of scholars have focused their attention on the related field. This study applies an empirical study with a high explanatory power of examining factors affecting users' continuance usage intention of FDAs during the COVID-19 pandemic, which significantly contributes to the literature of continuance adoption of information technology. Furthermore,

the current study proposed a comprehensive model integrating UTAUT, ECM and the Task-Technology Fit model and investigated 532 FDA users in China by a quantitative research method. The research model consists of seven factors, performance expectancy, effort expectancy, social influence, trust, perceived task-technology fit confirmation and satisfaction, to explore the determinators of users' continuance intention of using FDAs during the COVID-19 pandemic. The measurement model demonstrates good construct reliability and sufficient convergent and divergent validity. This study concludes that customers' continuance intention of using FDAs during the COVID-19 pandemic is not only significantly determined by satisfaction but also dramatically influenced by perceived task-technology fit, trust, performance expectancy, and social influence. Moreover, it is necessary to emphasise that user-perceived task-technology fit plays a crucial role to formulate users' technological and mental perceptions when the technology' characteristic is beneficial to a specific situation. However, this study does not find strong associations between effort expectancy with other variables (performance expectancy, satisfaction and continuance intention). In addition, this study contributes with various theoretical and practical implications. The perceived task-technology fit is an essential antecedent of UTAUT, which associates ECM to complementarily explain users' technological and mental perceptions determining their continuance usage intention. Relevant researchers and stakeholders should combine particular technology features with users' technological and mental perceptions to analyse and understand users' behaviour and continuance intention in a specific situation integrally.

5. Chapter 5 - A comprehensive model integrating UTAUT and ECM with espoused cultural values for investigating users' continuance intention of using mobile payment

5.1. Introduction

Mobile payment (M-payment), as a burgeoning payment method, has dramatically increased in recent years, and it has been estimated to increase to 29.6% of the global point of sale in 2023 (Worldpay, 2020). Accordingly, smartphone users' consumption habits have significantly changed. The determinants of users' behaviours on M-payments are valuable for relevant stakeholders comprehensively understanding users' expectations and behaviour, which had been attracted many previous studies to explain users' behavioural intention on using M-payments (Di Pietro *et al.*, 2015; Cao and Niu, 2019) by applying various adoption models (e.g., Technology Acceptance Model (TAM), Diffusion of Innovation Model (DOI), Unified Theory of Acceptance and Use of Technology (UTAUT), etc.). However, a limited number of researchers have focused on users' continuance intention of using M-payments under cultural moderators' effect. Cultural value, as a predictor and a moderator, performances as crucial information affecting consumer decisions, made by shaping perceptions and preferences of products, services and innovations on theoretical and practical aspects of technology adoption (Hofstede, 1984; Lu, Wei, Yu, and Liu, 2017; Cruz-Cárdenas *et al.*, 2019). Moreover, cultural values consist of the following dimensions, collectivism/individualism, masculinity/femininity, power distance, uncertainty avoidance, and long-term orientation (Hofstede, 1984). According to the updated information provided by Hofstede Insights with a 100-point scale, different countries present different cultural values. For example, the power distance score in China is 80, individualism-collectivism is 20, masculinity is 66, uncertainty avoidance is 30, and Long-term orientation is 87; the power distance score in

Portugal is 63, individualism-collectivism is 27, masculinity is 31, uncertainty avoidance is 99, and Long-term orientation is 28.

Furthermore, traditional adoption models (e.g., TAM and UTAUT) evaluate users' intention determined by technological perceptions with obvious limitation of influence from users' mental perception (Venkatesh *et al.*, 2011). Meanwhile, the Expectancy Confirmation Model (ECM) efficiently explains users' mental expectations by confirming and satisfying their continuance intention to use technology (Bhattacharjee, 2001). Therefore, this study aims to develop a theoretical framework by integrating UTAUT and ECM with Hofstede's cultural value to explain users' continuance intention of using M-payment. The paper is structured in sections as follows: literature review, development of hypotheses and proposed model; subsequently, future research; and conclusion.

5.2. Theoretical backgrounds

5.2.1. Continuance usage of mobile payment

M-payment, as a contactless financial transaction method for paying goods, services, and bills by mobile devices, became a new business climate. The wide adoption of M-payments facilitates financial transactions anywhere, anytime and for anyone (Di Pietro *et al.*, 2015). Most previous studies generally focused on M-payments initial adoption (Di Pietro *et al.*, 2015; Cao and Niu, 2019; Kaitawarn, 2015; Liébana-Cabanillas *et al.*, 2018), there are a limited number of studies concentrated on continuance usage intention of M-payment. This paper summarises prior studies related to the continuance intention of using mobile technology in Table 5.1 with relevant theoretical frameworks and variables. Specifically, it can be summarised that UTAUT is an increasingly primary theoretical model for exploring users' continuance intention of using mobile technology.

Moreover, performance expectancy, social influence, trust and satisfaction are the most significant predictors. However, the effect of cultural values has been ignored by most previous studies. Therefore, it is necessary to incorporate cultural values to explain users' continuance intention on M-payments.

Table 5.1. Review of previous literature related to continuance intention on mobile technologies

Studies	Theoretical frameworks	Variables
Zhou, 2013	IS success model	System quality, information quality, service quality, trust, flow and satisfaction
Dlodlo, 2014	IS success model	System quality, trust, and satisfaction
Lu <i>et al.</i> , 2017	ECM	Social influence, privacy, mobility, privacy protection, mobility, usefulness and satisfaction
Zhu <i>et al.</i> , 2017	Elaboration Likelihood Model	Source credibility, perceived usefulness, perceived integration, trust, competitors' marketing efforts, and subjective norm
Shao <i>et al.</i> , 2018	DOI	Mobility, customisation, security, reputation, trust and perceived risk
Liébana-Cabanillas <i>et al.</i> , 2018)	UTAUT; TAM; DOI	Convenience, social value, perceived trust, satisfaction, service quality, effort expectancy and perceived risk
(Chopdar and Sivakumar, 2019	UTAUT2	Performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, habit and perceived risk
Marinković <i>et al.</i> , 2020	UTAUT	Performance expectancy, effort expectancy, social influence, perceived compatibility, customer involvement, epistemic value, competitive value, trust and satisfaction

5.2.2. Unified Theory of Acceptance and Use of Technology (UTAUT)

The UTAUT is an extension of the TAM model and incorporated by four fundamental determinants: performance expectancy, effort expectancy, social influences, and facilitating conditions (Venkatesh *et al.*, 2003). Thereinto, performance expectation, effort expectation and social influence have the most significant effect on M-payment adoption (Liébana-Cabanillas *et al.*, 2018). Moreover, UTAUT can be extended with additional variables to investigate mobile technology adoption (Kaitawarn, 2015). Furthermore, UTAUT has been integrated with other models to evaluate users' behavioural intention (Di Pietro *et al.*, 2015; Liébana-Cabanillas *et al.*, 2018). In addition, UTAUT also has been implemented to analyse users' continuance intention of using technology (Liébana-Cabanillas *et al.*, 2018). For example, the UTAUT model integrates with perceived trust and satisfaction to evaluate customers' continuance intention of using M-commerce (Marinković *et al.*, 2020).

5.2.3. Expectancy Confirmation Model (ECM)

The Expectancy Confirmation Model (ECM) is rooted in the expectation–confirmation theory (Oliver, 1980) to explain users' satisfaction and continuance behaviour of information systems by three dimensions,

performance expectancy, confirmation and satisfaction (Bhattacharjee, 2001). ECM has been widely applied with additional variables to explain users' continuance intention of using mobile technology. For example, ECM has been modified with trust and proved that satisfaction and trust significantly affect the continuance intention of mobile shopping (Hung *et al.*, 2012). Meanwhile, ECM also has been integrated with other adoption models to investigate IS continuance intention (Yuan *et al.*, 2016). For example, combining ECM with TAM to investigate mobile technology continuation (Shang and Wu, 2017; Alshurideh *et al.*, 2020). In addition, ECM also can be combined with espoused cultural value to analyse the factors affecting continuance intention of M-payment (Lu *et al.*, 2017).

5.2.4. Hofstede's cultural values

Hofstede defines culture as "the collective programming of the mind which distinguishes the members of one human group from another" (Hofstede, 1980). Cultural values embody the degree to which people embrace their national culture's trust, values, and behaviours (Aparicio *et al.*, 2016). Moreover, cultural values have been applied as moderators in various adoption models for investigating behavioural intention of technology acceptance (Srite and Karahanna, 2006). Baptista and Oliveira (2015) combined cultural moderators with UTAUT2 and found that collectivism, uncertainty avoidance, short term, and power distance have significant moderating effects on mobile banking adoption. Aparicio *et al.* (2016) integrated TAM and IS success model with the individualism/collectivism moderator to investigate e-learning system adoption; Tam and Oliveira (2019) integrated cultural moderators with the TTF model to explain users' performance of mobile banking. Furthermore, cultural moderators also have been applied in adoption models to explain users' continuance intention of mobile technologies (Lu *et al.*, 2017; Chopdar and Sivakumar, 2019).

5.3. proposed hypotheses and research model

5.3.1. Revisiting UTAUT and ECM

5.3.1.1. *Performance expectancy (PE)*

Performance expectancy (PE) is defined as the degree to which the users believe using a particular technology will facilitate their performance in a certain activity (Venkatesh *et al.*, 2003). PE as an important factor significantly determines a user's continuance intention. The higher utility users perceive from using an M-payment system, the greater continuance usage intention (Chopdar and Sivakumar, 2019; Yuan *et al.*, 2016). Moreover, PE has also been validated to have a significant effect on satisfaction towards continuance usage intention of mobile technologies (Tam and Oliveira, 2019), like mobile banking (Yuan *et al.*, 2016; Susanto *et al.*, 2016); mobile commerce (Marinković *et al.*, 2020). Therefore, the following hypotheses are proposed:

H1: *Performance expectancy (PE) positively affects continuance intention (CI) of using M-payments.*

H2: *Performance expectancy (PE) positively affects satisfaction (SA) towards continuously using M-payments.*

5.3.1.2. *Effort expectancy (EE)*

Effort expectancy is defined as the degree of ease associated with users' utilisation of a certain technology (Venkatesh *et al.*, 2003). This aspect means perceived ease associated with using a mobile technology leads users' to a higher intention to continuously use it (Venkatesh *et al.*, 2011; Marinković *et al.*, 2020). However, some studies found that EE has no significant effect on continuance intention towards mobile technology, such as mobile banking (Yuan *et al.*, 2016) and mobile shopping applications (Chopdar and Sivakumar, 2019). Furthermore, EE is a significant predictor affecting performance expectancy and satisfaction on technology continuance usage (Kim and Malhotra, 2005). Similar results have been confirmed on mobile technology, like mobile banking (Yuan *et al.*, 2016), mobile commerce (Marinković *et al.*, 2020) and mobile

shopping (Shang and Wu, 2017). Therefore, this study proposes the following hypotheses:

H3: *Effort expectancy (EE) positively affects continuance intention (CI) of using M-payments.*

H4: *Effort expectancy (EE) positively affects Performance expectancy (PE) towards continuously using M-payments.*

H5: *Effort expectancy (EE) positively affects satisfaction (SA) towards continuously using M-payments.*

5.3.1.3. *Social Influence (SI)*

Social influence (SI) is defined as the degree that users perceive from others (e.g., families, friends and colleagues) to encourage that they should use a certain technology (Venkatesh *et al.*, 2003). SI has a significant positive impact on continuance intention to use mobile technologies (Zhu *et al.*, 2017), such as mobile shopping apps (Chopdar and Sivakumar, 2019). Moreover, SI also affects satisfaction towards mobile technology continuance intention (Marinković *et al.*, 2020). Likewise, SI has been confirmed to have both a significant effect on users' satisfaction and continuance usage intention of mobile technology (Hsiao *et al.*, 2016). Therefore, the following hypotheses are proposed:

H6: *Social influence (SI) positively affects continuance intention (CI) of using M-payments.*

H7: *Social influence (SI) positively affects satisfaction (SA) towards continuously using M-payments.*

5.3.1.4. *Trust (TR)*

Trust (TR) originates from social psychology, as a state of individual perceived uncertain vulnerability from others, subsequently conceptualised as a faith regarding the intentions and prospective actions will follow the appropriate behaviour of integrity and ability (Gefen, 2000). Specifically, the higher trustworthiness users perceived from M-payment systems, the higher the continuance intention towards using them (Zhou, 2013; Shao *et al.*, 2018). Trust is positively associated with the continuance usage of M-purchases (Gao *et al.*, 2015). Furthermore, trust

also strongly relates to the construct of satisfaction (Sharma and Sharma, 2019). Perceived trust has been demonstrated to significantly influence satisfaction on continuance usage of M-payment (Dlodlo, 2014), as well as mobile banking (Liébana-Cabanillas *et al.*, 2016), mobile websites (Zhou, 2011a) and mobile commerce (Jarvenpaa *et al.*, 2003).

Accordingly, this study formulates the following hypotheses:

H8: *Trust (TR) positively affects continuance intention (CI) of using M-payments.*

H9: *Trust (TR) positively affects satisfaction (SA) towards continuously using M-payments.*

5.3.1.5. *Confirmation (COF)*

Confirmation (COF) is defined as the degree of users' perception of an information system is congruent with their prior expectations and actual performance (Bhattacharjee, 2001). This study defines that confirmation is the degree of users' confirmation of their initial expectations for M-payment systems. Confirmation is a significant predictor determining performance expectancy and satisfaction (Bhattacharjee, 2001).

Specifically, these results have been verified by previous studies related to continuance usage intention of various technologies, such as web-based services (Lee and Kwon, 2011), mobile banking (Yuan *et al.*, 2016), and mobile learning systems (Alshurideh *et al.*, 2020). Therefore, the following hypotheses are proposed:

H10: *Confirmation (COF) positively affects satisfaction (SA) towards continuously using M-payments.*

H11: *Confirmation (COF) positively affects Performance expectancy (PE) towards continuously using M-payments.*

5.3.1.6. *Satisfaction (SA)*

Satisfaction (SA) is defined as cumulative feelings when individual prior emotion is coupled with surrounding disconfirmed expectations (Oliver, 1980). If perceived service performance exceeds the users' expectations, the user will be satisfied, leading to positive actions towards continuance usage of M-payments (Dlodlo, 2014). Moreover, previous studies have

supported that satisfaction is a significant antecedent affecting users' continuance intention towards various mobile technologies, such as mobile banking (Yuan *et al.*, 2016; Susanto *et al.*, 2016), mobile apps (Hsiao *et al.*, 2016), mobile commerce (Marinković *et al.*, 2020), and mobile purchases (Gao *et al.*, 2015). Therefore, the hypothesis is proposed as follows:

H12: *Satisfaction (SA) positively affects continuance intention (CI) of using M-payments*

5.3.2. Espoused cultural values

5.3.2.1. Long/short-term orientation (LTO)

Long/short-term orientation (LTO) deals with change from past to future based on its cultural traditions (Hofstede, 1984). Specifically, a society with high LTO cultural value focuses more on traditions, emphasising persistence, relationships, thrift loyalty and trustworthiness (Yoon, 2009). Consequently, once a technology is socially accepted, the speed of change is extremely fast with high LTO culture value by its trustworthiness and commitments features (Lee *et al.*, 2013). By this logic, people with high LTO values have stronger beliefs to take risks during uncertainty towards enhancing trust to use M-payments continuously. Accordingly, trust has a higher effect on the behavioural intention for users with higher values of LTO (Yoon, 2009). Thus, the hypothesis is proposed as follows:

H13: *The positive effect of trust (TR) on continuance intention (CI) towards M-payments will be stronger for users with high long/short-term orientation (LTO) value.*

5.3.2.2. Individualism/collectivism (IC)

Individualism/collectivism refers to people's independent preference being conceived as separate from society and identity (individualism), as opposed to where people expect being interdependent as members of a group in society to protect themselves in exchange for their loyalty (collectivism) (Hofstede, 1980). Moreover, from a social psychology perspective, people from collectivistic cultures display higher conformity

and lower initiative levels than people from individualistic cultures (Hofstede, 1984; Bond and Smith, 1996). By this logic, people who espouse collectivistic cultural values are more concerned about the opinions of their referent group (Srite and Karahanna, 2006). Therefore, people from a collectivistic culture more readily perceive others' opinions to formulate their behaviour and decisions (Bond and Smith, 1996; Roberts, 1991). Previous studies validated that social influence has more influence on behavioural intention with collectivist cultures (Lin, 2014).

On the other hand, people who espouse individualism are less affected by others' opinions and focus more on efficiency, speed and performance (Hofstede, 1984; Srite and Karahanna, 2006). Effort expectancy of users with high Individualism significantly determines the continuance intention of mobile technologies, such as mobile shopping applications (Chopdar and Sivakumar, 2019), mobile commerce (Hung and Chou, 2014). Therefore, this paper proposes the following hypotheses:

H14: *The positive effect of social influence (SI) on continuance intention (CI) towards M-payments will be stronger for users with high espoused collectivism.*

H15: *The positive effect of effort expectancy (EE) on continuance intention (CI) towards M-payments will be stronger for users with high espoused individualism.*

5.3.2.3. Masculinity/femininity (MF)

Masculinity/femininity is a measure of psychological gender in which people espouse masculine values emphasising earnings, advancement, competitiveness and performance, as opposed to people who espouse feminine values which emphasise personal goals, like, atmosphere, comfortable work environment, quality of life, and warm personal relationships (Hofstede, 1984) (Srite and Karahanna, 2006). Specifically, performance expectancy is closely related to achievement, which users with a higher degree of masculinity will have. Therefore, performance expectancy will have a higher effect on IT adoption (Srite and Karahanna, 2006). Thus, masculinity has a moderate effect between performance expectancy and users' intention to use e-commerce (Yoon, 2009). On the other hand, people who espouse feminine cultural values have a greater desire for social interaction and more readily conform to others'

suggestions, reflecting higher influenceability with social effect (Hofstede, 1984) (Roberts, 1991).

Moreover, femininity value orientation has been proven to positively interact with social influence and technology acceptance (Srite and Karahanna, 2006). Thus, the behaviours of users who espouse feminine culture are strongly affected by social influence (Manrai and Manrai, 2011). Therefore, related hypotheses are proposed as follows:

H16: *The positive effect of performance expectancy (PE) on continuance intention (CI) towards M-payments will be stronger for users with high espoused masculinity values.*

H17: *The positive effect of social influence (SI) on continuance intention (CI) towards M-payments will be stronger for users with high espoused femininity values.*

5.3.2.4. Power distance (PD)

Power distance (PD) refers to the degree to which unequal distribution of status is accepted and expected as normal in a given culture (Hofstede, 1984). It conditions the extent to which individuals who espouse high power distance values accept and conform to the ideas or suggestions from their superiors (Hofstede, 1984) (Srite and Karahanna, 2006). Due to this compliance effect, social influence is more decisive in determining the continuance intention of M-payments usage with higher espoused power distance values. Similar results are supported in technology acceptance (Srite and Karahanna, 2006) and the adoption of knowledge management systems (Lin, 2014). Therefore, the suggested hypothesis is shown as follows:

H18: *The positive effect of social influence (SI) on continuance intention (CI) towards M-payments will be stronger for users with high power distance values.*

5.3.2.5. Uncertainty avoidance (UA)

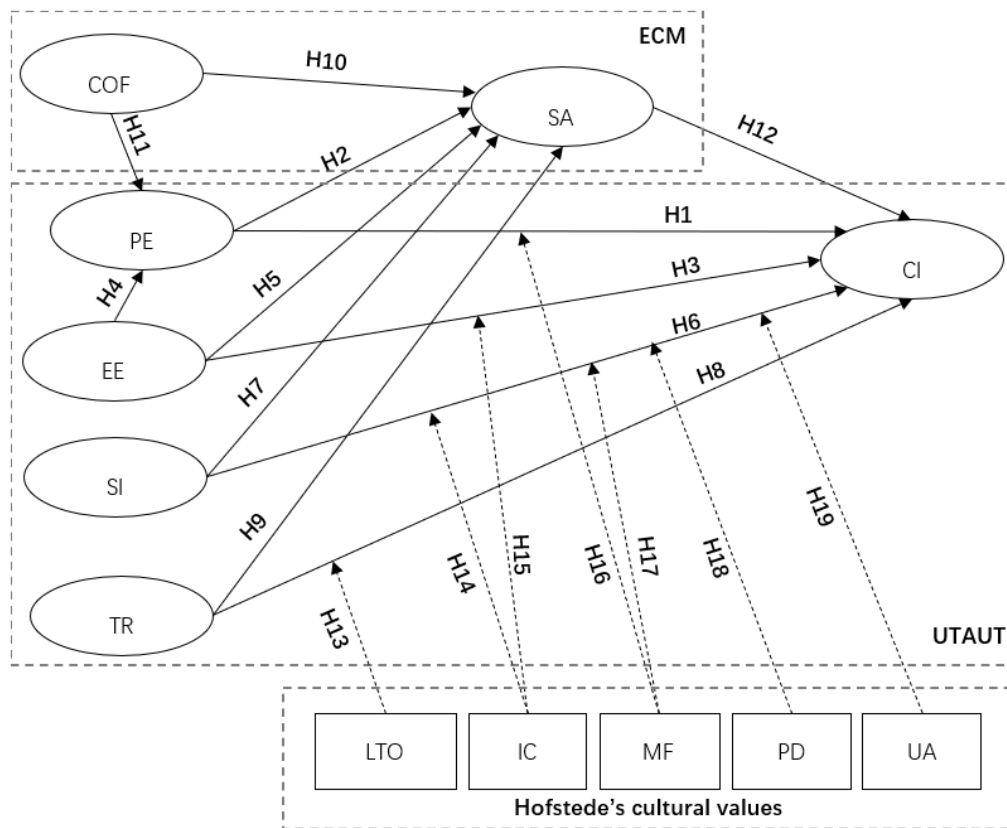
Uncertainty avoidance (UA) refers to the users' uncertainty and ambiguity from society's tolerance. In other words, people with higher uncertainty avoidance feel threatened by unpredictable and unknown situations and

require predictability through formal rules and supports (Hofstede, 1984). The social environment is a valuable determinant to reduce uncertainty by appropriate peer influence of personal experiences and perceptions (Srite and Karahanna, 2006). By this logic, social influence should be a stronger predictor of the behavioural intention of continuance usage of M-payments for individuals with high uncertainty avoidance values. Thus, social influence is strongly affected by the espoused uncertainty avoidance on M-payments continuance usage (Lu *et al.*, 2017). This paper proposes the following hypothesis:

H19: *The positive effect of social influence (SI) on continuance intention (CI) towards M-payments will be stronger for users with high Uncertainty avoidance (UA) values.*

5.3.3. Proposed research model

Based on the above hypotheses, all measurement items were modified to correspond with the research purposes and are presented in Appendix C table with relevant references. Moreover, the proposed model integrating UTAUT and ECM with Hofstede's cultural values as moderators is depicted in Figure 5.1.



(PE=Performance expectancy; EE=Effort expectancy; SI=Social influence; TR=Trust; COF=Confirmation; SA=Satisfaction; CI=Continuance intention; LTO=Long/short-term orientation; IC=Individualism/collectivism; MF=Masculinity/femininity; PD=Power distance; UA=Uncertainty avoidance)

Figure 5.1. Research model with proposed hypotheses relations

5.4. Recommendations for Future research

The future research of this study will need to consist of data collection, data analysis and discussion sections to explain factors influencing users' continuance intention to use M-payments under cultural values' moderation.

An online questionnaire survey is recommended for data collection. Specifically, the questionnaire can consist of two parts. The first part contains the respondents' demographic data with close-ended questions, including gender, age, education, occupation and M-payments experience. The second part is developed by implementing constructs and items from previous hypotheses and measured by a five-point Likert scale (from strongly disagree = "1" to strongly agree = "5"), which consists of 49 measurement items as indicators to explain perceived benefits, performance expectancy, effort expectancy, social influence,

trust, individualism/collectivism, masculinity/femininity, power distance, uncertainty avoidance long/short-term orientation and continuance intention. Afterwards, after removing the data with missing values, the valid data will be evaluated by Kolmogorov–Smirnov (K–S) test for non-response bias (Ryans, 1974) and Harman's one-factor test for common method bias (Podsakoff *et al.*, 2003).

Furthermore, measurement models and structural models are required to evaluate model assessment. Specifically, the measurement model needs to be assessed for construct reliability (composite reliability > 0.7; Cronbach's alpha > 0.7), indicator reliability (indicator loading >0.7), convergent validity (Average variance extracted > 0.5), and discriminant validity (Fornell-Larcker criteria, cross-loadings criteria and heterotrait-monotrait) to verify the fitness between indicators and latent variables. Moreover, the model fit must be assessed by the Standard root-mean-square residual (SRMR) and Normed fit index (NFI). In addition, the structural model must be examined, including the R² of endogenous variables and path coefficients of internal structure, to assess the explanatory power of the structural model and test the hypotheses. Accordingly, based on the results of the data analysis, the discussion section needs to evaluate the factors affecting users' continuance intention of using M-payments under cultural moderation effects and provide relevant theoretical and practical contributions.

5.5. Conclusion

This study is a theoretical development by proposing a comprehensive model integrating UTAUT and ECM with trust to explain users' continuance intention of using M-payment under cultural moderation effects. Moreover, the proposed model fills the gap of traditional adoption models only focusing on users' technological perception and limited studies on continuance intention of using technology under cultural moderation. Meanwhile, this study also provides an overview of a future study to assess the proposed model. In addition, the proposed model and measurement in this study can be used as a reference for relevant studies.

6. Chapter 6 - Theoretical Development: Extending the Flow Theory with Variables from the UTAUT2 Model

6.1. Introduction

With the significant development of information technology, the global business climate has changed dramatically from traditional social commerce to online commerce towards mobile commerce in recent two decades. Examples of this burgeoning phenomenon are that Mobile payment technology has been widely adopted in various industries (Morosan and DeFranco, 2016; Hossain and Zhou, 2018; Oliveira *et al.* 2016); catering service has transformed from traditional eat-in to online-to-offline order and delivery service (Zhao and Bacao, 2020); and traditional brick-and-mortar shopping has developed to online shopping towards live-streaming shopping (Wongkitrungrueng and Assarut, 2018). Customers' consumption habits have changed by increasingly interacting with information technology (Zhao and Bacao, 2020). Thus, investigating the antecedents determining users' adoption intention of information technologies is becoming progressively crucial for relevant business stakeholders to extend markets and manage business strategy. A variety of prior works of literature have investigated the factors influencing customers' intention of using information technology in various contexts (Morosan and DeFranco, 2016; Hossain and Zhou, 2018; Zhao and Bacao, 2020; Wongkitrungrueng and Assarut, 2018). However, previous studies unilaterally analysed users' adoption intention from technological perceptions or mental expectations, respectively (Wongkitrungrueng and Assarut, 2018; Venkatesh *et al.*, 2012).

Moreover, several studies involved perceived flow into adoption models as a mediating variable to illustrate customers' mental cognition to connect the perceptions and behavioural intention (Hossain and Zhou, 2018; Chen and Lin, 2018). Therefore, the current study aims to develop the Flow theory by integrating the variables from the revised Unified

Theory of Acceptance and Use of Technology 2 (UTAUT2) model as technological perceptions (Venkatesh *et al.* 2012), in turn formulating customers' mental cognition and concentration (including flow and satisfaction) (Csikszentmihalyi, 1975; Pereirai *et al.*, 2016), towards determining adoption intention. The proposed model is applied to investigate customers' behaviour from perceptive determinants to affective engagement towards intentional reaction on new information technology adoption.

In addition, in order to comprehensively understand users' adoption intention, the following sections are addressed in this study to develop the theoretical framework: section two includes reviewing of theoretical background; section three and section four contains hypotheses and model development; section five proposes a future research demonstration; section six demonstrates the conclusion and contributions.

6.2. Theoretical backgrounds

6.2.1. Flow theory

Csikszentmihalyi (1975) initially proposed the Flow theory for explaining the particular mental state of people. Flow reflects the level of concentration engaged in a certain activity, which is influenced by a loss of self-awareness, internal enjoyment, human-machine, and self-reinforcement to filter out other unrelated perceptions (Csikszentmihalyi, 1975). When users apply a specific information technology, the flow state represents their holistic feeling of total involvement and immersive experience, which is influenced by the perceptions of the technology's features and sense of interacting with a machine (Hossain and Zhou, 2018). Meanwhile, flow is validated as significantly formulating users' engagement in using information technology in different contexts, e.g., mobile payment systems (Zhou, 2013; Gao *et al.*, 2015) and live streaming applications (Chen and Lin, 2018). Furthermore, flow theory has been modified in prior literature by incorporating different theoretical frameworks to investigate information technology adoption from the users' dimension. Examples of this include integrating with the IS success model to investigate customers' usage intention of mobile

payments (Zhou, 2013); combining with TAM to explain users' adoption intention of online games (Kim *et al.*, 2013); and coordinating with the stimulus-organism-response framework to examine consumers' purchase intention of mobile payment (Hossain and Zhou, 2018). Wherein, flow plays a role as a mediating variable, reflecting users' perceptions of technological features and, in turn, determining users' mental cognition and emotion towards formulating psychological reaction or actual behaviour, such as adoption intention, continuance usage (Zhou, 2013; Gao *et al.*, 2015; Chen and Lin, 2018; Hossain and Zhou, 2018). Accordingly, this study defines flow as the mental cognition and affection state of customers engrossed in using information technology that is not easily disturbed by the outside world, and it contains the mediating effect that responds to users' technological perceptions, reflecting users' mental cognition towards determines users' adoption intention.

6.2.2. Unified Theory of Acceptance and Use of Technology 2

UTAUT2 reflects social cognition theory, designed by Venkatesh, Thong and Xu (2012) as an advanced version of UTAUT to predict users' adoption intention of information technology (Venkatesh *et al.* 2012). Moreover, the UTAUT2 model can be revised by extending or subtracting variables to analyse users' adoption intention of information technology in a particular situation appropriately, such as excluding price value and adding privacy to investigate mobile payment adoption (Morosan and DeFranco, 2016) or adding cultural moderators to predict mobile banking adoption (Baptista and Oliveira, 2015). Moreover, the UTAUT2 model has been revised by integrating with other theoretical models to analyse the antecedents of information technology adoption comprehensively. For example, integrating with Diffusion of Innovation models to investigate mobile payment adoption (Oliveira *et al.* 2016); cooperating with Expectancy Confirmation Model and Task-Technology fit model to explain food delivery apps adoption (Zhao and Bacao, 2020). Therefore, the majority of users' technological perceptions can be reflected by the variables of the UTAUT2 model, as the extension of Flow theory with synthetical determinants, to formulate users' adoption intention of information technology.

6.3. Hypotheses development

6.3.1. Independent variables from UTAUT2

Performance expectancy (PE)

PE refers to users' perceived usefulness when using a particular technology, which can improve their performance in a certain activity (Venkatesh *et al.*, 2012). When service provided from relevant information technology meets users' expectations, they will tend to adopt it, which has been verified in various contexts, like mobile banking (Yuan *et al.*, 2016), mobile payment (Di Pietro *et al.*, 2015) and mobile internet (Venkatesh *et al.* 2012). Thus, PE formulates customers' mental cognition with a positive attitude of utilisability. Hossain and Zhou (2018) validated that when customers feel a certain technology can increase the efficiency of a particular activity, they will feel more engaged in using that technology (Hossain and Zhou, 2018). Moreover, as an affective expectation, satisfaction is partially conceptualised when users are satisfied with the performance of the service provided by the information technology (Marinković *et al.*, 2020). Therefore, PE significantly determines customers' satisfaction when adopting a new technology (Yuan *et al.*, 2016; Marinković *et al.*, 2020). Consequently, two hypotheses are formulated as follows:

H1: The effect of PE positively affects flow on information technology adoption.

H2: The effect of PE positively affects satisfaction on information technology adoption.

Effort expectancy (EE)

The definition of EE is the degree of users' perceived easiness when they participate in a particular information technology usage (Venkatesh *et al.*, 2012). When users' perceive a technology has an understandable interface, operating system, and accessible service, they will formulate a positive attitude to use the new information technology. This factor means that users' psychological cognition is formulated by perceived ease of the relevant technology, which can be summarised that customers' perceived flow is positively influenced by EE (Hossain and Zhou, 2018; Kim *et al.*,

2013). Moreover, EE has also been proven to positively influence PE when users tend to adopt new information technologies (Di Pietro *et al.*, 2015; Yuan *et al.*, 2016). In addition, satisfaction as a further cognitive reflection has also been confirmed by Marinković, Đorđević and Kalinić (2020) that significantly influenced by the perceived easiness of usage (Marinković *et al.*, 2020). This aspect means that when users feel the new technology is easy to operate, their mental requirements will be easier to meet. The effects of EE are concluded in the following hypotheses:

H3: The effect of EE positively affects flow on information technology adoption.

H4: The effect of EE positively affects PE on information technology adoption.

H5: The effect of EE positively affects satisfaction on information technology adoption.

Social influence (SI)

The definition of SI in technology adoption is “the degree to which an individual perceives that significant others believe he or she should use the new system” (Venkatesh *et al.*, 2012). SI considerably explains users’ adoption intention of information technology (Morosan and DeFranco, 2016), which can be summarised that the recommendation and support from relevant important people can decrease the uncertainty and anxiety of using a new information technology when users are not yet familiar with it (Yuan *et al.*, 2016). Moreover, users’ mental flow state can be formulated by users’ social recommendations and interactions (Park and Lin, 2019). Thus, SI formulates users’ attitude of accepting a new information technology and accelerates users’ engagement towards influencing users’ satisfaction (Chen and Lin, 2018; Kim *et al.*, 2013). Therefore, this paper proposes that SI significantly affects users’ flow and satisfaction from the influence of important relevant people, shown in the following hypotheses.

H6: The effect of SI positively affects flow on information technology adoption.

H7: The effect of SI positively affects satisfaction on information technology adoption.

Hedonic motivation (HM).

Based on the concept of UTAUT2, HM is proposed as the degree of customers' apperceptive pleasure or joy when using an information technology (Venkatesh *et al.*, 2012). HM significantly formulates mental perception of relevant information technology, which indicates that users will emerge with a higher acceptance attitude towards impacting positive adoption intention once they acquire higher entertainment value (Chen and Lin, 2018). This result is confirmed in various information technology adoption literature, such as mobile banking (Baptista and Oliveira, 2015), mobile payment (Yuan *et al.*, 2016; Morosan and DeFranco, 2016), and mobile shopping apps (Tak and Panwar, 2017). Meanwhile, when users assume using an information technology can bring them pleasant and enjoyable feelings by interacting with a machine, they will acquire higher levels of engagement (Wongkitrungrueng and Assarut, 2018). Thus, HM represents customers' enjoyment, concentration and curiosity, positively formulating users' mental state of flow (Chen and Lin, 2018).

Moreover, HM is one of the antecedents of customers' mental expectations, which in turn formulates users' satisfaction when they tend to adopt a new information technology (Kerviler *et al.*, 2016). Chen and Lin (2018) confirmed that entertainment and enjoyment play a considerable role in explaining users' satisfaction (Chen and Lin, 2018). Therefore, according to previous works of literature, the following hypotheses are addressed:

H8: The effect of HM positively affects flow on information technology adoption.

H9: The effect of HM positively affects flow on information technology adoption.

6.3.2. Mediating variables

Flow

Flow describes a state of users' mental cognition and affection that fully concentrates on participating in a particular technology or activity (Csikszentmihalyi, 1975). When customers are engaged in using information technology, if the relevant technology can fill their perceived enjoyment, relaxation and pleasure, they will totally immerse into

interacting with the machine and difficultly be disturbed by outside irrelevant things (Hossain and Zhou, 2018). Thus, flow is considered a temporary experience of unawareness that shapes a positive attitude of engagement for customers, which influences their behavioural intention of adoption. Accordingly, flow directly contributes to a significant influence on the adoption intention of information technology (Zhou, 2013). Furthermore, flow establishes customers' satisfaction, in turn affecting their adoption intention (Chen and Lin, 2018; Zhou, 2013). Customers will feel more satisfied with the service quality and information quality when immersed in a certain technology (Gao *et al.*, 2015). Thus, the influences of flow on satisfaction and behavioural intention can be summarised in the following hypotheses:

H10: The effect of flow positively affects satisfaction on information technology adoption.

H11: The effect flow positively affects behavioural intention on information technology adoption.

Satisfaction

Satisfaction refers to customers' general psychological cognition that believing a certain technology can bring them a positive operating experience to meet their multi-dimensional expectations (Chen and Lin, 2018; Pereirai *et al.*, 2016). Satisfaction is positively impacted by engagement in using information technology (Wongkitrungrueng and Assarut, 2018). Thus, this study assumes satisfaction, as a mediating variable, reflects users' technological perceptions and experience of engagement, in turn formulating users' adoption intention of information technology, which corresponds with prior technology adoption literature in online purchase intention (Pereirai *et al.*, 2016), mobile payment adoption (Kerviler *et al.*, 2016; Park and Lin, 2019), and live streaming adoption (Chen and Lin, 2018). Accordingly, it can be demonstrated that satisfaction reflects customers' technological perceptions and mental engagement towards formulating customers' behavioural intention of adopting information technology, which generates the following hypothesis:

H12: The effect of satisfaction positively affects behavioural intention on information technology adoption.

6.4. Theoretical model development

Based on the above literature review and hypotheses development, Flow theory is theoretically developed by integrating four variables (performance expectancy, effort expectancy, social influence and hedonic motivation) from the revised UTAUT2 model as independent variables to measure customers' technological perceptions. Meanwhile, facilitating conditions, habit and price value are considered to be excluded in the proposed model because these variables require incorporating the actual adoption situation of a specific information technology and sufficient usage experience, respectively (Zhao and Bacao, 2020; Baptista and Oliveira, 2015). Moreover, the mediating variables are extended with flow and satisfaction to represent customers' engagement and mental cognitions, which reflect users' technological perceptions (Chen and Lin, 2018; Pereirai *et al.*, 2016; Park and Lin, 2019). Furthermore, customers' behavioural intention is assumed as a mental reaction, influenced by their mental process of adopting information technology (Venkatesh *et al.*, 2012). Specifically, according to the research objectives, the theoretical framework is developed based on the relevant studies with the demanded measurement constructs by extending the boundaries of flow theory with the revised UTAUT2 model to complementarily investigate external and internal antecedents determining customers' adoption intention of information technology. The proposed theoretical model is demonstrated in figure 6.1, with relevant causal relations of the hypotheses mentioned above and a postscript of abbreviations. Moreover, all measurement items are defined based on the relevant hypotheses and modified to adapt the proposed research model as presented in the table in Appendix D with the relevant references.

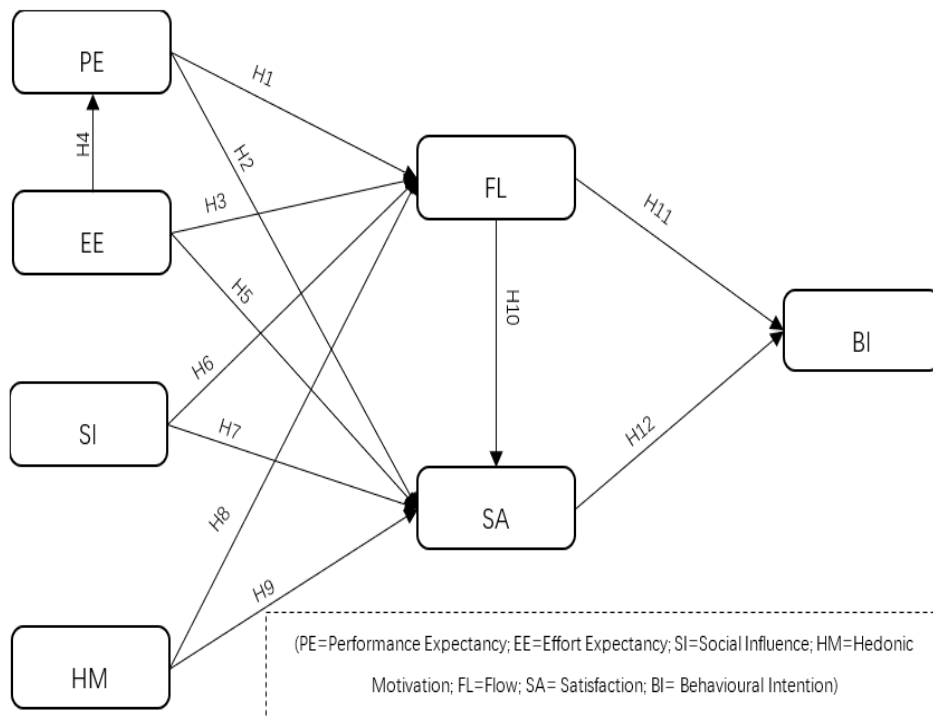


Figure 6.1. Research Model

6.5. Recommendations for future research

This study's future research will consist of data collection, data analysis, and discussion sections to verify the proposed theoretical model and explain the factors influencing users' adoption intention of information technology. An online questionnaire survey will be applied for data collection. Specifically, the questionnaire will be designed with two sections. The first section will involve close-ended questions for the respondents' demographic data, including users' gender, age range, educational background, and experience using information technology. The second section will be developed by implementing constructs and items for structural equation modelling based on previous hypotheses to explain performance expectancy, effort expectancy, social influence, hedonic motivation, flow, satisfaction and behavioural intention. A seven-point Likert scale (from strongly disagree = "1" to strongly agree = "7") will measure the relevant items from the table in appendix D with 29 measurement items as indicators. Afterwards, after removing the data with missing values, the valid data will be evaluated by the Kolmogorov–Smirnov test for non-response bias (Ryans, 1974) and Exploratory Factor

Analysis (EFA) will be applied by SPSS to evaluate common method bias in the dataset (Podsakoff *et al.*, 2002).

Furthermore, a covariance-based structural equation model will be applied using SPSS and AMOS through the two-step approach to evaluate the measurement model and structural model (Anderson and Gerbing, 1988). Specifically, in the measurement model, this paper will apply SPSS to implement EFA to examine the construct reliability (Cronbach's $\alpha > 0.7$). Meanwhile, Confirmatory Factor Analysis in AMOS will be applied to assess the convergent validity (factor loading >0.7 ; Composite Reliability >0.7 ; Average variance extracted (AVE) >0.5) and discriminant validity (square root of AVE should be greater than all correlations between any other pair of constructs) to verify the quality of measurement model. Moreover, the model fit will be assessed by the ratio of chi-square to degrees-of-freedom, comparative fit index, the goodness of fit index, adjusted goodness-of-fit index, normalised fit index, Tucker-Lewis index, and root mean square error of approximation. Afterwards, the structural model will be examined by AMOS with the maximum likelihood estimation method and bootstrapping technique. Specifically, the R^2 values of endogenous variables and path coefficients of the internal structure will be assessed to illustrate the explanatory power of the structural model and test the hypotheses.

In addition, based on the results of the data analysis, the discussion section will evaluate the factors affecting the adoption intention of information technology to verify the quality of theoretical development and provide relevant theoretical and practical contributions based on the specific information technology.

6.6. Conclusion and contributions

A theoretical development is proposed in this research by extending Flow theory with the revised UTAUT2 model to explain users' behavioural intention of adopting information technology. The proposed model fills the gap of traditional Flow theory, only focusing on users' mental perceptions by integrating variables from UTAUT2. Moreover, with the extension of mediating variables, flow and satisfaction, reflecting users' mental cognition and engagement, which conjointly explains users' adoption intention of information technology progressively. Specifically, this study

proposes that users' psychological processes, FL and SA, are influenced by their perceived technological perceptions, PE, EE, SI and HM. Accordingly, this study proposes a comprehensive model to contribute a complementary research idea for explaining factors determining users' adoption intention of various information technology.

Furthermore, corresponding to the sharp development of information technology involved in various business industries, the factors affecting customers' adoption intention of information technology has attracted growing attention by researchers and relevant business stakeholders. Consequently, this study contributes a theoretical foundation to analyse customers' mental processes determined by technological perceptions critically. Moreover, the current study extends the Flow theory with the revised UTAUT2 variables and satisfaction to fill the gap of Flow theory which insufficiently explains users' technological perceptions.

Furthermore, this study also contributes with an overview of the methodology process and measurement process to assess the proposed theoretical framework, which encourages future studies to modify and apply in different information technology adoption based on specific situations. In addition, the proposed research model and measurement method can be applied as a reference for relevant business stakeholders to analyse the customers' adoption intention to better understand users' behaviours and establish an enhanced appropriate business strategy.

7. Chapter 7 – How does gender moderate customer intention of shopping via live-streaming apps during the COVID-19 pandemic lockdown period?

7.1. Introduction

Live streaming commerce, as a burgeoning e-commerce pattern, with unique features of real-time live-streaming demonstration of products and instant interactions among sellers and viewers, provides personalised services for customers remotely (Wongkitrungrueng and Assarut, 2018). Meanwhile, based on the broad application of telecommunication networks and extensive adoption of mobile devices, live streaming shopping apps (LSSAs) have furnished an immersive experience for viewers (Sun *et al.*, 2019), which formulated a new consumption phenomenon, shopping via LSSAs, especially in the e-commerce industry in recent years in China. According to a report from iiMedia (2020), live streaming commerce industry transactions were estimated to exceed 129 billion USD in 2020 from 61 billion USD in 2019. Wherein 2019, only considering the Taobao e-commerce platform, over 60,000 live streaming shows hosted by brands or stores or celebrities attracted more than 400 million consumers (Taobangdan, 2019). Shopping via LSSAs has established an entertainment environment for customers to facilitate the revolution of commerce. Especially under the lockdown measures for defending COVID-19 transmission, interaction and entertainment were in significant demand by individuals. Despite several previous studies demonstrating that the adoption of LSSAs was influenced by the motivations of participants (Cai *et al.*, 2018; Cai and Wohn, 2019), technology features (Wu, 2017), and human-computer interaction (Sun *et al.*, 2019), few studies have focused on the customer's psychological process under the age and gender moderating effects in a particular environment. LSSA is an entertaining mobile commerce

application, and its adoption should take age and gender moderating effects into consideration (Yu *et al.*, 2018).

Consequently, the objective of the current study is to investigate customers of different ages and genders' psychological processes when shopping via LSSAs in the COVID-19 epidemic lockdown situation. The proposed model embeds the revised Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) as a stimulus, and Flow theory as an organism, into the stimulus-organism-response (SOR) framework. Wherein, the SOR framework, as the main structural foundation of the research model, explains that customers' psychological processes of behaviours are determined by external antecedents and internal cognitions (Peng and Kim, 2014; Hossain and Zhou, 2018; Wu and Li, 2018; Kim, Lee and Jung, 2020). UTAUT2, as a theoretical framework, has coordinated consumer-oriented perceptions to predict users' behavioural intentions (Venkatesh, Thong and Xu, 2012), which is legitimately considered a perceptive process to explain customers' perceptions of LSSAs to constitute stimulus components. Flow theory supports organisms theoretically by representing participants' concentration and engagement in shopping activities via LSSAs (Csikszentmihalyi, 1975). These theoretical frameworks are initially integrated and verified in this study, supporting relevant researchers and stakeholders to understand customers' behaviours better.

The current study comprises eight sections investigating customers' psychological shopping processes via LSSAs under the pandemic lockdown condition. Section two consists of literature reviews of shopping via LSSAs and relevant theoretical frameworks. This section is followed by the research model and hypotheses development, which are presented in section three. Section four illustrates the method of data collection and data demographic distribution. Subsequently, section five presents the data analysis results. Furthermore, section six discusses the findings, and section seven illustrates the theoretical and practical implications. Finally, limitations and recommendations for future research and conclusion are outlined in sections eight and nine.

7.2. Theoretical background

7.2.1. Live streaming shopping apps (LSSAs)

The current LSSAs comprise e-commerce functions into live-streaming platforms with simultaneous and authentic consumption interactions between vendors and customers (Cai *et al.*, 2018; Cai and Wohn, 2019). Shopping via LSSAs can be divided into two patterns. One is consumption activities on mobile e-commerce apps with extensional live-streaming functions, such as Taobao and AliExpress and the other is shopping through LSSAs through a third-party e-commerce service, such as Tiktok and LiveMe (Cai and Wohn, 2019). Shopping via LSSAs has become a thriving new consumption phenomenon. Off-line consumption activities were restricted, especially under the lockdown conditions during the COVID-19 pandemic. Shopping via LSSAs supported customers' daily supply and demand requirements and provided a relaxation pattern during the quarantine time to formulate a positive perception to users. Cai *et al.* (2018) claimed that customers' decisions to shop via live streaming are not only influenced by utilitarian perceptions of service and production but also determined by hedonic motivation. According to the entertainment feature of live-streaming, viewers' engagement and gratification significantly affected their shopping activities (Sjöblom and Hamari, 2017). Based on LSSA's conspicuous human-machine interaction, the affordance of LSSAs and customers' engagement conjointly determine customers purchasing via LSSAs (Sun *et al.*, 2019). Meanwhile, previous studies have found that customer's endorsement and behavioural responses to LSSAs were observably determined by their intrinsic and extrinsic motivations, social influence, entertainment, perceived flow, and emotional engagement (Chen and Lin, 2018; Zhao *et al.*, 2018; Lim *et al.*, 2020). Accordingly, customers' mental perceptions, such as trust and perceived value, have significantly influenced the engagement of using live streaming commerce (Wongkitrungrueng and Assarut (2018). Moreover, the simultaneity, authenticity, interactivity and customisability characteristics of LSSAs significantly formulate customers' perceived technological perceptions towards affecting their behaviour (Ho and Yang, 2015; Wu, 2017). However, prior literature has investigated customers' psychological shopping processes via LSSAs

under a specific condition insufficiently. Moreover, the moderating effects of age and gender might lead to the opposite results in different market segmentation (Marinković, Đorđević and Kalinić, 2020). Thus, it is meritorious to clarify the differences of age and gender moderating customers' mental shopping processes via LSSAs in the pandemic lockdown situation.

7.2.2. Stimulus-organism-response (SOR) framework

The SOR framework demonstrates that external antecedents influence customers' psychological processing, as a perceptive stimulus, affecting their cognitive and emotional reflections, as an organism, towards formulating their mental or behavioural traits, as responses, such as attitude, adoption intention, and actual usage (Mehrabian and Russell, 1974). The SOR framework has been modified with external variables to qualifiedly analyse the connections from the stimulus (environmental input) to the organism (mental process) towards response (behavioural outputs) to explain users' behaviours in various business analysis studies (Chen and Yao, 2018; Wu and Li, 2018), as well as innovative technology adoption works of literature (Hossain and Zhou, 2018; Kim, Lee and Jung, 2020; Zhao, Wang and Sun, 2020), which are demonstrated in Table 7.1. Kim, Lee and Jung (2020) assumed customers' actual experiences as a stimulus, cognition and affection (including enjoyment, emotional involvement and flow) as organisms, and attachment and intention as responses to investigate users' visiting intention of virtual reality tourism. Zhao, Wang and Sun (2020) proposed stimulus including interactivity, media richness and sociability, and assumed virtual experience as an organism including telepresence, social presence, and flow, which in turn determined students' continuance intention on using massive open online courses. Moreover, the SOR framework had been applied in investigating customers' online shopping intentions, which were significantly influenced by their attitude, which was affected by the internal and external environment (Peng and Kim, 2014). However, compared with traditional online shopping, streaming service quality and promotion campaigns played more significant roles in formulating customers' purchase intention via mobile shopping apps (Chen and Yao, 2018).

Furthermore, the moderating effects of age and gender have rarely been examined in the SOR framework. Despite a few previous studies partially involving the moderators in the SOR model, the results were presented inconsistently. Wu and Li (2018) found that gender had a significant moderating effect on customers' loyalty in online social commerce, against the findings from Islam and Rahman (2017). Therefore, this study proposes the SOR framework as the theoretical foundation to create the research model.

Table 7.1. Literature review of the SOR framework

STUDIES	TOPIC	STIMULUS	ORGANISM	RESPONSE
Chen and Yao, 2018	Mobile shopping	<ul style="list-style-type: none"> ● Ubiquity, ● Ease of use, ● Information exchange, ● Discounted price, ● Scarcity 	<ul style="list-style-type: none"> ● Impulsive buying tendency, ● Normative evaluation, ● Positive affect. 	<ul style="list-style-type: none"> ● purchase intention
Wu and Li, 2018	Social commerce	<ul style="list-style-type: none"> ● Structural capital ● Cognitive capital ● Relational capital ● Social identification ● Social influence ● Social commerce needs ● Social commerce risk ● Social commerce convivence 	<ul style="list-style-type: none"> ● consumer value 	<ul style="list-style-type: none"> ● consumer loyalty
Hossain and Zhou, 2018	Mobile payment	<ul style="list-style-type: none"> ● Usefulness, ● Emotion, ● Security. 	<ul style="list-style-type: none"> ● Flow 	<ul style="list-style-type: none"> ● Satisfaction ● Purchase intention
Kim, Lee and Jung, 2020	Virtual reality tourism	<ul style="list-style-type: none"> ● Actual experiences 	<ul style="list-style-type: none"> ● Enjoyment, ● Emotional involvement, ● flow 	<ul style="list-style-type: none"> ● Attachment, ● Visit intention
Zhao, Wang and Sun, 2020	Massive open online courses	<ul style="list-style-type: none"> ● Interactivity, ● Media richness, Sociability 	<ul style="list-style-type: none"> ● Virtual Experience: ● Telepresence, ● Social presence, ● flow 	<ul style="list-style-type: none"> ● Continuance intention

7.2.3. Unified Theory of Acceptance and Use of Technology 2 (UTAUT2)

UTAUT2 was developed by Venkatesh, Thong and Xu (2012). As an extension of the UTAUT model, UTAUT2 predicts users' technological perceptions determining their adoption intention of a particular technology. Several researchers have modified UTAUT2 in miscellaneous mobile technology adoption studies by extending it with additional variables or moderators. For example, trust (Slade *et al.*, 2015; Alalwan, Dwivedi and Rana, 2017), privacy (Morosan and DeFranco, 2016), and Hofstede's cultural values (Baptista and Oliveira, 2015; Chopdar and Sivakumar, 2019). Some studies have incorporated UTAUT2 with other theoretical frameworks, such as diffusion of Innovation (Oliveira *et al.*, 2016), expectation confirmation model (Tam,

Santos and Oliveira, 2020; Zhao and Bacao, 2020), in investigating customers' behaviours on mobile technology. Furthermore, UTAUT2 involves age, gender and experience as moderators to explain the individual differences in adoption intention (Venkatesh, Thong and Xu, 2012). Moreover, UTAUT2 was applied for mobile shopping applications' adoption by Tak and Panwar (2017), who found that hedonic motivation was the most significant antecedent, which corresponds with the current study's situation that LSSAs are entertaining mobile shopping applications. Therefore, UTAUT2 is considered the appropriate theoretical foundation for investigating users' perceptions as a stimulus in the proposed model.

7.2.4. Flow theory

Flow theory was initially proposed by Csikszentmihalyi (1975) to predict individuals' mental engagement in a certain activity. Subsequently, Flow theory's applicability has been extended into the human-computer interaction domain to describe users' absorption in technology (Webster *et al.*, 1993). Specifically, flow represents users' holistic, immersive consciousness when they concentrate entirely on a particular activity or technology; their involvement will be self-reinforced by constitutional enjoyment and engaging interactivity; in turn, their self-consciousness will become indistinct to ignore irrelevant interruptions (Csikszentmihalyi and Csikszentmihalyi, 1988). Flow has been applied as a mediator in various technology adoption studies to describe customers' cognition and engagement for predicting users' adoption intention (Hsu and Lu 2004; Zhou, 2013; Hossain and Zhou, 2018), especially in the fields of entertaining technologies, such as live streaming (Chen and Lin, 2018) and mobile shopping (Gao, Waechter and Bai, 2015). Flow is significantly influenced by users' technological perceptions (Zhou, 2013; Kim *et al.*, 2013), and mental determinants, such as emotion (Hossain and Zhou, 2018), trust (Gao, Waechter and Bai, 2015), enjoyment (Chen and Lin, 2018). Meanwhile, the combination of flow theory with other frameworks, such as the Information Systems Success Model (Zhou, 2013; Gao, Waechter and Bai, 2015), Stimulus-Organism-Response framework (Hossain and Zhou, 2018), also reasonably illustrated users' adoption intention. Thus, Flow theory is considered a theoretical foundation for

representing users' shopping engagement via LSSAs during the pandemic lockdown period as the organism in the proposed model.

7.2.5. Moderating effects of age and gender

According to the current research objectives, age and gender are proposed as moderating variables involved in the analysis process. Venkatesh, Thong and Xu (2012) initially confirmed that age and gender have moderating effects on the UTAUT2 constructs affecting users' adoption intention. Moreover, further other works of literature have integrated age and gender as moderators within various frameworks (UTAUT, Technology Acceptance Model (TAM), Diffusion of Innovation (DOI) Theory) and confirmed age and gender significantly moderated constructs in different contexts, respectively (Venkatesh and Zhang, 2010; Liébana-Cabanillas, Sánchez-Fernández and Muñoz-Leiva, 2014; Khalilzadeh, Ozturk and Bilgihan, 2017; Riskinanto, Kelana and Hilmawan, 2017; Shao *et al.*, 2018; Marinković, Đorđević and Kalinić, 2020). However, based on the differences in research objectives, sample targets, and involved variables in various scenarios, the moderating effects of age and gender have presented diversity in different literature. Venkatesh and Zhang (2010) validated that performance expectancy in the behavioural intention of information technology was significantly moderated by younger male users, and effort expectancy was strongly moderated by older female customers, which is contrary to the findings of Riskinanto, Kelana and Hilmawan (2017) claimed that state age had insignificant effects on perceived usefulness and ease of use on adoption intention of E-payment technology. On the other hand, Liébana-Cabanillas, Sánchez-Fernández and Muñoz-Leiva (2014) complementally illustrated that social influence bore strong influence on users above 35 years old and trust was more affected by younger groups in mobile payments adoption. Moreover, Shao *et al.* (2018) claimed that males had a stronger moderating effect on mobility and reputation in the trust formation process of mobile payments, while females moderated customisation and security on trust more. Likewise, Pascual-Miguel, Agudo-Peregrina and Chaparro-Peláez (2015) found that the moderating effects of female customers on effort expectancy and social influence were significantly stronger than male customers on online purchase intention. In order to analyse the moderating effects of age and gender on

all constructs in the proposed research model, a multi-group analysis is applied in this research, which is widely applied in previous studies for multi-group comparisons (Pascual-Miguel, Agudo-Peregrina and Chaparro-Peláez, 2015; Shao *et al.*, 2018; Marinković, Đorđević and Kalinić, 2020).

7.3. Development of research model and hypotheses

Based on the previous literature reviews, the integration of the SOR framework with UTAUT2 and Flow theory is considered the theoretical foundation to propose a comprehensive model for the investigation. Specifically, according to previous paradigms of the SOR framework application, this research extends the SOR framework by integrating variables from the revised UTAUT2 model proposed as stimulus components, roused by technological perceptions of LSSAs during the pandemic lockdown period (performance expectancy, effort expectance)(Islam and Rahman, 2017; Chen and Yao, 2018), social influence (Wu and Li, 2018), hedonic motivation (Kim, Lee and Jung, 2020) and trust (Kim, Lee and Jung, 2020). These variables reflect users' external and internal perceptions towards inciting their further psychological cognition. On the other hand, on account of the popularisation of smartphones, proficiency in using various mobile applications and no monetary cost to operate LSSAs, original variables, facilitating conditions, habit and price value, are excluded from the UTAUT2 model, which is in accordance with previous findings respectively (Baptista and Oliveira, 2015; Slade *et al.*, 2015; Alalwan, Dwivedi and Rana, 2017; Tam, Santos and Oliveira, 2020; Zhao and Bacao, 2020). Flow theory provides theoretical support to reflect customers' mental cognitive and affective intermediary states of shopping via LSSAs during the COVID-19 pandemic lockdown period, which is appropriate to assume as an organism in the SOR framework (Hossain and Zhou, 2018; Kim, Lee and Jung, 2020; Zhao, Wang and Sun, 2020). Moreover, this study proposes that perceived value and adoption intention reflects customers' psychological reactions and behaviours to constitute response elements of the SOR framework (Hossain and Zhou, 2018; Kim, Lee and Jung, 2020). In addition, age and gender are considered moderators in the theoretical model to compare the different effects of antecedents on customers' adoption intention of LSSAs in each

subgroup. The proposed research model is generalised and presented in Figure 7.1 with the relevant hypotheses relations.

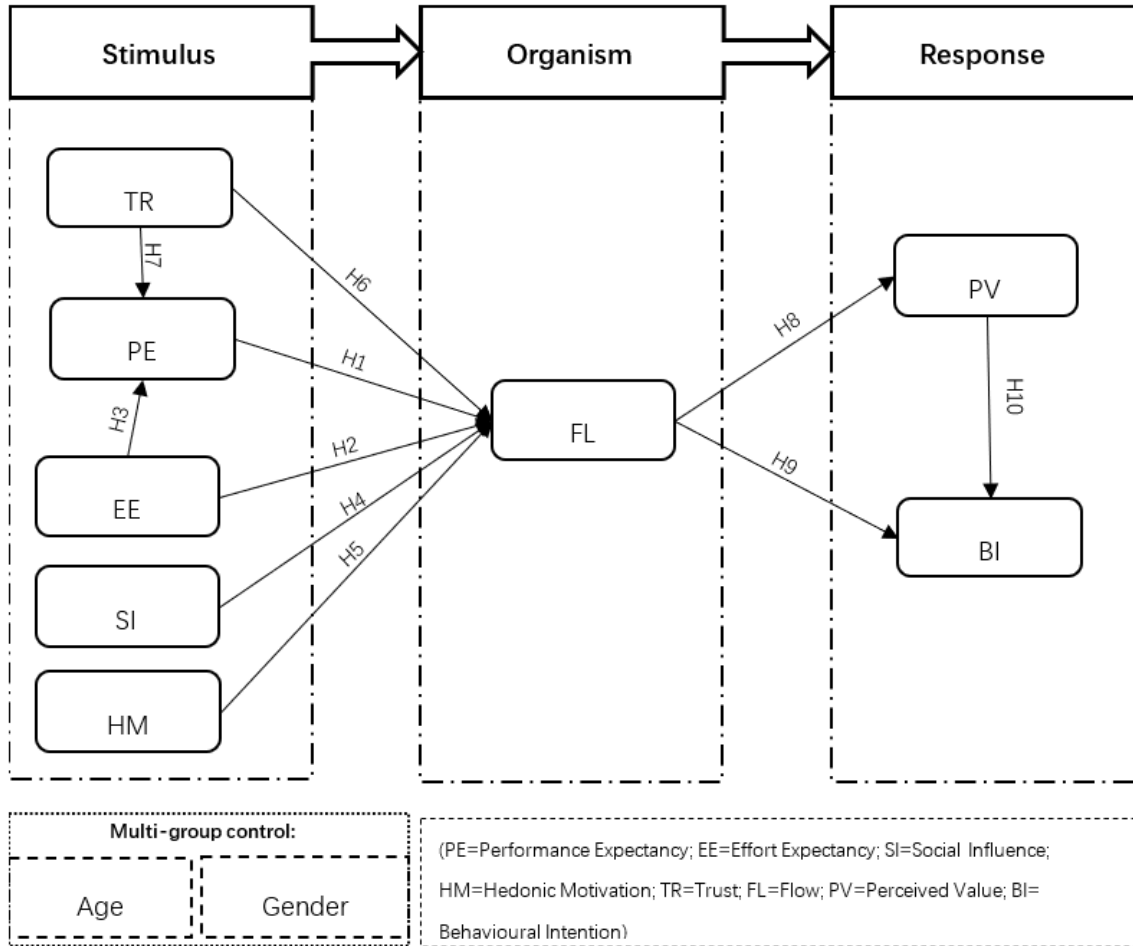


Figure 7.1. Proposed research model

7.3.1. Stimulus components: variables from the revised UTAUT2 model

Performance expectancy (PE), as a technological perception, represents users' perceived usefulness of a certain technology that can optimise their experience in a specific technology or reinforce their performance in particular activities (Venkatesh, Thong and Xu, 2012). Moreover, users' perceived technological features, like compatibility, service quality, information quality, and system quality, can be generalised as perceived usability of technology, represented as PE (Gu, Lee and Suh, 2009; Zhou, 2013; Di Pietro *et al.*, 2015). Related to technology adoption, PE

significantly formulates users' mental responses, like attitude, adoption intention, and continuance usage intention, which are confirmed by prior literature, respectively (Suh and Han, 2002; Oliveira *et al.*, 2016; Yuan *et al.*, 2016). Accordingly, customers' psychological cognitions are formulated by their perceptions of the satisfying usability, which indicates that PE significantly influences customers' perceived flow when they intend to adopt new technology (Kim *et al.*, 2013; Hossain and Zhou, 2018). Therefore, the hypothesis can be generalised as follow:

H1: Customers' performance expectancy (PE) as a stimulus positively determines the organism flow (FL) when shopping via LSSAs during the pandemic lockdown period.

Effort expectancy (EE), as a technological perception, expresses that users acquire feelings of easiness from understanding, operating and interacting with a specific information technology (Venkatesh, Thong and Xu, 2012). A variety of literature has verified EE's considerable effect on customers' attitude and behavioural intention in technology adoption research (Suh and Han, 2002; Di Pietro *et al.*, 2015; Riskinanto, Kelana and Hilmawan, 2017). Consequently, customers' engagement and flow experience are formulated by understandability, operability, and intractability (Hsu and Lu 2004; Kim *et al.*, 2013). On the other hand, the influence of EE has been confirmed by Kim *et al.* (2013) as not only affecting flow but also performance expectancy when users adopt entertainment technology. When customers recognise that a technology is easy to access, they will tend to confirm its usability. This phenomenon has been validated in various technology adoption works of literature, such as Live streaming (Ho and Yang, 2015), mobile banking (Gu, Lee and Suh, 2009; Yuan *et al.*, 2016; Alalwan, Dwivedi and Rana, 2017) and mobile payment (Di Pietro *et al.*, 2015; Liébana-Cabanillas, Ramos de Luna and Montoro-Ríosa, 2017). Thus, the hypotheses related to EE are proposed as follows:

H2: Customers' effort expectancy (EE) as a stimulus positively determines the organism flow (FL) when shopping via LSSAs during the pandemic lockdown period.

H3: Customers' effort expectancy (EE) as a stimulus positively determines performance expectancy (PE) when shopping via LSSAs during the pandemic lockdown period.

Social influence (SI), as an environmental perception, represents customers perceiving the influence from their relevant people, like close friends, family members and colleagues, who recommend and support them to use a certain technology (Venkatesh, Thong and Xu, 2012). Customers' anxiety is derived from new technology's uncertainty, which can be decreased by the influence of their close social network (Slade *et al.*, 2015). Various technology adoption studies have involved SI in theoretical frameworks and confirmed SI is an essential antecedent in determining customers' attitudes and behaviours (Kerviler, Demoulin and Zidda, 2016; Morosan and DeFranco, 2016; Khalilzadeh, Ozturk and Bilgihan, 2017; Chopdar and Sivakumar, 2019). Moreover, Chen and Lin (2018) claimed that the effect of SI dramatically formulated users' mental awareness of engagement when using live streaming. Accordingly, interacting with relevant people on a specific information technology can facilitate users' flow experience (Zhao, Wang and Sun, 2020). Hence, the current study proposes that users' flow experience of LSSAs is positively determined by SI, which formulated the following hypothesis.

H4: *Social influence (SI) as a stimulus positively determines the organism flow (FL) when shopping via LSSAs during the pandemic lockdown period.*

Hedonic motivation (HM) was initially adapted in UTAUT2 by Venkatesh, Thong and Xu (2012), which is conducted as the internal emotional perception that users perceive enjoyment and pleasure descend from their expectation or experience of a certain information technology. The directly positive effect of HM on adoption intention has been confirmed by prior researchers who applied UTAUT2 on mobile technology adoption, e.g. mobile payment (Morosan and DeFranco, 2016) and mobile banking (Baptista and Oliveira, 2015; Alalwan, Dwivedi and Rana, 2017).

Meanwhile, HM had been assumed as an antecedent also having a significant indirect effect on customers' behavioural intention. Yeo, Goh and Rezaei (2017) claimed HM formulated attitude via convenience motivation and post-usage usefulness when customers adopt online food delivery services. Likewise, engagement, as the main characteristic of users' flow experience, is formulated by enjoyment, curiosity, and concentration (Ghani and Deshpande, 1994; Moon and Kim, 2001).

Consequently, Wongkitrungrueng and Assarut (2018) validated HM directly and indirectly (through trust), formulating users' engagement in

live streaming commerce. Furthermore, Chen and Lin (2018) illustrated that live streaming's entertainment features formulated viewers' HM, which positively determined their mental affection of perceived value towards affected their final behavioural intention. Thus, the current study assumes that HM positively affects customers' engagement and affection in hypothesis 5.

H5: *Customers' hedonic motivation (HM) as a stimulus positively determines the organism flow (FL) when shopping via LSSAs during the pandemic lockdown period.*

Gefen (2000) defined trust (TR) as describing users' subjective awareness of believing a particular technology can fulfil obligations and positively guarantee a qualified performance to meet their expectations. Specifically, under the lockdown measures of the COVID-19 epidemic, trust reflected users' perceptions of technology characteristics, like mobility, security, etc., which correspond with perceived security against perceived risk and uncertainty conditions (Shao *et al.*, 2018). LSSAs' contactless online consumption functions, as a beneficial feature for the lockdown situation during the COVID-19 pandemic, formulated customers' perceived trust towards positively influenced enjoyable and practical cognitions (Khalilzadeh, Ozturk and Bilgihan, 2017). Accordingly, trust, as an essential variable to investigate users' behavioural intention, had been integrated into various adoption models, such as UTAUT2 (Slade *et al.*, 2015), TAM (Gu, Lee and Suh, 2009), IS success model (Zhou, 2013). Moreover, from the participation aspect, the interaction between customers and vendors on live streaming commerce facilitated users' perceived trust in sellers and products, which in turn optimised the engagement (Wongkitrungrueng and Assarut, 2018). Therefore, this paper proposes that trust formulates users' engagement and cognitive acceptance towards positively influencing flow (Zhou, 2013; Gao, Waechter and Bai, 2015). Meanwhile, as an antecedent of users' utilitarian perceptions, trust positively facilitates customers' performance expectancy stimulus (Gu, Lee and Suh, 2009; Alalwan, Dwivedi and Rana, 2017). Hence, the following hypotheses are addressed.

H6: *Trust (TR) as a stimulus positively determines the organism flow (FL) when shopping via LSSAs during the pandemic lockdown period.*

H7: *Trust (TR) as a stimulus positively determines performance expectancy (PE) when shopping via LSSAs during the pandemic lockdown period.*

7.3.2. Organism component: Flow (FL)

Csikszentmihalyi (1975) defined flow as an individual's cognition and affection of intrinsic absorption in a particular activity or technology. Flow experience of technology was described as users' temporarily unawareness derived by their internal enjoyment, pleasure, engagement, and interaction with a certain technology (Gao, Waechter and Bai, 2015; Chen and Lin, 2018). Moreover, the lockdown measure provided an appropriate environment to enhance an individual's immersive shopping experience via LSSAs at home. Various technology adoption studies have validated that flow was significantly formulated by users' technological perceptions towards positively determining their behavioural intention of adoption or continuance usage (Zhou, 2013; Gao, Waechter and Bai, 2015; Lim et al., 2020). Consequently, flow is in accordance with the conception of an organism, which is assumed as a mediator connecting technological and environmental stimuli and responses in shopping via LSSAs.

Flow has been examined by previous researchers as also having an indirect effect on users' final responses, like adoption intention, actual usage, continuance intention, via users' mental reflection variables, perceived value, satisfaction, attitude (Hung *et al.*, 2010; Kim *et al.*, 2013; Chen and Lin, 2018). Meanwhile, the effects of flow and mental reflections had been validated to determine customers' behavioural intentions conjointly in various pieces of literature (Zhou, 2013; Gao, Waechter and Bai, 2015; Hossain and Zhou, 2018). Chen and Lin (2018) claimed that flow positively affected perceived value towards formulated customers' usage intention of live-streaming. Therefore, the following hypotheses are proposed:

H8: *Customers' flow (FL) as an organism positively determines the response perceived value (PV) when shopping via LSSAs during the pandemic lockdown period.*

H9: *Customers' flow (FL) as an organism positively determines the response behavioural intention (BI) when shopping via LSSAs during the pandemic lockdown period.*

7.3.3. Response components: Perceived value (PV) and Behavioural intention (BI)

Perceived value (PV), as defined by Zeithaml (1988), represents customers' universal assessments of a service or technology. PV is determined by users' perceptions of acquisition and investment. Sweeney and Soutar (2001) extended the dimensions of perceived value, including quality and price of production, customers' emotional responses, and social influence. Meanwhile, Petrick (2002) modified behavioural price, monetary price, emotional response, quality, and reputation to emerge as other dimensions of PV. PV also represents customers' perceived multi-dimensional benefits, including utilitarian, hedonic and social perspectives (Kim, Kim and Wachter, 2013; Kerviler, Demoulin and Zidda, 2016). Specifically, in this study, perceived value represents the customers' general mental responses to shopping via LSSAs during the COVID-19 pandemic lockdown period. Perceived value has been assumed as a cognitive variable in various adoption models, such as the Expectation Confirmation Model (Hsu and Lin, 2015), Value-based Adoption Model (Kim, Chan and Gupta, 200) and Mobile user Engagement Model (Kim, Kim and Wachter, 2013), which positively determines customers' behaviours. On the other hand, Chen and Lin (2018) confirmed that perceived value, as a conative factor, was determined by flow and, in turn, formulated users' behaviours. Therefore, this study proposes that perceived value, as customers' conational response, constitutes one component of the responses, which is demonstrated in the following hypothesis.

H10: *Customers' perceived value (PV) positively determines behavioural intention (BI) when shopping via LSSAs during the pandemic lockdown period.*

7.4. Methodology and data demographic distribution

7.4.1. Measurement

Quantitative methodology is applied in this study to evaluate the proposed model. An online questionnaire survey was conducted to collect data in China, which included two parts. The first part demonstrated demographic information (consisting of gender, age and frequency of using LSSAs during the COVID-19 pandemic lockdown period) of participants with Dichotomous, Bounded continuous and Ordinal-polytomous close-ended questions; the second part consisted of a seven-point Likert scale (from strongly disagree = "1" to strongly agree = "7") structural questions to evaluate performance expectancy (PE), effort expectancy (EE), social influence (SI), hedonic motivation (HM), trust (TR), flow (FL), perceived value (PV) and behavioural intention (BI) with 34 measurement items referred from previous literature, shown in Appendix E with Chinese translation.

The questionnaire was designed and managed in English. Then equivalently translated into the Chinese language by language experts to avoid the biases of language and culture because the target population of the survey was smartphone users in China. Afterwards, according to the translation-back translation method, it was reversely translated into the English language. In order to minimise the non- Response rate, a short introduction and respondent-friendly survey questionnaire techniques were applied in the survey (Lynn, 2008).

7.4.2. Data collection

The online questionnaire was designed via Wenjuan.com (a Chinese online survey platform). According to the formulae from Westland (2010) and the numbers of 34 observed indicators and eight latent variables in the proposed model, the recommended minimum sample size for the model structure was 91. The questionnaires were distributed via online and WeChat (Chinese mobile social media application) on 9 August 2020 for data collection. After four weeks of data collection, 400 empirical data were collected on 6 September 2020, of which 138 were derived from online responses and 262 via WeChat. After filtering out the responses

with missing values in a scrutinising process, 374 valid data were accepted for data analysis, which obtained a 93.5% final response rate. The Kolmogorov-Smirnov test was applied to examine the early respondents' group with 100 participants and the late respondents with 274 participants. This test confirmed no statistical difference between the two independent groups (Ryans, 1974). Meanwhile, the Shapiro-Wilk test of the demographic data, age, gender and frequency of shopping via LSSAs were 0.636, 0.862 and 0.918, and all showed a significant level of 0.000, which indicated the data was nonnormally distributed.

7.4.3. Data demographic characteristics

The data was collected via online and WeChat randomly, and the geographical distribution of respondents consisted of 43.5%, 13.1%, 3.5% located in Henan, Guangdong and Shandong provinces, respectively, the top three largest population Chinese provinces, which represented general smartphone users in China. Wherein 51.87% female and 48.13% male smartphone users participated in the survey. The largest age group was adults between 21-35 with 27.01%, and the age range of participants younger than 36 comprised 51.07%, with the group over 35 years old being 48.93%. These figures are consistent with the QusetMobile report (2020) that users between 19 and 35 years old were the leading group of shoppers via LSSAs in China. Moreover, 24.06% of participants used LSSAs at least once per week. More than 39% of respondents shopped via LSSAs every week. Table 7.2 presents the specific demographic distribution of participants.

Table 7.2. Demographic distribution of participants

Measure	Item	N	%
Gender	Male	180	48.13%
	Female	194	51.87%
Age	<20	90	24.06%
	21-35	101	27.01%
	36-50	96	25.67%
	>51	87	23.26%
Frequency of using LSSAs during the COVID-19 pandemic lockdown period	At least 1 time per 1 day	59	15.78%
	At least 1 time per 1 week	90	24.06%
	At least 1 time per 2 weeks	81	21.66%
	At least 1 time per 1 month	55	14.71%
	At least 1 time per 3 months	41	10.96%
	At least 1 time per 6 months	29	7.75%

	Never used during the pandemic lockdown period	19	5.08%
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7.5. Data analysis

As the proposed model was generated based on a solid theoretical foundation, structural equation modelling is appropriate to operationalise the hypothesised latent constructs and associated indicators for the theory development (Hair, Gabriel and Patel, 2014). Besides minimising the difference between the observed and estimated covariance matrices, covariance-based structural equation modelling (CB-SEM) applies a maximum likelihood procedure to assess correlations among all constructs and their interactive effects simultaneously (Hair *et al.*, 2010; Bagozzi and Yi, 2012). Meanwhile, the proposed model in this study consists of mediating variables and moderators. The CB-SEM approach is well performed to assess models involving mediation and moderating effects (Bagozzi and Yi, 2012; Hair, Gabriel and Patel, 2014). CB-SEM performs highly accurately with sum scores than both PLS-SEM and regression in a small sample size (Goodhue, Lewis and Thompson, 2012). Meanwhile, CB-SEM presents more accurately than PLS-SEM for nonnormally distributed data with a sample size over 50 (Jannoo *et al.*, 2014). CB-SEM provides optimal coefficient estimates and more accurate model analyses to evaluate research models (Gefen, Straub and Boudreau, 2000). Moreover, the two-step approach, consisting of the measurement model assessment and structural model evaluation, proposed by Anderson and Gerbing (1988), is applied in this study. Specifically, the CB-SEM technique is conducted for confirmatory factor analysis (CFA) to assess the convergent and discriminant validity for each construct in the measurement model assessment and to evaluate the path coefficient to test hypotheses with a comparison of differences between age (<36 VS >35) and gender (Male VS Female) sub-samples in the structural model evaluation by AMOS.

Before implementing the two-step approach, The Exploratory Factor Analysis (EFA) was applied by SPSS to evaluate the dataset adequacy. The Kaiser criterion and scree plot were applied to identify the number of underlying extractive factors. The Kaiser test obtained an eight-factor solution with eigenvalues larger than 1, and the first inflexion point was located at the 9th point in the scree plot. The results indicate that eight

factors can be extracted, which is aligned with the proposed model (Cattell, 1966).

7.5.1. Measurement Model

Firstly, the reliability and validity of the measurement model were assessed by the following criteria, construct reliability was confirmed by Cronbach's alpha (CA). The CAs of all constructs exceeded 0.70 (Nunnally and Bernstein, 1994), convergent validity was validated by factor loadings above 0.7 (Henseler *et al.*, 2014), Composite Reliability (CR) exceeded 0.7. Average Variance Extracted (AVE) exceeded 0.5 (Fornell and Larcker, 1981), discriminant validity was qualified by the square root of AVE of each latent construct exceeding any two pairs of its inter-construct correlation (Fornell and Larcker, 1981), and the AVE was higher than the maximum shared squared variance (MSV) of each construct (Hair *et al.*, 2010). The constructs' CA, CR, AVE, MSV, and factor loading of items results are presented in Table 7.3. Table 7.4 displays the results of the square root of AVE and correlations of each latent construct. The values of the results reached the relevant recommended threshold of each criterion, respectively. Therefore, the reliability and validity of the measurement model were confirmed for further assessment.

Moreover, the model-fit of measurement model shown in table 7.5 was validated by the goodness-of-fit results meeting the standards of each index (Gefen, Straub and Boudreau, 2000). Namely, the ratio of chi-square to degrees-of-freedom ($X^2/df < 3$), comparative fit index (CFI > 0.9), the goodness of fit index (GFI > 0.8) (Doll, Xia, and Torkzadeh, 1994), adjusted goodness-of-fit index (AGFI > 0.8)(Gefen, Straub and Boudreau, 2000), normalised fit index (NFI > 0.9), Tucker-Lewis index (TLI > 0.9), root mean square error of approximation (RMSEA <0.08) (Bollen, 1989).

Furthermore, the potential common method bias of this study was evaluated by Harman's one-factor test and the fitness of a single-factor model. The result of Harman's one-factor test is 49.63%, which meets the criteria proposed by Podsakoff *et al.* (2003) that the largest variance of one factor should be below 50% to confirm that a single factor cannot explain the majority of the variance. The fitness results of a single-factor

model are shown in Table 7.5, which illustrates the unqualified model fit of a single-factor model.

Based on the previous assessments, the measurement model is eligible for further structural model evaluation.

Table 7.3. Latent constructs' CA, CR, AVE, MSV, and items' factor loading

Factors	CA	CR	AVE	MSV	Items	Loadings
Performance expectancy (PE)	0.943	0.943	0.807	0.510	PE1	0.875
					PE2	0.912
					PE3	0.905
					PE4	0.899
Effort expectancy (EE)	0.935	0.932	0.820	0.326	EE1	0.896
					EE2	0.874
					EE3	0.916
					EE4	0.858
Social influence (SI)	0.949	0.936	0.785	0.264	SI1	0.896
					SI2	0.904
					SI3	0.925
					SI4	0.902
Hedonic motivation (HM)	0.946	0.949	0.822	0.416	HM1	0.868
					HM2	0.89
					HM3	0.909
					HM4	0.869
					HM5	0.869
Trust (TR)	0.948	0.946	0.776	0.412	TR1	0.905
					TR2	0.883
					TR3	0.873
					TR4	0.898
					TR5	0.873
Flow (FL)	0.965	0.948	0.786	0.446	FL1	0.911
					FL2	0.923
					FL3	0.930
					FL4	0.910
					FL5	0.927
Perceived value (PV)	0.943	0.965	0.847	0.510	PV1	0.882
					PV2	0.901
					PV3	0.909
					PV4	0.900
Behavioural Intention (BI)	0.923	0.923	0.800	0.394	BI1	0.892
					BI2	0.892
					BI3	0.899

(CA= Cronbach's alpha; CR=Composite Reliability; AVE=Average Variance Extracted; MSV=maximum shared squared variance)

Table 7.4. Latent constructs' square root of AVE and correlation

	PV	PE	EE	SI	HM	TR	FL	BI
PV	0.898							
PE	0.571	0.905						
EE	0.514	0.416	0.886					
SI	0.645	0.408	0.427	0.907				
HM	0.642	0.422	0.463	0.551	0.881			
TR	0.668	0.506	0.460	0.565	0.535	0.886		
FL	0.714	0.523	0.470	0.599	0.592	0.635	0.920	
BI	0.608	0.494	0.486	0.538	0.541	0.600	0.628	0.894

Table 7.5. The Model-fit of each model.

	X²/DF	CFI	GFI	AGFI	NFI	TLI	RMSEA
RECOMMEND VALUE	<3	>0.9	>0.8	>0.8	>0.9	>0.9	<0.08
SINGLE-FACTOR MODEL	12.471	0.526	0.398	0.360	0.505	0.525	0.175
MEASUREMENT MODEL	1.166	0.994	0.918	0.902	0.959	0.993	0.021
ORIGINAL STRUCTURAL MODEL	1.477	0.982	0.899	0.882	0.947	0.980	0.036
MODEL WITH AGE SUBGROUPS	1.433	0.968	0.825	0.796	0.902	0.965	0.034
MODEL WITH GENDER SUBGROUPS	1.371	0.972	0.829	0.801	0.906	0.970	0.032

7.5.2. Structural Model

According to the research objectives and proposed hypotheses, the structural equation model was created by AMOS and developed into two versions with age and gender subgroups, respectively.

Firstly, the model-fits of structural models (including the original structural model and two structural models with age and gender subgroups) were assessed consistently as the previous evaluation process of model-fit of the measurement model. The results meet all thresholds of goodness-of-fit as presented in Table 7.5, which demonstrates that all structural models have eligible goodness-of-fit.

Moreover, the R² values of endogenous variables were assessed to evaluate the structural models' explanatory powers. The R² values of endogenous variables in the three structural models are presented in Table 7.6. Specifically, the model with gender subgroups has the highest R² values of performance expectancy (R² = 0.35), flow (R² = 0.70) and behavioural intention (R² = 0.45). The model with age subgroups has the highest R² value of perceived value (R² = 0.55).

Table 7.6. R² values of endogenous variables in different models

Endogenous variables	R ²		
	Original structural model	Model with age subgroups	Model with gender subgroups
PE	0.30	0.30	0.35
FL	0.58	0.58	0.70
PV	0.53	0.55	0.52
BI	0.45	0.42	0.45

Furthermore, the hypotheses' testing was evaluated by the coefficient of each path. The results are depicted in Table 7.7. Specifically, except for H2 (EE → FL) being rejected ($\beta=0.078$, $p=0.068$), all the other hypotheses were supported in the original structural model and sorted by the significance from high to low shown as follows: H8 (FL → PV, $\beta = 0.732$, $p < 0.001$), H9 (FL → BI, $\beta = 0.44$, $p < 0.001$), H7 (TR → PE, $\beta = 0.38$, $p < 0.001$), H10 (PV → BI, $\beta = 0.308$, $p < 0.001$), H6 (TR → FL, $\beta = 0.275$, $p < 0.001$), H5 (HM → FL, $\beta = 0.232$, $p < 0.001$), H3 (EE → PE, $\beta = 0.209$, $p < 0.001$), H4 (SI → FL, $\beta = 0.205$, $p < 0.001$) and H1 (PE → FL, $\beta = 0.187$, $p < 0.001$). Furthermore, based on the evaluation of path coefficients of each subgroup in Table 7.8, the model performed variously. The effect of flow on perceived values (H8) was validated and it had the most significantly positive influence in all four subgroups. Meanwhile, the effect of flow on behavioural intention (H9) was verified with the second largest coefficient in the male subgroup ($\beta = 0.555$, $p < 0.001$) and age over 35 subgroup ($\beta = 0.51$, $p < 0.001$) respectively. However, H2 (EE → FL) was rejected in the model with the female group ($\beta = 0.038$, $p = 0.55$), group with age below and equal to 35 ($\beta = 0.076$, $p = 0.18$) and group with age higher than 35 ($\beta = 0.084$, $p = 0.207$). Meanwhile, hypotheses H5 (HM → FL, $\beta = 0.07$, $p = 0.248$) and H10 (PV → BI, $\beta = 0.179$, $p = 0.083$) were rejected in the model with the male subgroup. Likewise, H4 (SI → FL, $\beta = 0.124$, $p = 0.062$) and H6 (SI → FL, $\beta = 0.12$, $p = 0.155$) were found with insignificant effects in the female subgroup.

In addition, the model invariances were evaluated by comparing the chi-square of two subgroups models. See the results presented in Table 7.9. The model demonstrated a variance under the moderating effect of gender. However, there were insignificant differences at the model level of the model with different age groups. Specifically, to illustrate the differences of the path effect in each subgroup, the critical ratio was assessed to test the hypotheses, and the z-score was tested to evaluate

the data. As shown in Table 7.8, the results demonstrate the effects of hedonic motivation, trust and social influence on flow, and perceived values on behavioural intention were significantly variant between male and female groups. Meanwhile, only the flow path to perceived value significantly differed between younger and older age groups.

Table 7.7. Hypotheses testing of the original structural model

		Original model					
H	Relations	Estimate	S.E.	T	P	Decisions	
H1	PE→FL	0.187	0.047	3.958	***	Supported	
H2	EE→FL	0.078	0.043	1.825	0.068	Rejected	
H3	EE→PE	0.209	0.048	4.319	***	Supported	
H4	SI→FL	0.205	0.044	4.642	***	Supported	
H5	HM→FL	0.232	0.052	4.485	***	Supported	
H6	TR→FL	0.275	0.053	5.196	***	Supported	
H7	TR→PE	0.38	0.052	7.323	***	Supported	
H8	FL→PV	0.732	0.046	15.799	***	Supported	
H9	FL→BI	0.44	0.069	6.38	***	Supported	
H10	PV→BI	0.308	0.069	4.469	***	Supported	

(Est. = estimate; S.E. = standard error; T = t-value; P = p-value)

Table 7.8. Hypotheses testing of the subgroups

MODEL WITH GENDER SUBGROUPS												
		Male					Female					
H	Relations	Est.	S.E.	T	P	Dec.	Est.	S.E.	T	P	Dec.	Z-score
H1	PE→FL	0.146	0.061	2.401	0.016	Sup.	0.186	0.068	2.73	0.006	Sup.	0.446
H2	EE→FL	0.162	0.054	3.014	0.003	Sup.	0.038	0.064	0.598	0.55	Rej.	-1.485
H3	EE→PE	0.265	0.066	4.009	***	Sup.	0.151	0.07	2.151	0.031	Sup.	-1.173
H4	SI→FL	0.283	0.056	5.075	***	Sup.	0.124	0.067	1.866	0.062	Rej.	-1.83*
H5	HM→FL	0.07	0.061	1.154	0.248	Rej.	0.465	0.088	5.297	***	Sup.	3.699***
H6	TR→FL	0.367	0.064	5.697	***	Sup.	0.12	0.084	1.421	0.155	Rej.	-2.331**
H7	TR→PE	0.385	0.071	5.447	***	Sup.	0.389	0.076	5.145	***	Sup.	0.035
H8	FL→PV	0.681	0.066	10.293	***	Sup.	0.771	0.065	11.902	***	Sup.	0.973
H9	FL→BI	0.555	0.099	5.609	***	Sup.	0.337	0.096	3.526	***	Sup.	-1.583
H10	PV→BI	0.179	0.103	1.734	0.083	Rej.	0.409	0.092	4.46	***	Sup.	1.664*

MODEL WITH AGE SUBGROUPS												
		<=35					>35					
H	Relations	Est.	S.E.	T	P	Dec.	Est.	S.E.	T	P	Dec.	Z-score
H1	PE→FL	0.196	0.063	3.106	0.002	Sup.	0.182	0.071	2.57	0.01	Sup.	1.431
H2	EE→FL	0.076	0.056	1.341	0.18	Rej.	0.084	0.067	1.263	0.207	Rej.	-0.153
H3	EE→PE	0.145	0.068	2.131	0.033	Sup.	0.285	0.07	4.097	***	Sup.	-0.411
H4	SI→FL	0.21	0.063	3.319	***	Sup.	0.205	0.062	3.295	***	Sup.	0.096
H5	HM→FL	0.287	0.066	4.383	***	Sup.	0.155	0.082	1.892	0.058	Rej.	-0.058
H6	TR→FL	0.204	0.076	2.666	0.008	Sup.	0.342	0.075	4.58	***	Sup.	-1.259
H7	TR→PE	0.479	0.074	6.512	***	Sup.	0.277	0.073	3.773	***	Sup.	1.293
H8	FL→PV	0.744	0.065	11.37	***	Sup.	0.72	0.065	10.995	***	Sup.	-1.947*
H9	FL→BI	0.352	0.099	3.566	***	Sup.	0.51	0.096	5.308	***	Sup.	-0.268
H10	PV→BI	0.341	0.1	3.405	***	Sup.	0.284	0.095	2.983	0.003	Sup.	1.15

(Est. = estimate; S.E. = standard error; T = t-value; P=p-value; Dec.= decision; Sup. = Supported; Rej. = Rejected;

***: P-value<0.01; *: P-value<0.05; *: P-value<0.1)

Table 7.9. Comparison between the models of gender and age subgroups

	MODEL WITH GENDER SUBGROUPS			MODEL WITH AGE SUBGROUPS		
	Chi-square	df	p-value	Chi-square	df	p-value
UNCONSTRAINED	1401.159	1022		1464.315	1022	
FULLY CONSTRAINED	1451.548	1058		1496.514	1058	
NUMBER OF GROUPS		2			2	
DIFFERENCE	50.389	36	0.056	32.199	36	0.650
MODEL INVARIANT		NO			YES	

7.6. Discussion

Based on this research's key objectives and the data analysis results, the findings are discussed in the sequence of the stimulus-organism-response of customers' psychological shopping processes via LSSAs under the lockdown measure during the COVID-19 pandemic.

The variables from the revised UTAUT2 model, as the stimulus in users' psychological processing, demonstrated variance in different sub-models. Specifically, except for performance expectancy, which had significant effects on flow in all subgroups, the other path effects of antecedences of flow presented differently in different subgroups. Effort expectancy only significantly affected flow in the male subgroup, contrary to the findings of Pascual-Miguel, Agudo-Peregrina and Chaparro-Peláez (2015). This study found that male customers' engagement and immersion were more determined on the understandability, accessibility and operability of LSSAs. On the other hand, effort expectancy had a positive influence on performance expectancy in all subgroups, which was consistent with previous findings that when customers perceive the ease of using LSSAs, they will feel using an LSSA is a useful and efficient way for online shopping (Riskinanto, Kelana and Hilmawan, 2017; Alalwan, Dwivedi and Rana, 2017; Ramos de Luna *et al.*, 2018). LSSA providers should maintain applications with easily understandable interfaces and functions to increase the accessibility of LSSAs.

Meanwhile, social influence had a significant effect on flow in all subgroups except for female customers, which was consistent with the findings of Liébana-Cabanillas, Sánchez-Fernández and Muñoz-Leiva

(2014), but contrary to the results of Pascual-Miguel, Agudo-Peregrina and Chaparro-Peláez (2015). The results of this study validated that female customers are more difficultly influenced by other relevant people when they purchase through LSSAs during the COVID-19 epidemic lockdown period. However, the recommendations and support from relevant important people significantly formulate users' mental cognition in the male subgroup and both age subgroups, which means they would feel less anxiety and uncertainty from the support of important, relevant people when using LSSAs during the pandemic lockdown period (Slade *et al.*, 2015; Park *et al.*, 2018). When customers' close friends or families are engaged in LSSAs, they are more inclined to participate and interact with sellers on LSSAs (Chen and Lin, 2018). Therefore, word-of-mouth marketing is an efficient and reliable way to establish an excellent reputation of LSSAs, to increase male customers' engagement and enjoyment when shopping via LSSAs during the pandemic lockdown period.

Moreover, hedonic motivation had more significant influences on the younger female group when they were shopping via LSSAs during the pandemic lockdown period. Therefore, live streaming content's enjoyment and entertainment features are essential to optimise users' experience towards increasing engagement, especially for younger female customers. Furthermore, trust had a significant impact on flow in all age subgroups and the male group. Specifically, male customers pay more attention to the trustworthiness and security of LSSAs (Shao *et al.*, 2018). On the other hand, trust was an essential antecedent of flow in all age ranges, which was opposite to the finding from Liébana-Cabanillas, Sánchez-Fernández and Muñoz-Leiva (2014), where trust was more affected by younger groups. Under the situation of social commerce lockdown, live-streaming production demonstration increased customers' perceived trust by providing reliable control, which positively influenced consumers' shopping experiences during the pandemic lockdown period (Gao, Waechter and Bai, 2015). Likewise, trust had a significant influence on performance expectancy in all subgroups. When users perceive a higher sense of trust in shopping via LSSAs under the pandemic lockdown measures, their holistic mental perceptions of technology's utility will increase accordingly (Park *et al.*, 2018). Therefore, information accuracy, information security and customers' privacy should be

guaranteed by LSSA providers, especially for male customers (Kim *et al.*, 2013).

Furthermore, flow, as an organism of users' psychological processing, had the most significant effects on perceived value and behavioural intention in all subgroup models, which is consistent with previous findings that engagement and immersive experience can significantly formulate users' mental and physical reactions of shopping via LSSAs during the pandemic lockdown period (Kim *et al.*, 2013; Gao, Waechter and Bai, 2015; Chen and Lin, 2018). When customers are immersed in live streaming shopping, they tend to escape from the pandemic situation and forget about time and problems, which are difficult to be disturbed by irrelevant things (Hossain and Zhou, 2018). Therefore, optimising customer engagement and interaction in live-streaming demonstrations are necessary to increase users' immersive shopping experiences via LSSAs in the pandemic lockdown situation (Gao, Waechter and Bai, 2015).

In addition, in response components, perceived value significantly determined customers' behavioural intention of using LSSAs in all subgroups except male customers. When customers feel pleasure when purchasing through LSSAs during the pandemic lockdown period, they will perceive higher multi-dimensional benefits of LSSAs, including utilitarian, hedonic and social benefits, which in turn significantly determined customers' usage intention (Kim, Kim and Wachter, 2013; Kerviler, Demoulin and Zidda, 2016; Chen and Lin, 2018). Male customers' holistic perceptions of LSSAs' benefits might be indirectly influenced by their technological perceptions (Peng and Kim, 2014). Therefore, it is necessary to optimise the interfaces and functions of LSSA-services for improving the practicability, usability, creditability of LSSAs, to attract male customers' engagement. These methods can increase users' enjoyment, recognition and satisfaction when shopping through LSSAs, towards formulating their actual usages.

7.7. Theoretical and practical implications

7.7.1. Theoretical implications

As shopping via live-streaming is becoming an immensely popular social and commercial phenomenon, the factors determining customers' intention on shopping via live-streaming apps has attracted increasing attention in recent years. The current research demonstrated novel insights into explaining customers' psychological shopping processes via LSSAs during the COVID-19 pandemic lockdown period. This study contributes three theoretical implications. Firstly, this study bridges a gap in the existing literature by initially evaluating the moderating effects of gender and age on determinants of customers' psychological processing to use LSSAs, which enriches the literature of relevant fields and verifies previous findings with gender and age moderating effects. Comparing the influences of different moderators, gender and age, on each path provide a better understanding of the effects of customers' demographic characteristics on LSSA adoption. Secondly, this study contributes to theoretical development by extending the SOR framework with UTAUT2 and flow theory. Notably, this study integrates the variables from the revised UTAUT2 model as the stimulus component of the SOR framework, and flow theory supports organism in the SOR framework as a mediator of the adoption model. The comprehensive model was validated in this study to support understanding of applying the SOR framework in the LSSA adoption context. Thirdly, the current study successfully explains that customers' psychological processes of shopping via LSSAs under the pandemic lockdown condition are inducted by perceived technological perceptions (performance expectancy, effort expectancy, hedonic motivation) and environmental perceptions (social influence, trust), mediated by mental cognition (flow), and demonstrated by actual responses (perceived value and behavioural intention). This finding generates new insights for future research to assess various connections, interactions, and relationships among the variables between or within different components in the SOR framework for different technology adoption studies.

7.7.2. Practical implications

This study's results are essential for LSSA-service providers, LSSA sellers, streamers, and relevant stakeholders interested in the live-streaming commerce industry. The current study supports LSSA relevant stakeholders in understanding different demographic customers' behaviours influenced by gender and age moderating effects. In particular, hedonic motivation, trust and social influence had the most significant differences in male and female groups. This study provides insights to LSSA stakeholders, encouraging them to consider gender differences on various antecedents in different stages of customers' psychological shopping processes via LSSAs to create or manage a better strategy for their target customers in the future. For example, LSSA providers and vendors should focus on maintaining a relaxing and comfortable live-streaming environment and guaranteeing the originality and fascination of the live-streaming context to optimise entertainment for attracting female customers.

Moreover, this study contributes to LSSA-platform providers, streamers and LSSA sellers as a guidebook to understanding each component in customers' mental processes of using LSSAs for shopping during the pandemic lockdown period. Based on the findings, flow had both significant effects on perceived value and behavioural intention. LSSA-platform providers should emphasise user-centred principles to guarantee the reliability, convenience and efficiency of LSSA-services to meet customers' expectations and requirements, towards formulating an immersive environment for customers to improve their engagement and optimise their mental cognition of shopping through LSSAs. Streamers and LSSA sellers should ensure entertainment, instantaneity and accuracy of interactions with customers to formulate a pleasant and enjoyable environment for optimising their shopping experience when using LSSAs. Furthermore, the current research contributes a framework to investigate customers' mental processes under a specific environmental condition. This study proposed a critical procedure (technological and environmental perceptions → engagement and mental cognition → reaction) to evaluate customers' psychological processes. Meanwhile, the assessment and evaluation of gender and age moderating effects applied in this study provide a reference to analyse

demographically different customers' behaviours. Relevant stakeholders can generate particular strategies for their different customers based on the variation of gender and age moderating effects on different determinants.

7.8. Limitations and future research

Although the current study proposed a rigorous framework of customers' psychological processing to adopt LSSAs, four limitations are summarised as follows with correspondent recommendations for future research. First, this study's target location was China, which indicates the limited generalisability of results in different cultures, regions, and countries. Therefore, future research is recommended to pay more attention to investigating relevant studies in various regions and cultural backgrounds, respectively, as well as the comparison between locations with different cultures. Second, moderators analysed in this study only consisted of participants' basic demographic characteristics, gender and age. Various moderators can contribute different moderating effects on different constructs in the model. Thus, future research is recommended to investigate users' behaviours under various moderating effects, such as experience, educational background, Hofstede's cultural values, etc. Third, this research did not distinguish the types of LSSAs in the study. The different types of LSSAs may lead to different results (Cai and Wohn, 2019).

Consequently, future research is recommended to distinguish the differences between various technologies and platforms. Last, this study conducted a four-week data collection during the COVID-19 pandemic lockdown period, indicating the limitation of a short investigation period for generalising the overall analysis in different scenarios. Thus, a long-term approach and comparison between customers' different stages of shopping experiences via LSSAs and under different situations might be several meritorious directions for future research.

7.9. Conclusion

Shopping via live-streaming is booming after the lockdown measures of the COVID-19 pandemic. This study investigated customers'

psychological shopping processes via LSSAs during the COVID-19 epidemic lockdown period in China. The proposed model extended the SOR framework with UTUAT2 and Flow theory and was tested by CB-SEM with 374 valid data with four subgroups by age and gender. The empirical results demonstrate that flow as a mediator had the most significant influence on users' responses. Technological and environmental perceptions significantly formulate customers' engagement and immersive experience towards determining their behaviours. This study validates that gender has significant moderating effects on hedonic motivation, trust, social influence and perceived value. The current research findings provide a better understanding of customers' psychological processes under a particular condition. The current study contributes with a theoretical development and a practical framework for supporting relevant researchers and stakeholders.

8. Chapter 8 – Conclusions

With the comprehensive utilisation of mobile technology, mobile payments have been developing rapidly, and they are providing an efficient, convenient and ubiquitous financial transaction service in various industries, which has fostered a strong relationship between vendors and customers (Baptista and Oliveira, 2015), and supported social economy development under pandemic situation (Zhao and Bacao, 2020). Combining mobile payment functions with business services and products to adapt to a specific environmental condition is a novel and valuable direction for relevant technology adoption research, and it is essential for current enterprises to reduce operational costs, understand customers' interests and requirements, widen the potential market, and maintain business development under emergency situations. The main findings, contributions, and limitations of this study are presented as follows.

8.1. Summary of findings

The current study focused on understanding the determinants of customer's continuance usage intention of mobile payments and food delivery apps under the COVID-19 pandemic situation and the main antecedents of different demographic customer's psychological shopping processes via live-streaming shopping apps during the COVID-19 epidemic lockdown period. A total of six separate studies were presented in the previous chapters. Wherein, beginning with a systematic literature review of mobile payment provided a complete list of the main determinants, a summary of the popular theoretical foundations and a presentation of the main obstacles to support the remaining chapters. Two of the remaining five chapters focused on users' continuance usage of mobile technologies combining payment functions, mobile payments, and food delivery apps under the COVID-19 pandemic condition. The following two chapters were theoretical development studies based on the limitations of UTAUT and UTAUT2 applied in previous studies. The last one focused on different age and gender users' mental shopping processes through live-streaming apps during the COVID-19 lockdown

period. The theoretical foundations applied in each chapter and the key findings of variables' relations are displayed in table 8.1.

Table 8.1. Theoretical basics and variables' relations

Chapter	Theoretical basics	Variables' relations
3	UTAUT + MAT	PE → BI ; EE → BI ; SI → BI ; TR → BI ; PB → BI ; PS → BI ; EE → PE ; TR → PE ; TR → PB ; SI → PB ; PS → TR
4	UTAUT + ECM + TTF model	PE → CI ; EE → CI ; SI → CI ; TR → CI ; SA → CI ; TTF → CI ; PE → SA ; EE → SA ; SI → SA ; TR → SA ; COF → SA ; COF → PE ; EE → PE ; TTF → PE
5	UTAUT + ECM (With cultural moderators)	PE → CI ; EE → CI ; SI → CI ; TR → CI ; SA → CI ; PE → SA ; EE → SA ; SI → SA ; TR → SA ; COF → SA COF → PE ; EE → PE
6	UTAUT2+ Flow theory	FL → BI ; SA → BI ; PE → SA ; EE → SA ; SI → SA ; HM → SA ; FL → SA ; PE → FL ; EE → FL ; SI → FL ; HM → FL EE → PE
7	UTAUT2+ Flow theory + SOR (Under age and gender moderating effects)	FL → BI ; PV → BI ; FL → PV ; PE → FL ; EE → FL ; SI → FL ; HM → FL ; TR → FL EE → PE , TR → PE

(MAT=Mental Accounting Theory; ECM=Expectancy Confirmation Model; TTF model=Task-Technology Fit model; SOR=Stimulus-Organism-Response framework; BI= Behavioural Intention; PE=Performance Expectancy; EE=Effort Expectancy; SI=Social Influence; TR=Trust; PB=Perceived Benefits; PS=Perceived Security; CI=Continuance Intention; SA=Satisfaction; COF=confirmation; TTF=perceived task-technology fit; FL=Flow; HM=Hedonic Motivation; PV=Perceived Value; **Bold= Significant relation**)

According to the summary from table 8.1, performance expectancy, social influence, and trust significantly affected users' behavioural intention in all three studies. Customers' mental cognitions, like perceived benefits, satisfaction, flow and perceived value, positively formulated users' behavioural intention in three studies, chapters three, four and seven, respectively. Hedonic motivation and flow had significant influences on behavioural intention when mobile technologies consist of entertainment features. On the other hand, effort expectancy was found to have insignificant effects on behavioural intention in all three studies. The specific findings are concluded in the following parts.

According to the results from the second chapter, mobile payment studies have obtained increasing research attention in the last decade. The most critical determinants of mobile payments adoption include perceived usefulness, perceived ease of use, social influence, trust, perceived risk, security, hedonic motivation, culture and habit. Moreover, TAM and UTAUT were the most popular theoretical foundations for adoption studies of mobile technologies combining payment functions. Furthermore, applying the comprehensive model was a new trend for

developing a theoretical framework in relevant studies. Meanwhile, target region, sample size, age difference were the main obstacles mentioned in the previous works of literature limitations sections. The results support future research related to mobile technologies combining payment functions.

The third chapter found that performance expectancy, perceived benefits, social influence, trust and perceived security significantly influenced users continuously using mobile payments during the COVID-19 pandemic. Meanwhile, several new causal relationships were found in this chapter. Social influence and trust significantly determined perceived benefits. Performance expectancy was influenced by effort expectancy and trust. These results indicate that the contactless characteristic of mobile payment techniques facilitates maintaining social distancing and protecting personal safety in the transaction process, supports vendors' business operation, and protects social economy development under the COVID-19 pandemic.

In the fourth chapter, we integrated UTAUT, ECM and the TTF model and found that customers' consumption habits had changed due to the influence of the pandemic. Specifically, continuance intention of using food delivery apps during the COVID-19 pandemic was not only significantly determined by satisfaction but also dramatically formulated by perceived task-technology fit, trust, performance expectancy and social influence. Wherein, perceived task-technology fit played a crucial role in formulating users' technological and mental perceptions when the technology's characteristic is beneficial to fit a specific situation. The contactless feature of food delivery apps was a two-way benefit for customers' demands and catering enterprises' requirements to survive in the pandemic situation.

Based on the limitation of proposed models in the previous two chapters, chapter five involved Hofstede's cultural values to develop the theoretical framework and proposed a comprehensive model integrating UTAUT and ECM with an additional variable, trust, under cultural moderating effects. This chapter contributed theoretical development for mobile technology adoption studies. The proposed model indicated that users' behavioural intention should be conjointly determined by their technology perceptions and mental expectations.

Considering that customers' behaviours are formulated by technological and psychological perceptions conjointly, chapter six developed a new comprehensive model by integrating the UTAUT2 model with Flow theory. Wherein flow and satisfaction, acting as mediating variables, reflect users' mental cognition and engagement and influence users' perceived technological perceptions, including performance expectancy, effort expectancy, social influence, and hedonic motivation. The proposed model demonstrated that a mediating variable played an essential role in formulating users' behavioural intention, contributing critical thinking and providing a theoretical foundation and a measurement method to investigate users' behaviours on adopting new technology in future research.

The seventh chapter extended the SOR framework with the variables from the revised UTAUT2 model as a stimulus, flow as an organism, and perceived value and behavioural intention as a response investigated customers' psychological processes of shopping via live-streaming shopping apps under the moderating effects of age and gender during the COVID-19 pandemic lockdown period. The empirical results demonstrated that flow, as a mediator, had the most significant influence on users' responses. Technological and environmental perceptions significantly formulated customers' engagement and immersive experience of using live-streaming shopping apps during the pandemic lockdown period to determine their final mental responses. Moreover, this study found that the gender moderator had significant effects on hedonic motivation, trust, social influence and perceived value when customers shop via live-streaming shopping apps in the COVID-19 lockdown situation. However, age had insignificant moderating effects on users' mental processes of shopping through live-streaming shopping apps.

8.2. Main contributions

This thesis contributed several theoretical and practical implications. Specifically, the proposed adoption models contributed the theoretical knowledge advancements for relevant researches. The finding and results supported the decision-making for mobile technologies combined payment function relevant enterprises, service providers, service managers, marketing departments and governments.

Chapter two provided a concise and clear summary of key determinants, main theoretical foundations, and obstacles from previous mobile payments adoption studies. This chapter supported systematic review advance knowledge and provided relevant suggestions, such as concentrating on interactions between factors, implementing comprehensive models for better model predict performance to investigate new technology adoption, and considering the specific technologies' attributes and particular application scenarios in the future research. Meanwhile, this chapter also provided a framework for mobile payment relevant stakeholders to better understand the trend of mobile payment development and key antecedents of consumers' behaviours.

The third chapter contributed a theoretical expansion of Unified Theory of Acceptance and Use of Technology (UTAUT) and Mental Accounting Theory by initially proposing and verifying new causal paths between technological and mental perceptions. This chapter served as a valuable reference to modify existing adoption models and evaluate users' continuance usage intention of new technology. This study initially focused on technology characteristics adapted to the pandemic situation as a potential antecedent determining users' mental and technological perceptions, which demonstrate the importance of considering a particular technology's feature can formulate users' interpretations of the perceived mental and technological benefits corresponding to particular situations. Moreover, this study supports start-up companies, policymakers, government bodies, and private service providers interested in mobile payment services with a comprehensive understanding of customers' behaviours, determined by technological and psychological perceptions conjointly. Consequently, relevant stakeholders should take advantage of technologies' benefit features adapted to a particular situation. Relevant stakeholders could utilise the results to develop appropriate business strategies for expanding markets in emergency situations and build better customer bases.

The study in chapter four initially integrated UTAUT, ECM and the Task-Technology Fit model and explained the technological and psychological factors affecting users' continuance intention of using food delivery apps during the COVID-19 pandemic. This study enriched the literature of continuance usage intention of an emerging mobile technology, food delivery apps, in an emergency situation. This study explained that the

specific technology's characteristics can appropriately optimise users' technological perceptions and mental expectations in a particular situation, contributing a theoretical framework for relevant research. Moreover, this study provides several practical contributions for start-up companies, policymakers, government bodies, and service providers interested in the catering industry who should take advantage of food delivery apps' contactless characteristics, maintaining service quality, reliability and efficiency to optimise users' experience to achieve higher customers' satisfaction to increase the continuance acceptance among their target population in a particular situation.

Chapter five proposed a comprehensive model integrating UTAUT with Expectancy Confirmation Model and Hofstede's cultural values. The theoretical development and framework coordination filled the gap of traditional adoption models, which only focused on users' technological or mental perceptions, respectively. This chapter enriched the relevant studies on users' continuance usage intention under cultural moderation. Meanwhile, this study provides a theoretical framework and measurement method to support future studies.

The sixth chapter proposed a theoretical development by extending the Flow theory with the revised UTAUT2's variables and satisfaction to fill the gap of Flow theory's insufficient explanatory power on users' technological perceptions. The proposed comprehensive model contributed a complementary research idea for explaining technological and psychological factors determining users' adoption intention. Meanwhile, this study provided an overview of the methodology and measurement processes to encourage future studies to modify and apply the proposed research process to analyse customers' mental processes determined by technological perceptions in different information technologies adoption.

In chapter seven, the study contributed a theoretical framework by initially extending the Stimulus-organism-response framework (SOR) with UTAUT2 and Flow theory on investigating the determinants of customers' psychological processes of shopping via live-streaming shopping apps under the age and gender moderating effects during the COVID-19 pandemic lockdown period, which enriched the information management works of literature. This study verified the previous findings of gender and age moderating effects under the exceptional environmental condition.

The generated new insights from this chapter contribute to future research to assess the connections, interactions, and relationships among the variables between or within different SOR components to establish a critical procedure (technological perceptions and environmental perceptions → engagement and mental cognition → mental reaction) for better understanding customers' psychological processes of using a new information technology. This study contributes practical guidance for service providers, streamers, and relevant stakeholders interested in live-streaming commerce, to focus on maintaining a relaxing, reliable and comfortable streaming environment and guaranteeing the originality and fascination of the streaming context to meet customers' expectations and requirements corresponding with the environmental condition. Meanwhile, the assessment and evaluation of gender and age moderating effects applied in this study provided a reference to better understand customer's behaviours moderated by age and gender for better marketing strategy and more efficient business management.

8.3. Limitations and future work

This study contains several limitations requiring additional examination and further research. This section summarises the main limitations and provides relevant recommendations for future research.

This study applied a systematic literature review in the second chapter. The qualitative research method might generalise the results from previous literature subjectively. Thus, statistical analysis is recommended in the literature review process. For example, a meta-analysis could be applied to summarise the multiple scientific studies addressing the same questions statistically to provide additional insights to reinforce the findings. Meanwhile, with the limited period and number of selected studies to review, some other studies, such as qualitative research, focusing on other perspectives rather than individual adoption, were excluded in the review process. Accordingly, extending the range of selected studies and incorporating with other selected studies might contribute different insights into key factors and new interactions between variables in different theoretical frameworks.

Chapters five and six focused on the theoretical development and framework proposition without model assessment and evaluation. The proposed theoretical frameworks must be applied and examined in future research to evaluate the explanatory power and applicability of different technologies in different scenarios.

This paper only focused on users' perspectives on mobile technologies combining payment function adoption. Future research is recommended to focus on different perspectives of mobile technologies, such as stakeholders of the mobile technology industry, service providers, merchants or organisations.

Moreover, China was the only target region in this study, demonstrating that the results might not be generalisable in different cultural backgrounds, regions and countries. Therefore, future research is recommended to pay attention to different regions or countries combined with different cultural values. Moreover, comparisons across cultures and regions are highly recommended.

Furthermore, this study only conducted a short-term data collection during the COVID-19 pandemic to analyse users' behaviours under particular environmental conditions. According to the spatio-temporal dynamic changes of individuals' behaviours, future research should apply longitudinal and experimental methods to explore users' perceptions in different situations, investigate causality over time, and make comparisons for comprehensively explaining users' behaviours in different scenarios.

In addition, the current study only focused on mobile payments and two emerging mobile technologies consisting of payment function, food delivery apps and live-streaming shopping apps, which did not distinguish the difference of technologies and operational platforms. Consequently, the research models and measurement methods are suggested to be implemented on different platforms, different technologies to distinguish the differences in terms of the significance of the variables and relationships identified.

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Appendixes

Appendix A. Survey (Chapter 3)

Constructs	Items	References
Perceived benefit (PB) 感知收益	<p>PB1- I perceive convenience when using M-payments during the COVID-19 pandemic. PB1-我觉得在新冠疫情期间使用移动支付很方便。</p> <p>PB2- I feel using M-payments as a contactless payment is safer than traditional payments during the COVID-19 pandemic. PB2-在新冠疫情期间，我认为移动支付作为无接触的支付方式比传统的支付方式更安全。</p> <p>PB3- I feel using M-payments is a beneficial payment method for people conducting financial transactions during the COVID-19 pandemic. PB3-在新冠疫情期间，我认为通过移动支付与人交易更有益。</p>	(Kerviler <i>et al.</i> , 2016; Park <i>et al.</i> , 2018; Tang <i>et al.</i> , 2020)
Performance expectancy (PE) 绩效期望	<p>PE1- I feel M-payment is a useful way of purchasing during the COVID-19 pandemic. PE1- 我觉得移动支付在新冠疫情期间是一种有效的支付方式。</p> <p>PE2- Using M-payments makes the handling of payments easier during the COVID-19 pandemic. PE2- 在新冠疫情期间使用移动支付使支付过程变得更容易。</p> <p>PE3- Using M-payments improves my payment efficiency during the COVID-19 pandemic. PE3- 在新冠疫情期间使用移动支付使我的支付效率提高了。</p> <p>PE4- Using M-payments improves my payment more quickly during the COVID-19 pandemic. PE4- 在新冠疫情期间使用移动支付使支付过程变得更快速。</p>	(Venkatesh <i>et al.</i> , 2012)
Effort expectancy (EE) 易用期望	<p>EE1- Learning how to use M-payments is easy. EE1- 学习使用移动支付是容易的。</p> <p>EE2- It is easy to follow all the steps of M-payments. EE2- 使用移动支付的步骤比较简单。</p> <p>EE3- It is easy to become skilful at using M-payments. EE3- 移动支付的操作比较容易上手。</p> <p>EE4- Interaction with M-payments is clear and comprehensible during the COVID-19 pandemic. EE4- 在新冠疫情期间使用移动支付的交互过程比较清晰容易。</p>	(Venkatesh <i>et al.</i> , 2012; Shankar and Datta, 2018)
Social influence (SI) 社会影响	<p>SI1- People who are important to me (e.g., family members, close friends, and colleagues) recommend using M-payments during the COVID-19 pandemic. SI1- 和我关系较近的人（家人，朋友，同事）会推荐我在新冠疫情期间使用移动支付。</p> <p>SI2- People who are important to me view M-payments as beneficial during the COVID-19 pandemic. SI2- 和我关系较近的人认为在新冠疫情期间使用移动支付是有益的。</p> <p>SI3- People who are important to me think using M-payments during the COVID-19 pandemic is a good idea. SI3- 和我关系较近的人认为在新冠疫情期间使用移动支付是个好主意。</p> <p>SI4- People who are important to me support me to use M-payments during the COVID-19 pandemic. SI4- 和我关系较近的人支持我在新冠疫情期间使用移动支付。</p>	(Khalilzadeh <i>et al.</i> , 2017; Cao and Niu, 2019)
Trust (TR) 信任度	<p>TR1- I believe M-payment platforms are competent and effective in handling my contactless transactions during the COVID-19 pandemic. TR1- 我相信移动支付平台在新冠疫情期间可以很高效的完成我的支付需要。</p> <p>TR2- I believe M-payment platforms keep customers' interests in mind during the COVID-19 pandemic. TR2- 我相信移动支付平台在新冠疫情期间可以随用户喜好进行合理推荐。</p> <p>TR3- I believe M-payment platforms are trustworthy during the COVID-19 pandemic. TR3- 我相信在新冠疫情期间使用移动支付是可靠的。</p> <p>TR4- I believe M-payment platforms are honest to users during the COVID-19 pandemic. TR4- 在新冠疫情期间，我认为移动支付对用户是诚实可信的。</p> <p>TR5- I believe that legal frameworks for M-payments provision sufficiently protect consumers. TR5- 我相信移动支付平台的法律条款可以很好的保护用户信息。</p>	(Khalilzadeh <i>et al.</i> , 2017; Shao <i>et al.</i> , 2018)

<p>Perceived security (PS) 感知安全</p>	<p>PS1- I feel secure using my credit/debit card information through M-payments during the COVID-19 pandemic. PS1- 在新冠疫情期间，我认为我的银行卡绑定在移动支付是安全的。 PS2- I feel M-payments are secure when transmitting sensitive information during the COVID-19 pandemic. PS2- 在新冠疫情期间，我认为移动支付传递的信息是安全的。 PS3- I feel secure providing personal information when using M-payments during the COVID-19 pandemic. PS3- 我认为在新冠疫情期间使用移动支付，个人信息是安全的。</p>	<p>(Khalilzadeh <i>et al.</i>, 2017)</p>
<p>Behavioural intention (BI) 行为意图</p>	<p>BI1- Given the opportunity, I will use M-payments during the COVID-19 pandemic. BI1- 如果有机会，我会在新冠疫情期间使用移动支付。 BI2- I am willing to continuously use M-payments in the near future during the COVID-19 pandemic. BI2- 在新冠疫情期间，我会继续使用移动支付。 BI3- I am open to using M-payment as my mainly payment method in different transaction processes. BI3- 我会把移动支付作为我的主要支付方式。 BI4- I intend to continuously use M-payments in the future. BI4- 我有意图未来继续使用移动支付。</p>	<p>(Venkatesh <i>et al.</i>, 2012; Tang <i>et al.</i>, 2020)</p>

Appendix B. Survey (Chapter 4)

Constructs	Items	References
Performance expectancy (PE) 绩效期望	PE1-I feel that food delivery apps (FDAs) are useful for ordering and receiving food deliveries during the COVID-19 pandemic. PE1- 在新冠疫情期间, 我认为外卖 app 订餐很有用。 PE2-I feel FDAs are convenient to order and receive food deliveries during the COVID-19 pandemic. PE2- 我认为在新冠疫情期间使用外卖 app 订餐很方便。 PE3-Using FDAs improves the process of ordering and receiving food deliveries. PE3- 使用外卖 app 提升的订餐过程。 PE4-Using FDAs improves the efficiency of ordering and receiving food deliveries during the COVID-19 pandemic. PE4- 在新冠疫情期间, 使用外卖 app 提高了订餐效率。	Bhattacharjee (2001); Venkatesh <i>et al.</i> (2003); Roh and Park (2019)
Effort expectancy (EE) 易用期望	EE1-Learning how to use FDAs is easy. EE1- 学习使用外卖 app 是容易的。 EE2-It is easy to follow all the steps of FDAs. EE2- 外卖 app 的操作流程是容易上手的。 EE3-It is easy to become skilful at using FDAs. EE3- 很容易熟练掌握如何使用外卖 app。 EE4-Interaction with FDAs is clear and comprehensible. EE4- 用户与外卖 app 的交互是清晰明了的。	Venkatesh <i>et al.</i> (2003); Yuan <i>et al.</i> (2016)
Social influence (SI) 社会影响	SI1-People who are important to me (e.g., family members, close friends, and colleagues) recommend using FDAs during the COVID-19 pandemic. SI1- 和我关系较近的人 (家人, 朋友, 同事) 会推荐我在新冠疫情期间使用外卖 app。 SI2-People who are important to me think FDAs are beneficial during the COVID-19 pandemic. SI2- 和我关系较近的人认为在新冠疫情期间使用外卖 app 是有益的 SI3-People who are important to me think it is a good idea to use FDAs during the COVID-19 pandemic. SI3- 和我关系较近的人认为在新冠疫情期间使用外卖 app 是个好主意。 SI4-People who are important to me support me to use FDAs. SI4- 和我关系较近的人支持我在新冠疫情期间使用外卖 app。	Venkatesh <i>et al.</i> (2003);
Trust (TR) 信任度	TR1- I believe FDAs are trustworthy. TR1- 我认为外卖 app 是可信的。 TR2- I believe FDAs keep customers' interests in mind. TR2- 我认为外卖 app 可以投其所好。 TR3- I felt secure in ordering and receiving delivery food through the FDAs. TR3- 我觉得通过外卖 app 订餐是可靠的。 TR4- The information provided by the FDAs is reliable. TR4- 外卖 app 提供的信息是可靠的。	Zhu <i>et al.</i> (2017); Shao <i>et al.</i> (2018); Cho <i>et al.</i> (2019)
Perceived task-technology fit (TTF) 任务-技术适配度	TTF1-The functions of FDAs are enough for me to order and receive the food deliveries. TTF1- 外卖 app 的功能足以满足我对订餐的需要。 TTF2-The functions of FDAs are appropriate to help manage the ordering and receiving food deliveries during the COVID-19 pandemic. TTF2- 外卖 app 的功能很适合在新冠疫情期间使用。 TTF3-The functions of FDAs fully meet my requirements of ordering and receiving the delivery of food during the COVID-19 pandemic. TTF3- 外卖 app 的功能很好的满足了我在新冠疫情期间对于订餐业务的要求。 TTF4-The functions of FDAs support me to maintain my personal safety during the COVID-19 pandemic. TTF4- 在新冠疫情期间, 外卖 app 的功能很好的保护了我的就餐安全。	Goodhue and Thompson (1995); Zhou <i>et al.</i> (2010); Yuan <i>et al.</i> (2016);
Confirmation (COF) 确认度	COF1-My experience with using FDAs is better than what I expected. COF1- 我使用外卖 app 的经历超出了我的预期。 COF2-The functions of FDAs are more than what I expected. COF2- 外卖 app 的功能超出了我的预期。 COF3- The service provided by FDAs is better than what I expected during the COVID-19 pandemic. COF3-在新冠疫情期间, 外卖 app 的服务供应商超出了我的期待。 COF4- Overall, most of my expectations from using FDAs were confirmed. COF4- 总体来说, 我认可外卖 app 的服务。	Bhattacharjee (2001); Hung <i>et al.</i> (2012)
Satisfaction (SA) 满意度	SA1- I am very satisfied that FDAs meet my requirements during the COVID-19 pandemic. SA1- 在新冠疫情期间, 我对外卖 app 很满意。 SA2-I am satisfied with FDAs efficiency during the COVID-19 pandemic. SA2- 在新冠疫情期间, 我很满意外卖 app 的高效。 SA3- My interaction with the FDAs is very satisfying. SA3- 我对自己使用外卖 app 的经历很满意。 SA4-I think I did the right thing by using FDAs during the COVID-19 pandemic.	Bhattacharjee (2001); Hung <i>et al.</i> (2012)

	SA4- 在新冠疫情期间，我认为使用外卖 app 是很正确的选择。	
Continuance intention (CI) 继续使用意图	CI1- I intend to use FDAs during the COVID-19 pandemic continuously. CI1- 在新冠疫情期间，我会继续使用外卖 app。 CI2- If I have an opportunity, I will continue ordering food through FDAs. CI2- 如果有机会，我会继续通过外卖 app 订餐。 CI3- I have an open attitude to use FDAs continuously. CI3- 我对外卖 app 持开放的态度。 CI4- I am willing to use FDAs continuously in the future. CI4- 我会在将来继续使用外卖 app。	Bhattacharjee (2001); Shao <i>et al.</i> (2018); Cho <i>et al.</i> (2019);

Appendix C. Measurement constructs (Chapter 5)

Constructs	Items	References
Performance expectancy (PE)	PE1-I feel M-payments are a useful way of purchasing. PE2-Using M-payments make the handling of payments easier. PE3-Using M-payments improve my payment efficiency PE4-Using M-payments improve my payments more quickly.	(Venkatesh <i>et al.</i> , 2011)
Effort expectancy (EE)	EE1-Learning how to use M-payments is easy. EE2-It is easy to follow all the steps of M-payments. EE3-It is easy to become skilful at using M-payments. EE4-Interaction with M-payments is clear and comprehensible.	(Venkatesh <i>et al.</i> , 2011)
Social influence (SI)	SI1-People who are important to me (e.g., family members, close friends, and colleagues) recommend using M-payments. SI2-People who are important to me view the M-payments as beneficial. SI3-People who are important to me think it is a good idea to use M-payments. SI4-People who are important to me support me to use M-payments.	(Cao and Niu, 2019)
Trust (TR)	TR1-I believe M-payment platforms are competent and effective in handling my contactless transactions. TR2-I believe M-payment platforms keep customers' interests in mind. TR3-I believe M-payment platforms are trustworthy. TR4-I believe M-payment platforms implement adequate security measures to secure the transactions for users. TR5-I believe that legal frameworks for M-payments provision are sufficiently robust to protect consumers.	(Shao <i>et al.</i> , 2018)
Confirmation (COF)	COF-1 My experience with using M-banking was better than I expected COF-2 The service level provided by M-banking was better than what I expected COF-3The benefits provided by M-banking was better than what I expected	(Bhattacharjee, 2001)
Satisfaction (SA)	SA1 - I was very satisfied that M-payments meet my requirements SA2-I am satisfied with M-payment efficiency SA3- My interaction with the M-payments system was very satisfying SA4-I have a positive attitude toward using M-payments for purchasing.	(Pereira <i>et al.</i> , 2016)
Long/short-term orientation (LTO)	LTO1-Respect for tradition is important for me. LTO2- Personal steadiness and stability are important to me. LTO3- I work hard for success in the future LTO4-I have a long-term planning for performing a particular task	(Cruz-Cárdenas <i>et al.</i> , 2019)
Individualism/collectivism (IC)	IC1- Being accepted as a member of a group is more important than having autonomy and independence. IC2- Group success is more important than individual success. IC3- Group welfare is more important than individual rewards. IC4- Being loyal to a group is more important than individual gain.	(Cruz-Cárdenas <i>et al.</i> , 2019)
Masculinity/femininity (MF)	MF1-It is more important for men to have a professional career than it is for women to have one MF2- A male should have a high-level position than a female. MF3-There are some jobs that a man can always do better than a woman. MF4-Men usually solve problems with logical analysis; women usually solve problems with intuition. MF5- Males are more focused on achievement and success, and females are more focused on relationships and quality of life.	(Cruz-Cárdenas <i>et al.</i> , 2019)
Power distance (PD)	PD1- People in higher positions should make most decisions without consulting people in lower positions. PD2- People in higher positions should not ask the opinions of people in lower positions too frequently. PD3- People in higher positions should avoid social interaction with people in lower positions. PD4-People in higher positions should not delegate important tasks to people in lower positions PD5- People in lower positions should not disagree with decisions by people in higher positions.	(Cruz-Cárdenas <i>et al.</i> , 2019)
Uncertainty avoidance (UA)	UA1- I do not use M-payments content when I am unsure of its quality. UA2- Specific rules and regulations are important to me UA3- It is important to have instructions spelt out in detail so that I always know what I'm expected to do. UA4- It is important to closely follow instructions and procedures to use M-payments.	(Cruz-Cárdenas <i>et al.</i> , 2019; Tam and Oliveira, 2019)
Continuance intention (CI)	CI1-Given the opportunity, I will use M-payments. CI2-I am willing to use M-payments in the near future. CI3-I am open to using M-payments in the near future.	(Venkatesh <i>et al.</i> , 2011)

Appendix D. Measurement constructs (Chapter 6)

Construct	Items	References
Performance expectancy (PE)	PE1: I feel information technology is useful. PE2: Using information technology makes my life easier. PE3: Using information technology makes me more efficient in dealing with things. PE4: Using information technology bring me more convenience.	(Venkatesh <i>et al.</i> 2012)
Effort expectancy (EE)	EE1: It is easy to learn how to use information technology. EE2: Following all the functions of information technology is easy. EE3: It is easy to become skilful at using information technology. EE4: I feel it is clear and comprehensible to interact with information technology.	(Venkatesh <i>et al.</i> 2012)
Social influence (SI)	SI1: People who are important to me (e.g., family members, close friends, and colleagues) recommend using information technology. SI2: People who are important to me think information technology is valuable. SI3: People who are important to me think using information technology is a good idea to involve in daily life. SI4: People who are important to me support me to use information technology.	(Venkatesh <i>et al.</i> 2012)
Hedonic motivation (HM)	HM1: Using information technology is entertaining. HM2: Using information technology relaxes me. HM3: Using information technology gives me pleasure. HM4: Using information technology get me excited. HM5: I enjoy using information technology.	(Wongkitrungrueng and Assarut, 2018) (Venkatesh <i>et al.</i> 2012)
Flow (FL)	FL1: I am totally focused when using information technology FL2: When using information technology, I do not realize how time passes. FL3: Using information technology gives me a short-time escape from the real world. FL4: I can forget my troubles when using information technology. FL5: Using information technology makes me forget the work I should sometimes do.	(Wongkitrungrueng and Assarut, 2018) (Chen and Lin, 2018) (Gao <i>et al.</i> , 2015)
Satisfaction (SA)	SA1: Using information technology make my daily life better. SA2: Using relevant information technology can meet my basic requirements. SA3: Using information technology makes me very happy and satisfied. SA4: I am intent on using information technology in various aspects of my daily life.	(Chen and Lin, 2018) (Pereirai <i>et al.</i> , 2016) (Park and Lin, 2019) (Kerviler <i>et al.</i> , 2016)
Behavioural intention (BI)	BI1: I have an open mind to use information technology. BI2: Given the opportunity, I will use information technology. BI3: I am willing to use information technology in the future.	(Venkatesh <i>et al.</i> 2012) (Chen and Lin, 2018)

Appendix E. Survey (Chapter 7)

Construct	Items	References
Performance expectancy (PE) 绩效期望	PE1- I feel using LSSA is a useful way of shopping during the pandemic lockdown period. PE1- 我认为封城期间使用直播购物 app 是有用的。 PE2- Using LSSAs makes purchasing easier during the pandemic lockdown period. PE2- 封城期间使用直播购物 app 是容易的。 PE3- Using LSSAs improves my shopping efficiency during the pandemic lockdown period. PE3- 封城期间使用直播购物 app 是高效的购物方式。 PE4- Using LSSAs makes shopping more convenient during the pandemic lockdown period. PE4- 封城期间使用直播购物 app 更方便。	(Venkatesh, Thong and Xu, 2012)
Effort expectancy (EE) 易用期望	EE1- Learning how to use LSSAs is easy. EE1- 学习使用直播购物 app 很容易。 EE2- It is easy to follow all the functions of LSSAs. EE2- 直播购物 app 功能很好掌握。 EE3- It is easy to become skilful at using LSSAs. EE3- 很容易熟练掌握直播购物 app。 EE4- Interaction with LSSAs is clear and comprehensible. EE4- 与直播购物 app 的交互清晰明了。	(Venkatesh, Thong and Xu, 2012)
Social influence (SI) 社会影响	SI1: People who are important to me (e.g., family members, close friends, and colleagues) recommend I use LSSAs for shopping during the pandemic lockdown period. SI1- 和我关系较近的人（家人，朋友，同事）会推荐我在封城期间使用直播购物 app。 SI2- People who are important to me view LSSA as a beneficial way for shopping during the pandemic lockdown period. SI2- 和我关系较近的人认为封城期间使用直播购物 app 是有益的购物方式。 SI3- People who are important to me think it is a good idea to use LSSAs for shopping during the pandemic lockdown period. SI3- 和我关系较近的人认为封城期间使用直播购物 app 是个好主意。 SI4- People who are important to me support my use of LSSAs. SI4- 和我关系较近的人支持我使用直播购物 app。	(Venkatesh, Thong and Xu, 2012)
Hedonic motivation (HM) 享乐动机	HM1- Shopping via LSSAs is entertaining during the pandemic lockdown period. HM1- 封城期间使用直播购物 app 是种消遣。 HM2- Shopping via LSSAs relaxes me during the pandemic lockdown period. HM2- 封城期间使用直播购物 app 购物使我放松。 HM3- Shopping via LSSAs gives me pleasure during the pandemic lockdown period. HM3- 封城期间使用直播购物 app 购物让我开心呢。 HM4- Activities (e.g., flash sales, freebies) on LSSAs make me excited. HM4- 直播购物 app 中直播活动（快销，赠品）让我兴奋。 HM5- I enjoy shopping via LSSAs during the pandemic lockdown period. HM5- 我很享受在封城期间使用直播购物 app。	(Venkatesh, Thong and Xu, 2012); (Wongkitrungrueng and Assarut, 2018)
Trust (TR) 信任度	TR1- I believe LSSAs are competent and effective in handling customers' shopping activities. TR1- 我认为直播购物 app 可以高效的完成客户的购物需求。 TR2- I believe LSSAs keep customers' interests in mind. TR2- 我认为直播购物 app 可以根据用户喜好合理推荐。 TR3- I trust the product demonstration from high-reputation sellers on LSSAs. TR3- 我相信直播购物 app 上的产品展示。 TR4- I believe that the products I purchase from LSSAs will be the same as those demonstrated on LSSAs. TR4- 我认为我在直播购物 app 上购买的产品与描述一致。 TR5- Overall, I believe LSSAs are a trustworthy way for shopping during the pandemic lockdown period. TR5- 总体来说，我认为在封城期间直播购物 app 是值得信任的购物方式。	(Venkatesh, Thong and Xu, 2012); (Wongkitrungrueng and Assarut, 2018)
Flow (FL) 沉浸感	FL1- When using LSSAs, my attention is focused on the shopping activities. FL1- 当我使用直播购物 app 时，我全神贯注于购物过程。 FL2- When shopping via LSSAs, I do not realise how time passes. FL2- 当我使用直播购物 app 时，我忽略了时间的流逝。 FL3- Using LSSAs gives me a temporary escape from the real-world pandemic situation. FL3- 当我使用直播购物 app 时，我会暂时逃离现实时间的疫情形势。 FL4- While shopping through LSSAs, I am able to forget my problems.	(Gao, Waechter and Bai, 2015); (Chen and Lin, 2018)

	<p>FL4- 当我使用直播购物 app 时，我会暂时忘记我的问题。 FL5- When shopping via LSSAs, I often forget the work I should do. FL5- 当我使用直播购物 app 时，我会忽略我该做的事情。</p>	
<p>Perceived value (PV) 感知价值</p>	<p>PV1- Using LSSAs makes shopping more efficient and safer during the pandemic lockdown period. PV1- 使用直播购物 app 让我在封城期间购物更高效。 PV2- Shopping via LSSAs would allow me to take advantage of additional promotions during live-streaming. PV2- 使用直播购物 app 让我能更好的利用直播中的折扣活动。 PV3- Shopping via LSSAs provides me with a lot of enjoyment or gives me happiness during the pandemic lockdown period. PV3- 使用直播购物 app 让我觉得在封城期间很放松和享受。 PV4- Given the time I need to spend doing it during the pandemic lockdown period, shopping via LSSAs is worthwhile to me. PV4- 如果在封城期间选择一种消遣给方式，我会选择在直播购物 app 购物。</p>	<p>(Kerviler, Demoulin and Zidda, 2016);</p>
<p>Behavioural intention (BI) 行为意图</p>	<p>BI1- Shopping via LSSAs had become one of the consumption and entertainment patterns for me. BI1- 直播购物 app 是一种很好的购物和消遣方式。 BI2- Given the opportunity, I will continuously shop via LSSAs in future. BI2- 如果有机会，我会继续使用直播购物 app。 BI3- I would like to recommend others to use LSSAs for shopping during the pandemic lockdown period. BI3- 我会建议身边的其他人在封城期间通过直播购物 app 购物。</p>	<p>(Venkatesh, Thong and Xu, 2012)</p>



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