# The Study of Consumers' Intention to Purchase in Unmanned Stores

Shu-Ling Hsu [a*]

[a] Department of Accounting Information, Southern Taiwan University of Science and Technology, Tainan, Taiwan

## Abstract

With the advancement of the technology era, the technology of various industries has gradually developed rapidly. The type of shopping that people pursue has also changed with time. From the grocery store gradually stepping into the supermarket, convenience stores have been gradually introduced to Taiwan and have slowly flourished in Taiwan because of the high desire of people to pursue a higher quality of life. In the case of an unmanned store, we focused on the X-Store, a 7-11 unmanned store in Taiwan, in which the development goals were to explore, experience, and excellent. We applied the Extended Integrated Technology Acceptance Model (UTAUT2) to conduct research on consumers' intentions toward unmanned stores, and we retrieved 180 valid questionnaires online. From the research results, it was found that "performance expectancy", "effort expectancy", "social influences", "facilitating conditions", "behavioral intention" and "use behavior" would affect consumers' intentions for unmanned shops.

Keywords: Extended Integration Technology Acceptance Model, Unmanned Store, Use Intention

JEL Classifications: M10, M31

[*]Corresponding author.
*E-mail address*: reneehsu@stust.edu.tw.
*Address*: No. 1, Nan-Tai Street, Yungkang Dist., Tainan City, Taiwan R.O.C..

## 1. Introduction

In the early retail industry, there was also the so-called honest store. Its concept was regarded as the predecessor of unmanned stores, but most of the payment methods were biased towards moral values. The greed of minded people led to theft and forced honest stores are gradually losing money in terms of revenue, and eventually face the crisis of collapse. Today, with the advancement and maturity of technology, the implementation of honest stores has been further changed, the use of new technologies has been more integrated, and it has been connected online and offline, and collected and analyzed through customer consumption behavior data. Achieving a variety of functions such as promotion, marketing, and enhance the consumers' experience, to create a new retail type of "unmanned store".

Amazon Go, an unmanned supermarket that officially open in USA in early 2018, advertising the fast-moving consumers' experience of "No lines, no checkout – just grab and go!" The software is called "Just Walk Out".  Shoppers simply scan a smartphone app while they arrive at a store. Then, shoppers can put their shopping in their bag and just walk out of the store. This software automatically calculates the cost of the customer's shopping and charges the cost of their shopping to the customer's Amazon account. It's a new kind of store featuring the world's most advanced shopping technology. It caused a global sensation as soon as it opened. It not only attracted a large crowd of people from all over the world, but with curiosity, waiting to enter the store for consumption. The new style of unmanned retail has become the hottest topic in the technology circle, and even set off a wave of unmanned stores around the world, including chain operators in China, Japan, South Korea, and Taiwan. Coronado-Hernandez *et al*. (2021) state that the implemented methodology allowed obtaining, for Amazon Go Stores and traditional retails, the key performance indicators (KPIs) such as the cycle time (CT), work in process (WIP), and the throughput (TP), revealing that the Amazon Go Store model exhibits better performance regarding the WIP and CT. Therefore, the Amazon Go Store model renders a higher-quality, more cost-effective service in the retail sector. The Market reported that the global smart retail market is forecast to grow from US$21.6 billion in 2020 to US$62.5 billion by 2025, with a compound annual growth rate of 23.6% (Market, 2021). The key factors facilitating the rapid growth of this market are the elevating use of robots and automation to offer shopping convenience to customers and the promoting adoption of big data analytics, machine learning, blockchain, and artificial intelligence technologies by retailers.

China's internet titans have also ventured into the unmanned store industry. Various types and technologies of unmanned store have been dynamically activated in China. One of China's largest e-commerce companies, Jingdong (JD), launched unmanned stores in 2018. The e-commerce giant Alibaba also launched Tao Cafe, a cashierless and cashless cafeteria. The social media giant Tencent has partnered with EasyGo to open unmanned flash-sale stores selling WeChat-themed products. However, the trend of unmanned store in China is coming and going

fast because of the depth of money pit. Even Alibaba and Tencent are wary, and no further actions have been taken after opening pop-up stores. Ruo (2019) indicated that the main reasons for the rapid bubble of China's unmanned stores are two. First, the industry grows savagely. there is disorderly competition, and the money is constantly burned but no profit model is found. Second, underestimating the investment cost of unmanned stores. The common illusion of the industry is that unmanned stores do not need to hire in-store cashiers and service personnel. They do not realize that they still need to rely on manpower to maintain goods, cleaning, etc., and unmanned stores must assemble various technological equipment that replaces manpower, and their investment is far more than the province. The labor cost is very difficult to recover in a short period of time. In short, the market for unmanned stores will ultimately be able to be played by powerful technology or retail giants.

In the innovative retail industry, whether major companies have sufficient and mature technology is the major key factor. Letting consumers walk into a store without clerk service is, on the one hand, an unprecedented first experience; on the other hand, for the industry, how to apply and connect artificial intelligence and the Internet of Things technology to make consumption. The flow of people, logistics and gold among consumers, goods and checkout can be perfectly and seamlessly connected. This is not only a major challenge for the retail industry, but also a brand-new consumers' market. The most important thing is whether "unmanned stores" can save costs for major operators, and further effectively grasp big data such as consumers' buying behaviors, preference models and spending power, and make analysis from them to make unmanned stores have mastered a new generation of consumers' markets, allowing Taiwan to take a completely new form of retail in the future.

Because of the COVID-19 crisis, enterprises were forced to take business online and consumers are looking to connect with brands and communities safely. "Untact" has been coined in South Korea to describe a contactless world, and it is also a trend across industries where brands utilize technology to reduce person-to-person contact. Kwak and Cho (2019) indicate the promotion strategy of the unhandy and retailers needs to offer "expansion of education and learning", readiness for the law aspect, reform of kiosk industry and priority of sufficient budge and politic assistance by government side.

The era of Internet development is coming. With the rise of FinTech, financial technology, markets and technologies that have never been in the past have been gradually created. For example, mobile payment has successfully solved some unnecessary losses caused by the early cash collection and payment system and brought many conveniences to the society. In daily life, consumers often go to convenience stores to shop. Today's Taiwan has a very convenient environment, with convenience stores and supermarkets everywhere. However, unmanned shops have not become popular in such a convenient environment in Taiwan. We can't help but wonder whether Taiwan's consumers are not well purchased in it. Or it may be that the plans

of enterprises for unmanned stores have not fully achieved effective promotion, which has caused the people of Taiwan to feel strange and afraid of this new type of retail industry. Therefore, this study attempts to investigate the factors that can affect consumers' intention of purchasing in unmanned stores, and whether the unmanned stores can make Taiwanese consumers feel at ease shopping. Guo *et al.* (2020) analyze the advantages and disadvantages of various customer-behavior recognition technologies in practical applications. The challenges and open issues faced by the development of unmanned stores, including noise interference, data redundancy and energy consumption, multi-person identification, and complex behavior recognition.

In the process of understanding unmanned stores, it is found that technology replaces manpower, saves time, and simplifies the tedious consumption process. However, in consumers' behavior, consumers not only care about the functions of unmanned stores, but also because of the external environment or personal psychology other factors. Therefore, we apply the Extending Unified Theory of Acceptance and Use of Technology, UTAUT2, to explore consumers' intentions to purchase in unmanned stores.

Han *et al*. (2020) analyzed the intention to continuously use unmanned store kiosks in South Korea. Their empirical results showed the analysis, empathy, reliability, convenience, and flexibility had a positive effect on expectations, and sympathy, reliability, and convenience factors had a positive effect on satisfaction. It also was verified that expectations and satisfaction had a positive effect on the intention to use. Also in South Korea, Oh (2020) tested through empirical analysis what role the social risk from COVID-19 plays in the process of consumption through unmanned stores. It was found that the perceived value of unmanned stores had a significant positive effect on the intention to continue use.

The two major e-commerce giants of China and the United States, Alibaba and Amazon, have successively deployed unmanned stores. However, after the unmanned store started, it has still not been able to scale up. The X-Store in Taiwan also announced its suspension plan of expansion unmanned stores. What is the reason why consumers are reluctant to continue to pay after the early adopters? This study will apply the effective questionnaires distributed and collected on the Internet for investigation and analysis to analyze the views of consumers in Taiwan on "unmanned stores" and their future expectations. In summary, the main research objectives of this study are as followed,

(1) The impact of consumers' expectation psychology on use intention in the unmanned store.
(2) The influence of consumers' external factors on use intention in the unmanned store.
(3) The impact of consumers' personal cognition on use intention in the unmanned store.

## 2. Literature

### *2.1. Retail Type of Unmanned Store*

With the development and changes of technology, the era of unmanned economy is gradually coming. Behind it, all are the use of various intelligent innovation technologies after the integration of artificial intelligence and Internet of Things technology, such as machine learning, Facial Recognition, robotics, RFID (radio frequency identification), artificial intelligence (AI), 3D printing, IOT (internet of things), autonomous driving, AR (augmented reality), VR (virtual reality), big data and drone. It has a physical business model that subverts e-commerce platforms and traditional retail department stores and is more valued by the commercial market.

The retail industry has undergone several changes so far. From the birth of retail stores of various types of department stores to the prevalence of online shopping, global e-commerce is growing strongly every year. But, Wang (2020) indicated that according to Stock-ai statistics, electronic retail only accounted for 10.5% of the overall retail in 2019 Q3, there are still many products that consumers need to touch, see, and experience in person before they are willing to pay. As a result, the two major e-commerce giants of China and the United States, Alibaba and Amazon, have successively deployed unmanned stores. Three types of unmanned stores are as followed (Wang, 2020):

(1) AI: Applying AI, Internet of Things, a large number of sensors, cloud computing and other artificial intelligence technologies to collect all kinds of consumers' information and identity verification and smart solutions for automatic checkout.

(2) RFID: Affixing an electronic label to each product. After the consumer has selected the product, he can go to the automatic checkout area to use induction technology to identify the checkout, saving shop assistants the time to scan the code.

(3) Vending machine: It has small footprint and low cost. But, different from traditional vending machines, it can be connected to the POS system to automatically count inventory, count revenue, and provide consumers with more payment methods.

However, the unmanned stores are not ubiquitous in Taiwan. Since the first X-Store set up in 2018, there are only four X-Stores in the three main city of Taiwan, Taipei, Kaohsiung, and Taichung. It seems that the unmanned stores are not necessarily suitable for every country, even though they have a lot of advantages for customers or retailer. Taking Taiwan's X-Store as an example, the consumers must establish an Open Point membership. However, the members with Open Point in Taiwan are not popular. The X-Store uses face recognition. Even if consumers have become members, they must establish face recognition information at the first time of entering the X-Store. After registration, consumers can enter the store, select products,

and use self-scanning product barcodes to checkout, and finally sense out of the store. Although the entire shopping process eliminates the clerk's checkout process, it increases the time cost of registering and exploring checkout equipment. At the same time, because the application technology of science and technology is not yet mature, some situations still need to be handled manually including the control of product quality, shelf replenishment, return and exchange, machine failures, unrecognition, checkout, and other problems. These problems tend to make consumers think that it is more convenient to buy in general stores.

### 2.2. Factors Affecting Consumers' Intentions and Hypothesis

MIC (2017) proposed the development trend of unmanned stores. Unmanned stores can provide 24-hour non-closed services, allowing consumers to conveniently pick up and pay without time restrictions, not only to quickly checkout. It can also quickly generate consumption details, which greatly shortens the time for consumers to shop. Amazon CEO Bezos (2018) believes that eliminating crowding during mealtimes in busy cities is a good opportunity for Amazon to change the shopping experience of physical stores, and accordingly points out that the level of consumption efficiency will affect consumers' use intention in unmanned stores. The innovation of a new technology cannot accurately understand the consumer's acceptance of this technology, so there are many theories and studies on consumers' acceptance, including the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB) and other methods.

*(1) The Impact of Consumers' Expectation Psychology on Use Intention in the Unmanned Store.*

Davis (1992) reported the relative effects of usefulness and enjoyment on intentions to use, and usage of, computers in the workplace. He indicated that usefulness and enjoyment were found to mediate fully the effects on usage intentions of perceived output quality and perceived ease of use. It seems that the consumers' expectation psychology, i.e., usefulness and enjoyment on intentions to use, increases their acceptability among potential users. Venkatesh *et al.* (2003) proposed a more effective and complete response to the influencing factors of user cognition, Unified Theory of Acceptance and Use of Technology (UTAUT). This theory is under test with explanatory power R-squared up to 70%, and this theory has used for analysis when discussing the factors that affect consumers. Researchers have utilized UTAUT to identify the most influential factors driving the adoption of technology. According to the studies, hedonic factors are the most important determinants of young generation's use of new technology (Boonsiritomachai and Pitchayadejanant, 2018). The UTAUT model has also been utilized in a number of studies (e.g., the adoption of smartphone) to investigate or identify the factors impacting new technology adoption in a range of research settings. It is then used to determine the factors that influence the adoption of technological and services (Escobar-Rodríguez *et al.*, 2014; Rahi and Ghani, 2019). The UTAUT summarizes the facets of four factors that affect

behavioral willingness and actual use: performance expectancy, effort expectancy, social influences, facilitating conditions, and four individual differences variables: gender, age, experience, and voluntariness.

Yousafzai *et al*. (2010) applied structural equation modeling to predict the consumers' behavior in the context of Internet banking based on three popular models, theory of reasoned action (TRA), theory of planned behavior (TPB), and technology acceptance model (TAM). Their results indicate that TAM is superior to the other models and highlights the importance of trust in understanding Internet banking behavior. Munir and Ilyas (2017) considered the acceptance of new technologies tend to always use the construct of perceived usefulness and perceived ease of use of TAM, but this may not be able to explain the behavior of customers towards new information technologies. They added perceived enjoyment as new factors that reflect the intrinsic belief in the acceptance of mobile banking customers. They also discovered that perceived ease of use affects perceived enjoyment of mobile banking positively, perceived enjoyment affects intention to use mobile banking positively, perceived ease of use affects perceived of usefulness of mobile banking and perceived of usefulness affects intention to use mobile banking positively. Chang and Chen (2021) applied the hedonic information systems acceptance model to identify the utilitarian and hedonic motivations affecting consumers' shopping intention. Their results show that perceived ease of use significantly affects perceived usefulness and perceived enjoyment. Perceived ease of use, perceived usefulness, and perceived enjoyment directly influence shopping intention. In addition, perceived ease of use has a stronger impact on perceived usefulness and shopping intention when the customer has a high level of technology readiness. Oh (2020) tested through an empirical analysis in the process of consumption through unmanned stores. It was found that the perceived benefits (perceived usefulness, perceived economics, perceived playfulness, and relative advantages) of unmanned stores all had a significant positive effect on perceived value. Besides, all perceived sacrifices (perceived risk, technicality) of unmanned stores had a significant negative effect on perceived value. Finally, the perceived value of unmanned stores had a significant positive effect on the intention to continue use. Therefore, the following hypotheses are proposed:

Hypothesis 1: Performance expectancy has a positive effect on consumers' use intention.

Hypothesis 2: Effort Expectancy has a positive effect on consumers' use intention.

*(2)The Influence of Consumers' External Factors on Use intention in the Unmanned Store.*

Moore and Benbasat (1991) described the development of an instrument designed to measure users' perceptions of adopting an information technology innovation. They indicated that the effects of corporate mandates on adoption is one which has been raised as a further factor which needs addressing in diffusion research. Industry analyst Wei (2019), according to the research of market analysis agency iiMedia Research, pointed out that Taiwan 7-11 currently uses different technologies to develop unmanned stores X-Store, facing the traditional retail

industry to step into unmanned. The competition in the store, the output value is expected to grow by leaps and bounds. It is pointed out that unmanned stores need to adopt different solutions due to different consumption habits in different places, and pay close attention to consumers, so that unmanned stores can develop their own stage in Taiwan. Lo and Wang (2019) include the emotional domain, moving experience, and the qualia product, which incorporated the essence of various experience types that were proposed by scholars. The most representative factors behind these elements include being unable to perform immersive shopping, being no memory of limited-edition souvenirs, and apps that are not good to use.

The related literature about social influence and facilitating conditions affecting the users' usage intention for new technology indicate that the success of an e-learning service depends on both its initial acceptance and its continued usage. Bakar and Razak (2014) analyzed the impact of social influence and facilitating conditions on intention to continue e-learning usage based on UTAUT. Their results indicated that social influence and facilitating condition were positively related to continuance intention explaining a total of 58% variance. Therefore, their study improved the understanding of the factors influencing continuance intention to use e-learning. Alraja (2016) chose two constructs, social influence and facilitating conditions, from UTAUT to investigate their impact on e employees' intention to adopt electronic government in Sultanate of Oman. Their results showed that both of constructs social influence and facilitating conditions had a significant effect on employees to adopt the electronic government. Wang *et al*. (2017) explored the determinants of teachers' continuance intention concerning cloud services, and their findings revealed that continued intention to use the cloud services was primarily determined by their attitude towards using it. However, attitude towards using is affected by perceived ease of use and perceived usefulness. In addition, perceived ease of use is influenced by facilitating conditions, and perceived usefulness is influenced by social influence. Boonsiritomachai and Pitchayadejanant (2018) applied the structural equation modeling and artificial neural networks techniques to explore the residents' attitudes toward sports event tourism development. They figured out that all sports event tourism impacts, including socio-cultural, economic, and environmental, are significant contributors toward the total impact on residents' perceptions. Zhou *et al*. (2019) assessed the social influence and facilitating conditions to support nurses' acceptance of Hospital Electronic Information Management Systems (HEIMS) in Ghana based on UTAUT. They concluded that nurses' adoption of HEIMS in terms of the use behavior was influenced by social influence and behavioral intention, whiles social influence intention and facilitating conditions had the strongest influence on behavioral intention (serving as mediator) of use behavior to adopt and use HEIMS among the nurses in Ghanaian hospitals.

Therefore, we apply the two factors, i.e., social influences and facilitating conditions, of Venkatesh *et al*. (2003) as consumers' external factors and propose the following hypotheses:

Hypothesis 3: Social influences have a positive effect on consumers' use intention.

Hypothesis 4: Facilitating conditions have a positive effect on consumers' use intention.

*(3)The Impact of Consumers' Personal Cognition on Use Intention in the Unmanned Store.*

Venkatesh *et al.* (2012) have successively proposed the "Extending Unified Theory of Acceptance and Use of Technology (UTAUT2)" transfer the perspective of business operators to the perspective of consumers. It covers a total of seven facets in terms of factors that affect consumers' behavioral willingness and actual use. Based on the original UTAUT, three additional purchase facets are expanded: Hedonic Motivation, Price Value, and Habit. These three purchase facets will also affect consumers' behavioral intentions in shopping. That is, the efficiency of consumption, the cost of consumption, the influence of family and friends, the consumption experience, the value of goods and the high efficiency of consumption, which can make consumers have a positive influence on the intention of using unmanned stores.

UTAUT2 has been applied by scholars in various research areas such as mobile payments, e-learning, mobile banking, and online shopping, etc. Yuan *et al.* (2015) adopted the UTAUT2 model to examine the predictors of the users' intention to adopt health and fitness apps. Their empirical findings supposed that performance expectancy, hedonic motivations, price value, and habit were significant predictors of users' intention of continued usage of health and fitness apps. Moorthy *et al.* (2019) identified the factors affecting accounting students' behavioral intention to accept mobile learning based on UTAUT2. They indicated that habit and hedonic motivation were the strongest influences in mobile learning behaviors among higher education students in Malaysia. Their empirical results revealed that habits had the most influence on accounting students' intention to adopt mobile learning through an investigation of technology acceptance in the domain of mobile learning. Chang *et al.* (2019) investigated the factors influencing the use intention and behavioral intention of online hotel booking based on UTAUT2 along with age, gender, and experience as moderators. Their results showed that behavioral intention was significantly and positively influenced by performance expectancy, social influence, facilitating condition, hedonic motivation, price value, and habit behavior. Wu and Wu (2020) investigated the people's intention of use of Google Chromecast by applying the UTAUT2 theory. They found that performance expectancy, facilitating conditions, hedonic motivation, price value, habit and brand image had significant effect on the behavioral intention of using Chromecast, while effort expectancy and social influence do not. Nikolopoulou *et al.* (2021) applied UTAUT2 model and extended it to include the technological pedagogical knowledge (perceived self-efficacy) factor to investigate the constructs-factors that influence teachers' intention of mobile internet use in the educational process. Their empirical results showed that habit, hedonic motivation, performance expectancy, and technological pedagogic knowledge significantly predicted teachers' intention to use mobile

internet, while behavioral intention, technological pedagogical knowledge, and habit affected actual use.

Joung *et al*. (2020) confirmed the positive effects of visual merchandising of unmanned stores and the affordance of unmanned systems on a customer's value. Additionally, there is also a positive relationship between a customer's value and intention of revisit. Therefore, we take hedonic motivation, price value, and habit as three factors of consumers' personal cognition. This study proposes the following hypotheses.

Hypothesis 5: Hedonic motivation has a positive effect on consumers' use intention.

Hypothesis 6: Price value has a positive effect on consumers' use intention.

Hypothesis 7: Habit has a positive effect on consumers' use intention.

## 3. Methodology

### 3.1. Research Framework

The research framework of this study is surveying the related literature papers of customers' intention use of unmanned store. Based on the prior literature, delivering three research hypotheses of this study: (1) the impact of consumers' expectation psychology on use intention in the unmanned store, (2) the influence of consumers' external factors on use intention in the unmanned store, (3) the impact of consumers' personal cognition on use intention in the unmanned store. Then, investigating consumers' views on the use of unmanned stores in a questionnaire to understand the advantages and disadvantages of unmanned stores in various aspects and how to attract consumers to use them. The questionnaire is mainly targeted at consumers in Taiwan. After the questionnaire is withdrawn, the questionnaire is analyzed, and the results are sorted out. The research framework is as followed:
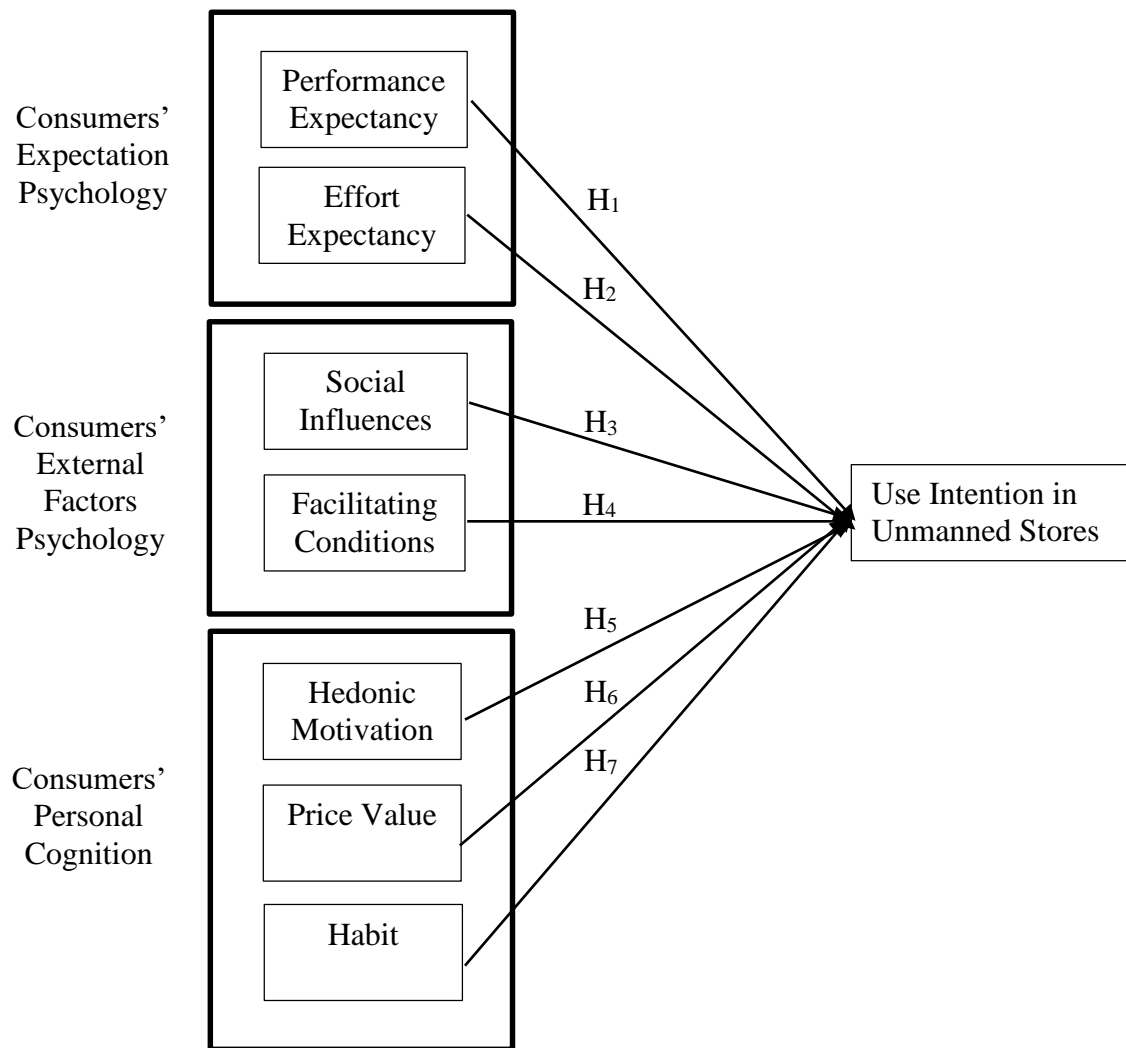
Figure 1: The Research Framework

### 3.2. Questionnaire Survey

To improve the effectiveness of data collection in this study, the design of the questionnaire questions is based on the UTAUT2 to conduct a question analysis survey to ensure the accuracy of the recovered data. The design of the questionnaire is divided into two parts. The first part is the survey of the basic information of the respondents, which includes gender, age, occupation, living area, monthly income, and education level. In the cognitive survey, the topics are measured by the facets in the UTAUT2. There are 35 questions in seven facets. The measurement index is based on the five-point scale of Likert, in order strongly agree, agree, normal, disagree, strongly disagree. We distribute questionnaires on the popular mainstream social media, such as Dcard, Facebook and Instagram.

## *3.3. Factor Definition*

Table 1: Factor Definition

| Variables | Definition |
| --- | --- |
| Performance Expectancy | Consumers shop in unmanned stores to improve shopping efficiency. |
| Effort Expectancy | Consumers' effort of purchasing in high-tech unmanned stores. |
| Social Influences | Consumers' acceptance of shopping in unmanned stores created by high-tech due to the influence of their surroundings and the environment. |
| Facilitating Conditions | Consumers believe that high-tech applications can be used in life. |
| Hedonic Motivation | Consumers adopt new technology in unmanned stores to increase their entertainment level. |
| Price Value | Consumers' acceptance of the prices of goods sold in unmanned stores. |
| Habit | Under the condition that high technology has not yet become popular, the influence on consumers to adopt high-tech products. |
| Use Intention | The consumers' acceptance of unmanned stores in the future. |

Based on the UTAUT2 provided by Venkatesh *et al*. (2012), we have chosen seven factors, "performance expectancy", "effort expectancy", "social influences", "facilitating conditions", "hedonic motivation", "price value", and "habit" as independent variables. And consumers' "use intention" has chosen as the dependent variable according to Davis (1992). Table 1 is the factor definition of this paper.

## 4. Research Results

Applying SPSS 24 for data statistics, a total of 181 data were issued, 1 invalid sample was deducted, and 180 were effectively recovered. The data was analyzed, and the data was organized into tables and presented as follows.

### *4.1. Descriptive Statistics*

There are six demographic variables in this study, which are divided into gender, age, occupation, living area, monthly income, and education level. The analysis results are shown in Table 2 below:

(1) The proportion of women is higher than that of men. 107 women are account for 59.4% of the sample, and 73 men are account for 40.6% of the sample.

(2) The age group is mainly 18-25 years old, which is 114 people account for 63.3% of the sample. Followed by 41-65 years old, which is 34 people account for 18.9% of the sample.

(3) Due to the age distribution of 18-25 years old, most occupations are students, which is 101 people accounting for 56.1% of the sample. Followed by 38 people in the service industry is accounting for 21.1% of the sample.

(4) The living area is the southern part of the county and city where the research is located, which is 106 people accounting for 58.9% of the sample. Followed by 58 people in the north where X-Store is located is accounting for 32.2% of the sample.

(5) Due to many respondents aged 18-25 with occupations as students, most of the monthly income fell below NT $10,000, which is 64 people accounted for 35.6% of the sample. Followed by NT $30,001-40,000 in the service industry, 33 people is accounted for 18.3%.

(6) The level of education is the highest in universities, which is 126 people accounted for 70.0% of the sample.

The measurement index adopts Likert's five-point scale. In order, 5 points means strongly agree, 4 points agree, 3 points ordinary, 2 points disagree, 1 point strongly disagree. The higher the score, the more respondents agree with the problem.

The results of the survey and analysis are shown in Table 3. The median is between 3 and 4, indicating that the respondents' answers fall between the ordinary and the agreed, and they agree with the subject. The average is 3, indicating that the respondent's answer to be between the ordinary and the average, so the respondents can all accept the impact of the unmanned store. After all the data is integrated, the standard deviation is shown to be close to 1, indicating that the data is centralized data. Besides, the average is less than the median and less than the mode. Therefore, the distribution of the data is left-biased or positive-biased, and the distribution is concentrated in the middle and high values. The respondents choose normal or mostly agree in most of the questionnaires.

Table 2: Descriptive Statistics of Questionnaire

| Variables | Category | Number | Percentage |
|---|---|---|---|
| Gender | Male | 73 | 40.6% |
|  | Female | 107 | 59.4% |
| Age | Under 18 years old | 3 | 1.7% |
|  | 18-25 years old | 114 | 63.3% |
|  | 26-40 years old | 29 | 16.1% |
|  | 41-65 years old | 34 | 18.9% |
| Occupation | Student | 101 | 56.1% |
|  | Public Servant | 4 | 2.2% |
|  | Service Industry | 38 | 21.1% |
|  | Freelance | 10 | 5.6% |
|  | Other | 27 | 15.0% |
| Living Area | North | 58 | 32.2% |
|  | Central | 14 | 7.8% |
|  | South | 106 | 58.9% |
|  | East | 2 | 1.1% |
| Monthly Income | Below NT $10,000 | 64 | 35.6% |
|  | NT $10,001-20,000 | 32 | 17.8% |
|  | NT $20,001-30,000 | 27 | 15.0% |
|  | NT $30,001-40,000 | 33 | 18.3% |
|  | Over NT $40,001 | 24 | 13.3% |
| Education | Below Junior High School | 2 | 1.1% |
|  | Senior High School | 29 | 16.1% |
|  | College | 17 | 9.4% |
|  | University | 126 | 70.0% |
|  | Master, PhD | 6 | 3.3% |

Table 3: Descriptive Statistics of Variables

|  | Performance Expectancy | Effort Expectancy | Social Influences | Facilitating Conditions | Hedonic Motivation | Price Value | Habit |
|---|---|---|---|---|---|---|---|
| Minimum | 1.500 | 1.000 | 1.000 | 1.000 | 1.000 | 1.500 | 1.000 |
| Maximum | 5.000 | 5.000 | 5.000 | 5.000 | 5.000 | 5.000 | 5.000 |
| Average | 3.681 | 3.610 | 3.692 | 3.811 | 3.729 | 3.568 | 3.417 |
| Median | 4.000 | 3.875 | 3.800 | 4.000 | 3.750 | 4.000 | 3.400 |
| Standard Deviation | 0.822 | 0.858 | 0.876 | 0.855 | 0.901 | 0.882 | 0.893 |
| Mode | 4.000 | 4.000 | 3.800 | 4.000 | 3.750 | 4.000 | 3.400 |

We apply Harman's one-factor test to analyze the presence of common method bias. Podsakoff *et al*. (2003) indicate that all the relevant items of the factors are put together as one to conduct the un-rotated factor analysis. If either a single factor emerged or one general factor explained most of the covariance in the independent and criterion variables, then substantial common method bias was present. In this study, all the 35 items from Performance Expectancy, Effort Expectancy, Social Influences, Facilitating Conditions, Hedonic Motivation, Price Value and Habit are included in a principal component factor analysis. The results of this analysis generated seven factors that explained 65.38% of the total variance, so no common method bias is identified.

### *4.2. Related Analysis*

The correlation analysis results of the measurement variables are shown in Table 4. The closer the value is to 1, the stronger the positive linear correlation between the two. The closer the value is to 0, the weaker the linear correlation between the two. The correlation coefficient can generally be divided into three levels, $|r| < 0.4$ is a low-level linear correlation; $0.4 \leq |r| < 0.7$ is a significant correlation; $0.7 \leq |r| < 1$ is a highly linear correlation. All values of the correlation coefficient of this study are greater than 0.5, indicating a positive correlation, and the ** represents 5% significance. The variables in this study have a positive correlation and are significant.

Table 4: Correlation Analysis

| Variables | Performance Expectancy | Effort Expectancy | Social Influences | Facilitating Conditions | Hedonic Motivation | Price Value | Habit |
|---|---|---|---|---|---|---|---|
| **Performance Expectancy** | 1 | 0.709** | 0.693** | 0.731** | 0.688** | 0.610** | 0.619** |
| **Effort Expectancy** | 0.709** | 1 | 0.719** | 0.688** | 0.608** | 0.595** | 0.608** |
| **Social Influences** | 0.693** | 0.719** | 1 | 0.786** | 0.730** | 0.625** | 0.698** |
| **Facilitating Conditions** | 0.731** | 0.688** | 0.786** | 1 | 0.795** | 0.615** | 0.682** |
| **Hedonic Motivation** | 0.688** | 0.608** | 0.730** | 0.795** | 1 | 0.700** | 0.697** |
| **Price Value** | 0.610** | 0.610** | 0.595** | 0.625** | 0.700** | 1 | 0.740** |
| **Habit** | 0.619** | 0.619** | 0.608** | 0.698** | 0.697** | 0.740** | 1 |

We apply the variance inflation factors (VIF) test to exam the existence of multi-collinearity in the estimation of relationship between dependent and independent variables. The results show in Table 5, all VIFs for our independent variables are below 2. These results suggest that multi-collinearity is not likely to be a major issue driving results in this study.

Table 5: Multi-Collinearity Test

| Variables | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| | B | Std. Error | Beta | | | Tolerance | VIF |
| (Constant) | 0.087 | 0.163 | | 0.359 | 0.527 | | |
| Performance Expectancy | 0.027 | 0.007 | 0.498 | 4.138 | 0 | 0.317 | 1.867 |
| Effort Expectancy | 0.025 | 0.006 | 0.043 | 0.574 | 0.538 | 0.886 | 1.908 |
| Social Influences | 0.023 | 0.004 | 0.219 | 2.754 | 0.057 | 0.892 | 1.683 |
| Facilitating Conditions | 0.231 | 0.052 | 0.277 | 2.297 | 0.047 | 0.351 | 1.826 |
| Hedonic Motivation | 0.088 | 0.068 | 0.473 | 0.075 | 0.047 | 0.785 | 1.924 |
| Price Value | 0.513 | 0.061 | 0.572 | 1.783 | 0.073 | 0.127 | 1.743 |
| Habit | 0.913 | 0.669 | 0.668 | 0.968 | 0.172 | 0.773 | 1.682 |

### *4.3. Reliability Analysis and Validity Analysis*

Reliability analysis is based on the measurement of variation theory, and whether the results are consistent in the test. Generally, Cronbach's Alpha value should be above 0.7, and the internal consistency of the factor should be at least higher than 0.6. The results of the reliability analysis and validity analysis of the variable in this study are shown in Table 6. The Cronbach's Alpha values are all greater than 0.7, and the "money value" is only 0.675 but close to 0.7. The significance is equal to 0.000, which is less than 5%. Therefore, according to the analysis results, it is shown that the variables in this study have certain reliability.

Validity analysis refers to whether the measurement is correct, that is, the degree to which the measurement tool can truly match what the researcher wants to measure. The KMO value is above 0.9 approaching 1, indicates excellent effect. The value above 0.7 is moderate, and the value above 0.6 is acceptable. The validity analysis of this study is shown in Table 6. We take seven variables as a representative of the population, and its KMO value is 0.943, which means that the research results are in excellent condition and meet our research purposes.

Table 6: Reliability Analysis and Validity Analysis

| Variables | Performance Expectancy | Effort Expectancy | Social Influences | Facilitating Conditions | Hedonic Motivation | Price Value | Habit |
|---|---|---|---|---|---|---|---|
| Cronbach's Alpha Value | 0.806 | 0.838 | 0.865 | 0.873 | 0.824 | 0.675 | 0.837 |
| Significance | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| KMO Value | | | | 0.943 | | | |
| Bartlett Test | | | | 3700.890 | | | |

### 4.4. Regression Analysis

(1)Consumers' expectation psychology on use intention in unmanned stores.

The results of the regression analysis of consumers' intention to accept the unmanned store caused by the consumers' expectations psychology are shown in Table 7. The larger the R-squared value, the better the interpretation ability of this regression equation. Research result shows that the adjusted R-squared is 0.475, indicating that its explanatory ability is 47.5%.

Table 7: Regression Analysis of Performance Expectancy and Effort Expectancy

| | Adjusted R-Square | Standardized Coefficient β Value | T Value | Significance |
|---|---|---|---|---|
| (Constant) | | | 4.860 | 0.000 |
| Performance Expectancy | 0.475 | 0.420 | 5.477 | 0.000 |
| Effort Expectancy | | 0.329 | 4.287 | 0.000 |

a. Hypothesis 1: "Performance Expectancy" has a positive effect on "Use Intention".

Regression analysis using "performance expectancy" as the independent variable and "use intention" as the dependent variable shows that at the level of $\alpha = 0.05$, "performance expectancy" has a positively significant relationship with "use intention", while the T value is

5.477 and standardized coefficient β is 0.42. The higher the efficiency of consumers in the consumption process of accepting unmanned stores, the higher the willingness of consumers to consume in the unmanned stores. Therefore, the results of this study support hypothesis 1: "Performance Expectancy" has a positive impact on "Use Intention", which is consistent with Venkatesh *et al*. (2003) and Davis (1992) that consumers accept unmanned stores for shopping, which can improve shopping efficiency.

b.   Hypothesis 2: "Effort Expectancy" has a positive effect on "Use Intention".

Regression analysis using "effort expectancy" as the independent variable and "use intention" as the dependent variable shows that at the level of α = 0.05, "effort expectancy" has a positively significant relationship with "use intention", while the T value is 4.287 and the standardized coefficient β is 0.329. The ease of operation and use of the machine in the unmanned store where high-tech is expected to be used by consumers is acceptable. Therefore, the results of this study support Hypothesis 2: "Effort Expectancy" has a positive effect on "Use Intention", which is consistent with Venkatesh *et al*. (2003) that the difficulty in operation of high-tech used in unmanned stores will affect consumers' intention to accept.

(2)Consumers' external factors on use intention in unmanned stores.

The results of regression analysis of consumers' intention to accept unmanned stores caused by external factors are shown in Table 8. The larger the value of R-squared, the better the interpretation ability of this regression equation. Research result shows that the adjusted R-squared is 0.553, indicating that its explanatory ability is 55.3%.

Table 8: Regression Analysis of Social Influences and Facilitating Conditions

|  | Adjusted R-Square | Standardized Coefficient β Value | T Value | Significance |
|---|---|---|---|---|
| (Constant) |  |  | 5.267 | 0.000 |
| Social Influences | 0.553 | 0.409 | 5.064 | 0.000 |
| Facilitating Conditions |  | 0.381 | 4.709 | 0.000 |

a.   Hypothesis 3: "Social Influences" has a positive effect on "Use Intention".

Regression analysis was conducted using "social influences" as the independent variable and "use intention" as the dependent variable. The results show that at the level of α = 0.05, "social influences" has a positive and significant relationship with "use intention". The T value

is 5.064 and standardized coefficient β is 0.409, which represents influential. The deeper the influence of consumers on family and friends around life, the greater the willingness to accept unmanned stores. Therefore, the results of this study support Hypothesis 3: "Social Influence" has a positive effect on "Use Intention", which is consistent with Venkatesh *et al*. (2003) and Moore and Benbasat (1991) suggest that consumers will be affected by others, the environment, etc. to accept unmanned stores.

b.  Hypothesis 4: "Facilitating Conditions" have a positive effect on "Use Intention".

Regression analysis was carried out using "facilitating conditions" as independent variables and "use intention" as dependent variable. The results show that at the level of α = 0.05, "facilitating conditions" has a positively significant relationship with "use intention". The T value is 4.709 and the standardized coefficient β is 0.381, which represents influential. Consumers believe that technology can be used in life, and the new business model can improve their own quality of life and thereby increase their willingness to accept unmanned stores. Therefore, the results of this study support Hypothesis 4: "Facilitating Conditions" has a positive impact on "Use Intention", which is consistent with Venkatesh *et al*. (2003) and Moore and Benbasat (1991) that consumers believe that the technology of unmanned stores can be used in life to improve their own quality of life.

(3) Consumers' personal cognition on use intention in unmanned stores.

The results of the regression analysis of the intention to accept unmanned stores caused by consumers' personal cognition are shown in Table 9. The larger the R-squared value, the better the interpretation ability of the regression equation. The research shows that the adjusted R-squared is 0.673, indicating that its explanatory ability is 67.3%.

Table 9: The Regression Analysis of Hedonic Motivation, Price Value, Habit

|  | Adjusted R-Square | Standardized Coefficient β Value | T Value | Significance |
|---|---|---|---|---|
| (Constant) |  |  | 4.139 | 0.000 |
| Hedonic Motivation | 0.673 | 0.366 | 5.669 | 0.000 |
| Price Value |  | 0.070 | 1.017 | 0.310 |
| Habit |  | 0.466 | 6.803 | 0.000 |

a.   Hypothesis 5: "Hedonic Motivation" has a positive effect on "Use Intention".

Regression analysis was carried out using "Hedonic Motivation" as the independent variable and "Use Intention" as the dependent variable. The results show that at the level of α = 0.05, "Hedonic Motivation" has a positively significant relationship with "Use Intention". The T value is 5.669, and the standardized coefficient β is 0.366, which represents influential. Consumers use the high-tech new products in unmanned stores for freshness and entertainment. Therefore, the results of this study support Hypothesis 5: "Hedonic Motivation" has a positive effect on "Use Intention". According to Venkatesh *et al*. (2012), consumers can apply technology in unmanned stores to improve their entertainment.

b.   Hypothesis 6: "Price value" has a positive effect on "use intention".

Regression analysis was carried out using "price value" as the independent variable and "use intention" as the dependent variable. The results show that at the level of α = 0.05, "price value" has no significant relationship with "use intention". The T value is 1.017 and standardized coefficient β is 0.070, it means that it has no influence. Because the price of goods in unmanned stores is the same as that of general convenience stores, the price of goods does not affect the willingness of customers to accept unmanned stores. Therefore, the results of this study do not support Hypothesis 6: "Price value" has a positive effect on "use intention", which is not in line with Venkatesh *et al*. (2012) 's suggestion that consumers have high acceptance of the price of goods in unmanned stores.

c.   Hypothesis 7: "Habit" has a positive effect on "use intention".

Regression analysis using "habit" as the independent variable and "use intention" as the dependent variable. The results show that at the level of α = 0.05, "habit" has a positively significant relationship with "use intention" and the significance is less than 5%. The T value is 6.803 and the standardized coefficient β is 0.466, which represents influential. With the advancement of technology, consumers will change their original consumption habits to improve the quality of life and will increase the willingness to accept unmanned stores. Therefore, the results of this study support Hypothesis 7: "Habit" has a positive impact on "use intention", which is in line with Venkatesh *et al*. (2012) that consumers will change their consumption habits as technology advances.

   (4)Consumers' expectation psychology, external factors, and personal cognition on use intention in unmanned stores.

Table 10 shows the results of regression analysis using "performance expectancy", "effort expectancy", "social influences", "facilitating conditions", "hedonic motivation", "price value", and "habit" as the independent variable and "use intention" as the dependent variable. The results show that at the level of α = 0.05, all seven independent variables have a positively

significant relationship with "use intention" and the significance is less than 5%. The full factors regression has the same results and conclusions with partial factors regression above.

Table 10: The Regression Analysis of Performance Expectancy, Effort Expectancy, Social Influences, Facilitating Conditions, Hedonic Motivation, Price Value, and Habit

|  | Adjusted R-Square | Standardized Coefficient β Value | T Value | Significance |
|---|---|---|---|---|
| (Constant) |  |  | 3.235 | 0.000 |
| Performance Expectancy |  | 0.745 | 5.482 | 0.000 |
| Effort Expectancy |  | 0.542 | 2.563 | 0.000 |
| Social Influences | 0.528 | 0.152 | 4.304 | 0.000 |
| Facilitating Conditions |  | 0.635 | 2.531 | 0.000 |
| Hedonic Motivation |  | 0.483 | 4.592 | 0.000 |
| Price Value |  | 0.168 | 3.173 | 0.037 |
| Habit |  | 0.253 | 2.791 | 0.000 |

## 5. Conclusions

### 5.1. Research Findings

Since the 1990s, Taiwan's industry has shifted to information and communication technology (ICT). It is expected that the major contribution of global and Taiwan's GDP in the next 10 years will come from the "digital business" to "future business". The rise of unmanned stores will not only expand the field of high-tech applications of artificial intelligence in Taiwan, but also make the business model of industrial intelligence more complete (Xie & Zhou, 2018), and the unmanned business model will become the future trend.

(1) The impact of consumers' expectation psychology on use intention in unmanned store.

The results of this study show that performance expectancy and effort expectancy will in turn affect consumers' willingness to accept the unmanned stores. In terms of performance expectancy, most consumers will have a high degree of acceptance of unmanned stores because the use of unmanned stores can bring good shopping efficiency and save time. Besides, unmanned stores mainly focus on "unmanned services" and "all-in-one self-service", so consumers can buy products with less pressure. When buying in the store, consumers agree that the possible effects of accepting unmanned stores are satisfactory. There is automatic sensing with the monitoring and control, therefore, consumers' safety and freshness of food are recognized.

For effort expectancy, new products under high technology are all new to consumers, and they will try to learn how to use them because of curiosity. Therefore, in the operation of unmanned stores, consumers think it is easy and simple. It is not difficult to learn and use, and customer further recognizes that all automated operations of unmanned stores are convenient and easy to use.

(2) The influence of consumers' external factors on use intention in unmanned store.

The results of this study show that social influences and facilitating conditions will affect consumers' willingness to accept the unmanned stores. For social influences, consumers are mostly influenced by relatives and friends around them and the Internet to accept the unmanned stores. Consumers also believe that the unmanned stores may become an indicator of future trends, but consumers do not agree that accepting the unmanned stores can enhance their position in the group. That means consumers go to the unmanned stores with considering the convenience brought by unmanned stores and the entire consumption process.

For facilitating conditions, consumers can accept the new business model of unmanned stores and believe that unmanned stores are developmental in this convenient society and can clearly understand and use related services in unmanned store stores. For example: self-service coffee, microwave, etc. And customers strongly agree that unmanned stores can bring better quality of life for themselves.

(3) Impact of consumers' personal cognition on use intention in unmanned store.

The results of this study indicate that hedonic motivation and habit affect the intention to accept the unmanned stores. For hedonic motivation, consumers accept new retail sales like unmanned stores, which creates a sense of freshness and interest, because such new retails subvert the services of general convenience stores. Entering the store is not just service staff to assist in checkout, coffee making, etc. The service is more of a self-service service that allows consumers to complete independently, and all this consumption process allows customers to feel a free, fast, and convenient three-in-one shopping experience.

For habit, although people prefer to pay on cash, the public will use electronic vouchers such as cards, leisure cards, etc. to pay for consumption. Some consumers begin to feel that they are bring a pile of change is cumbersome and causes great inconvenience when going out. For X-store in Taiwan, electronic vouchers are currently the most common payment method, so a few consumers who prefer to pay by credit card will not be considered.

For price value, most consumers can accept the additional purchase and binding of icash 2.0 before entering the X-Store. They are willing to spend this cost to become a member and agree to experience high-tech services when going to the unmanned stores. Consumers also believe that the prices sold in unmanned stores are reasonable, but the unmanned stores should sell on promoted or discounted to consumers while saving labor costs.

### 5.2. Managerial Implication

The research finding provides practical implications for unmanned stores in Taiwan. Consumers' expectation psychology, external factors, and personal cognition on consumers' use intention in unmanned stores all tent to positive. In fact, unmanned stores are not widespread in Taiwan. Since the first X-Store set up in 2018, there are only four X-Stores in the three main city of Taiwan, Taipei, Kaohsiung, and Taichung. Although unmanned stores are convenient, they are not necessarily suitable for every country. After unmanned stores settle in Taiwan, the management still need to gradually cultivate new shopping habits for consumers and think about how to maintain the convenience of technology and the warmth of humanity at the same time. Auto-sensing refrigerators, self-service coffee and other special technologies, unmanned shops are a novel experience for the public, and they can indeed save personnel costs. However, for Taiwanese who are accustomed to personal service, it may take some time to adjust. Maybe, compound management no longer emphasizes unmanned people but combines automated machines to retain the experience of clerk service. In addition, technology should also be used to extensively collect consumers' data to create a personalized shopping experience.

### 5.3. Limitation and Suggestion

Only a few of unmanned stores in Taiwan now, this research does have some limitations. Firstly, partial of respondents who participated in this study haven't purchased in unmanned stores, which means they don't have real consumers' experience of purchasing in the unmanned stores and only answer the questionnaire by their imagination. For the potential consumers, they might still have no problem with the unmanned stores and not yet feel how their intention after the consistent purchasing in the unmanned stores.

This research might need more respondents of consumers in unmanned stores so that the other researchers may evaluate more whether the consumers have a truly willing or unwilling to purchase in unmanned stores. The future study may need to collect more samples from consumers that have already purchased in unmanned stores to understand their intention.

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