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EXPLORING THE ROLE OF UNCERTAINTY-AVOIDANCE AND INDIVIDUALISM-COLLECTIVISM ON FACTORS AFFECTING THE ADOPTION OF SMART LOCKERS FOR LAST-MILE DELIVERY: A CROSS-PROVINCIAL STUDY

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ABSTRACT

The research adopted the Unified Theory of Acceptance and Use of Technology (UTAUT) and Hofstede's Cultural Dimensions Theory to determine how performance expectancy, effort expectancy, social influence, and facilitating conditions and two moderators (uncertainty-avoidance and individualism-collectivism) interact and affect the adoption of Smart Lockers for last-mile delivery. A sample of 796 was collated from international students in twenty universities in eleven Provinces in China. The outcome of the Structural Equation Model analysis (SmartPLS version 4) indicates that performance expectancy, effort expectancy, social influence, and facilitating conditions positively affect the adoption of Smart Lockers for last-mile delivery. In addition, uncertainty-avoidance and individualism-collectivism did not moderate the associations between UTAUT dimensions and the adoption of Smart Lockers. Finally, the study adds to the literature on combining the UTAUT model and Hofstede's cultural dimensions, enriching theoretical studies on technology adoption and providing logistic delivery companies insight into understanding users' behaviors.

KEYWORDS: *UTAUT theory, uncertainty-avoidance, individualism-collectivism, Smart locker technology, Hofstede cultural dimension*

1 INTRODUCTION

The world has seen a sharp rise in e-commerce, resulting in volumes of consumer freight globally. E-commerce sales globally were predicted to reach nearly US$4.5 and US$5.55 trillion by 2021 and 2022, respectively (Finance Online review for business, 2022). This reveals the alterations in the buying experiences of consumers and distortion in the traditional pattern of delivering items, also bringing into place numerous parcel delivery services (Yuen et al., 2019; Zenezini et al., 2018). Simultaneously, the situation has given birth to the Smart Locker for last-mile delivery service, which represents a business-to-customer item delivery approach where the last consignee receives the item at home or at a collection point (Liu et al., 2019). The delivery approach posits to reduce delivery cost (Lee & Lyu, 2016), annihilate home delivery failures (Amjad & Muhammad, 2021), reduce gas emissions (Zenezini et al., 2018), and create convenience for users (Ranieri et al., 2018). This innovative and technological solution for delivering parcels has gained prominence in Asian countries, especially China. Few studies on using Smart Locker technology among Chinese have been conducted (Liu et al., 2019; Yuen et al., 2019), but it is rare to find a study considering how foreign nationals, especially students in China, fare in the use of Smart Locker technology. Literature on the studies regarding adopting smart lockers is reported to be at the infantile stage (de Leon et al., 2020; Djelassi et al., 2018).

It is natural for consumers to respond positively to the use of a technology based on the benefits they derive (Ranieri et al., 2018). Literature shows several studies that situate to unravel factors that aid individuals in using a particular technology or application in different jurisdictions (Demoulin & Djelassi, 2016; Djelassi et al., 2018). Elements from

several theories, such as the Technology Acceptance Model (Davis et al., 1989), the SST adoption model (Bitner et al., 2000), the Theory of Planned Behavior (Ajzen, 1991), the Theory of Reasoned Action (Ajzen, 1991), and Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003) among others have been deployed to determine the factors that influence individuals to adopt technology from a different perspective. ADOU et al., (2021) used UTAUT to examine the use of M-payment systems. Johnson et al., (2014) used UTAUT models to evaluate companies' intention to use information systems. UTAUT models were used to explain the decisions to engage in online shopping (Chang et al., 2016). On the contrary, it is infrequent to identify literature that has employed UTAUT models to examine the intention to use Smart Locker technology. A suggestion by Quan et al., (2022) called for future studies to explore factors that could aid the use of Smart Locker. Additionally, Erjavec & Manfreda (2022), indicated that the UTAUT could be deployed to determine how people adopt other technologies after using the same model on online shoppers. The current research posits to employ UTAUT elements to justify why people use Smart Locker for last-mile delivery. Components under the UTAUT model, such as performance expectancy, effort expectancy, social influence, and facilitating conditions, would be deployed as reasons why people opt to use smart lockers for last-mile deliveries in China.

Past literature shows that when it comes to adopting technology, several elements such as age, income level, gender, experience, and voluntariness have been deployed to elements that could moderate people's behavioral intentions (Tarhini et al., 2017) Additionally, the proliferation of technology brings to mind several ways and issues that ought to be understood to fasten technological adoption (Lee & Lyu, 2016). Literature has indicated that culture is one critical element that influences the choice of individuals to use a particular innovation or technology (Cacas et al., 2022). Comprehending cultural issues is critical for companies and app developers (Khaled, 2019). Given this, the present research intends to deploy by extension two essential elements of Hofstede's Cultural Dimension Theory (uncertainty-avoidance & individualism-collectivism) at the level of individuals in adopting Smart Locker technology. It is believed that these two dimensions have been relatively recorded to be associated with behavior to use technology (Negara et al., 2020; Tarhini et al., 2017). On the contrary, literature is minimal on deploying Hofstede's Theory to moderate an effect on the intention to adopt Smart Locker technology to the best of researchers' knowledge. Jang et al., (2018) argue that there is a lack of consensus in literature to deploy the cultural aspect of Hofstede's model to play a moderating role in the technological acceptance space. This research acknowledges the scarcity of studies presented and the paucity of a knowledge base regarding the phenomenon. This present empirical study posits to fill the gap by deploying uncertainty-avoidance and individualism-collectivism to moderate associations that influence the use of Smart Locker for last-mile deliveries among foreigners in China.

The subsequent sections are categorized as follows; segment 2 stipulates literature review and hypothesis development. Portion 3 covers research methodology. Segment 4 covers results analysis. Section 5 considers results discussions, theoretical & practical contributions, limitations & proposals for future studies. Section 6 covers conclusion.

2 LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 Smart locker technology and smart lockers usage in China

Smart lockers are automated and automated systems that rely on cloud computing to aid the collection of parcels by users through storage spaces (Quan et al., 2022) It has been designed to be self-regulating that does not call for management by external parties (Tsai & Tiwasing, 2021). Primarily, they are located at safe places outside the residence of users, e.g.; ground floors of apartments, designated delivery places, car and train stations, parking lots, campuses, recreational centres, and workplaces (Akeb et al., 2018; Chen et al., 2018). The storage spaces could be unlocked with a particular key or an electronic code (Chen et al., 2018). Individuals who patronize smart lockers mostly use them when receiving parcels (Chen et al., 2018). In China, it is commonly used by the food delivery industry in addition to devices that manage the food temperature to deliver to clients (Liu et al., 2019; Yuen et al., 2019) On various university campuses in China, students pick up their food and other essential items from smart lockers (Yuen et al., 2019). The usage of Smart Locker is replicated across several estates in the country, making delivery less stressful, more efficient, and flexible picking parcels (Liu et al., 2019). Technology has become a necessity in the country, especially in the wake of the Covid-19 pandemic (Liu et al., 2019). The emergence of the technology has created a B2C distribution channel providing individuals with easy delivery options, eradicating issues of failed deliveries, and positing to be a solution for delivery challenges (Amjad & Muhammad, 2021; Mostakim et al., 2019).

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

The foundation of the UTAUT model was to be used in the context of how individuals within organizations use and accept technology (Chang et al., 2016). The theory was carved to respond to many questions from other theories relative to technology acceptance. This was done through the synergy of eight essential theories to evaluate perception, welcoming, and preparedness to use a technology (Erjavec & Manfreda, 2022; Venkatesh et al., 2003). The UTAUT has since been deployed to ascertain the usage of innovations and technology stretching to several applications, unifications, and broadening, including smart lockers usage (Venkatesh, 2022). The UTAUT theory initially has dimensions such as performance expectancy, effort expectancy, social influence, and facilitating conditions that have been used to ascertain the adoption of technology in different studies until the introduction of UTAUT2 introduced three new dimensions for usage in consumer studies (Cacas et al., 2022; de Luna et al., 2019). The current study opted to use the standard four dimensions of UTAUT, fine-tuned for smart lockers context use.

The first critical UTAUT dimension used in the context of technology usage is performance expectancy (PE), explained as the extent to which users benefit from using the technology (Venkatesh et al., 2016). Past studies have shown that people use technologies whose benefits are verifiable and can conceptualize their gains (Chang et al., 2016; Erjavec & Manfreda, 2022; Venkatesh, 2022), unraveled that online shoppers commit to shopping there based on the extent they consider using online websites and applications would help them attain their desired buying objective. Erjavec & Manfreda, (2022) ascertained that the perceived expectations of a learning and teaching system caused educators to use the system in Jordan. Technologies that aid users in being efficient and avoiding time wastage such as m-payment systems, have been proven to associate with performance expectancy (Adou et al., 2021). Since smart lockers are one technology that addresses issues of delivery, we present the following hypothesis:
H1*-Perceived expectancy positively influences intention to adopt Smart Locker in last-mile delivery*

Effort expectancy (EE) is classified as the extent of soothe connected with people's use of technology (Venkatesh et al., 2016). The use of technology sometimes could be challenging and frustrating, especially for the aged, which may cause people to opt-out. Given that, effort expectancy is one key factor considered before using an innovation (Erjavec & Manfreda, 2022). It has been ascertained that the user interface for various websites and applications makes the shopping experience easier and cures resistance (Faqih, 2016). Elements such as perceived ease of use and less complexity represented under effort expectancy were ascertained to induce the acceptance of m-payment, mobile banking, and e-commerce (de Luna et al., 2019). Using technological medical devices that supplement health services has been ascertained that patients patronize these medical devices due to their effort to use them (Hoque & Sorwar, 2017). Studies on technology adoption conducted in the wake of Covid-19 showed that effort expectancy is a fundamental determinant (Chayomchai, 2020; Soh et al., 2020). Hence, this research proposes that:
H2*-Effort expectancy positively influences intention to adopt smart lockers in last-mile delivery*

With reference to the UTAUT model, social influence (SI) is said to be the level to which individuals have the thinking that persons who matter to them require they should employ technology (Venkatesh et al., 2016). Research on UTAUT has shown that social influence affects technological usage based on the antecedents of the effect and the receivers of the same (Chayomchai, 2020). It is essential to indicate that the subjective norm is highlighted when discussing issues of social influence(Venkatesh, 2022). This perception comes as people are affected by their close communities, and they have not entirely employed a technology, yet they have opinions about it and could perceive a potential adopter relative to technology adoption (Oliveira et al., 2014). Lukmantara et al., (2021) determined that people's social environment influences their resolve to employ techniques such as m-payment. Soh et al., (2020) showed that social influence during the pandemic influenced the aged intention to engage in online shopping. ADOU et al., (2021) also established the role of social influence as an influencing factor that allows the usage of mobile payment systems. In line with the evidence above, this study proposes that:
H3*-Social influence positively influences intention to adopt smart lockers in last-mile delivery*

The facilitating conditions of UTAUT cover the extent to which people believe resources and support exist to aid the use of a system or behavioural intention (Venkatesh et al., 2016). Some past research showed that facilitating conditions adversely affect individuals, precisely the aged readiness to adapt a technology (Chayomchai, 2020; Lukmantara et al., 2021). However, with the continuous advancement in technological infrastructure and technical men to support the success of these technologies, there is a general rise in the usage of available technology, especially among the youth. Chen et al., (2018) indicated that the presence of technocrats who aid in fixing and maintaining

smart lockers assures users that the service will persist for a longer time. Erjavec & Manfreda, (2022); Soh et al., (2020) study recognized a positive association exists between facilitating conditions and perceptions, readiness, and acceptance to buy online. The current study, hence, proposes that:
H4*-Facilitation conditions positively influence intention to adopt smart lockers in last-mile delivery*

2.3 Culture and Technology Adoption

The nature of culture makes it challenging to conceptualize and has become a contentious issue in academia (Akhtar et al., 2019). Due to that, several models have been carved to comprehend and evaluate how individual behaviour toward technology adoption is influenced by culture (Budde-Sung, 2013). Hofstede explained culture as a shared state of the human mind that segregates one group from another (Hofstede, 1980). These cultural dimensions proposed by Hofstede have been primarily accepted and validated by researchers over the decades (Frank et al., 2015; Schneider, 2022). The traditional model contains four elements: uncertainty-avoidance, individualism-collectivism, power distance, and masculinity-femininity (Hofstede, 1980). According to Faqih (2016), the model's dimensions have been well organized, empirically determined, and seemingly used to determine technology acceptance by researchers. More so, the ones that have been discovered to have more impact on IT usage are uncertainty-avoidance and individualism-collectivism (Budde-Sung, 2013; Khaled, 2019).

Moreover, cultural values have been ascertained to be significant variations at the individual level. Hence, deducing the changes at the individual-level cultural orientations could affect users' perception towards employing technology (Soh et al., 2020). This pattern has been ascertained to be a good option for assessing peoples' behaviour toward innovation adoption (Lukmantara et al., 2021). Despite the controversies surrounding the use of the model at the levels of individuals since it was instituted for a national-level study, there is also sufficient empirical information to validate and second the reliability of the model to be used at the individual level (Tarhini et al., 2017). The current research posits to unravel this knowledge gap by; ascertaining the moderating role of uncertainty-avoidance and individualism-collectivism on people's desire to use the smart locker for mile deliveries.

Hofstede (1980) characterized uncertainty-avoidance (UA) as the extent to which individuals are willing to cope with unpredictability and manage risk. Individuals who are saturated by high UA opt to be at a place that is structured and steered by rules and regulations. On the contrary, persons with low UA are said to be less rules or regulations oriented. Empirical evidence shows that studies have employed UA to significantly influence a person's behavior and decision-making, particularly in adopting an innovation. According to Schneider (2022), from a high UA cultural viewpoint, persons exhibit a low level of acceptance, forbearance, and anxiety in an unexplained situation. Furthermore, the high state of UA manifests in people becoming apprehensive and less inspired to take on new challenges, such as adopting new technology. In another breath, cultures saturated with a low level of UA posit to be responsive to change, open-minded, tolerate uncertainties, comprehend new challenges, and adjust to using innovations. It has been determined that people with a high UA cultural perspective are less eager to use new technology, unlike those with low UA who embrace new technologies.

Literature supports the assertion that persons with high UA are more affected by the performance of innovation and social influence (Karahanna et al., 2013). Moreso, it is believed to be a standard feature that people who are socially influenced and are expectant are people who would adopt technology and has been discovered to have a high UA that aids them in embracing innovations (Akhtar et al., 2019). Research undertaken on e-learning indicated that UA positively moderates the association between social influence and performance expectations (Tarhini et al., 2017). Uncertainty-avoidance has been deployed to moderate the association of dimensions of the TAM Model, and it has been revealed that UA can affect the intention to use innovation (Metallo et al., 2022; Sharma et al., 2022). A Malaysian study that evaluated the usage of e-government service on the TAM viewpoint revealed that the association between TAM theory's dimensions was weaker with Malaysians with high UA (Reddick, 2010). To this effect, persons with low UA tend to embrace technologies. So, it is expected that low UA cultures demonstrate higher intention if they find such technologies to meet their expectations and satisfy their needs (Khan et al., 2022; MAZAN & ÇETİNEL, 2022). To the knowledge of the researchers, there are insufficient IT-associated studies that have been administered to investigate the moderating influence of uncertainty avoidance and the dimensions of UTAUT theory. Given this, the study proposes that:
H5 *– uncertainty-avoidance moderates the association between performance expectancy and behavioral intention such that the association is stronger at lower UA and weaker at higher UA.*

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H6 *- uncertainty-avoidance moderates the association between effort expectancy and behavioral intention such that the association is stronger at lower UA and weaker at higher UA.*
H7 *- uncertainty-avoidance moderates the association between social influence and behavioral intention such that the association is stronger at lower UA and weaker at higher UA.*
H8 *- uncertainty-avoidance moderates the association between facilitating conditions and behavioral intention such that the association is stronger at lower UA and weaker at higher UA.*

Hofstede, (1980) regards individualism-collectivism (IC) as the degree to which people give credence to their self-interest and contributions to the group. According to Metallo et al., (2022), a culture that shows individualism is self-centred, often focuses on attaining individual objectives, and believes personal identity is critical. Cultures that are collective in nature stress community gains. Some cultures are designed to be more collective than individualistic and vice versa (Mazan & Çetinel, 2022). Furthermore, IC cultural values have been examined in the scheme of technology adoption, such as e-learning, e-commerce, and m-payments, among others, due to the intrinsic nature of IC that is connected to changes in peoples' social and behavioral features and patterns (Akhtar et al., 2019; Alkhwaldi et al., 2022; Khan et al., 2022). Relying on this information, the section of IC has been linked to significantly influencing people's rationality, attitudes, deductions, and choices (de Mooij, 2019; Sharma et al., 2022; Yates & de Oliveira, 2016).

Additionally, IC is one significant critical determinant of whether people are willing to choose to use innovation (Schneider, 2022) A Legion of empirical information has ascertained the role of IC in the adoption of several IT products and services (Alkhwaldi et al., 2022; Quadri et al., 2017). On the contrary, little focus has been channelled to ascertain the possible moderating role of IC at the individual level in adapting technology (Akhtar et al., 2019; Faqih, 2016). The current study purports to deploy the UTAUT model and ascertain the moderating effect of IC on the intention to adopt smart lockers for last-mile deliveries. The study proposes the following hypotheses:
H9 *- individualism-collectivism moderates the association between performance expectancy and behavioral intention such that the association is stronger at higher IC and weaker at lower IC.*
H10 *- individualism-collectivism moderates the association between effort expectancy and behavioral intention such that the association is stronger at higher IC and weaker at lower IC.*
H11 *- individualism-collectivism moderates the association between social influence and behavioral intention such that the association is stronger at higher IC and weaker at lower IC.*
H12 *- individualism-collectivism moderates the association between facilitating conditions and behavioral intention such that the association is stronger at higher IC and weaker at lower IC.*

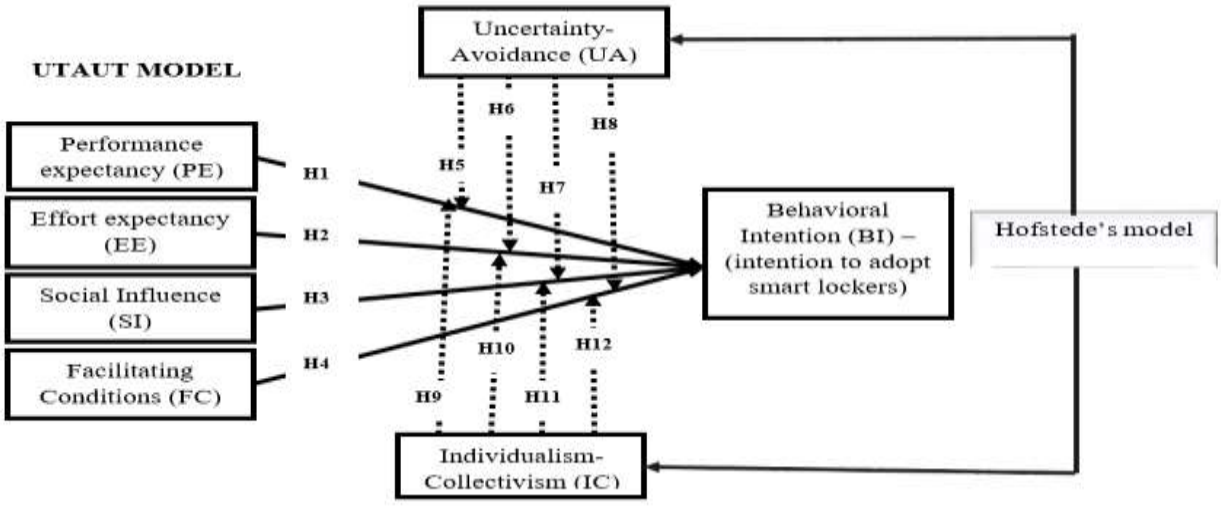


Figure 1 Conceptual framework of the research

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3 RESEARCH METHODOLOGY

3.1 Research design and instrument

A quantitative survey approach was adopted as the data-gathering approach of this research. The research team prepared an online questionnaire to test the study's hypothesis. The objective of the research was explained at the beginning of the questionnaire. The questionnaire was structured into two sections. The first aspect covered the demographic nature of respondents, and the second covered the measurement items. The questionnaire comprised many elements measuring UTAUT factors, intentions to use smart lockers for last-mile delivery, uncertainty-avoidance, and individualism-collectivism. The measurement elements used in evaluating the variables were extracted from existing research. These items have already been validated in the existing literature. All variables were assessed with a 5-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Table 1 shows the study constructs, their notations in the study, and literature sources.

Table 1 Measurement of constructs

Constructs	Number of items	Notation	Literature sources
Perceived Expectancy (PE)	5	PE1-PE5	(Venkatesh et al., 2016)
Effort Expectancy (EE)	4	EE1-EE4	(Venkatesh et al., 2016)
Social Influence (SI)	3	SI1-SI3	(Erjavec & Manfreda, 2022)
Facilitating Conditions (FC)	4	FC1-FC4	(Erjavec & Manfreda, 2022)
Uncertainty-Avoidance (UA)	4	UA1-UA4	(Tarhini et al., 2017)
Individualism-Collectivism (IC)	6	IC1-IC6	(Tarhini et al., 2017)
Behavioral Intention (BI)	5	BI1-BI5	(Tarhini et al., 2017)

3.2 Data collection, sampling, and analysis procedure

To respond to the research gaps, the study evaluated a sample of foreigners in china, specifically international students from universities in eleven (11) Provinces in China, who have smart lockers on their campuses, and their estates and patronized their usage. Participants were chosen through a random sampling method to allow equal participation. The sample population covered all international students in the schools we engaged in. The questionnaire was distributed through WeChat and Ding Talk applications for sixteen weeks with the help of the leadership of various international student organizations on the campuses after approval from the departments in charge of overseas students in the respective schools. Altogether, 796 international students completed the survey with the relevant data for analysis. A breakdown of the survey based on schools is captured in table 2.

Table 2 Questionnaire distribution and completion

Province	Number of universities	Questionnaire distributed	Completed	Uncompleted
Jiangsu	2	150	142	8
Zhejiang	3	200	161	39
Anhui	2	70	55	15
Shanghai	4	150	138	12
Shandong	2	115	75	40
Jiangxi	1	30	24	6
Fujian	2	55	45	10
Taiwan	1	50	38	12
Henan	1	45	30	15
Hunan	1	65	45	20
Hubei	1	70	43	27
Total	20	1000	796	204

The total sample size used for the study was 796 (79.6% response rate). The sample size meets the standards that enable researchers to undertake exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and SEM analysis (Hair, 2021).

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With the analysis, the study used the Smart-PLS 4.0 software to process data. According to Hair, (2021), the Smart-PLS statistical tool is appropriate for churning best estimates, especially with complex models, using primary information, and working with larger data sample sizes. Subsequently, the PLS-SEM approach (Partial Least Squares Structural Equation Modeling) that aids in assessing and establishing hypothesized associations between variables was deployed. This is because several studies have deployed the same in measuring relationships and complex models in several academic fields (Hair, 2021; Sharif et al., 2019). It is also appropriate for theory extensions (Shmueli et al., 2019). The first section of the study considered the models' reliability and discriminant validity of the constructs under investigation. Secondly, the study evaluated the structural aspect of the model and made decisions based on the assumptions suggested.

4 RESULTS PRESENTATION

4.1 Sample characteristics

The sample's socio-demographic features of participants are stipulated in table 3.

Table 3 Profile of the respondents

	Items	Frequency	Percentage (%)
Gender	Males	440	55.3%
	Females	356	44.7%
Education	Undergraduate	451	56.7%
	Master	238	29.9%
	PhD.	107	13.4%
Residence	On-campus	584	73.4%
	Off-campus	212	26.6%
Continent	Africa	554	69.6%
	Asia	62	7.8%
	North & South America	23	2.9%
	Europe	106	13.3%
	Oceania	44	5.5%
	Antarctica	7	0.9%

4.2 Measurement model assessment

The study started with undertaking some parameters to evaluate the fitness of the measurement model and ascertain internal consistency. Hence, the reliability and validity were estimated. The outcome is presented in tables 4, 5 & 6, and figure 2, which outlines the indications for the fitness of the model. These are the standardized factor loadings (λ), the variance inflation factor (VIF), the Cronbach alpha (α), the Composite Reliability (CR), and the average variance extracted (AVE) of all the seven variables. Cognizance of the loadings (λ) of all the seven constructs, they go beyond the threshold of 0.6 as suggested by (Hair et al., 2011). Cognizance to the Cronbach alpha (α), they exceed the threshold of 0.7 as indicated by (Hooper et al., 2008), which explains the high-reliability state of the measurement items. The average variance extracted (AVE) of all seven variables are higher than the standard value of 0.5, which exhibits convergent validity (Hair et al., 2019). The composite reliability of all seven variables is between 0.890 and 0.930, which is beyond the recognized standard of 0.7 (Hair et al., 2011). For VIF, all the figures below 5 posit to avoiding the multi-collinearity challenge (Hair et al., 2011). The general outcome illustrates that the measurement model is essentially fit. Additionally, the measurement items are reliable.

Table 4 Reliability of items and variables

Constructs	Notations	VIF	Loadings (λ)	Cronbach Alpha (α)	CR	AVE
Performance Expectancy (PE)	PE1	2.190	0.876	0.846	0.890	0.619
	PE2	1.718	0.757			
	PE3	1.732	0.763			
	PE4	1.706	0.769			
	PE5	1.692	0.762			
Effort Expectancy (EE)	EE1	2.022	0.839	0.852	0.900	0.692
	EE2	1.933	0.827			
	EE3	1.902	0.830			
	EE4	1.923	0.832			

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Social Influence (SI)	SI1	1.899	0.867	0.835	0.901	0.751
	SI2	1.946	0.864			
	SI3	1.966	0.869			
Facilitating Conditions (FC)	FC1	2.176	0.858	0.860	0.905	0.705
	FC2	2.051	0.842			
	FC3	1.928	0.831			
	FC4	1.895	0.827			
Uncertainty-Avoidance (UA)	UA1	2.040	0.845	0.863	0.907	0.709
	UA2	2.009	0.839			
	UA3	2.071	0.847			
	UA4	1.986	0.838			
Individualism-Collectivism (IC)	IC1	2.475	0.845	0.909	0.930	0.688
	IC2	2.275	0.830			
	IC3	2.265	0.825			
	IC4	2.247	0.825			
	IC5	2.276	0.831			
	IC6	2.182	0.821			
Behaviour Intention (BI) (intention to use smart lockers for last-mile delivery)	BI1	2.169	0.833	0.882	0.914	0.680
	BI2	2.074	0.824			
	BI3	2.156	0.833			
	BI4	2.103	0.829			
	BI5	1.905	0.804			

Note: *(λ) standardized factor loadings, (α) Cronbach alpha, VIF, variance inflation factor, CR, composite reliability, AVE, average variance extracted.*

Furthermore, the study proceeded to determine the validity of the measurement model by undertaking the discriminant validity. This was to ensure there was no duplication among items in the model. The widely acceptable approaches are the Fornell-Larcker and Heterotrait-Monotrait Ratio (HTMT) methods suggested by (Henseler et al., 2015). Table 5 (Fornel-Lacker) ascertains the discriminant validity where the correlations between the two dimensions exceed the square root of its AVE in each dimension as they satisfy the standard < 0.85. Table 5 shows that the HTMT is < 0.90, which meets the standard requirement. The reported figures ascertain the reliability and validity of the constructs (see Tables 4, 5 & 7).

Table 5 Fornell -Larcker criterion

Constructs	BI	EE	FC	IC	PE	SI	UA
Behaviour Intention	**0.864**						
Effort Expectancy	0.225	**0.846**					
Facilitating Conditions	0.154	0.232	**0.840**				
Individualism-Collectivism	0.291	0.382	0.318	**0.830**			
Performance Expectancy	0.491	0.391	0.151	0.186	**0.787**		
Social Influence	0.228	0.121	0.247	0.261	0.335	**0.867**	
Uncertainty Avoidance	0.358	0.247	0.375	0.287	0.260	0.442	**0.847**

Table 6 Heterotrait-Monotrait Ratio (HTMT)

Constructs	BI	EE	FE	IC	PE	SI	UA
Behavioral Intention							
Effort Expectancy	**0.784**						
Facilitating conditions	0.781	**0.778**					
Individualism-Collectivism	0.791	0.782	**0.796**				
Performance Expectancy	0.720	0.722	0.738	**0.744**			
Social Influence	0.793	0.709	0.720	0.713	**0.848**		
Uncertainty-Avoidance	0.798	0.706	0.800	0.701	0.860	**0.886**	

Note: *shaded boxes are modes of reporting HTMT. Moreover, the diagonal values (in bold) are the square root of the average variance extracted (AVE); the off-diagonal values are the correlation among variables. BI=behavior*

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EPRA International Journal of Economics, Business and Management Studies (EBMS)
Volume: 11 | Issue: 8 | August 2024 -Peer-Reviewed Journal

intention, PE=performance expectancy, EE= effort expectancy, SI= social influence, FC= facilitating condition, UA=uncertainty avoidance, IC=individualism-collectivism.

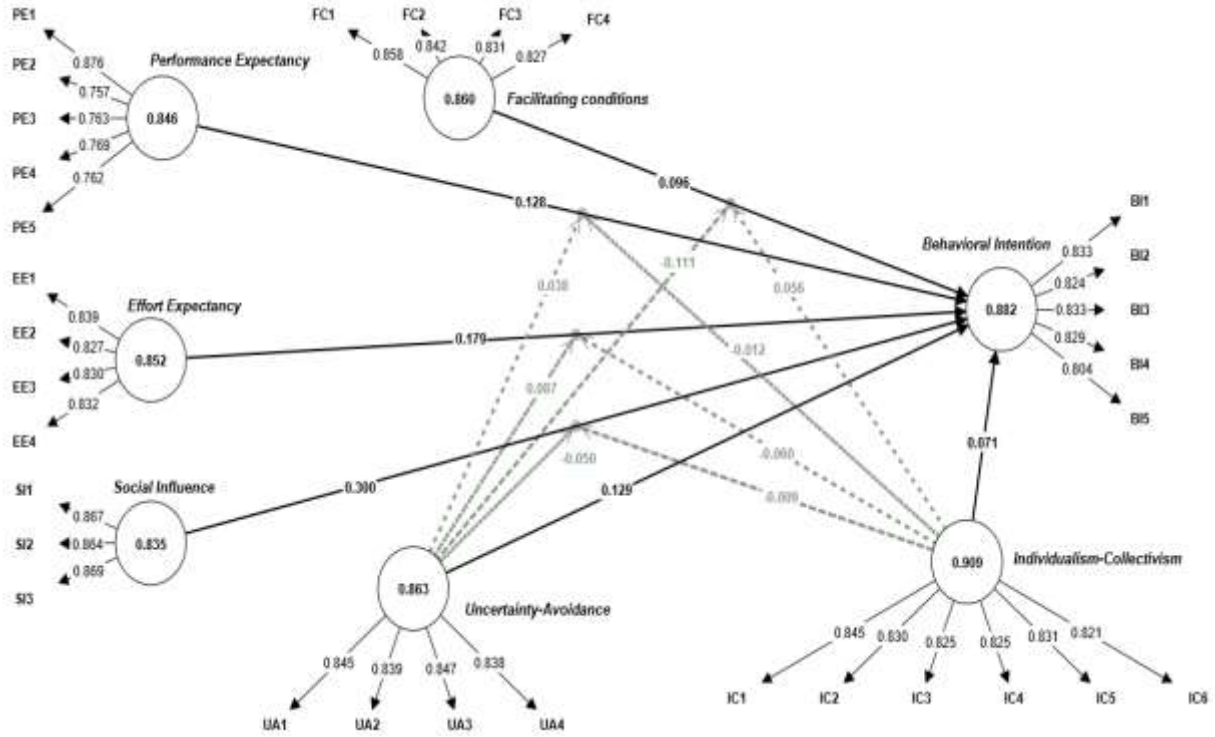


Figure 2 Measurement model assessment (factor loadings)

4.3 Evaluation of structural model (hypothesis testing)

Relying on the bootstrapping approach Hai (2021) suggested, the PLS regression was determined to evaluate the direct, moderating effect and decide on the hypothesis. All the direct associations' hypotheses reveal significance, as shown in Table 7 and figure 3. The outcomes illustrate that performance expectancy (*β =0.128, t=4.347, p<0.000),* effort expectancy (*β =0.178, t=2.258, p<0.000),* social influence (*β =0.300, t=6.398, p<0.000),* and facilitating conditions (*β =0.096, t=4.465, p<0.000)* show a positive relationship and significant influence on behaviour intention to adopt smart lockers for last-mile deliveries. Hence, H1, H2, H3, and H4 are supported.

Table 7 Testing for direct relationships – Hypotheses

Hypothesis	Path coefficient *(β)*	T-value	P-values	Decision
H1: Performance Expectancy-> Behavior Intention	0.128	4.347	0.000***	Supported
H2: Effort Expectancy-> Behavior Intention	0.178	2.258	0.000***	Supported
H3: Social Influence -> Behavior Intention	0.300	6.398	0.000***	Supported
H4: Facilitating Condition-> Behavior Intention	0.096	4.465	0.024***	Supported

Note: ** T-value >1.96, ***p<0.001.*

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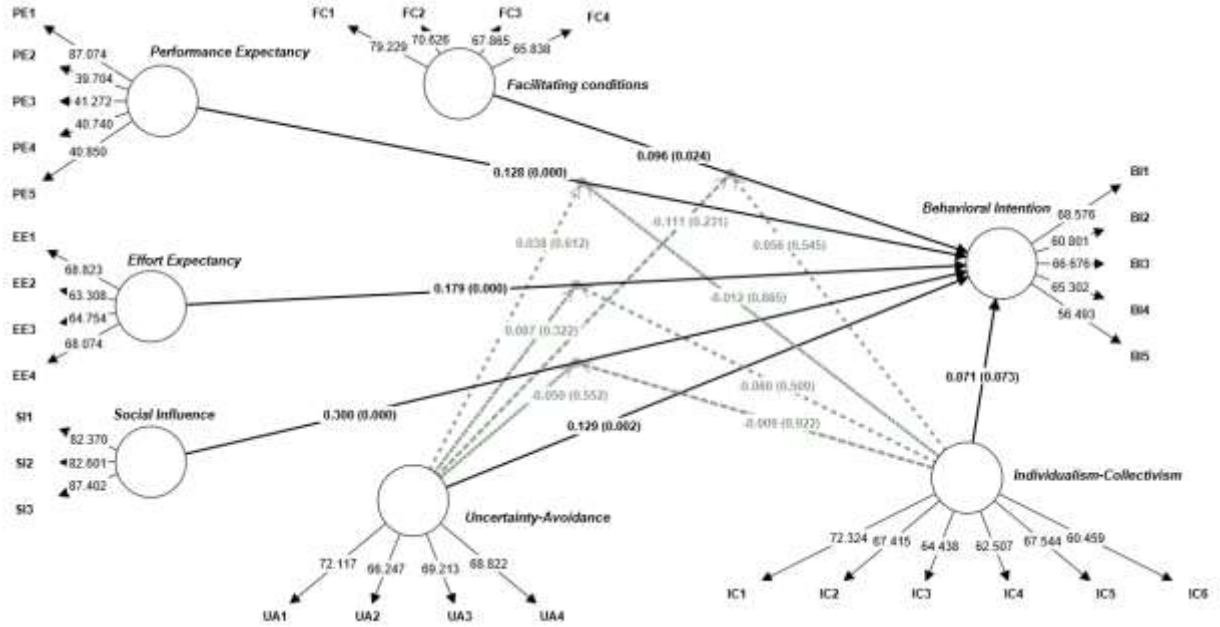


Figure 3 Structural model assessment (direct effects and moderation effects)

Additionally, the study has four hypotheses (H5-H8) that posit that uncertainty-avoidance moderates the association between the four elements of the UTAUT model and the intention to adopt a smart locker for last-mile delivery. Results in table 8 and figure 3 show that uncertainty-avoidance did not moderate the associations between performance expectancy and behavioral intention (*β =0.038, p>0.05);* effort expectancy and behavioral intention (*β =0.087, p>0.05);* social influence and behavioral intention (*β =0.050, p>0.05);* facilitating conditions and behavioral intention (*β =-0.111, p>0.05)*. The outcome failed to support hypotheses (H5-H8).

Table 8 Hypothesis testing (Moderating relationships)

Hypothesis	Path Coefficient *(B)*	T-Value	P-Value	Decision
H5: Uncertainty-Avoidance × Performance Expectancy-> Behavior Intention	0.038	0.508	0.612	Not supported
H6: Uncertainty-Avoidance × Effort Expectancy-> Behavior Intention	0.087	0.991	0.322	Not supported
H7: Uncertainty-Avoidance × Social Influence-> Behavior Intention	0.050	0.595	0.552	Not supported
H8: Uncertainty-Avoidance × Facilitating Conditions-> Behavior Intention	-0.111	1.198	0.231	Not supported
H9: Individualism-Collectivism × Performance Expectancy-> Behavior Intention	-0.012	0.170	0.865	Not supported
H10: Individualism-Collectivism × Effort Expectancy-> Behavior Intention	-0.060	0.660	0.509	Not supported
H11: Individualism-Collectivism × Social Behavior-> Behavior Intention	-0.009	0.097	0.922	Not supported
H12: Individualism-Collectivism × Facilitating Condition-> Behavior Intention	0.056	0.605	0.545	Not supported

Note: *significant at T-value >1.96, **p<0.05*

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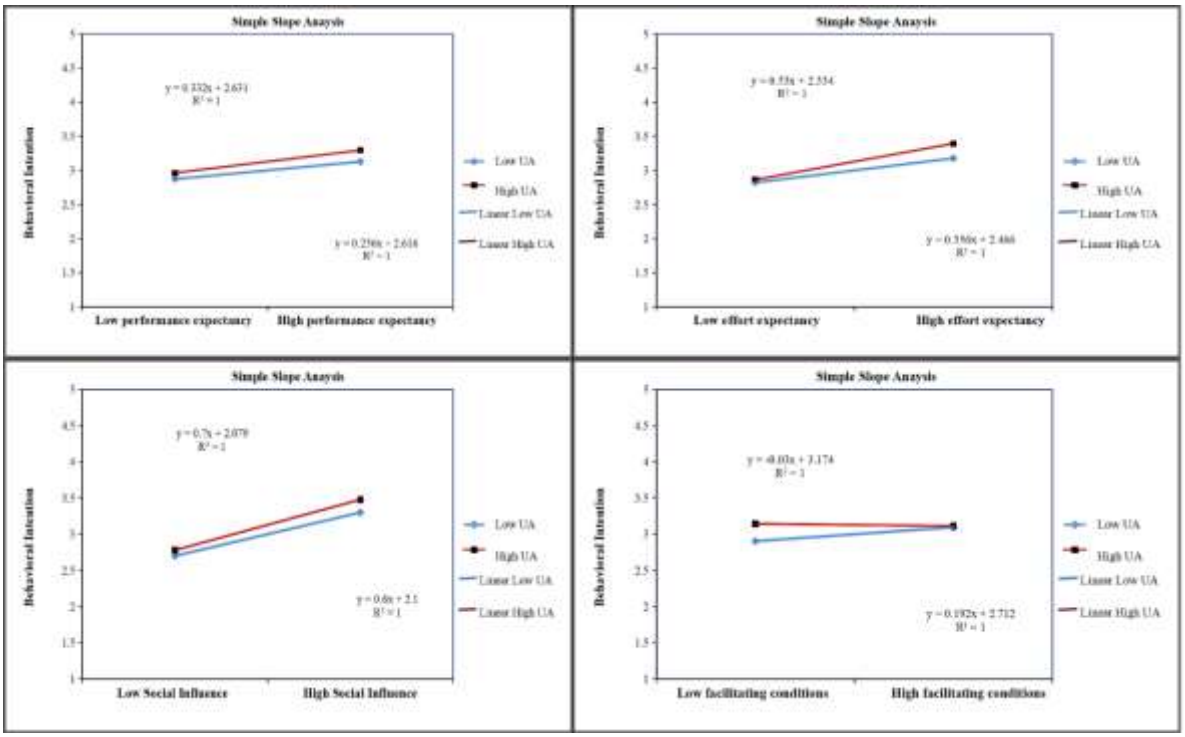


Figure 4 The moderating effects of uncertainty-avoidance on the relationship between dimensions of the UTAUT model and intention to adopt smart lockers for last-mile delivery

Additionally, the study has four hypotheses (H9-H12) posit that individualism-collectivism moderates the association between the four elements of the UTAUT model and the intention to adopt a smart locker for last-mile delivery. Results in table 8 and figure 3 show that IC did not moderate the associations between performance expectancy and behavioral intention (*β =-0.012, p>0.05);* effort expectancy and behavioral intention (*β =-0.060, p>0.05);* social influence and behavioral intention (*β =-0.009, p>0.05);* facilitating conditions and behavioral intention (*β =0.056, p>0.05)*. The outcome failed to support hypotheses (H9-H12).

Figure 4 & 5 covers the slopes on all UA and IC moderating associations after plotting the coefficients of the independent variables, the moderators, and the interaction effect. The x values indicate the high and low limits of the predicting variable. According to Hair, (2021), R^2 values range between 0 to 1, which shows a percentage assessment of how good the model plotted is. The R^2 value of 1 on the graphs makes the model 100% right and close to the points deployed in graphing.

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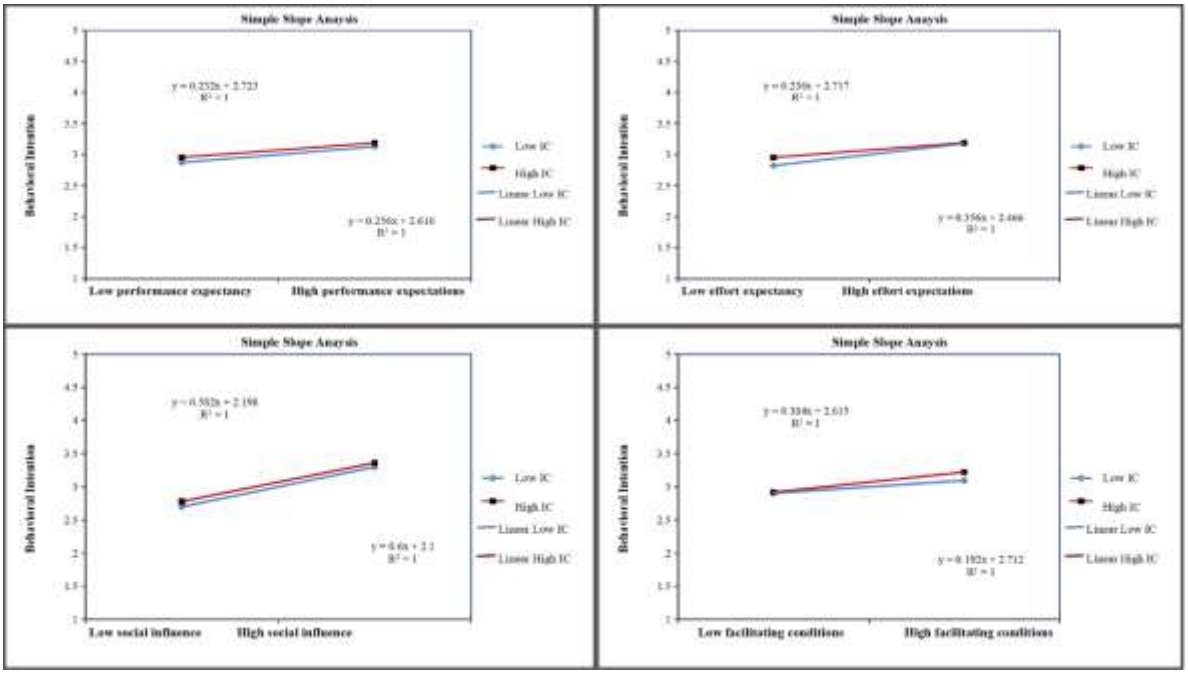


Figure 5 *The moderating effects of individualism-collectivism on the relationships between dimensions of the UTAUT model and intention to adopt smart lockers for last-mile delivery*

4.3.1 Effects sizes (f^2)

The f^2 is a statistical approach under PLS-SEM that aid in estimating the variations in a particular exogenous construct's significant effect on an endogenous variable (Shmueli et al., 2019). Cohen (1988) thumb rule indicates that when f2 = 0.02, 0.15, and 0.35, the effect is weak, medium, and strong, respectively. The four dimensions of the UTAUT model recorded f^2 values of 0.236, 0.110, 0.269, and 0.132 (see table 9) are medium, small, medium, and small effect sizes, respectively. Moderation associations involving UA and IC recorded insignificant or no effects (see table 9).

Table 9 Effect size of Exogenous Factors.

F^2 thumb rule says that f^2 = 0.02 indicates small, f^2 = 0.15 indicates medium, f^2 = 0.35 shows high effect size		
Relationship	f square (f^2)	Effect size
PE→BI	0.236	Medium
EE→BI	0.110	Small
SI→BI	0.269	Medium
FC →BI	0.132	small
UA × PE→BI	0.027	-
UA × EE→BI	0.017	-
UA × SI→BI	0.001	-
UA × FC→BI	0.003	-
IC × PE→BI	0.001	-
IC × EE→BI	0.004	-
IC × SI→BI	0.000	-
IC × FC→BI	0.001	-
Predictive relevance		
	(R^2)	Adjusted *(R^2)*
BI	0.848	0.844

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5 DISCUSSIONS

Enthused by the requirement for an appropriate comprehension of foreigners in China on their perception and use of smart lockers triggered this study. The present study drafted a model to ascertain the effect of four dimensions of the UTAUT model on the behavioral intention to adopt smart lockers for last-mile deliveries among foreigners in China, particularly international students in 20 universities across the East and Central Provinces. The research also incorporated two cultural dimensions from Hofstede that have been discovered to be associated with assessing technology adoption. This study deployed performance expectancy, effort expectancy, social influence, and facilitating conditions as antecedents to behavioral intention.

The results of the research showed that performance expectancy (H1), effort expectancy (H2), social influence (H3), and facilitating conditions (H4) have a positive and significant impact on the behavioral intention of international students to use smart lockers for last-mile delivery with social influence recording the highest coefficient. The outcome on performance expectancy is consistent with results from (Chang et al., 2016) that determined its positive effect on respondents' online shopping behaviour. The same could be deduced from the studies of (Erjavec & Manfreda, 2022). Furthermore, it has been shown that effort expectancy positively affects adapting technology (Hoque & Sorwar, 2017; Soh et al., 2020), for which these outcomes are in tandem with results from this study. However, Erjavec & Manfreda, (2022) established that effort expectancy does not affect consumers who engage in online shopping. The outcome is contrary to the result of this study. Chayomchai, (2020) ascertained that social influence is not a significant factor in the UTAUT model in determining technology usage. On the contrary, this study ascertained that social influence is a stronger predictor of the usage of smart lockers in China. The outcome of this study conforms to (Khaled, 2019; Nyesiga et al., 2017), that determined that social influence affects the adoption of E-learning and ATM fingerprint authentication. The outcome is unique in light of international students in China. This might have occurred due to suggestions from friends, classmates, and association members among other social groups aiding participants to use smart lockers. Additionally, facilitating conditions are the least influencing determinant in the UTAUT model that predicts the intention to use smart lockers among participants, as indicated by the current results. This outcome is consistent with (Hussain et al., 2022), that considered acceptance of teachers' online meetings (Hutagaol & Napitupulu, 2022), that considered acceptance of digital banking, and (Shariat Ullah et al., 2022), that centred on the acceptance of online classes by students. On the contrary, facilitating conditions did not significantly affect online shopping acceptance (Erjavec & Manfreda, 2022).

The current research highlights the relevance of uncertainty-avoidance (UA) and individualism-collectivism (IC). These two dimensions under the Hofstedes cultural dimensions were deployed to moderate the four dimensions under the UTAUT model. The uncertainty-avoidance cultural element has been determined to have no interacting effects on the relationship between performance expectancy (H5), effort expectancy (H6), social influence (H7), and facilitating conditions (H8) and the intention to adopt smart lockers for last-mile deliveries respectively. This suggests that any changes in the case of UA will not strengthen or weaken the associations between the dimensions of the UTAUT model and intention to use smart lockers. Commonly, it is believed that individualistic cultures posit to adopt an innovation because of the expected performance (Metallo et al., 2022), effort to use (Sharma et al., 2022), influence socially (Khan et al., 2022), and conditions that facilitate the use of the technology (MAZAN & ÇETİNEL, 2022). On the contrary, previous research highlights inconsistent results regarding moderating effect of UA on the adoption of technology (Faqih, 2016; Tarhini et al., 2017).

Furthermore, the current outcome indicates that individualism-collectivism also did not moderate the relationship between performance expectancy (H9), effort expectancy (H10), social influence (H11), and facilitating conditions (H12) and the intention to adopt smart lockers for last-mile deliveries respectively. This suggests that an increase or decrease in IC would not significantly affect the associations being measured. However, the results on performance expectancy, effort expectancy, and social influence indicated a negative influence but insignificant. The outcome of the present research is in harmony with previous studies conducted by (Erjavec & Manfreda, 2022; Mazan & Çetinel, 2022; Tarhini et al., 2017) relative to adopting technology. It, however, contradicts the results from the following studies. However, the lack of contrary studies in the context that seeks to moderate IC to positively affect the association that encourages the adoption of technology makes it challenging to compare current results and previous outcomes. Several pieces of literature available focused on deploying IC as independent variables and determining its effects on the intention to adopt a technology instead of a moderator (Frank et al., 2015; Hoque & Sorwar, 2017; Lukmantara et al., 2021; Oliveira et al., 2014; Schneider, 2022; Soh et al., 2020). The outcome of UA and IC of the

current study indicates that to the participants, their decisions to use the smart lockers for last-mile deliveries have no connection with their cultural affiliations and beliefs.

5.1 Theoretical Contribution

From a theoretical angle, this research employs the Unified Theory of Acceptance and Use of Technology and the Hofstedes national culture model to investigate foreigners' intention to use smart lockers in last-mile delivery. Firstly, previous researchers have applied TAM (Chayomchai, 2020; Tarhini et al., 2017), innovation diffusion theory (Wang et al., 2018), TPB and UTAUT theory (Khan et al., 2022), and others to determine the acceptance of technology. Few studies have used theories such as TPB theory (Tsai & Tiwasing, 2021), perceived value theory (Yuen et al., 2019), and SSL customer value model (Quan et al., 2022) in studying people's intention to use smart lockers. In this research, we introduce the UTAUT dimensions; performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003) in the context of adopting smart lockers for last-mile deliveries to enrich literature and provide new theoretical insight. It must be noted there have been numerous digital transformative innovations that are gradually making digitalization nearly a necessity (Hussain et al., 2022; Sharma et al., 2022). Hence, users from all walks of life have reasons for using one technology or another (Hutagaol & Napitupulu, 2022). We argue that even though introducing innovations could create an atmosphere of usage, it must be triggered by elements of performing particular behaviours.

The need for smart lockers has gradually become a necessity and tool for resolving challenges related to delivering purchased items but influenced by several elements (Tsai & Tiwasing, 2021; Yuen et al., 2019). In this vein, our study has shown that social influence is the most influential when considering antecedents that make people use smart lockers. In addition, performance expectancy, effort expectancy, and facilitating conditions are also significant factors. Performance expectations have been discovered as the most influential element in the UTAUT model (Erjavec & Manfreda, 2022; Jadil et al., 2021), and social influence is the least significant factor in behavioral intention (Giri et al., 2018). Our study discovered that the social influence of UTAUT has the most significant effect on technology adoption, which differs from previous outcomes in context. The contribution from this study is relevant because existing literature lacks this conclusion and augments contemporary literature with novel empirical developments and judgments.

Before this study, we have seen previous research moderating dimensions of the UTAUT model on technology acceptance with demographic features such as age, gender, experience, the voluntariness of use, and sample size (Hoque & Sorwar, 2017; Jadil et al., 2021; Lukmantara et al., 2021; Mazan & Çetinel, 2022). This study, aiming to add to literature and practice, adopted two critical dimensions from Hofstede's cultural dimensions; uncertainty-avoidance and individualism-collectivism on adapting smart-lockers. Previous studies deployed the cultural dimensions to moderate elements under theories such as social cognitive theory (Faqih, 2016), Technology Acceptance Model (Giri et al., 2018), and the job-demand resource model (Jang et al., 2018). Previous studies reveal that there are rare studies investigating the moderating effect of Hofstede's cultural dimensions on technology adoption. Hence, the administration of this research is imperative in enhancing our understanding of how individual cultural elements could affect people's perceptions, choices, and behaviour in adopting an innovation such as smart lockers. The results of this study highlight the relevance of the contributions of the present analysis as they would stimulate future researchers even though the study's outcome showed that UA and IC did not moderate any association with the UTAUT model dimensions. Moreover, the current contributions will fill the knowledge gap in the literature because these conclusions are surprisingly absent from the literature.

5.2 Practical Implications

With the practical implications, the general outcome offers critical insights that would aid logistics service providers in China to provide appropriate parcel locker services, as people (respondents) always consider attributes such as performance expectancy, effort expectancy, social influence, and facilitating conditions before using new technological services. Firstly, for performance expectancy, the benefits users obtain from using smart lockers are one of the primary reflections for people to adopt this technology. If the users utilizing the smart locker for last-mile delivery do not experience the benefits, foreigners in China may consider using a different parcel reception approach. Hence, logistics service providers can ensure users by offering smart lockers to give them the expected benefits they obtain.

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Volume: 11 | Issue: 8 | August 2024 -Peer-Reviewed Journal

Secondly, for effort expectancy, the uncomplicated usage of smart lockers for last-mile delivery is one of the fundamental antecedents that lead users to use this technology. If the processes of using smart lockers are too complicated and tiring, the users may not be encouraged to continue using the technology and could divert. Logistics delivery entities and businesses should ensure their smart lockers that are easy to use and can minimize time and effort for users. Thirdly, regarding social influence, suggestions and recommendations from others who matter to users could lead them to use technology. The social influence posited to be the more significant predictor in this study could be a pervasive force in altering people's behaviour, which invariably influences their technological choices. The social influence outcome in the current study means that foreigners in China are exposed to influences from social forces. Logistics delivery companies and relevant entities must establish strategies that can fundamentally exploit the environment of friends, peers, and classmates, which can trigger perceptions that draw out the benefits of using technology. Additionally, although facilitating conditions appeared to be the least significant factor that triggers the use of smart lockers in the current study, its effects are positive and significant. Assuring users of this technology that logistic companies have the technical men and other supporting elements that could aid them in using this technology for a long time is a recipe for stirring their interest in staying with the innovation. Companies should have resource personnel who constantly educate and update users on the use and new developments.

The current research has attempted to cover at length the rarely theoretical-empirical based study dwelling on the moderating effect of uncertainty-avoidance and individualism-collectivism cultural elements at the individual level on technology usage factors and behavioral intention. It is a de facto belief that culture comes to bear as a critical and predominantly social element that significantly affects people's behaviour, choices, and actions. Professedly, unravelling means to develop functional and efficacious strategies to exploit the effect of culture on technology acceptance has not been a simple pursuit and is challenging to synthesize. Culture is essential, and changing one's culture over time is sometimes quite difficult. The current study on moderating UA and IC cultural elements at the individual level was insignificant. Hence, recommending logistics companies to formulate and administer to accelerate the usage rate of innovation would trigger debate. Even though the outcome of a study (Faqih, 2016) ascertained the moderating effect of UA and IC in using E-learning and recommended that technology should resonate seemingly with varying cultures, it would be challenging for this study to suggest the same. However, to the current outcomes, logistics companies' strategies developed to promote performance expectancy, effort expectancy, social influence, and facilitating conditions on technology adoption should not include the elements of culture.

5.3 Limitations and Recommendations

Cognizance of the study's contributions, the study also had some shortcomings. First, the sample size was limited to only eleven (11) provinces due to inadequate financial resources. These provinces were chosen due to proximity and accessibility to leaders of international student organizations who were willing to assist the research team. Other provinces also have universities with foreigners. Expanding the province number or studying the phenomenon by future researchers using different provinces, especially the ones in the North of China, would produce a different result other than this and generalize the outcome to an extent. The research team purposefully chose foreigners who use smart lockers voluntarily to partake in the survey to unravel why they use this innovation. Although the sample size was enough to satisfy the model preconditions, subsequent researches could expand the sample size to different provinces to generate more detailed knowledge on adopting smart lockers.

Additionally, the last-mile logistics delivery sector is booming at an increasing rate with several technological innovations. To be competitive in the coming years, the numerous logistics entity providers must endeavor to make their last-mile logistics delivery processes more efficient. Currently, there are new and sophisticated last-mile delivery approaches have surfaced, such as drone delivery, robotic delivery, and automated fulfilment centers. Accordingly, future studies could possibly investigate the intention to adopt these last-mile delivery methods. Moreover, the current research deployed two cultural elements to moderate the direction relationships, which was insignificant. Future researchers could focus on deploying socio-demographic aspects such as gender, income, and experience as developed in the original model of UTAUT to moderate the direct relationships between this study and the technology adoption of foreigners in China.

6 CONCLUSION

People's way of life, buying patterns, and processes of receiving their parcels have evolved. This has also resulted in behavioral change towards using or accepting technologies serving such purposes. People use these delivery

technologies due to several factors best known to them. Some may derive benefits from the technology, the ease of use, influence from others, and other conditions surrounding the use of the technology. Therefore, our research investigated factors that affect the adoption of smart lockers for last-mile delivery and a moderating role of uncertainty-adoption and individualism-collectivism adopted from the Hofstede cultural dimensions. The elements consisted of four main dimensions of UTAUT. We identified that the four factors (performance expectancy, effort expectancy, social influence, and facilitating conditions) affected the adoption of smart lockers. However, the moderating role of UA and IC did not suffice. The outcome shows that cultural values at the individual levels do not play a role in them using smart lockers.

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