國 立 清 華 大 學

碩 士 論 文

探 討 台 灣 採 用 與 使 用 中 英 菜 單 翻 譯 應 用 程 序：基 於 擴 展 的 UTAUT-2 模 型 的 洞 察

Exploring the Adoption and Usage of Chinese-to-English Menu Translation

Applications in Taiwan: Insights from an Extended UTAUT-2 Model

系 別：國 際 專 業 管 理 碩 士 班 IMBA

學 號：110077443

研 究 生：布 萊 登 Brendon Pedro

指 導 教 授：謝 英 哲 博 士 Dr Ying-Che Hsieh (ALI)

中 華 民 國 一 一 二 年 六 月

Abstract

The aim of this study was to examine the factors influencing adoption and usage for Chinese-to-English meu translation applications (CEMTA) by users in Taiwan, utilizing a two-stage research process. In the first phase, the study positioned CEMTA within the context of a platform-based model (PBM) that can facilitate a user-centered approach to its design and implementation, rationalizing this approach by acknowledging the unique advantages a PBM offers, as well as the challenges and success factors for its operation. The second phase proposed a research model which extended and adapted upon the unified theory of acceptance and use of technology (UTAUT-2) framework, introducing two new constructs, translation accuracy and cultural adaptability, to explore key elements influencing CEMTA adoption. The data was collected from non-Chinese speaking users of CEMTA (n = 281) and analyzed using partial least squared structural equation modeling (PLS-SEM). Although the proposed constructs did not significantly impact users' intentions to use CEMTA, this study does emphasize the importance of performance expectancy, habit, and hedonic motivation as central determinants of intention to use CEMTA, as well as validates the significant and positive influence of intentions to use on actual usage of a technology in the context of CEMTA, expanding the UTAUT-2 framework's applicability to this domain. The study further highlights Taiwan's suitability as a research location given the high demand for English translations of menus and high prevalence of Chinese-only and poorly translated bilingual menus at food service establishments in the country. The findings have both research and practical implications, advancing our understanding of CEMTA adoption in Taiwan and providing valuable insights for improving the technology's usability for non-Chinese speakers.

Keywords: Chinese-to-English menu translation (CEMTA); technology adoption; platform-based model (PBM); UTAUT-2; performance expectancy; habit; hedonic motivation, translation accuracy; cultural adaptability; Taiwan

Acknowledgements

I would like to dedicate this thesis to my late father, Fernandez Pedro. I started this journey a year after his passing, and his absence has been profoundly felt. By completing this program, I feel that I am following in his footsteps, and although he couldn't physically be here to witness this accomplishment, I know his spirit has been with me every step of the way, providing words of encouragement and a deep sense of comfort.

I am deeply grateful to my wife, Portesche Warnick Pedro, who has been my pillar of strength throughout my journey. Her sacrifices, both in terms of time and financially, allowed me to focus on my work and research. She has managed the household and contributed significantly to our financial stability, all the while believing in me and boosting my confidence. I can't express how much I appreciate her support.

I am also extremely grateful for the continuous support from my mother, Ronell Pedro, and sister, Ferron Pedro, in South Africa. Despite our geographical distance, they never missed an opportunity to send words of encouragement. Your love has kept me motivated, and always made me feel well supported, even during the toughest of times.

A special thanks to Lungani Hlongwa who inspired the idea of this research. I Also owe a debt of gratitude to my supervisor, Dr. Ying-Che Hsieh (ALI), for his guidance throughout my research. He afforded me the freedom to pursue a topic that truly interested me, for which I am very grateful.

Finally, I would like to express my appreciation to all my friends and extended family for their support and words of encouragement during this journey. Your support has been instrumental in helping me reach this milestone. I love you all and thank you from the bottom of my heart.

Table of Contents

List of Figures

List of Tables

Chapter 1

1. Introduction

1.1 Background of the Study

The restaurant industry in Taiwan has experienced significant growth with foreign tourists playing an important role in driving this expansion (Blazyte, 2022). In addition to restaurants, food service establishments, such as food trucks, street food stalls, and night market vendors are particularly popular in Taiwan and other Asian countries (Erway, 2015). While Taiwan is eager to welcome tourists (Erway, 2015), language barriers present a challenge for these tourists, expats, and other non-natives when trying to order food at the local establishments. To address this issue, non-natives may need to either invest time to learn the language, spend money on lessons, or both. On the other end, the Taiwan government promotes bilingualism with the Bilingual 2030 initiative in which investment is made into the education system for locals to learn English (National Development Council *et al*, 2021), or food servicing businesses may need to hire staff with English proficiency, which is often at a higher wage. Another approach is the use of translation applications.

To address this issue in a global context, many machine translation applications have emerged because of the rapid development of mobile technology and the integration of platform-based models (PBM) (Parker *et al*, 2016), providing users with a convenient way to translate food menu items in foreign languages, and bridging the language gap faced in many food service establishments. However, these tools do not serve as a panacea for solving the language barrier in this context, as they have not been specifically designed to address Chinese-to-English menus, but rather offer advanced machine learning capabilities that make it useful for translation menus. A popular translation application such as Google Translate for example, is criticized for providing culturally insensitive translations for many Chinese food items as it uses translation algorithms

that do not take context into consideration because it relies on probability rather than accuracy (Fuentes-Luque, 2017). While there is no tool designed to specifically address menu translations without losing the meaning of the source text, which is known to be a difficult feat to achieve (Amenador & Wang, 2022), there are popular translation applications such as Waygo and Pleco, which are designed for translating Asian languages, including Chinese-to-English to better service this language barrier in Chinese and other Asian language speaking countries.

For the purposes of this study, a Chinese-to-English menu translation application (CEMTA) is defined as a mobile tool that contains the functionality of converting text of Chinese food menu items, which includes Traditional or Simplified Mandarin, to English. Positioning CEMTA as a platform-based model has significant potential because the benefits exceed that of a well-functioning application. A PBM functions as a two-sided marketplace in the context of CEMTA, in which consumers who need translation services are linked with businesses that need English-speaking customers, thereby facilitating the interactions. Moreover, the PBM has unique benefits in which it grows with it its user base through network effects, potentially leading to improved services. As a PBM, CEMTA can incentivize stakeholders and developers to invest in the development of the technology to yield feasible and monetary results, while consumers reap the benefits of having accurate translation applications. Thus, an effective and successful PBM for CEMTAs could serve as a feasible solution for bridging the language barrier between restaurant staff and consumers, especially in Taiwan, ultimately improving the overall dining experience and servicing the needs of all stakeholders (Fuentes-Luque, 2017, Srinivasan, 2021).

1.2 Problem Statement

There is a need for accurate and efficient menu translation services in the food servicing industry, particularly in Taiwan due to the current language barrier. The lack of research on the factors

influencing the adoption and usage of Chinese-to-English menu translation applications (CEMTA) presents a gap in literature. Moreover, there is a need to assess the effectiveness of existing CEMTAs in meeting user needs and identify areas of improvement in their design and implementation, as well as the design and implementation of their platform-based business models (PBM).

This study addresses this gap by examining the key elements of PBMs for Chinese-to-English menu translation applications operating in Taiwan which encompasses both unique PBM characteristics and factors influencing user adoption and acceptance as identified in the Unified Theory of Acceptance and Use of Technology (UTAUT-2) framework. By exploring these elements and factors, as well as user needs and preferences, this study identifies specific areas of improvement for PBMs for Chinese-to English menu translation applications and proposes recommendations for improving their design and implementation to better meet the needs of users and in the Taiwanese market.

1.3 Key Research Question

How can a Chinese-to-English menu translation application operating in Taiwan be improved to better meet the needs of users?

1.4 Theoretical Frameworks: Modified UTAUT-2

To achieve the aim and answer the research question guiding the study, the primary framework employed in this study was based on The Unified Theory of Acceptance and Use of Technology (UTAUT-2) as proposed by Venkatesh et al (2012) which is an extension of UTAUT initially proposed by Venkatesh *et al* (2003). UTAUT is often used in studies that focus on the adoption of new technologies in general, while UTAUT-2 is modified for the consumer technology acceptance and use context (Venkatesh *et* al (2012). Palau-Saumell *et al* (2019) adapted and extended the

UTAUT-2 framework to be specifically designed to investigate the adoption of information and communication technologies (ICT) and created a model to better fit the context of mobile applications for restaurants.

Given that this study investigated user adoption of a Chinese-to-English menu translation application, which is an information technology, the extended UTAUT-2 framework proposed by Palau-Saumell *et* al (2019) was a better fit. By applying the modified UTAUT-2 framework with the addition of two new constructs proposed in this study, namely, translation accuracy and cultural adaptability, this research was better able to identify factors that influence the user adoption and acceptance of the applications specific to the context of Chinese-to-English menu translation applications.

Additionally, the Business Model Canvas (BMC) initially proposed by Osterwalder (2004) and later adapted by Osterwalder *et al* (2014) was highlighted in the literature review to address its promise as a lens for future investigations into the specific business models underlying CEMTA. As such, the BMC was not directly utilized for analysis or used as a theoretical framework for the study, but rather referenced for future research to enhance the understanding of the key elements of PBM for CEMTA operating in Taiwan.

1.5 Scope & Significance of the Study

The key focus of this study is the current state of Chinese-to-English menu translation applications (CEMTA) operating in Taiwan. The study includes a literature review and the use of a modified UTAUT-2 as the primary theoretical framework for analysis. The results are used to identify areas of improvement and conclude by providing recommendations for enhancing PBMs for CEMTAs to better meet the needs of users. The study also contributes to the broader literature on platform-based business models and their impact on the food service industry in the context of menu

translation applications. These insights provide practical recommendations for improving the design and implementation of these applications operating in Taiwan.

The findings and recommendations of this study have practical implications for users, food servicing businesses in the Taiwanese market, and developers of these applications. For users, the recommendations aim to improve the accuracy and usability of CEMTA, making the dining experience more enjoyable and accessible for non-native speakers. For food servicing businesses, the recommendations aim to enhance the PBMs of these applications, potentially increasing their customer base and improving the overall customer experience. For developers, the UTAUT-2 results provide insights into focus areas for these applications. The Findings could also be useful to entrepreneurs and businesses looking to develop similar applications or solutions to improve the dining experience of users.

1.6 Methodology, Research Objectives, & Thesis Structure

This study used quantitative research design, using surveys for primary data collection and structural equation modelling (SEM) for analysis. This paper is constructed in two phases. The first phase involves conducting a literature review to provide a comprehensive understanding of platform-based business models for Chinese-to-English menu translation applications operating in the Taiwanese market. The literature review serves as the foundation for more focused primary data collection in the second phase.

The second phase is data collection and analysis and is the primary data collection phase. In this phase, data is collected using a questionnaire. A modified UTAUT-2 framework is used to guide the survey instrument and answer specific research questions related to the factors influencing adoption and usage of Chinese-to-English menu translation applications in the Taiwanese market. The research objectives and hypothesis are intrinsically tied to the framework and the specific

areas of improvement identified in the study as they investigate the factors that influence user adoption and acceptance of these applications. Data analysis was conducted using a combination of statistical analysis, specifically descriptive, and partial least squares structural equation modelling (PLS-SEM). These quantitative approaches provide a comprehensive understanding of the collected data from different perspectives, revealing the factors important to users and the factors that significantly influence user adoption and acceptance. This evidence forms the basis for the proposed recommendations to improve PBMs for Chinese-to-English menu translation applications.

Research Objectives of Phase 1

The research objectives for phase one include positioning CEMTAs within the context of a Platform-Based Model (PBM), identifying the challenges and success factors associated with PBMs for CEMTA in two-sided marketplace, addressing key elements of a platform-based business model for CEMTA using the Business Model Canvas framework, and identifying constructs that can be used to extend the UTAUT-2 framework to better understand user adoption and usage of CEMTA.

Research Objectives of Phase 2

The research objectives for phase two include the introduction of the new constructs to the UTAUT-2 framework, modifying the framework, and applying it to a new context. This is followed by the exploration of the key factors that influence user adoption and usage of CEMTA among non-Chinese speaking individuals who have firsthand experience dealing with language barriers using a modified UTAUT-2 framework for prediction. The research objectives also include validating Taiwan as an ideal location for study because of the high volume of non-mandarin individuals operating in Taiwan, as well as the large volume of food servicing businesses with

Chinese-only menus or poorly translated menus. In addition, focusing on the findings from users who directly face the challenge that the technology was designed to address and who actively use the technology for this purpose should provide valuable insights into user adoption and acceptance. Following data collection, the proposed relationships between the constructs in the proposed UTAUT-2 model are tested by using partial least squared structural equation modeling (PLS-SEM), a method of analysis conducted in similar studies. The analysis should determine the level of importance of these factors in Taiwan using the proposed model.

Achieving the research objectives of each phase should provide valuable insights to answer the key research question of this study: *How can CEMTA be improved to better meet the needs of users?*

Chapter 2

2. Literature Review

This literature review introduces Chinese to English menu translation applications, provides an overview of platform-based business models, their importance in today's economy, and highlights their key characteristics and features in relation to traditional business models. The Chinese-to-English menu translation application (CEMTA) is then positioned as a platform-based business in a two-sided marketplace, discussing the challenges, strategies, and key success factors related to these PBMs. This is followed by a brief discussion on the Business Model Canvas and how it can be used to analyze and potentially improve platform-based businesses and their user adoption and acceptance. The current state of menu translation applications operating in the Taiwanese market is then further elaborated on, focusing on user preferences, food service establishment challenges and preferences, the role of cultural adaptability and Skopos theory in CEMTA, as well as the impact on dining experiences. This is followed by a discussion on how the UTAUT-2 framework is used to understand user motivations and adoption factors of CEMTAs, as well as the hypothesis development and theoretical basis for the proposed conceptual model, which provided insights into the overall user experience to inform the development of more user-centric CEMTAs in the Taiwanese market. The review concludes with a summary of the key findings derived from the existing literature.

2.1 Overview of Chinese-to-English Menu Translation Applications (CEMTA)

This section of the literature review introduces the concept of menu translation applications and their purpose. It also provides an overview of Chinese-to-English menu translation applications (CEMTA), setting the foundation for understanding the context and relevance of these applications

8

in the platform-based business model framework (Parker et al, 2016; Evans & Schmalensee, 2016; Cusumano et al, 2019).

Translation applications are devices that allow for software programs or mobile applications to convert text or speech from one language to another, allowing users to communicate and understand context across different languages (Fuentes-Luque, 2017). Menu translation applications specifically focus on translating food menu items from one language to another, enabling users to understand and order food items from restaurants with menus in languages they may not be familiar with (Fuentes-Luque, 2017). As previously mentioned, a Chinese-to-English menu translation application (CEMTA) is defined as a mobile tool that contains the functionality of converting text of Chinese food menu items, which includes Traditional or Simplified Mandarin, to English. This is achieved by using a smart phone with translation capabilities, in which the camera is used to instantly translate text (Chen *et al*, 2017).

The primary function of CEMTA as defined by this study is to bridge the language gap between non-native individuals and Chinese menus, enhancing the dining experience for tourists, expatriates, international students, professional workers, and other non-fluent Chinese speaking individuals operating in Chinese-speaking countries. (Sun & Sun, 2017; Zhong, 2020, Huo *et al*, 2020). By facilitating communication and understanding between users and food servicing establishments, these applications contribute to a more enjoyable dining experience and expand the customer base of these establishments (Liu *et al*, 2022).

It's important to recognize that not all translation applications are equal as they vary in terms of features, translation accuracy (Chen *et al*, 2017), cultural adaptability of user interfaces (Reinecke & Bernstein, 2013), and pricing models (Cusumano *et al*, 2019). These factors can significantly impact the overall effectiveness and user satisfaction of a translation application, making it crucial

for developers to understand and address the specific needs and preferences of their target audience when designing and refining their products.

2.1.1 Relevance of CEMTA in Tawain

CEMTAs are particularly relevant to the Taiwanese market due to the increasing number of international tourists who may have limited knowledge of Traditional Mandarin Chinese, the local, and predominantly spoken language of Taiwan. These applications are important tools for bridging the language gap and enhancing the overall dining experience. Restaurant, cafes, and other types of food serving businesses in Taiwan has generated a total of 609 billion New Tawan dollars in 2021 (approximately 20 billion USD), an increase from 404 billion New Taiwan dollars (approximately 13.25 billion USD), in 2011 (Blazyte, 2022).

Foreign tourists are an important income generator in this sector with many tourists visiting Taiwan specifically to experience its local cuisine (Wang, Yu, & Lee, 2023). Despite the decrease of 11.864 million international visitors in 2019 to a mere 895,000 in 2022 (Taiwan Tourism Bureau, 2023) and impact of the COVID-19 pandemic on Taiwan's food serving industry, Taiwan's government is making concerted efforts to invest in the industry and attract foreign tourists to see its continued growth (Wang, Yu, & Lee, 2023).

Unfortunately, very few foreigners can communicate or understand Traditional Mandarin Chinese or Taiwanese Mandarin, the native and most used language in Taiwan spoken by around 83.5% of the population (Directorate-General of Budget, Accounting and Statistics, Executive Yuan, R.O.C. (Taiwan), 2012). Additionally, many local restaurants in Taiwan prioritize an authentic and localized experience for their customers, resulting in limited English menus available to cater to English-speaking customers (Liu, et al, 2022). Consequently, this restricts the customer experience and potential range of customers for these restaurants.

CEMTAs could greatly aid English customers to navigate and understand Chinese menus, facilitating communication and understanding between users and food servicing businesses, making their dining experiences more enjoyable, and expanding the customer base of these businesses. However, while these translation applications have gained popularity among users and represents a notable advancement in addressing the language barrier experienced by non-natives, they still face challenges that hinder their effectiveness in meeting the needs of both users and these businesses. These challenges are further discussed in the latter part of this study of this study, In addition, there are challenges related to the PBM (Rochet & Tirole, 2003; Evans & Schmalensee, 2016; Parker et al, 2016; Schweiger et al, 2016; Cusumano et al, 2019), particularly those used by these applications.

To address these challenges, many of these applications have integrated advanced features such as tailored machine learning algorithms to improve translation accuracy (Chen *et al*, 2017), user interfaces to enhance usability (Reineck & Bernstein, 2013), and alternative pricing models to provide suitable options for users (Cusumano et al, 2019). However, there is still room for improvement in these specific areas, as well as in the design and implementation of PBMs for CEMTAs. This requires a deeper understanding of these challenges and potential solutions to improve the adoption and success of these applications in the Taiwanese market.

2.2 Overview of Platform-based Business Models

This section of the literature review briefly introduces the concept of platform-based business models (PBM), its importance in today's economy, distinguishes traditional business models from platform-based business models through their key characteristics and features. In doing so, this section aims to provide a foundational understanding of platform-based business models, offering

valuable context to better understand and evaluate the unique dynamics of menu translation applications as a PBM.

2.2.1 What are Platform-Based Business Models?

In order to become familiar with the concept of platform-based business models, we first must address what is meant by "platform" in this context. Smicek (2017) defines a "platform" as a digital infrastructure that enables the interaction of two or more groups. This digital infrastructure connects different groups of users in a two-sided or multi-sided market, providing an open and participative environment to interact and exchange goods, services, or information (Parker et al, 2016). The term "platform" or "digital platform" is often used interchangeably with "platform-based business model" or "platform-based model", but it's important to clarify the difference because they refer to different aspects of the platform phenomenon and this distinction can help clarify the nature of value creation in a platform ecosystem (Kim, 2014).

In the most general sense, the term "platform based-business" refers to companies which develop platforms for their activities, while a "platform-based business model" refers to a specific type of business model that leverages the use of these platforms to connect different groups of users and facilitate value creation (Parker et al, 2016). Kim (2014) states that a platform business model involves a transaction occurring in a two-sided market that consists of a component, a rule, and two sides in which the occurrence of transaction, network effects, a business ecosystem, and innovation take place sequentially. While the term is not clearly defined because of how different levels of research address this phenomenon (Schweiger et al, 2016), there is a consensus for this distinction which is that a "platform" is the general term for the underlying technology infrastructure consisting of many dimensions and types that are designed for specific use cases or industries, and as such, would have different governance structures, business models, and

ecosystem dynamics which can impact their success or failure. A "platform-based business model" refers to a specific type of business model that leverages this infrastructure or 'digital platform' to create and capture value for different stakeholders in a two-sided or multi-sided market (Parker et al, 2016; Evans & Schmalensee, 2016; Rogers, 2016).

2.2.2 Importance of Platform-Based Business Models in today's Economy

The platform-based business model is not a new phenomenon but is gaining increasing importance in today's economy due to the growth of digital technology (Srinivasan, 2021). Prior to the emergence of digital technology, platform businesses operated under a brick-and-mortar framework (Hagel, 2015) which could be traced back to as early as the 1900s, where physical platforms such as shopping malls, transportation hubs, and stock exchanges were used to connect buyers and sellers (Parker et al, 2016). Cusumano *et al* (2019) adds that the telephone, yellow pages, electric power, railroads, and radio and television were all heavily dependent on network effects and complementary innovations for their business to grow.

Rochet & Tirole (2003), introduced the application of the two-sided market theory to these models which explains pricing and competition strategies in markets where one business serves two different types of customers that are mutually dependent on each other. This economic theory was later expanded upon to multisided markets, in which Eisenmann et al (2006) argues that the same dynamics could be extended to markets with more than two types of customers, such as credit card companies bringing together customer, merchants, and banks. The works of Rochet & Tirole (2003) have therefore become increasingly relevant in explaining and understanding the growth of platform-based business models in today's economy.

With the emergence of digital technology and digital platforms, the accelerated growth of these platform-based businesses has led to new business models, allowing for the potential to create new

opportunities for businesses and consumers, as well as transform many traditional industries (Parker et al, 2016). The importance of these models can be seen in the growth of the sharing economy in which companies such as Uber, Amazon, and Airbnb have revolutionized their respective industries due their model's scalability, positive network effects, and ability to leverage data to create value (Parker et al, 2016; Srinivasan, 2021). In addition, Evans & Schmalensee (2016) argue that these models can create significant value by reducing costs and facilitating the collaboration among different stakeholders. The fuel provided by digital technologies has enabled platforms to rapidly expand, allowing businesses to scale more easily and create network effects that were previously not possible.

2.2.3 Key Characteristics and Features of Traditional businesses vs. PBMs

Platform-based businesses present unique characteristics with value flows that differentiate them from traditional businesses (Parker et al, 2016; Srinivasan, 2021). According to Evans & Schmalensee (2016), they differ in how they create and capture value through connecting different user groups. Traditional businesses typically function under a linear value chain in which the means of production and distribution is controlled and owned by these businesses to compete based on economies of scale, product differentiation, and cost efficiency (Parker et al, 2016; Cusumano et al, 2019). The value is created through products and services by taking raw materials as inputs and creating products or services to sell to customers and their respective markets (Hagel, 2015). The distribution of these products and services usually involves significant investment in physical distribution networks such as warehouses, transportation, and retailers.

The platform business model in contrast, does not own the means of production, but rather creates and facilitates the means of connection (Hagel, 2015). These models create value by connecting different groups of users in a networked market and facilitating the exchange and collaboration

14

between them (Parker et al, 2016; Srnicek, 2017; Srinivasan, 2021). Their value proposition is enhanced by leveraging data and technology to create positive network effects, reduce transaction costs, and increase efficiency (Evans & Schmalensee, 2016; Rogers, 2016). The internet for example allows for zero marginal cost and since platforms can connect buyers and sellers virtually allowing for digital delivery of products and services, economies of scale and scope is further enhanced for the strongest players (Cusumano et al, 2019).

Key characteristics that distinguish platform-based business models from traditional businesses include, their multisided nature, in which they bring together multiple groups of users that depend on each other and create value through interaction (Eisenmann et al, 2006; Parker et al, 2016), an open and participative environment, in which users can co-create value, share information and resources, and innovate (Parker et al, 2016, Cusumano et al, 2019), as well as the winner-takes-all dynamic, in which the dominant platform is able to capture a significant portion of the market and create a high barrier to entry for competitors (Rochet & Tirole, 2003; Parker et al, 2016). Their revenue models also differ in that platform-based business models typically generate revenue through a fee or commission on the transactions occurring on the platform, as opposed to profit from selling a physical product or service (Parker et al, 2016, Cusumano et al, 2019). Furthermore, depending on the specific platform model and target market, these models rely heavily on data to drive growth, create value, and gain a competitive advantage (Evans & Schmalensee, 2016; Srnicek, 2017). The literature strongly suggests that many traditional businesses can benefit from adopting multi-sided platform strategies with the idea being less of an option and more of an imperative to stay competitive in today's digital economy (Parker et al, 2016; Evans & Schmalensee, 2016; Rogers, 2016; Cusumano et al, 2019

2.3 Menu Translation Applications as a PBM in a Two-Sided Marketplace

This section of the literature review positions menu translation applications as a platform-based business model (PBM) in a two-sided market, and discusses the challenges, strategies, and key success factors of PBMs, making specific reference to menu translation applications operating in two-sided marketplaces. In doing so, this section aims to provide valuable insights into optimizing PBMs and meeting the needs of both users and food service businesses effectively.

2.3.1 Two-sided Platforms and Their Relevance to Menu Translation Applications

In the context of this research, it's essential to understand the concept of two-sided platforms, also referred to as two sided marketplaces, and their significance in the development and implementation of menu translation applications. Two-sided platform-based business models are characterized by their ability to facilitate interactions between two distinct groups of users (Rochet & Tirole, 2003) with interdependent demands (Evans & Schmalensee, 2016). Examples of two-sided marketplaces include ride-sharing services like Uber, who connect riders and drivers, online marketplaces like eBay, which connects buyers and sellers, and payment platforms like PayPal, which connects consumers and merchants (Rochet & Tirole, 2003; Evans & Schmalensee, 206; Parker *et al*, 2016; Srinivasan, 2021).

Menu translation applications align with the concept of two-sided markets in that one side of the platform involves the customers who require the translation service to understand the menu, and the other side of the platform involves the food servicing business, such as restaurants that offer the menu items in need of translation. The platform itself acts as the intermediary that brings these two sides together and facilitates the transactions between them (Parker et al, 2016), which in this context is providing accurate menu translations that enable customers to make informed food choices, and helping these food service establishments reach a broader customer base. This can

help solve the problem of friction that can arise between the two sides of a two-sided market and create value for both sides (Evans & Schmalensee, 2016), ultimately leading to greater adoption and use of the application. This exchange of value is a key characteristic of two-sided markets (Rochet & Tirole, 2003; Srinivasan, 2021).

2.3.2 Challenges in Developing a Two-Sided PBM for Menu Translation Applications

Previous studies propose several unique challenges for platforms in a two-sided market. One of the major challenges highlighted by several papers is the chicken-and egg problem, which refers to the difficulty of attracting both sides of the market simultaneously to create value, and there is no one-size-fits-all solution to this problem (Rochet & Tirole, 2003; Evans & Schmalensee, 2016; Parker *et al*, 2016; Schweiger *et al*, 2016; Cusumano *et al*, 2019; Srinivasan, 2021). In the context of menu translation applications, platforms need both the food servicing business owners to upload menus and customers seeking translation services.

These models are also difficult to create and operate effectively because they involve balancing the needs and demands of the two distinct groups (Rochet & Tirole, 2003; Srinivasan, 2021), and ensuring trust and maintaining a strong reputation among users (Evans & Schmalensee, 2016; Srinivasan, 2021). Thus, balancing the needs of both the food servicing business owners and customers seeking translation services, while protecting their data privacy and security are challenges that also need to be overcome. Parker et al (2016) also highlight the unique risks of lock-in effects, which refers to users becoming dependent on a specific platform due to switching costs, disintermediation, which refers to the risk of users bypassing the platform to engage in direct transactions, and negative network effects, which refers to the increase of users reducing the platform's overall value. In the context of menu translation applications, lock-in effects could be a result of using one translation tool such as Google Translate for everything instead of a more

specialized CEMTA such as Waygo, which could deter their experience or use of a translation tool when ordering food, potentially leading to the avoidance of the establishments that do not offer English menus or an overall unpleasant experience when ordering food. Disintermediation could occur if users prefer personal interaction with staff, and negative network effects could be a result of low-quality translations overcrowding the platform, also leading to a decreased user experience and potential platform abandonment.

2.3.3 Strategies for Overcoming Challenges in Two-Sided Platform-Based Models

Building strong positive network effects, managing quality control, and creating a fair ecosystem are crucial strategies for overcoming these challenges. Creating value by leveraging network effects in which the value of the platform increases as more users join, creates a self-reinforcing cycle of growth (Evans & Schmalensee, 2016), and this can lead to platform dominance (Parker et al, 2016). Ensuring high-quality translations and user experience can help build trust, as well as attract more users (Groves & Mundt, 2015; Evans & Schmalensee, 2016; Fuentes-Luque, 2017; Palau-Saumell et al, 2019). In addition, carefully managing the pricing and incentives for the different user groups can contribute to a more balanced ecosystem, enhancing user satisfaction (Evans & Schmalensee, 2016; Cusumano et al, 2019). To mitigate the risk of lock-in effects and disintermediation, platforms should encourage innovation to keep users engaged and continually add value to user experience (Parker et al, 2016) to ensure the platform remains an essential part of the value exchange process. There should be a focus on maintaining quality control (Evans & Schmalensee, 2016; Parker et al, 2016), providing tools for users to rate and review translations, as well as implementing mechanisms to prevent or remove any low-quality content. In addition to quality control, user ratings and reviews could also be used to assist users to make informed decisions about their choices, as well as provide data on the most popular dishes, aiding food

service establishments and stakeholders of the application to effectively leverage the data (Parker et al, 2016; Srinivasan, 2021).

2.3.4 Key Success Factors of Menu Translation Applications in a Two-Sided Marketplace

Drawing on insights that can be generalized across various industries, the presence of network effects, the ability to scale rapidly, and the ability to leverage data to create value are key success factors of PBMs (Rochet & Tirole, 2003; Evans & Schmalensee, 2016; Parker et al, 2016; Schweiger et al, 2016; Cusumano et al, 2019). The platform's design and core value proposition play a vital role in attracting users and facilitating value exchange (Schweiger et al, 2016), and the platform's ability to rapidly scale is further enhanced by leveraging network effects in which platforms can build open electronic ecosystems with the ability to embrace millions of remote participants, enabling far larger value creation than a comparable traditional organization (Parker et al, 2016). In addition, the entire ecosystem should be successfully managed, in which building and managing the ecosystem of users, developers, and partners are a core focus (Parker et al, 2016). The importance of network effects, quality control, and balanced ecosystems can essentially make or break a platform-based business model (Evans & Schmalensee, 2016).

In summation, a Chinese-to-English menu translation application strongly exemplifies a two-sided platform-based business model that faces unique risks and challenges which could be overcome through successful implementation of strategies that address these challenges, such as ensuring high quality translations, providing tools for users to rate and review translations, and managing the pricing and incentives for the different user groups. The key success factors for these applications in a two-sided marketplace, including the presence of network effects, scalability, and leveraging data for value creation, highlight the importance of a well-designed platform that can manage its ecosystem and facilitate the exchange between users. Ultimately, these applications can

capitalize on the opportunities provided by two-sided marketplaces and establish a platform that adds value for both the customer and food servicing business. To further enhance these insights and answer the question of how platform-based business models can be improved to better meet the needs of users, this study integrates a modification of The Unified Theory of Acceptance and Use Technology (UTAUT-2) framework which is discussed in the latter part of this review.

2.4 Key Components of CEMTA

This section of the literature review discusses the key components of popular existing Chinese-to-English menu translation applications (CEMTA) by relating their business models to the business model canvas (BMC) as proposed by Osterwalder et al (2014). This helps identify gaps or missing components that are critical for achieving the identified key success factors of PBMs and satisfying user needs. Although a thorough analysis of the BMC is beyond the scope of this research, its usefulness in identifying these key elements is acknowledged and suggested for future research.

2.4.1 Business Model Canvas for Platform-Based Businesses

Osterwalder *et al* (2014) defines the Business Model Canvas (BMC) as a tool used to describe how organizations create, deliver, and capture value. The BMC outlines nine key building blocks of a business model, namely, customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure. In the context of platform-based businesses, the BMC can be adapted and utilized to analyze and improve their models by considering the unique aspects of the platform business, such as the presence of multiple stakeholders and how their needs and expectations align with the platform's value proposition(Osterwalder *et al*, 2014; Kim, 2014; Srinivasan, 2021), the importance of network effects (Parker *et al*, 2016; Srinivasan, 2021) in which the value of the platform increases as more users join the platform, incorporating and leveraging data and algorithms to enhance the value

proposition and create a competitive advantage (Evans & Schmalensee, 2016; Srnicek, 2017), addressing governance and trust in which privacy and security measures are put into place to balance openness with control (Evans & Schmalensee, 2016; Parker *et al*, 2016; Srinivasan, 2021), and highlighting their unique revenue models (Parker et al, 2016; Cusumano *et al*, 2019).Through adapting the BMC to better accommodate the unique aspects of platform-based business models, organizations could gain a deeper understanding of their model's strengths and weaknesses, as well as identify opportunities for growth and improvement in the digital economy's competitive landscape (Osterwalder *et al*, 2014; Kim, 2014; Parker *et al*, 2016, Srinivasan, 2021).

2.4.2 Key Components and Business Models of CEMTA

There are several CEMTA providers, such as Google Translate, iTranslate, Pleco, and Waygo, offering various features and value propositions that cater to the needs of users. For example, Google Translate and iTranslate offer free, widely accessible, and easy-to-use translation services that supports various languages, including Chinese and English, and their value proposition revolves around convenience and accessibility, targeting a broad customer segment, including professionals, students, and tourists. (Elliott, 2022; Wang, Yu, & Lee, 2023). Various applications, including Google Translate and iTranslate employ different revenue models, including advertising and data collection, among other strategies. Freemium models are particularly popular among translation applications as the platform becomes more valuable with greater usage (Parker et al, 2016). The applications are also typically compatible with different mobile devices such as Android, Windows, or iPhone devices.

Waygo and Pleco, on the other hand, focus on providing specialized translation services more specific to contexts such as menu translation applications because it caters to travelers and expatriates in Chinese-speaking countries (Waygo. n.d.; Pleco, n.d.). The key resources of these

applications include its proprietary translation technology, such as Waygo's optical character recognition (OCR) to provide more accurate translations as its value proposition, its application platform, and its relationships with restaurant partners (Waygo. n.d.; Pleco, n.d.). Their revenue models may include premium features and in-app purchases, creating additional value for users, whilst generating income for the providers (Lupton, 2021).

These examples highlight the different components and business models of CEMTA providers and how they can be analyzed using the BMC and other PBM frameworks (Srinivasan, 2021). By understanding the strengths and weaknesses of the various CEMTAs and their platform business models, researchers and industry experts can identify areas for improvements and potential opportunities for innovation in the CEMTA market. Moreover, providers can leverage the BMC and other PBM frameworks (Srinivasan, 2021) for improving the design and implementation of CEMTAs.

2.5 Current State of Menu Translation Applications in Taiwan

In the Taiwanese market, menu translation applications such as Google Translate, iTranslate, Waygo, and Pleco, among others, are utilized to enhance dining experiences by overcoming language barriers and improving the communication between users and food service businesses (Lupton, 2021; Liu *et al*, 2022). As previously discussed, users of these applications are typically tourists, expatriates, international students, and professional workers operating in Chinese speaking countries like Taiwan (Elliott, 2022; Wang, Yu, & Lee, 2023). Other stakeholders or participants include restaurants, developers, and partners, who play a pivotal role in this market (Srinivasan, 2021). To overcome the language barrier and address challenges faced when using Chinese-to-English menu translation applications (CEMTA) to optimize user experience, their PBMs should focus on the preferences of these customer segments and participants, as well as

translation accuracy, speed, offline capabilities for convenience, compatibility with other devices, user interface, and cultural adaptability (Amenador & Wang, 2022; Groves & Mundt, 2015; Fuentes-luque, 2017; Waygo, n.d.) as their value proposition (Srinivasan, 2021).

2.5.1 User Preferences

The literature suggests that users' needs and preferences for menu translation applications encompass ease of use, speed, translation accuracy, and culturally adaptable user interfaces (Reinecke & Bernstein, 2013; Groves & Mundt, 2015; Fuentes-Luque, 2017; Aresta, 2018). These features have been integrated into the proposed UTAUT-2 framework to better understand the factors that motivate users to use these applications, thereby validating the importance or lack thereof of these features.

2.5.2 Food Service Establishment Preferences & Challenges

Food service establishments may have different needs and preferences, such as cost-effectiveness and seamless integration with their existing systems (Parker *et* al, 2016; Evans & Schmalensee, 2016). Local restaurants in Taiwan for example, may not cater to English-speaking customers or provide English menus due to several factors, including language barriers, targeting primarily local customers, emphasizing localization, and cost and resource constraints (Liu et al, 2022). The focused efforts on localization may suggest that the current perceived value of partnering with CEMTA providers is low for attracting international customers. These factors could contribute to the limited available English menus in local Taiwanese restaurants, making it difficult for English-speaking customers to place a correct order when navigating the menu and communicating with the restaurant staff. Future research could be conducted to address the specific concerns of the food servicing business owners or managers to gather a more holistic understanding of the factors

influencing the adoption and usage of CEMTAs, as well as identify opportunities for improving these applications. This could also help validate the preferences and challenges highlighted here.

2.5.3 Cultural Adaptability and Skopos Theory in CEMTA

Reinecke & Bernstein (2013) claim that interfaces which automatically adapt their entire presentation to a user's national culture and do not only encompass language or date formats, can better fit user's preferences. This claim is supported by the previous studies of Evers and Day (1997), who showed that cultural adaptive interfaces could have a significant advantage over non adapted and even localized user interfaces. Moreover, cultural adaptability of CEMTAs is essential for ensuring that translations account for cultural nuances and preferences, ultimately contributing to an enhanced dining experience (Evers & Day, 1997; Reinecke & Bernstein, 2013, Sun & Sun, 2017). Furthermore, the findings of Fuentes-Luque's (2017) study on the importance of cultural context in menu translations could be applied to CEMTA in Taiwan to ensure that the translations are not only accurate, but also culturally appropriate for the local market.

Sun and Sun (2017) and Zhong (2020) apply the Skopos theory to CEMTA and business English translations in the hospitality industry, emphasizing the importance of considering the purpose of the translations, the target audience, and the cultural context of the target language. However, the incorporation of these factors in translation applications can be challenging as they require a deep understanding of cultural nuances and the specific needs of the target audience. Huo *et al* (2020), found that a Skopos-oriented translation approach effectively conveys the cultural characteristics of the source language, allowing the target language readers to better understand the source text's cultural connotation. However, implementing this approach in menu translation applications may require advanced algorithms and linguistic expertise to ensure that translations are both accurate and culturally appropriate.

While applying Skopos theory principles to menu translation applications could provide accurate and culturally appropriate translations, achieving this level of accuracy and cultural adaptability in translation applications may require overcoming limitations in current technology and developing more sophisticated algorithms that account for cultural context and the specific needs of the target audience. Sun and Sun (2017), state that from this perspective, it is not merely about knowing the literal translation of Chinese dishes, but rather prioritizing the intended function of foreign language translation, which is to focus on the unique features and essence of the Chinese cuisine, creating an enjoyable and engaging dining experience for non-Chinese speakers as they could now more fully appreciate the food and culture. Thus, the application of Skopos principles is an opportunity to improve the design and implementation of PBM for CEMTA.

2.5.4 Impact on Dining Experiences

Existing literature suggests that the impact on dining experiences of similar applications can be both negative and positive (Palau-Saumell, 2019; Srinivasan, 2022). It could be positive in that it provides users with a convenient way to translate dishes that would otherwise not be understood, saving time, and potential friction caused between the consumer and food service establishment's staff, who may be unable to adequately translate the items to English for the consumer (Evans & Schmalensee, 2016; Sun & Sun, 2017; Liu et al, 2022). In addition, users may find enjoyment in specialized features such as personal recommendations, a gaming factor in which users could cross out dishes they've already tried, visual representations of the dishes, and the potential enhancement of the cultural experience they may obtain (Erway, 2015; Sun & Sun, 2017; Fuentes-luque, 2017)

On the negative side, technical issues such as slow loading times, crashing of the application, and inaccurate translations could frustrate the user and may even prolong the ordering process (Chen et al, 2017). There may also be privacy concerns pertaining to sharing personal information on

these applications (Parker et al, 2016; Evans & Schmalensee, 2016; Srinivasan, 2021). In addition, it may take away from the overall customer service experience, an often-valued experience gained from the personal interaction between the staff and consumer (Fuentes-Luque, 2017).

2.6 User Motivations & Adoption Factors

This section of the literature review introduces the second phase of the study, which is to better understand the factors that influence the adoption and usage of CEMTAs using a modified UTAUT-2 framework. It also aims to evaluate the applicability of this framework by incorporating two new constructs, namely, translation accuracy and cultural adaptability, the importance of which was derived from the literature review. This should enable a better understanding of adoption and usage behavior in the context of CEMTA, as well as test the proposed relationships between the constructs in the data analysis of this study. Insights into the factors driving adoption and usage of CEMTA could inform the development and implementation of more effective PBMs for CEMTA.

2.6.1 Modified UTAUT-2 Framework

The Unified Theory of Acceptance and Use Technology 2 (UTAUT-2) is a widely used model for predicting user acceptance and use of technology and is considered to have greater predictive power than other models in the field of technology acceptance (Palau-Saumell et al, 2019). UTAUT-2 proposes seven constructs that are believed to influence user adoption and acceptance, namely, performance expectancy (PE), effort expectancy (EE), social influence (SI), facilitating conditions (FC), hedonic motivation (HM), price value (PV), and Habit (HT). The empirical findings of Venkatesh et al (2012), suggest that performance expectancy, effort expectancy, social influence, hedonic motivation, price value, and habit influence the intention to use a technology, and facilitating conditions, habit, as well as intentions to use are significantly related to actual

26

usage. Literature in related fields, such as mobile banking (Shaikh & Karjaluoto, 2015; Alalwan et al, 2017), and the tourism industry (Morosan & Defranco, 2016; Gupta et al, 2018) support these findings, while Palau-Saumell et al (2019) further reinforces the applicability of the UTAUT-2 model for research into user adoption and acceptance of technology in the specific context of mobile applications in the restaurant industry. Palau-Saumell et al (2019) substitutes the price value construct with price-saving orientation construct, introduces a new operationalization of the social influence construct, and incorporates a new construct, perceived credibility, all of which are shown to be significant predictors of behavioral intention to use mobile applications for restaurants (**Figure 1**). This suggests that the UTAUT-2 framework is flexible and could be modified and adapted to fit a specific domain and needs of different contexts.

Figure 1. UTAUT-2 Structural Model Results of Palau-Saumell et al (2019).
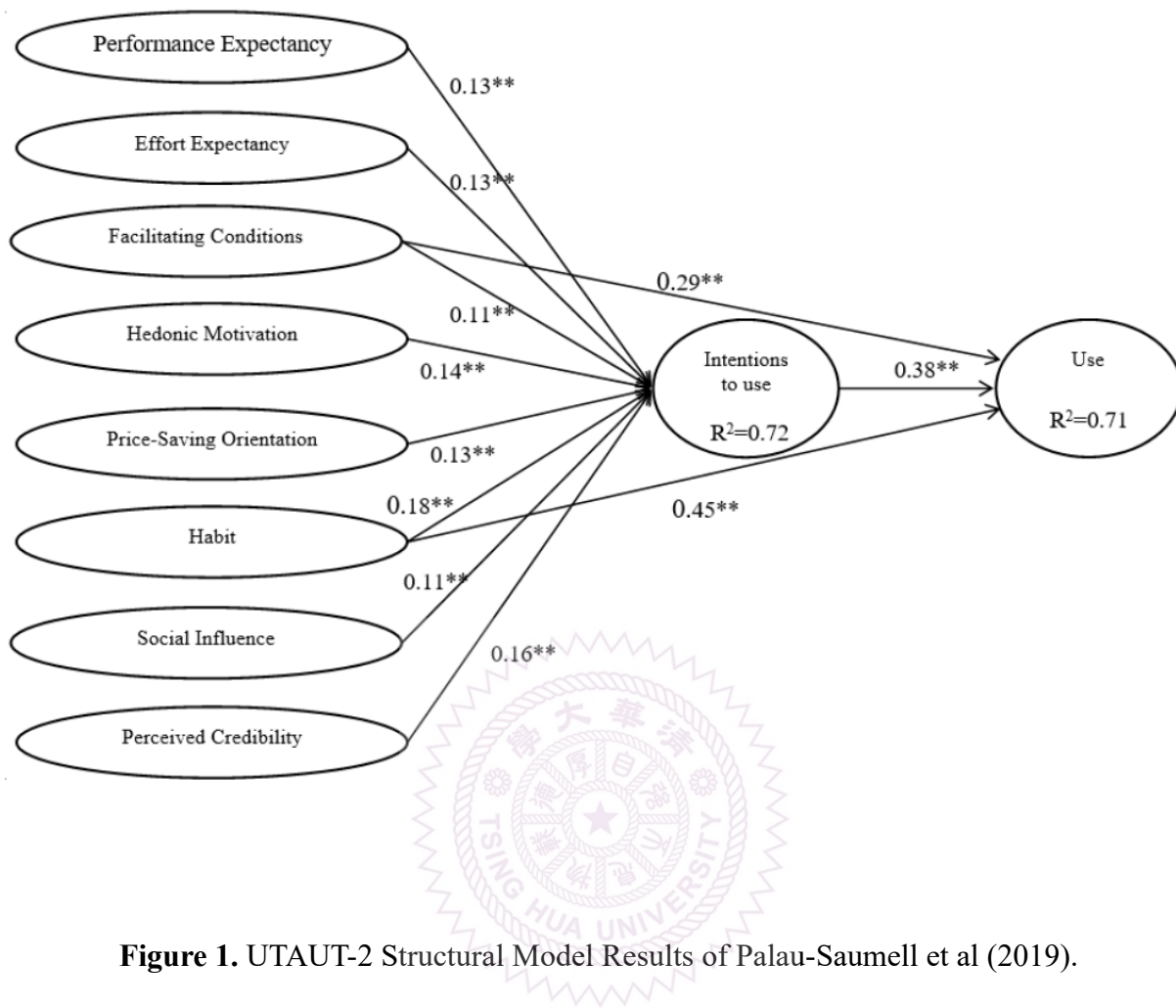
2.6.2 Conceptual Model

This study applies the original UTAUT-2 framework proposed by Venkatesh *et al* (2012), as well as the modified UTAUT-2 framework as proposed by Palau-Saumell *et al* (2019) into the conceptual framework. The addition of Palau-Saumell's *et al* (2019) framework provides a strong foundation for understanding user adoption and acceptance of mobile applications in the restaurant industry. Given the unique context of Chinese-to-English menu translation applications, this research aims to further extend the modified UTAUT-2 framework by introducing two new constructs, translation accuracy (TA) and cultural adaptability (CA) and validating the use of the model in the context of menu translation applications. In addition to mobile banking and tourism,

empirical evidence from similar studies in the field of technology acceptance, such as e-learning acceptance assimilation (Al-Gahtani, 2016), and self-service technology (Jeon *et al*, 2020) supports the decision to introduce additional constructs to the UTAUT-2 framework to fit the specific needs and contexts of research. The inclusion of these constructs in the proposed conceptual model allows this study to capture the factors that influence user's intention to use menu translation applications, as well provide insights into how to better design these applications to be more acceptable and attractive to potential users.

The moderating variables, namely, age, gender, and experience presented in the UTAUT-2 model are excluded from this study's conceptual framework based on two main rationales. Firstly, there is limited empirical evidence supporting their significant impact on the relationships hypothesized by similar models exploring technology acceptance in tourism service applications. The empirical study by Palau-Saumell *et al* (2019) found that the moderating variables had limited impact on the relationships between the main factors of the UATUT-2 and the behavioral intention to use mobile applications for restaurants, stating that no differences were found by gender or age in the relationships hypothesized in their model, which is consistent with findings from other literature in this domain (Morosan & DeFranco, 2016). Secondly, the addition of translation accuracy and culturable adaptability constructs to the conceptual framework increases the complexity, providing comprehensive nuance to the study. In addition, the moderating variables would further increase the complexity, potentially making the analysis too challenging for the scope of this study. However, it is acknowledged that this exclusion represents a limitation, presenting an opportunity for future research to explore the role of these moderating variables in greater depth to gain a more comprehensive understanding of the factors influencing user adoption and acceptance of menu translation applications.

The proposed conceptual model is depicted in **Figure 2**. This model includes two endogenous variables, namely, intentions to use, and actual usage, in which intentions to use is a predictor of actual usage, and ten exogenous variables, namely, performance expectancy, effort expectancy, facilitating conditions, social influence, price value, habit, hedonic motivation, perceived credibility, all of which are predictors for intentions to use (Venkatesh *et al*, 2012; Palau-Saumell *et al*, 2019; Chang *et al*, 2019; Nordhoff *et al*, 2020), as well as the two proposed exogenous variables, namely translation accuracy, and cultural adaptability. While the UTAUT-2 framework includes constructs found to be applicable across different domains, there is a lack of evidence testing the applicability and adaptability of the UTAUT-2 model itself, specifically in the context of menu translation applications. The findings of this study will therefore contribute to the body of knowledge in this area by testing and potentially expanding the UTAUT-2 model in a new context. The following section of the paper provides definitions of the constructs together with a theoretical basis and hypothesis development for the inclusion of the constructs in the proposed conceptual model (**Figure 2**).
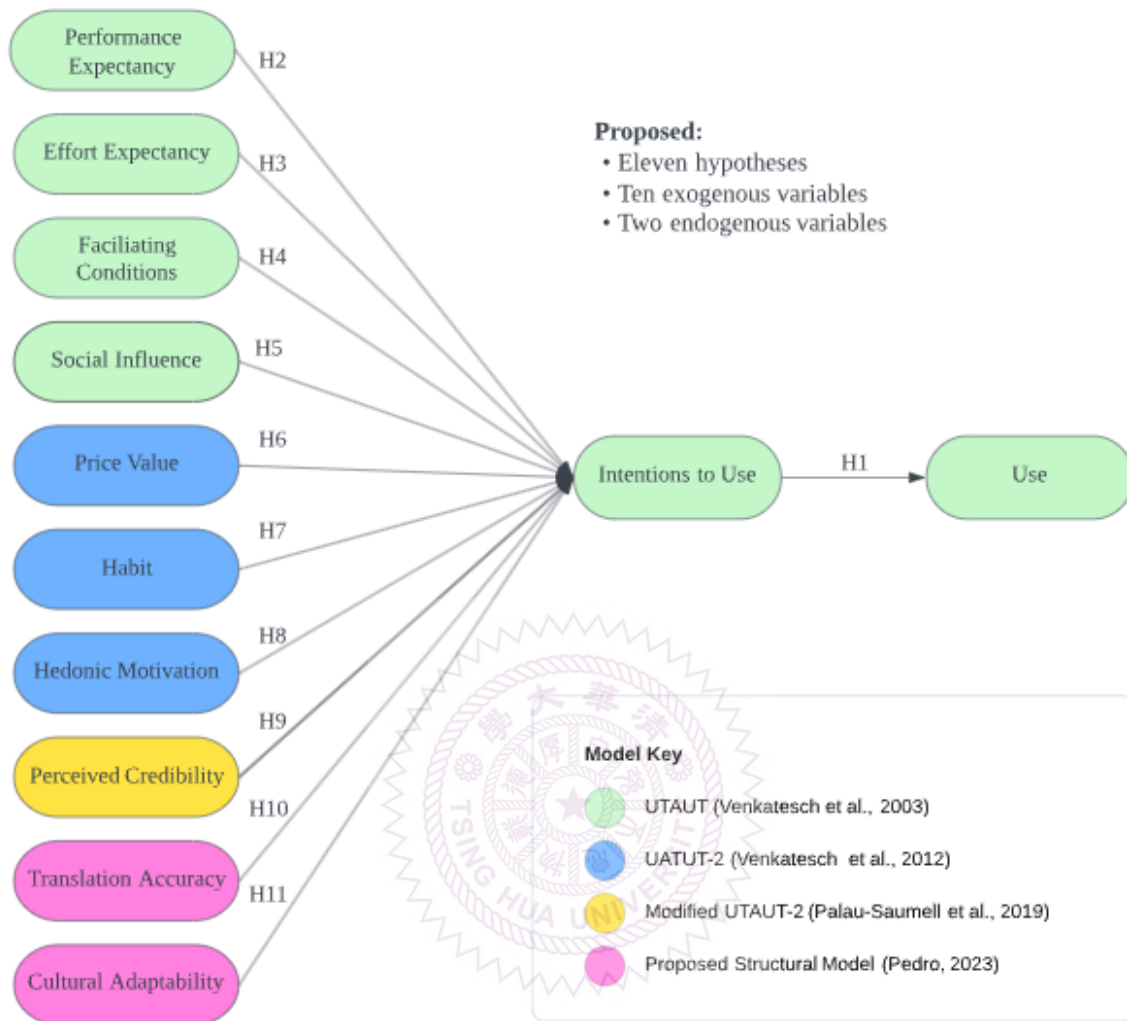
Figure 2. Proposed Structural Model.

2.6.3 Hypotheses Development

Intention to use refers to an individual's willingness to use a technology and has shown to be a strong predictor of actual technology use in numerous studies across various domains (Venkatesh *et al*, 2012; Palau-Saumell *et al*, 2019; Nordhoff *et al*, 2020). This is due to the evidence that intention to use is the individual's motivation and commitment to the actual use of a technology (Palau-Saumell *et al*, 2019). Based on the UTAUT-2 framework and prior empirical findings,

intention to use a technology is an endogenous variable influenced by performance expectancy, effort expectancy, social influence, facilitating conditions, price value hedonic motivation, and habit (Venkatesh *et al*, 2012), as well as perceived credibility (Palau-Saumell *et al*, 2019). The factors significantly influence user's behavioral intention to use across various domains, including mobile applications for restaurants (Palau-Saumell *et al*, 2019). Translation accuracy and cultural adaptability could also influence the intention to use this technology as they are important factors in user satisfaction and acceptance of the technology (Evers & Day, 1997; Reinecke & Bernstein, 2013; Groves & Mundt, 2015; Fuentes-Luque, 2017; Chen *et al*, 2017, Aresta, 2018). In the context of menu translation applications, the willingness, frequency, and specific contexts (Venkatesh *et al*, 2012) in which users are likely to use CEMTA, such as wanting to learn more about the cuisine (Sun & Sun, 2017), or simply needing to understand the menu items when ordering takeout or dining in, should be included to better understand the intention to use this technology. The following hypothesis is therefore proposed:

Hypothesis 1 (H1): *Intention to use (IU) directly and positively affects the individual use of Chinese-to-English menu translation applications (CEMTA).*

Performance expectancy refers to the degree to which using the technology is perceived to be useful (Venkatesh *et al*, 2012). Translation accuracy, speed, and convenience may therefore be important performance indicators of CEMTA (Groves & Mundt, 2015; Fuentes-Luque, 2017). Performance expectancy is one of the most used constructs for predicting the intention to adopt a technology (Palau-Saumell et al, 2019). This is supported by research in mobile banking (Shaikh & Karjaluoto, 2015; Alalwan et al, 2017), the tourism industry (Morosan & Defranco, 2016; Gupta et al, 2018), as well as mobile applications in the restaurant industry (Palau-Saumell *et al*, 2019), indicating the relevance of this construct in understanding user adoption and acceptance of menu

translation applications. Since CEMTAs enable consumers to understand the menu and place a correct order (Fuentes-Luque, 2017), their perceived usefulness may have a significant impact on intention to use the application, and therefore, the following hypothesis is proposed:

Hypothesis 2 (H2): *Performance Expectancy (PE) positively and directly affects the intention to use Chinese-to-English Menu Translation Applications (CEMTA).*

Effort Expectancy refers to the degree to which using the technology is perceived to be easy to use (Venkatesh *et al*, 2012). Prior research shows that effort expectancy influences the intention to use a technology across various domains, including mobile applications in the restaurant industry (Palau-Saumell et al, 2019), but not specifically menu translation applications. The literature also suggests that users prefer a technology that is easy to use (Reinecke & Bernstein, 2013; Groves & Mundt, 2015; Fuentes-Luque, 2017; Aresta, 2018). Moreover, menu translation applications may involve a complex process of translating menus in real-time (Groves & Mundt, 2015; Fuentes-luque, 2017) with varying user interfaces, so its perceived ease of use may significantly influence their intention to use the application. Due to the unique risks of PBM, users may also abandon the application because it's too difficult or time-consuming to use (Parker et al, 2016). Therefore, including effort expectancy is essential to assess user's perceived ease of use of the application and their willingness to adopt and use it. To test this relationship within the context of menu translation applications, the hypothesis is proposed as follows:

Hypothesis 3 (H3): *Effort Expectancy (EE) positively and directly affects the intention to use Chinese-to-English Menu Translation Applications (CEMTA).*

Facilitating conditions refers to the degree to which the individual perceives to be in possession of the resources and support to use the technology (Venkatesh *et al*, 2012). This involves the support

system that surrounds the technology, rather than the functionality of the technology itself (Palau-Saumell et al, 2019). In the context of menu translation applications, facilitating conditions might refer to reliable internet access, offline capabilities, compatibility with different devices, or technical support for users who may encounter difficulty using the application (Groves & Mundt, 2015; Fuentes-luque, 2017). Prior research relating to mobile applications for restaurants (Palau-Saumell et al, 2019) and online hotel booking (Chang et al, 2019) support the significance of facilitating conditions in understanding user adoption and acceptance in which external perceived barriers can significantly impact the intention to use the application (Venkatesh *et al*, 2012). Thus, the hypothesis is proposed as follows.

Hypothesis 4 (H4): *Facilitating Conditions (FC) positively and directly affects the intention to use Chinese-to-English Menu Translation Applications (CEMTA).*

Social influence refers to the degree to which using a technology is perceived to be appreciated in the social network important to the individual (Venkatesh *et al*, 2012). Previous research has shown that social influence has a positive impact on user intentions to use various technologies, including mobile applications in the restaurant industry (Palau-Saumell *et al*, 2019). For example, users may be influenced to use a particular menu translation application because people around them are doing the same. In addition, online reviews, word-of-mouth, and recommendations from friends could influence the choice to use a technology as the opinions about a product influences the purchasing decisions of others (De Matos & Rossi, 2008. Chang *et al, 2019;* Lupton, 2021). Palau-Saumell *et al's* (2019) study uses the social norms theory to provide an effective approach for understanding this complex concept and testing the relationship between social influence and intentions to use mobile applications in the restaurant industry. While this study operationalizes the construct in the same manner as Venkatesh *et al* (2012), the findings of Palau-Saumell *et al's*

(2019) is still relevant for the inclusion of social influence in the study of menu translation applications, and as such, the following hypothesis is proposed:

Hypothesis 5 (H5): *Social Influence (SI) positively and directly affects the intention to use Chinese-to-English Menu Translation Applications (CEMTA).*

Price value refers to the cognitive trade-off between the perceived benefits and monetary costs of using a technology (Nordhoff et al, 2020). Many studies suggest that price can influence behavioral intention to use a technology, including studies in online hotel booking industry (Chang, 2019), and other tourism related fields (Morosan & Defranco, 2016; Gupta et al, 2018). In the context of menu translation applications, applications such as Google Translate offer freemium models, while more specialized CEMTA's such as Waygo, simply offer a free trial of 10 translations before having to upgrade to a premium package for unlimited translations (Waygo, n.d.). Thus, the perceived cost of using the more specialized applications should be weighed against the benefits, such as translation accuracy, ease of use, and cultural adaptability of the user interface (Groves & Mundt, 2015; Aresta, 2018). Users may be willing to pay more for these enhanced features or it may have an adverse effect. Thus, the following hypothesis is being proposed:

Hypothesis 6 (H6)*: Price Value (PV) positively and directly affects the intention to use Chinese-to-English Menu Translation Applications (CEMTA).*

Habit refers to the degree to which people tend to perform behaviors automatically due to learning (Venkatesh et al, 2012). In the context of menu translation applications, habit could refer to the frequent usage of translating Chinese-only or poorly translated bilingual menus when visiting a restaurant that poses this language barrier. Based on prior research (Venkatesh *et* al, 2012, Shaikh & Karjaluoto, 2015; Morosan & Defranco, 2016; Alalwan *et al,* 2017; Gupta *et al*, 2018; Palau-

Saumell *et al*, 2019), habit influences the intention to use a technology in various domains. It is therefore expected that the habit would lead to intentions to use for menu translation applications. This theoretical review provides grounds to propose the following hypothesis:

Hypothesis 7 (H7): Habit (HT) positively and directly affects the intention to use Chinese-to-English Menu Translation Applications (CEMTA).

Hedonic motivation refers to the degree to which using the technology is perceived to be enjoyable (Venkatesh et al, 2012). Previous research suggests that users are more likely to adopt technologies they find enjoyable (Davis, 1989, Venkatesh et al, 2012). Specifically, previous studies have found that hedonic motivation has a positive influence on user attitudes and intentions to use various technologies, including mobile applications for restaurants (Palau-Saumell et al, 2019), making hedonic motivation a relevant construct for studying menu translation applications. In the context of CEMTA, users may find enjoyment in using these applications to enhance their dining experiences (Sun & Sun, 2017; Zhong, 2020). Users may also find enjoyment in the additional features these applications may offer, such as personalized recommendations, visual representation of the dishes, seeing new items they have yet to try, as well as ratings and reviews of the most popular dishes to further enhance their experience (Erway, 2015; Sun & Sun, 2017; Fuentes-luque, 2017). This provides grounds to propose the following hypothesis:

Hypothesis 8 (H8): Hedonic Motivation (HM) positively and directly affects the intention to use Chinese-to-English Menu Translation Applications (CEMTA).

In the mobile context, perceived credibility refers to the degree to which an individual perceived the use of a mobile technology to not entail any privacy or security threats (Palau-Saumell *et* al, 2019). Perceived credibility is a new construct introduced by Palau-Saumell *et* al (2019) to

Venkatesh *et al's* (2012) UTAUT-2 framework in which the construct was found to be significant in the context of mobile applications for restaurants. In the context of this study, detecting the influence of perceived credibility on intentions to use menu translation applications is especially relevant as ensuring trust through protecting user data privacy and security is a key challenge that platform-based business models need to overcome (Evans & Schmalensee, 2016; Srinivasan, 2021) For example, if users perceive the menu translation application as being credible and trustworthy in terms of protecting their personal data, they are more likely to use it, as opposed to if they feel their personal data is being compromised (Evans & Schmalensee, 2016; Srinivasan, 2021). This provides grounds to propose the following hypothesis:

Hypothesis 9 (H9): *Perceived Credibility (PC) positively and directly affects the intention to use Chinese-to-English Menu Translation Applications (CEMTA).*

Modifying Palau-Saumell *et al's* (2019) UTAUT-2 Framework

Translation accuracy (TA) and cultural adaptability (CA) are included as constructs in the proposed conceptual model of this study because they further tailor the UTAUT-2 framework to the specific needs of this type of application. These constructs are proposed to influence the intention to use menu translation applications as they are important factors in user satisfaction and acceptance of a technology (Groves & Mundt, 2015; Fuentes-Luque, 2017; Chen *et al*, 2017, Aresta, 2018). Translation accuracy could fit within the performance expectancy construct as it can influence the perceived usefulness of the technology, while cultural adaptability could fit within the effort expectancy construct as it can influence the perceived ease of use. However, since they represent unique factors that are specific to the context of CEMTA and may have different effects on user's intention to use relative to the other factors included in the modified UTAUT-2 framework, they are included as separate constructs in this study's conceptual model. This allows for a more

comprehensive and nuanced understanding of the factors that influence user adoption and acceptance of menu translation applications. An application that provides accurate translations and accounts for cultural nuances could be perceived as more user-friendly and easier to use, ultimately leading to higher adoption rates (Sun & Sun, 2017; Zhong, 2020).

Translation accuracy refers to the degree of equivalence between translated texts (Aresta, 2018). This definition highlights the importance of equivalence between texts, suggesting there should be a high degree of similarity between the original and translated content. In the context of menu translation applications, the degree of equivalence between translated texts is especially important as the smallest translation error could significantly impact user experience and ultimately lead to dissatisfaction or even rejection of the technology (Groves & Mundt, 2015; Fuentes-Luque, 2017). In addition, low-quality translations because of poor-quality control on the platform could lead to negative network effects if the platform is reliant on its development through users (Parker et al, 2016). Literature discussing the importance of translation accuracy in the context of academic learning (Groves & Mundt, 2015), health education materials (Chen et al, 2017), and a study analyzing the quality of menu translations in Spanish restaurants (Fuentes-Luque, 2017) supports this claim. Groves and Mundt (2015) found that perceived accuracy impacts use and adoption among students who rely on translation tools like Google Translate for accurate translations, while Fuentes-Luque (2017) found that a higher perceived translation accuracy in the context of restaurant menus, leads to greater user satisfaction and trust in the translated content. It is therefore reasonable to hypothesize that translation accuracy influences user intentions to use the menu translation applications. However, since translation accuracy has not been tested in any UTAUT-2 framework, this study proposes the following hypothesis:

Hypothesis 10 (H10): *Translation Accuracy (TA) positively and directly affects the intention to use Chinese-to-English menu translation applications (CEMTA)*

Cultural adaptability has not been explicitly defined in prior literature, but for the purposes of this study, it refers to the ability of a technology to cater to user's cultural preferences and characteristics, as suggested by Reinecke & Bernstein (2013). Previous studies emphasize the importance of considering cultural factors when designing user interfaces (Evers & Day, 1997), and creating applications (Reinecke & Bernstein, 2013) by providing evidence that cultural adaptability can significantly influence usability and overall satisfaction. An interface that is better able to adapt to users' cultural preferences and expectations, will lead to increased satisfaction among users from diverse backgrounds, positively influencing the behavioral intention to use these applications (Reinecke & Bernstein, 2013). In the context of menu translation applications, its interface could be adapted based on user preferences for certain types of cuisine or display certain cultural symbols or imagry to create a more welcoming and familiar experience for users of different cultural backgrounds. In addition, studies in the application of Skopos theory principles (Sun & Sun, 2017; Zhong, 2020; Huo *et al*, 2020) suggest that CEMTAs which incorporate these principles would provide more accurate and culturally appropriate translations, which allows for greater appreciation for the cuisine and a more enjoyable and engaging dining experience for non-Chinese speakers. It is therefore reasonable to hypothesize that cultural adaptability influences user intentions to use menu translation applications. Thus, the following hypothesis is proposed:

Hypothesis 11 (H11): *Cultural Adaptability (CA) positively and directly affects the intention to use Chinese-to-English menu translation applications (CEMTA).*

2.7 Summary of Key Findings of Literature Review (Phase 1)

1. The rise of platform-based business models (PBM) has led to innovative solutions, such as Chinese-to-English menu translation applications (CEMTA), which addresses the demand for effective menu translations in the food servicing industry.

2. The success of PBMs for CEMTA can be credited to various factors such as connecting different user groups and stakeholders, facilitating interactions, and creating value through network effects, data, and algorithms.

3. There are unique risks and challenges associated with PBMs in a two-sided marketplace, such as lock-in effects, disintermediation, and network effects, which should be considered when developing and implementing CEMTAs.

4. Strategies to overcome those challenges, and success factors of CEMTA have been identified and could be validated by understanding user adoption and usage of CEMTAs.

5. Users prefer applications that are easy to use, fast, provide accurate translations, and have culturally adaptable user interfaces. Food service establishment preferences include cost-effectiveness and seamless integration with their existing systems. In Taiwan, providing an authentic, local experience is important.

6. Adapting the business model canvas and PBM frameworks helps providers and organizations to gain insights into their model's strengths, weaknesses, and potential opportunities for growth.

7. CEMTA could have both a positive and negative impact on the user experience.

8. Findings from the users who directly face the challenge that the technology was designed to address and who actively use the technology for this purpose could yield valuable insights into user adoption and acceptance.

9. Translation accuracy, cultural adaptability, compatibility with other devices, offline capabilities, and user interface are important factors that influence user satisfaction and acceptance of CEMTA.

The next phase examines the factors driving user adoption and acceptance of CEMTA and is the primary data collection and analysis of this study. The aim of this phase is to understand how and why consumers would adopt and use CEMTA, providing valuable insights into what factors should be considered when designing and developing these applications.

Chapter 3

3. Methodology

3.1 Participants & Data Collection

The target population were current users of translation applications who used these applications for translating Chinese text to English, including food menu text. The instrument used for this study was a questionnaire. Participants with firsthand experience using CEMTA were ideal candidates as they would likely provide meaningful and context-specific findings for the adoption and usage of these applications (Venkatesh et al, 2012; Palau-Saumell et al, 2019). Questionnaires were therefore distributed to tourists, expatriates, international students, and professional workers operating in Taiwan who are not fluent in reading Chinese text. These individuals serve as the target population of this study as they align with the intended purpose of CEMTA as defined by this study. Collecting the data in Taiwan was ideal as there was a large enough population of non-Chinese speaking participants meeting this criterion.

The questionnaire was developed using Qualtrics, a popular survey platform (Boas et al, 2020) and distributed via social media channels such as Facebook groups, namely "Foreigners in Taiwan", "Foreigners Society in Taiwan", and Line groups with international students studying in Taiwan. 15 randomly selected participants were offered 7-11 gift cards valued at 100 Taiwanese dollars to encourage participation and served as a cost-effective way to recruit respondents. Given this, convenience sampling was used as the participants were selected because they were readily available and met the study's criteria. Convenience sampling is a nonprobability sampling technique that can be used for quantitative research (Etikan et al, 2016). While self-selection bias is always a risk in convenience sampling (Etikan et al, 2016), this approach helped attract a large and diverse pool of participants for the study. It should also be noted that this technique does have

the limitation of not being generalizable to the entire population. This was acceptable as one of the primary goals of this study was to gain a deeper understanding of the factors influencing user adoption and usage among non-Chinese speaking individuals operating in Chinese-speaking countries, using Taiwan as a representative example. While Taiwan serves as a good representative for Chinese-speaking countries, further research may need to validate these findings in other Chinese-speaking countries.

Out of the 334 completed questionnaires, 283 responses were returned and valid. The return rate was 84.73%, while questionnaires with incomplete or missing data were removed. In addition, two respondents who may have incorrectly indicated 'Never' as their frequency of usage were removed, despite having stated that they have used CEMTA as per the screening section of the survey. This is recognized as an error in the instrument development as it could have led to inconsistencies in the data if more respondents had answered 'Never' in this section. However, this error did serve a purpose by filtering out respondents who may not have fully understood the questions or paid close enough attention while completing the survey. Thus, only 281 valid questionnaires were used and the final return rate for data analysis was 84.13%. This sample size meets the requirements for exceeding the minimum sample size requirements for conducting PLS-SEM as the method of analysis. Hair *et al* (2011) proposed the 10-times rule in which the sample size should be greater than 10 times the maximum number of inner or outer model links pointing to any latent variable. The proposed model in this study has 10 constructs that have a direct relationship with 'Intentions to Use', making the minimum sample size 100. While there are critiques on this rule of thumb and more accurate methods have been proposed such as the inverse square root and gamma-exponential methods (Kock, 2015), 281 respondents should provide sufficient statistical power and generalizability for the findings given it far exceeds the 10 times rule.

The questionnaire followed Ethical guidelines in the collection of data by providing a clear introduction explaining the purpose of the study and estimated time to complete the survey, an informed consent section to ensure participants were above 18 and could legally provide consent, understood the process of the study and their rights to withdraw participation at any time, as well as a debriefing section thanking participants and providing contact information for any questions or concerns they may have (American Psychology Association, 2017).

3.2 Instrument Development

The questionnaire used in this study was designed with items adapted from Palau-Saumell *et al* (2019), and Venkatesh *et al* (2012) in which phrases were modified to reflect the CEMTA environment in Taiwan. The items are illustrated in **Appendix 1**. The questionnaire began with an introduction and informed consent section, followed by a screening question to ensure participants met the minimum requirement of having personal experience using the technology, and another screening question to determine the participant's proficiency level in reading Mandarin. If they answered "No" to using CEMTA before or "Fluent" in their proficiency level question, they would not be able to continue with the survey since the goal was to assess the relevance and effectiveness of CEMTA for the target population.

The questionnaire was then divided into three sections: The first section contained two questions and defined key terms used in the questionnaire. The first question was to determine the frequency in which participants encountered Chinese-only menu items at food service establishments in Taiwan. The aim of this question was to provide insight into the prevalence of Chinese-only menu establishments in Taiwan based on the participants' experience. The second question was to determine the frequency in which participants encountered bilingual menus with unclear or poorly translated items. The aim of this question was to provide insight into the prevalence of these

establishments, as well as capture the experiences of participants who may not frequently encounter Chinese-only menus, but still face challenges due to poor or unclear menus. This section also clarified the term, "CEMTA" to include all translation applications that has the functionality of translating Chinese menu items to English and defined "food service establishment" to include restaurants, food trucks, street food stalls, and night market vendors, which are all popular in Taiwan (Erway, 2015).

The second section included demographic questions of the participants, namely age, gender, nationality, and status in Taiwan were included and made optional to respect the privacy of participants and encourage participation as suggested by Fink (2015). While the impact of moderating variables was excluded from this study, this section helped to understand the diverse backgrounds of the participants, as well as identify any outliers in the data.

There were 42 questions in the third section on the 12 constructs that are included in the proposed UTAUT-2 model. Palau-Saumell *et al* (2019) modified and adapted the original items from Venkatesh *et al* (2012) to develop scales for these items in a mobile application context. The items used to measure actual use, intentions to use, performance expectancy, effort expectancy, facilitating conditions, hedonic motivation, and perceived credibility were based on Palau-Saumell *et al's* (2019) work, while social influence and price value were based on the original work of Venkatesh *et al* (2012) because Palau-Saumell *et al* (2019) used price-saving orientation instead of price-value and operationalized social influence differently. The two proposed constructs, translation accuracy, and cultural adaptability that were added in the questionnaire, integrated items derived from the prior literature discussed in this study's literature review.

Actual usage was measured using a five-point Likert scale to gather data on the frequency of usage among participants ranging from "Rarely = 1" to "Always = 4", as well as a multiple option

statement to gather data on the various contexts in which participants used CEMTA. Frequency is a common metric used to measure usage in the UTAUT2 as found in the studies by Venkatesh *et al* (2012) and Palau-Saumell *et al* (2019). Frequency of actual CEMTA usage was used in the proposed model as the observed variable measure while the situations in which respondents reported using CEMTA were only displayed in the descriptive statistics section of this study. Ultimately, these questions allowed for a more comprehensive understanding of the need and potential use of CEMTA in various situations. The scale for frequency of usage was rescaled to 1-5 to align with the scales of the other variables using a linear transformation method following the guidelines of Hair *et al* (2019). *The* remaining 11 constructs used a five-point Likert scale ranging from "strongly disagree = 1" to "strongly agree = 5" following the framework of Venkatesh *et al* (2012) and Palau-Saumell *et al* (2019).

3.3 Method of Data Analysis

Analysis for descriptive statistics was run using IBM SPSS Statistics (v. 29.0.1.0) software to provide an overview of the data and properties of the variables. In doing so, insight into the participants' background information could be gathered, evidence could be provided that there's a need for CEMTA by assessing the prevalence of Chinese-only and poorly translated bilingual menu establishments as experienced by the participants, as well as provide evidence into the utilization of CEMTA by measuring the frequency and situations of actual CEMTA usage. In addition, the descriptive statistics of the constructs could show the central tendency, dispersion, and reliability of the constructs, as well as provide a preliminary understanding of the factors that may need to be addressed to improve CEMTA adoption and usage.

To test the proposed model, partial least squares structural equation modeling (PLS-SEM) was employed using SmartPLS (v. 4.0.9.2), a leading software for conducting PLS-SEM analysis

(Sarstedt *et al*, 2022). PLS-SEM allows for the examination of relationships between latent constructs in technology acceptance models (Bentler, 1995). This method of analysis was selected based on the rules of thumb provided by Hair *et al* (2011), as well as the recommendations provided by Hair *et al* (2019) as it aligns with the research goals of this study. Furthermore, this analysis is consistent with previous studies using the UTAUT-2 framework (Venkatesh, 2012, Chang *et al*, 2019). While Palau-Saumell *et al* (2019) used covariance based structural equation modeling (CB-SEM), which the proposed model was largely influenced by, the research objectives and criteria for this study are more closely aligned with the criteria for PLS-SEM (Hair *et al*, 2011; Hair *et al*, 2019; Hair *et al,* 2021). **Table 1** summarizes the research goals and criteria based on Hair et al (2019) for selecting PLS-SEM as a suitable method of analysis.

Table 1: Criteria for Selecting PLS-SEM.

Hair *et al* (2019) Criterion	Research Goal & Relevance
Prediction Perspective	The study aims to investigate the factors influencing user adoption and usage of CEMTA in Taiwan using a modified UTAUT-2 framework. It serves the predictive purpose by predicting and explaining the relationships among the latent variables in the study in addition to theory testing.
Complexity of Structural Model	The proposed model incorporates multiple constructs and the introduction of two new constructs to the UTAUT-2 framework.
Exploratory Research for Theory Development	This study extends the UTAUT-2 model by incorporating new constructs, as well as applying it in a new context making it exploratory research for theory development.
Sample Size & Statistical Power	PLS-SEM can effectively handle small to medium sample sizes which suits the study's 281 respondents. Based on the 10 times rule, 281 respondents should provide sufficient statistical power

	and generalizability for the findings using PLS-SEM (Hair *et al*, 2011).
Distribution Issues	PLS-SEM is robust against violations of normality. The Shapiro-Wilk test was conducted in the R programming language to investigate the normality of data and found that the p-values for each variable were well below the 0.05 threshold, indicating non-normality as illustrated in **Appendix 2**.
Latent Variable Scores for Follow-up Analyses	This study aims to evaluate the effectiveness of existing CEMTAs and identify areas for improvement. PLS-SEM can provide latent variable scores for these follow-up analyses.

The steps for conducting the PLS-SEM analysis in this study incorporate the approach of Venkatesh *et al* (2013) and the guidelines proposed by Hair *et al* (2017), Hair *et al* (2019), and Hair *et al* (2021). First, the study accounted for preliminary considerations, which involved assessing sample size, distributional assumptions, statistical power, and normality of data. Next, to ensure the validity of the findings, common method bias was assessed which could be a potential issue and is common practice in any study that uses self-reported survey (Venkatesh *et al*, 2012; Palau-Saumell *et al*, 2019). To check for common method bias (CMB), Herman's single-factor test was conducted using the R programming language as illustrated in **Appendix 3**. The proportion of variance explained by the single factor was 37.03% or 0.37, suggesting that CMB was likely not an issue in the data and the relationships between the dependent and independent variables were not inflated due to common method bias (Kock, 2015).

After the preliminary considerations and common bias assessment, measurement model assessments were conducted to ensure validity and reliability. Since all the indicators were reflective in nature and the data was non-normal, the factor structure of the latent variables assessed involved convergent validity and discriminant validity criteria (Hair *et al*, 2022). Convergent

validity was evaluated using indicator loadings, Cronbach's alpha, composite reliability, and average variance extracted (AVE). Discriminant validity was evaluated using the hetertrait-monotrait (HTMT) ratio of correlations (Hair *et al*, 2022).

Once the measurement model was deemed valid and reliable, the structural model was used to examine the eleven hypothesized relationships. As suggested by Hair et al (2021), this involved checking for collinearity (VIF) among the predictor constructs, examining the coefficient of determination (R^2) for in-sample explanatory power, the effect size (F^2) to explain the presence of mediation, checking the blindfolding-based cross-validated redundancy measure (Q^2) and root mean square error (RMSE) for predictive relevance and power, as well as running bootstrapping to evaluate the significance of the path coefficients. Finally, unobserved heterogeneity was checked for assessing the robustness of the structural model results (Sarstedt *et al*, 2019).
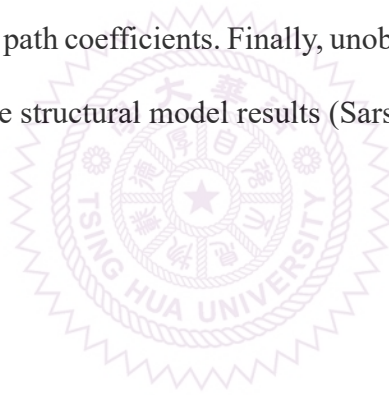
Chapter 4

4. Results

4.1 Descriptive Statistics

Table 2 displays the descriptive statistics of participants' background variables which includes gender, age, country of origin, and status in Taiwan. Despite the demographics section being optional, only one respondent chose not to provide their age, nine chose not to provide their country of origin, and one chose not to provide their status for being in Taiwan.

Table 2. Background information of the respondents.

Variable	Frequency	%
Language Proficiency	**N = 281**	
Advanced (I can read most words or phrases)	10	3.6
Intermediate (I can read many words or phrases)	139	49.5
Limited (I can read a few words or phrases)	119	42.3
None	13	4.6
Gender	**N = 281**	
Female	133	47.3
Male	141	50.2
Non-binary / third gender	6	2.1
Age	**N = 280**	
18-30	181	64.4
31-45	92	32.7
46+	7	2.5
Country of Origin (Continent)	**N = 272**	
North America	178	65.4
South America	7	2.6
Europe	28	10.3
Asia	26	9.6
Australia	3	1.1
Africa	30	11.0
Status in Taiwan	**N = 280**	

International student	56	19.9
Professional worker (non-teaching)	43	15.3
Teacher (including language instructors)	33	11.7
Tourist	145	51.6
Other	3	1.1

Most respondents (49.5%) reported an intermediate level of Chinese proficiency, followed by 42.3% reporting limited proficiency, and only a small percentage (4.6%) reporting no Chinese proficiency at all. The respondents comprised of 133 (47.3%) females, 141 (50.2%) males, and 6 (2.1%) reported a non-binary or third gender. Out of 281 participants, 280 respondents reported their age with the minimum age being 20 and the maximum age being 63. The ages were grouped to reveal 181 (64.4%) respondents being under 30 and only 7 (2.5%) reporting to be over 46.

Out of 281 participants, 272 respondents reported their country of origin. These respondents were from 41 different countries from six different continents. Their country of origin was grouped into continents to reveal that most respondents (65.4%) were from North America, in which 162 (57.7%) were from the United States of America. Although significantly lower, the next highest percentage (11%) was from Africa, in which 17 (6%) respondents were from South Africa. Three respondents reported Taiwan as their country of origin. These respondents were included in the analysis because they reported not being fluent in Chinese and they regularly use CEMTA. This could be due to living outside of the country for a prolonged period or other factors. Regardless of the reason, these participants align with the target population of this study and were therefore included in the analysis.

In terms of respondent's status for living in Taiwan, 145 (51.6%) reported to be tourists, 56 (19.9%) reported to be international students, 43 (15.3%) reported to be professional workers, and 33 (11.7%) reported to be teachers. Only 3 respondents selected "Other", with responses that included,

"spouse of Taiwanese", "factory worker", and "citizen". As previously stated, the citizen was included based on meeting the criteria of the target population. The frequency of respondents encountering Chinese-only and/or bilingual menu food establishments in Taiwan are displayed in **Table 3**.

Table 3. Food Service Encounter Experience.

Variable	Frequency	%
Chinese-only Menu Encounters	**N = 281**	
Very frequently	27	9.6
Frequently	83	29.5
Occasionally	127	45.2
Rarely	44	15.7
Never	0	0
Bilingual Menus (unclear translations) Encounters	**N = 281**	
Very frequently	5	1.8
Frequently	59	21
Occasionally	164	58.4
Rarely	52	18.5
Never	1	0.4

Most respondents (45.2%) reported occasionally encountering food establishments with Chinese-only menus, and a combined 39.1% who reported either frequently or very frequently encountering them. This suggests that food service establishments with Chinese-only menus are common among the places in Taiwan frequented by the respondents. In terms of food service establishments with bilingual menus with unclear or poorly translated menu items, 79.4% reported encountering these establishments occasionally or frequently. The frequency of actual CEMTA usage and the situations in which respondents reported using CEMTA are displayed in **Table 4**.

Table 4. Frequency and Situations of Actual CEMTA Usage.

Variable	Frequency	%
Frequency of CEMTA Use	**N = 281**	
Always	22	7.8
Often	129	45.9
Sometimes	98	34.9
Rarely	32	11.4
Situation for Using CEMTA (select all that apply)	**N = 281**	
Dining	212	75.4
Ordering Takeout	149	53
Learning Chinese Cuisine	166	59.1
Making Recommendations	72	25.6
Other	5	1.8

A combined 53.7% of respondents reported using CEMTA always or often, while only 11.4% reported using CEMTA rarely. Respondents could also select multiple options for the situations in which they use CEMTA. Most respondents (75.4%) selected using CEMTA when dining at a food establishment, 59.1% selected using CEMTA when wanting to learn about the cuisine, and 25.6% chose using CEMTA when ordering takeout. Only 5 out of the 281 respondents selected "Other" which could have been categorized under dining, ordering takeout, learning cuisine, and making recommendations, but were not recorded to fit these categories as they were only 5. Their responses included, "screen shot and translate", "delivery", "reading recipes", and "transacting with non-English speakers".

UTAUT2

Descriptive statistics in **Table 5** illustrate the central tendency and dispersion of UTAUT2 variables in the proposed model using mean and standard deviation.

Table 5. Descriptive Statistics of the Constructs.

Construct	Mean	Standard deviation	Cronbach's alpha *(> 0.7)*
Actual Use (AU)	3.01	1.08	
Intentions to Use (IU)	4.03	0.81	0.76
Performance Expectancy (PE)	4.08	0.79	0.83
Effort Expectancy (EE)	4.13	0.79	0.83
Facilitating Conditions (FC)	4.23	0.76	0.90
Social Influence (SI)	3.88	0.90	0.84
Price Value (PV)	3.80	0.97	0.76
Habit (HT)	4.13	0.81	0.90
Hedonic Motivation (HM)	3.89	0.95	0.78
Perceived Credibility (PC)	3.88	0.96	0.86
Translation Accuracy (TA)	3.93	0.89	0.85
Cultural Adaptability (CA)	4.06	0.82	0.81

The mean (3.01) and standard deviation (1.08) for the actual use construct stood out as an outlier. It is the only construct with one observed variable, specifically, measuring frequency of CEMTA usage. Having a single item for direct observation in this context is acceptable as the object and attribute of measurement can be considered simple and unambiguous (Bergkvist & Rossiter, 2009), and as previously stated, this is a common metric used to measure usage in UTAUT2 research. This is also why this construct does not have a Cronbach's alpha score as Cronbach's alpha is a measure of internal consistency reliability when multiple observed items are present (Cortina, 1993). The mean for all other 11 constructs in the proposed model were all above 3.80, with the majority being above 4.03 for the sample (N=281), which indicates that the respondents expressed a high level of agreement with the constructs being measured. The standard deviation value for these constructs were also relatively low, ranging from 0.76 to 0.97, indicating a reasonable degree

of consensus among the responses. In addition, Cronbach's alpha values for these constructs were all above the 0.7 threshold and below the 0.95 threshold concern for indicator redundancy, indicating that the items within each construct measured the same underlying concept (Hair et al, 2021) with the exception of "Actual Use".

With simple descriptive statistics, the two new proposed constructs (TA and CA), as well as the addition of perceived credibility as proposed by Palau-Saumell *et al* (2019), show an acceptable level of internal consistency, indicating that it may serve as a valuable addition to the model in this context. Intentions to use, performance expectancy, effort expectancy, facilitating conditions, and habit have mean values above 4, suggesting that these constructs were favored and that under the right conditions, these factors could play a significant role in promoting adoption and usage.

4.2 Structural Equation Modelling (SEM)

4.2.1 Measurement Model Results

Assessment of Convergent Validity

To check for reliability of the measurement model, the indicator loadings were evaluated to ensure that all loadings were greater than 0.708 which indicates that the constructs explained more than 50 per cent of the indicator's variance (Hair *et al*, 2022). The analysis found only two below this threshold, namely, PE3 (0.567) and SI4 (0.691), but this was acceptable as the loadings were greater than 0.4, the average variance extracted (AVE) was greater than 0.5, indicating sufficient convergent validity, and composite reliability was greater than 0.7 for all the tested constructs, further supporting the reliability of the model (Hair *et al*, 2021). Indicator loadings are displayed in **Table 6** and convergent validity results are given **in Table 7**.

Table 6. Survey Items and Indicator Loadings.

Items	Questionnaire Statements	Indicator Loadings
Actual Usage		
AU1	How often do you use CEMTA when dining at a food service establishment with Chinese-only menus?	1.00
Intentions to Use		
IT1	I will always try to use CEMTA when dining at food service establishments with Chinese-only menus.	0.82
IT2	I plan to continue using CEMTA frequently.	0.85
IT3	I intend to continue using CEMTA in the future.	0.78
Performance Expectancy		
PE1	I find CEMTA useful in my daily life when ordering food.	0.87
PE2	I believe that using CEMTA helps me make correct menu choices.	0.86
PE3	I believe that using CEMTA helps me avoid allergy related issues when ordering food.	0.57
PE4	I believe using CEMTA would improve my overall dining experience at food service establishments with Chinese-only menus.	0.77
Effort Expectancy		
EE1	I believe that learning how to navigate and use CEMTA is easy for me.	0.82
EE2	I believe my interaction with CEMTA is clear and understandable.	0.82
EE3	I find CEMTA easy to use.	0.79
EE4	I believe it is easy for me to become skillful at using CEMTA.	0.82
Facilitating Conditions		
FC1	I believe I have the necessary smartphone to use CEMTA.	0.88
FC2	I believe that I have the necessary knowledge to use CEMTA.	0.84
FC3	I feel comfortable using CEMTA.	0.79
FC4	I believe CEMTAs are compatible with the other technologies I use.	0.75
Social Influence		
SI1	People who are important to me think that I should use CEMTA.	0.89
SI2	People who influence my behavior think that I should use CEMTA.	0.87
SI3	People whose opinions that I value prefer that I use CEMTA.	0.83
SI4	Online reviews, including social media, affects my choice of CEMTA.	0.69
Price Value		
PV1	I believe more specialized CEMTA (e.g., Waygo) is reasonably priced given its benefits (More accurate translations, more user friendly).	0.85
PV2	I believe specialized CEMTA is good value for money.	0.90
PV3	I am willing to pay more for specialized CEMTA if it offers better features than free alternatives (e.g., Google Translate).	0.79
PV4	I will pay more for a CEMTA if its interface adapts to match my cultural preferences and expectations.	0.80
Habit		
HT1	The use of CEMTA has become a habit for me when dining at food service establishments with Chinese-only menus.	0.87
HT2	I am in favor of using CEMTA when dining at food service establishments with Chinese-only menus.	0.81
HT3	I feel the need to use CEMTA when dining at food service establishments with Chinese-only menus.	0.80
HT4	I believe I will use CEMTA consistently over time.	0.81
Hedonic Motivation		
HM1	I believe using CEMTA is fun.	0.94
HM2	I believe using CEMTA is enjoyable.	0.94
HM3	I believe using CEMTA is very entertaining.	0.83
Perceived Credibility		
PC1	When using CEMTA on a smartphone, I believe that my information is kept confidential.	0.92
PC2	I believe that my privacy will not be breached.	0.90
PC3	I believe that the environment provided by CEMTA is safe.	0.92
Translation Accuracy		
TA1	I expect CEMTA to provide accurate translations of menu items.	0.80
TA2	I believe CEMTA interprets the meaning of Chinese menu items accurately.	0.81
TA3	I believe CEMTA content maintains the original meaning of the menu items text.	0.78
TA4	I believe CEMTA minimizes errors related to the menu items.	0.79
Cultural Adaptability		
CA1	I believe that CEMTA takes my cultural preferences and characteristics into account.	0.71
CA2	I believe CEMTA provides an opportunity for a greater appreciation of Chinese cuisine.	0.91
CA3	I believe CEMTA helps me discover new and authentic Chinese dishes.	0.81

Table 7. Construct Reliability and Validity Overview.

	Cronbach's alpha (> 0.7)	Composite reliability (rho_a) (> 0.6)	Composite reliability (rho_c) (> 0.6)	Average variance extracted (AVE) (> 0.5)
Cultural Adaptability (CA)	0.758	0.905	0.853	0.661
Effort Expectancy (EE)	0.830	0.831	0.887	0.662
Facilitating Conditions (FC)	0.829	0.848	0.886	0.661
Habit (HT)	0.839	0.845	0.892	0.674
Hedonic Motivation (HM)	0.896	1.009	0.929	0.814
Intentions to use (IU)	0.757	0.771	0.859	0.669
Perceived Credibility (PC)	0.902	0.907	0.939	0.836
Performance Expectancy (PE)	0.775	0.830	0.856	0.605
Price Value (PV)	0.859	0.887	0.902	0.697
Social Influence (SI)	0.847	0.917	0.894	0.681
Translation Accuracy (TA)	0.811	0.837	0.873	0.632

The only concern as highlighted is in red, is the internal consistency reliability score (rho_a) for ''Hedonic Motivation" which is above 0.95, indicating possible redundancy in the indicators for this construct or the possibility of undesirable response patterns (Hair et al, 2022). However, this is considered acceptable as all other measures of reliability and validity are within the acceptable range, which indicates that the measurement model is still robust. It should also be noted that actual usage was not included in the convergent validity results because it is a single-item construct. To further assess the robustness of the measurement model, discriminant validity is assessed in the following section to ensure each construct is distinct from the other constructs (Hair *et al*, 2021).

Assessing Discriminant Validity

To assess discriminant validity, the heterotrait-monotrait (HTMT) ratio of correlations was used. The HTMT ratio of correlations proposed by Henseler *et al* (2015) offered flexibility based on

conceptual similarity and is consistent with recent SEM practices and recommendations of recent research in this field (Hair *et al*, 2021). The HTMT correlation matrix in **Table 8** illustrates the discriminant validity results for the constructs.

Table 8. Discriminant Validity – Heterotrait-Monotait (HTMT) Matrix.

	AU	CA	EE	FC	HM	HT	IU	PC	PE	PV	SI	TA
AU												
CA	0.17											
EE	0.30	0.64										
FC	0.38	0.59	0.88									
HM	0.11	0.90	0.42	0.36								
HT	0.46	0.53	0.69	0.73	0.46							
IU	0.31	0.34	0.62	0.70	0.21	0.81						
PC	0.06	0.78	0.40	0.41	0.70	0.44	0.35					
PE	0.33	0.75	0.85	0.86	0.60	0.79	0.79	0.56				
PV	0.11	0.69	0.35	0.22	0.64	0.38	0.25	0.65	0.43			
SI	0.09	0.80	0.47	0.41	0.88	0.59	0.34	0.64	0.65	0.72		
TA	0.11	0.91	0.55	0.49	0.80	0.52	0.41	0.75	0.72	0.70	0.79	

The HTMT values should reflect a threshold value of 0.90 for constructs that are conceptually similar and a threshold value of 0.85 for constructs that are conceptually more different (Henseler *et al*, 2015). Given that the UTAUT-2 framework is widely adopted and validated to reflect a set of constructs related to technology and acceptance and use, there should be conceptual similarity between the constructs, suggesting that the threshold value of 0.90 is appropriate. **Table 8** shows that all constructs are below this threshold, indicating acceptable discriminant validity with the exception of translation accuracy and cultural adaptability, which has a value of 0.91. This may indicate that that the respondents had difficulty distinguishing between the two constructs when responding to the questionnaire as they are theoretically different as discussed in the hypothesis

development section of this paper and should therefore have different conceptual underpinnings and effects on user adoption and acceptance of CEMTA. These concepts are therefore kept in the study, however, given that translation accuracy and cultural adaptability are above the 0.90 threshold, future research could investigate why they are closely related or refine the measurement items to ensure they more clearly capture the distinctness of these constructs.

The overall analysis of the measurement model shows promising results as it confirms the constructs' reliability and validity. Thus, the model is considered acceptable for the analysis of the structural model and testing the hypothesized relationships of the twelve constructs in the proposed model.

4.2.2 Structural Model Results

Once the measurement model was deemed valid and reliable, the structural model was used to examine the eleven hypothesized relationships. As suggested by Hair et al (2021), this involved checking for collinearity (VIF) among the predictor constructs, examining the coefficient of determination (R^2) for explanatory power, the effect size (F^2) to explain the importance of individual predictors, checking the blindfolding-based cross-validated redundancy measure (Q^2) and predictive statistics such as RMSE, and MAE for predictive relevance and power, as well as running bootstrapping in SmartPLS (v. 4.0.9.2) to evaluate the significance of the path coefficients.

Checking Collinearity (VIF)

The variance inflation factors (VIFs) were computed to test for multicollinearity. All VIF values were below 4 for the constructs, suggesting that collinearity was not a major issue among both the exogenous constructs and the endogenous constructs in this study. Hedonic motivation to intentions to use and performance expectancy to intentions to use were the only constructs with values above 3, with the highest indicator VIF value being 3.675 (HM3) and the highest construct VIF value being 3.434 (HM -> IU). While this may suggest some collinearity among these constructs, this was acceptable as it was still below the conservative threshold of 5 threshold which would otherwise be indicative of probable collinearity issues (Hair *et al*, 2019). An interesting observation is that intentions to use and actual usage had a VIF of 1, which is ideal as it suggests no shared variance multicollinearity between the two endogenous constructs. **Table 9** displays the inner model VIF values.

Table 9. Inner Model VIF Values (< 5)

	VIF
CA -> IU	2.865
EE -> IU	2.683
FC -> IU	2.982
HM -> IU	3.434
HT -> IU	2.112
IU -> AU	1
PC -> IU	2.167
PE -> IU	3.028
PV -> IU	2.026
SI -> IU	2.965
TA -> IU	2.706

The Coefficient of Determination (R^2)

The Coefficient of Determination (R^2) was checked as a measure of the model's explanatory power, with 0.75, 0.50, and 0.25 being considered substantial, moderate, and weak respectively (Hair *et al*, 2019). The proposed model has an R^2 of 0.556 and an adjusted R^2 of 0.539 for intentions to use, which suggests moderate explanatory power for this endogenous construct. This means that the model explained moderate to substantial variance of intentions to use CEMTA, indicating that variables of performance expectancy, effort expectancy, facilitating conditions, social influence,

price value, habit, hedonic motivation, perceived credibility, translation accuracy, and cultural adaptability explained 55.6% of variance in intentions to use. However, the model explained weak variance of actual usage, with an R^2 of 0.083 and an adjusted R^2 of 0.080 indicating intentions to use accounted for only 8.3% of variance in actual Usage. **Table 10** displays the R^2 and the adjusted R^2 for the proposed model, illustrating its in-sample explanatory power.

Table 10. Coefficient of Determination (R^2).

	R-square	R-square adjusted
AU	0.083	0.08
IU	0.556	0.539

The Effect Size (F^2)

Cohen's f-square was used to assess the effect size of the predictor variables in relation to intentions to use and intentions to use in relation to actual usage, with 0.02, 0.15, and 0.35 being considered small, medium, and large effect sizes respectively (Cohen, 1988). An interesting observation is that effort expectancy had a F^2 value of 0, indicating that the variable made no unique contribution to the explained variance of intentions to use in the sample when other predictors were controlled for in the model, while habit has a medium effect size of 0.199 on intentions to use and performance expectancy has a small to medium effect size of 0.11 on intentions to use. Based on Cohen's guidelines, all the other constructs are below 0.02, indicating very small effects, except for hedonic motivation to intentions to use with a small effect size of 0.034 and intentions to use to actual usage with a small effect size of 0.09.

Table 11. Effect Size (F^2).

(Small >= 0.02; Medium >= 0.15; Large >= 0.35)

	f-square
CA -> IU	0.005
EE -> IU	0
FC -> IU	0.01
HM -> IU	0.034
HT -> IU	**0.199**
IU -> AU	0.09
PC -> IU	0.004
PE -> IU	**0.11**
PV -> IU	0.004
SI -> IU	0.002
TA -> IU	0.003

61

Assessing Predictive Relevance Using Q^2, RMSE, and MAE

To assess the predictive relevance and power, the use of predictive statistics involving Q^2, RMSE, and MAE were used as suggested by Shmueli *et al* (2016) and Hair *et al* (2019). **Table 12** provides a predictive summary of these values using SmartPLS (v. 4.0.9.2), in which the RMSE and MAE values were compared with LM values of each for analysis.

Table 12. Predictive Relevance Summary – Overview.

	Q²predict	PLS-SEM_RMSE	LM_RMSE
Actual Use (AU)	*0.111*	*1.022*	*0.98*
Intention to Use (IU) IU1	0.428	0.587	0.634
IU2	*0.276*	*0.757*	*0.796*
IU3	*0.237*	*0.674*	*0.726*

Q^2 values larger than 0, 0.25, and 0.50 predict small, medium, and large predictive relevance respectively (Hair *et al*, 2019). The subcomponents of intention to use and actual use are all above 0, indicating predictive relevance for these constructs, with the Intention to use and its subcomponents depicting medium predictive accuracy and actual use depicting small predictive accuracy of the proposed model.

Based on the guidelines proposed by Shmueli *et al* (2019), the proposed model's prediction errors for actual use were greater than the LM benchmark's prediction error, indicating low predictive power, while each RMSE for the proposed model's values of each subcomponent of intentions to use had prediction error scores lower than the benchmark, indicating high predictive power. Since lower RMSE values indicate better fit, the proposed model fits better for intentions to use constructs than actual use.
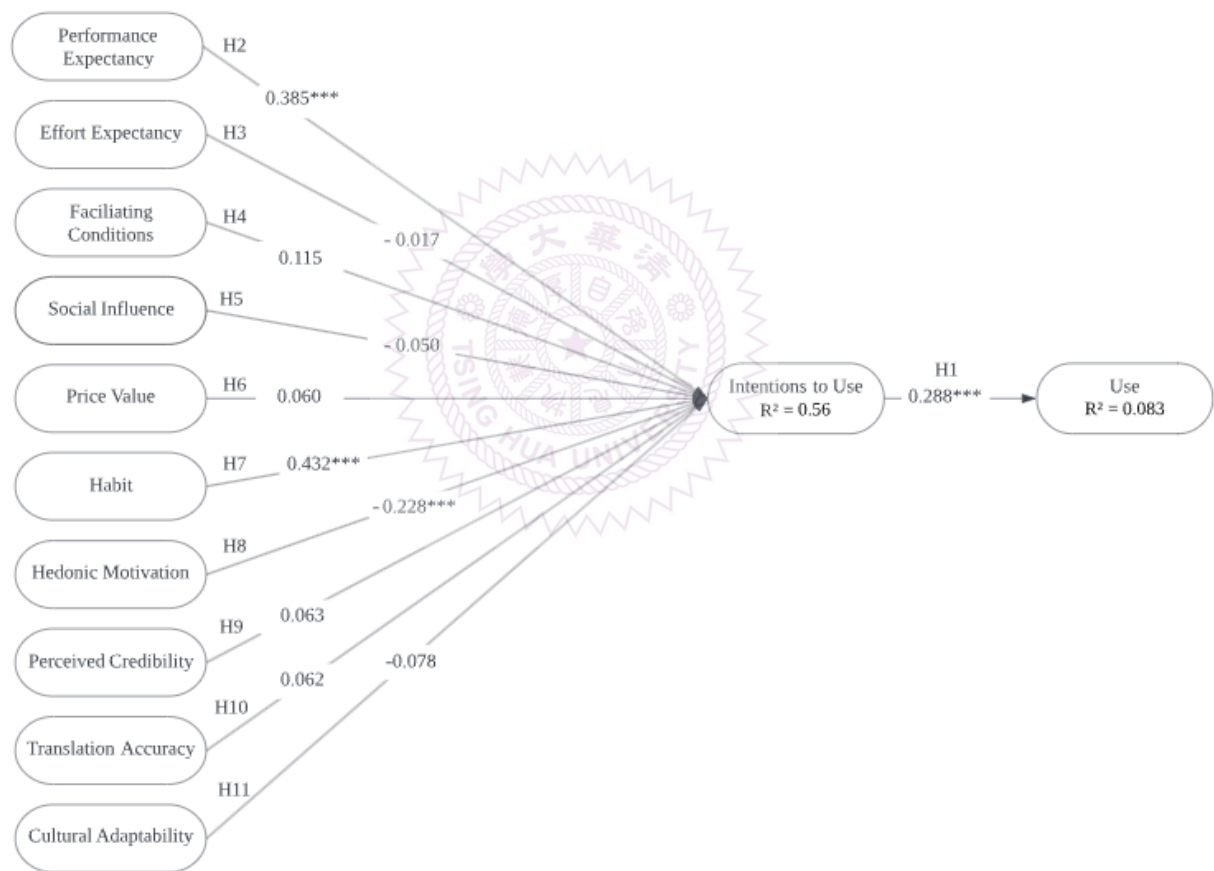
Path Results of Structural Model

Table 13 displays the statistical significance and relevance of the path coefficients to examine the eleven hypothesized relationships.

Table 13. Path Results of Structural Model.

Hypotheses	Paths	Path Coefficients	T statistics	P values	
H1	IU -> AU	0.288	4.824	0.000	***
H2	PE -> IU	0.385	4.089	0.000	***
H3	EE -> IU	-0.017	0.182	0.856	
H4	FC -> IU	0.115	1.106	0.269	
H5	SI -> IU	-0.050	0.550	0.583	
H6	PV -> IU	0.060	0.855	0.393	
H7	HT -> IU	0.432	4.536	0.000	***
H8	HM -> IU	-0.228	2.473	0.013	*
H9	PC -> IU	0.063	0.831	0.406	
H10	TA -> IU	0.062	0.776	0.438	
H11	CA -> IU	-0.078	1.125	0.261	

The exact significance of the path coefficients was interpreted from the p-values given that the data is non-normal, and bootstrapping was used (Hair *et al*, 2021). PE (β = 0.385), FC (β = 0.115), PV (β = 0.060), HT (β = 0.432), PC (β = 0.063), and TA (β = 0.062) appeared to have positive impacts on intention to use CEMTA. IU (β = 0.288) also appeared to have a positive impact on the actual use of CEMTA. EE (β = -0.017), SI (β = -0.050), HM (β = -0.228), and CA (β = -0.078) appeared to have negative impacts on intentions to use CEMTA. However, given the results of SEM analysis of the structural model as shown in **Table 13** and **Figure 3**, only performance expectancy and habit significantly and positively influenced intentions to use CEMTA (β = 0.385, p < 0.001; β = 0.432, p

< 0.001). These results support H2 and H7. Intentions to use also significantly and positively

influenced actual use of CEMTA (β = 0.288, p < 0.001). Hedonic motivation was found to have a

significant, but negative influence on intentions to use CEMTA (β = -0.228, p < 0.05). This result

contradicts H8 which predicted a positive relationship and suggests that as hedonic motivation

increases, the intention to use CEMTA decreases. Thus, the data supports H1, H2, and H7, with

statistical significance only supporting four relationships in the proposed structural model.

Figure 3. Structural Model Results. Note: Numbers are the path coefficients. *** p < 0.001; * p < 0.05)

Robustness Check: Unobserved Heterogeneity

Finally, unobserved heterogeneity was checked using the finite mixture partial least squares (FIMIX-PLS) method using SmartPLS (v. 4.0.9.2). The analysis identified segments within the data with different path coefficients, indicating how differently the segments reacted to each construct. This is important as the fact that H3, H4, H5, H6, H9, H10, and H11 did not align with prior research could indicate the presence of unobserved heterogeneity. **Table 14** displays these results.

Table 14. Unobserved Heterogeneity

	Original path coefficients	Segment1	Segment2
CA -> IU	-0.078	-0.297	0.343
EE -> IU	-0.017	-0.08	0.112
FC -> IU	0.115	0.322	0.029
HM -> IU	-0.228	-0.482	-0.058
HT -> IU	0.432	0.218	0.43
IU -> AU	0.288	0.174	0.452
PC -> IU	0.063	0.176	0.068
PE -> IU	0.385	0.265	0.453
PV -> IU	0.06	0.185	-0.206
SI -> IU	-0.05	0.01	0.021
TA -> IU	0.062	0.228	-0.188

The constructs, cultural adaptability, effort expectancy, price value, social influence, and translation accuracy were particularly interesting because the path coefficients varied significantly across the different segments, shifting from positive to negative relationships and or vice versa. These inconsistent relationships suggest the influence of unobserved factors that were not accounted for in the proposed model of this study. Specifically, these findings hint at the presence

of unobserved heterogeneity which could provide clarity into why H3, H4, H5, H6, H9, H10, and H11 did not align with prior research. Future research should consider this unobserved heterogeneity to provide a more comprehensive understanding of the factors influencing the use of CEMTA as it could be that these unseen factors have significantly impacted the outcome of these hypotheses.

Chapter 5

5. Findings and Discussion

5.1 Interpretation of Descriptive Results

The high prevalence of Chinese-only menus and bilingual menus that are unclear or poorly translated in Taiwanese food establishments frequented by the respondents, validates the need and relevance of CEMTA in Taiwan due to the language barriers presented. In addition, most of the respondents frequently or occasionally encountered these establishments, supporting the research claim of the importance of CEMTA as a viable solution for bridging the language barrier, and reinforcing the selection of Taiwan as a fitting location for this study. These findings also highlight that unclear translations are a frequent issue, providing evidence that there is a potential need for establishments to improve the quality of their translations, while those with Chinese-only menus should consider the implications for their non-Chinese speaking customers.

The high usage of CEMTA among respondents indicates a high demand for CEMTAs. Based on the usage scenarios for CEMTA, areas that could be well received among users, should involve improvements or additional features to CEMTA relating to customers dining at a food establishment, learning about the cuisine, and ordering takeout in that order of importance.

The constructs with lower mean values, specifically the use construct and the price value construct, warrant further exploration. In terms of actual usage of CEMTA, future research could explore the use of multiple indicators, adding moderating or control variables, or simply using a larger sample to ensure results are not sporadic. While intentions to use CEMTA may be high, actual usage is on the lower end, suggesting that certain barriers were not addressed by the applications used by the respondents. It's also important to note here that respondents may have used different translation applications for menu translation which are not created equally as discussed in the overview of

CEMTA section of this paper. The mean value for the price value construct was also on the lower end, suggesting that respondents may not perceive the price of specialized CEMTA with additional features, premium model CEMTAs or PBM for CEMTA without a freemium model as not providing good value, which could influence their decision to use it. The descriptive analysis of the questionnaire provided some insights and a preliminary understanding of the factors that may need to be addressed to improve CEMTA adoption and usage and ultimately answer how CEMTA can be improved to better meet the needs of users.

5.2 Theoretical Contributions

The SEM results reveal nine major theoretical contributions to the technology acceptance field. First, this research is one of the studies to extend the exploration of technology acceptance in tourism services applications to the specific case of consumer's adoption of Chinese-to-English menu translation applications (CEMTA).

Second, the empirical findings of this research suggest that drivers of intentions to use CEMTA in order of impact include, habit, performance expectancy, and hedonic motivation. The impact of habit and performance expectancy indicate that tourists, expatriates, international students, and professional workers operating in Taiwan who are not fluent in reading Chinese text, will have positive intentions for adopting CEMTA because they need to use the application to understand the menu and place a correct order, with the implication that the intention to use it will become habitual as long as a language barrier is present at food service establishments in Taiwan.

Third, these results align with prior research that intention to use is a strong predictor of actual technology use across various domains (Venkatesh *et al*, 2012; Palau-Saumell *et al*, 2019; Nordhoff *et al*, 2020).

Fourth, in analyzing the reliability of the constructs in the measurement model, the composite reliability scores for the intentions to use construct were higher than the Cronbach's aloha. This is an interesting pattern because Cronbach's alpha is generally considered a lower bound estimate of reliability, with composite reliability being higher. This suggests a higher degree of homogeneity or intercorrelation among the items within this construct compared to the other constructs which is worth further investigation to better understand why this is the case.

Fifth, the contradictory finding that increased hedonic motivation leads to decreased intention to use CEMTA, suggests that integrating fun and entertainment to CEMTA may have negative intentions for adopting CEMTA. Possible reasons for this could include respondents not having access to the additional features because of using freemium models or many of these applications do not yet incorporate additional features that could enhance the user experience, such as personalized recommendations, visual representation of the dishes, seeing new items they have yet to try, as well as ratings and reviews of the most popular dishes (Erway, 2015; Sun & Sun, 2017; Fuentes-luque, 2017).

Sixth, the empirical findings of this study also showed weak relationships between the other exogenous variables and intentions to use, which was inconsistent with prior research in numerous studies across various domains using the UTAUT2 framework. As per this framework, effort expectancy, facilitating conditions, social influence, price value, and perceived credibility should have a significant impact on intentions to use a technology (Venkatesh *et al*, 2012; Palau-Saumell *et al*, 2019; Nordhoff *et al*, 2020). In addition, the two proposed constructs, translation accuracy, and cultural adaptability, should also have a positive influence on intentions to use as supported by literature on the importance of translation accuracy for translation applications (Groves & Mundt, 2015; Fuentes-Luque, 2017; Chen *et al*, 2017, Aresta, 2018), user cultural preferences

when using a technology (Reinecke & Bernstein, 2013), as well as Skopos theory principles (Sun & Sun, 2017; Zhong, 2020; Huo *et al*, 2020).

Seventh, the lack of multicollinearity was consistent with previous research using the UTAUT-2 framework (Venkatesh *et al*, 2012; Palau-Saumell *et al*, 2019). Hedonic motivation to intentions to use and performance expectancy to intentions to use were the only predictor constructs with possible collinearity issues, suggesting further exploration in future studies.

Eight, the proposed model was able to suggest moderate explanatory power for intentions to use CEMTA, but weak explanatory power actual usage of CEMTA. While these results are consistent with Chang *et al* (2019) and their research into factors influencing online hotel booking using the UTAUT-2 framework, the variance in use, explained by intentions to use in Palau-Saumell *et al's* (2019) research was significantly higher ($R^2 = 0.71$). Future research could therefore examine additional factors that could influence actual use of CEMTA to improve the explanatory power of the model, since these factors are yet to be identified.

Lastly, in terms of effect size, effort expectancy made no contribution to the variance explaining intentions to use CEMTA when other predictors were controlled. This is worth exploring since this contradicts prior research which suggests users prefer a technology that is easy to use and may even abandon the application due to the unique risks of platform-based models (PBM). In terms of predictive relevance and power, there is a clear need to refine the proposed model for better accuracy in actual use predictions.

5.3 Practical Implications and Recommendations for Improving CEMTA in Taiwan

The first recommendation is to position CEMTA as a platform-based model for improving CEMTA to better meet user needs. This implies leveraging network effects, scalability, and other

characteristics unique to these models to enhance user experiences and acceptance. This also means that there are unique risks and challenges of CEMTA that need to be addressed to improve the user's platform experience. Factors that should be considered during the development and implementation of CEMTAs include lock-in effects, disintermediation, and network effects.

Strategies to overcome these challenges include attracting both users of CEMTA and food service establishments simultaneously to CEMTA platforms, since a significant proportion of the respondents were tourists (51.6%) who reported occasionally or frequently encountering food service establishments with Chinese-only menus (74.7%). Another strategy involves balancing the needs of these user groups. To ensure high-quality translations, providers of CEMTA should focus on quality control, user reviews, and ratings. Pricing and incentive structures should be developed in a way that appeals to both users and food service establishments. Cultural adaptability and localization of user interfaces should also be integrated for an improved user experience and adoption of the technology. Given the significance of the performance expectancy and habit constructs, platforms for CEMTA should be designed to make the application perform in line with these expectations while making it habit-forming as potential strategies for success.

The findings on hedonic motivation suggest that simply making the application fun might not be sufficient to drive user behavior, indicating a need for further refinement of CEMTA design to meet the needs of users and food service establishments. The lack of significant influence of effort expectancy, facilitating conditions, social influence, price value, and perceived credibility, suggest that users may have different preferences ad acceptance factors in the specific context of CEMTA, which stakeholders of these applications should explore when targeting a user segment.

Chapter 6

6. Limitations and Future Research

The first limitation concerns the findings of the test results. The lack of evidence to support H3, H4, H5, H6, H9, H10, and H11 could be due to several factors such as the specific context of CEMTA, measurement items, and unobserved heterogeneity in the data. Future studies could consider adjusting the measurement items for the specific context of CEMTA, investigating mediating or moderating variables to help explain the weak relationships, and explore the demographics, cultural attitudes, and prior CEMTA usage to better understand these dynamics.

To provide stronger evidence for model fit and the hypothesized relationships proposed in this study, future research could integrate translation accuracy as a measurable item for the performance expectancy construct as it could influence the perceived usefulness of CEMTA, as well as integrate subcomponents of cultural adaptability within the effort expectancy construct as it could influence the perceived ease of use.

The second limitation concerns the demographics of participants used in this study and the actual prevalence of food service establishments with Chinese-only menus or poorly translated bilingual menus in Taiwan. While the respondents were from 41 different regions across 6 different continents, the majority of the respondents in this study were young (64.4% were between the ages of 20-30) and from North America (65.4%), but CEMTA is meant for all age groups and users from different regions. Future research could dive deeper into the actual prevalence of these establishments based on specific locations and demographics of respondents.

The small percentage of users who reported rarely using CEMTA could be due to staff being bilingual or non-natives being accompanied by someone who can verbally provide a translation.

Regardless of the reason, it's worth investigating why a segment of users don't frequently use CEMTA and suggests a need to address certain barriers to adoption, usage, or the unique risks associated with platform-based models (PBM) such as disintermediation, lock-in or network effects. The high utilization and potential for improvement helps validate the positioning of CEMTA as a PBM and supports the need for future research into improving CEMTA platforms.

To further gain a comprehensive understanding of how CEMTAs can be approved, future research could also focus on gathering data from a bilingual perspective, in which participants are fluent in both Chinese and English. Broadening the target population in this way could allow for valuable insights into translation quality and cultural adaptability.

Chapter 7

7. Conclusion

The aim of this research was to investigate and understand the factors that influence the adoption and usage of Chinese-to-English menu translation applications (CEMTA) in Taiwan. The research objectives were achieved in two stages. Phase 1 positioned CEMTA within the context of a platform-based model (PBM) and identified challenges and success factors associated with CEMTA as a PBM. This phase provided valuable insights into the requirements of an effective CEMTA platform. In phase 2, the UTAUT-2 framework was expanded to explore key factors influencing the adoption and use of CEMTA. Despite the inclusion of two new constructs, translation accuracy and cultural adaptability, these variables did not significantly influence intentions to use CEMTA. Given the novelty of this research, this was not unexpected as the actual effect could be inherent within the performance expectancy and effort expectancy constructs.

The key findings highlight performance expectancy, habit, and hedonic motivation as crucial determinants of intention to use CEMTA, signifying the importance of these elements in technology adoption for consumers. The effect of hedonic motivation contradicts expectations, suggesting the need for further investigation. The research also validates Taiwan as a fitting location for the study and indicates a need for improvement in CEMTA platforms due to the high volume of non-Chinese speakers and the demand for English translations of Chinese menus. It also highlighted key areas for improvement, especially in terms of translation quality, pricing strategies, and cultural adaptability.

The extended UTAUT-2 model used in this study demonstrated moderate explanatory power for intentions to use CEMTA, but its performance predicting actual usage was weak. This suggests the need for a more comprehensive model or the inclusion of additional factors to better predict actual

usage. The practical implications of CEMTA developers are to improve platform aspects related to performance expectancy, habit, and hedonic motivation. Platforms should be designed in such a way that habitual use becomes seamless and intuitive, emphasizing performance, ensuring high quality translations, ease of use, and overall effectiveness of the platform. Pricing and barriers to usage should also be critically evaluated to enhance user satisfaction.

It is recommended that future research address the limitations encountered in this study such as the lack of support of some hypotheses, potentially by investigating the specific context of CEMTA and exploring additional mediating and moderating variables. There is also a need to reconsider the constructs within the UTAUT-2 framework, particularly by integrating translation accuracy and cultural adaptability into performance and effort expectancy constructs, respectively. Additionally, the participant demographics used in this study suggest that a more diverse user population should be integrated in future studies. Finally, the inclusion of bilingual participants could be beneficial to gain further insights into translation quality and cultural adaptability. The infrequent use of CEMTA by some participants signaled the necessity to further investigate the potential barriers to adoption and usage of CEMTA. By following these recommendations, we can continue to advance our understanding and improve the usability of CEMTA for non-Chinese speakers in Taiwan.

References

Alalwan, A. A., Dwivedi, Y. K., & Rana, N. P. (2017). Factors influencing adoption of mobile banking by Jordanian bank customers: Extending UTAUT2 with trust. *International Journal of Information Management*, *37*(3), 99-110.

Al-Gahtani, S. S. (2016). Empirical investigation of e-learning acceptance and assimilation: A structural equation model. *Applied Computing and Informatics*, *12*(1), 27-50.

Amenador, K. B., & Wang, Z. (2022). The translation of culture-specific items (CSIs) in Chinese-English food menu corpus: A study of strategies and factors. *SAGE Open*, *12*(2), 21582440221096649.

Aresta, R. (2018). The influence of translation techniques on the accuracy and acceptability of translated utterances that flout the maxim of quality. *Humaniora*, *30*(2), 176-191.

Bentler, P. M. (1995). *EQS structural equations program manual* (Vol. 6). Encino, CA: Multivariate software.

Bergkvist, Lars, and John R. Rossiter. "Tailor-made single-item measures of doubly concrete constructs." *International Journal of Advertising* 28.4 (2009): 607-621.

Blazyte, A. (2022, July 25). Taiwan: Food service business gross revenue from 2012 to 2021, with forecasts until 2025. Statista. Retrieved March 14, 2023, from https://www.statista.com/statistics/1318816/taiwan-food-service-business-gross-revenue/

Boas, T. C., Christenson, D. P., & Glick, D. M. (2020). Recruiting large online samples in the United States and India: Facebook, mechanical turk, and qualtrics. *Political Science Research and Methods*, *8*(2), 232-250.

Chang, C. M., Liu, L. W., Huang, H. C., & Hsieh, H. H. (2019). Factors influencing online hotel booking: Extending UTAUT2 with age, gender, and experience as moderators. *Information*, *10*(9), 281.

Chen, X., Acosta, S., & Barry, A. E. (2017). Machine or human? Evaluating the quality of a language translation mobile app for diabetes education material. *JMIR diabetes*, *2*(1), e7446.

Cohen, J. 1988. Statistical Power Analysis for the Behavioral Sciences (2nd ed.), Hillsdale, NJ: Lawrence Erlbaum Associates.

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of applied psychology*, *78*(1), 98.

Cusumano, M. A., Gawer, A., & Yoffie, D. B. (2019). The business of platforms: Strategy in the age of digital competition, innovation, and power (Vol. 320). New York: Harper Business.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340.

Directorate-General of Budget, Accounting and Statistics, Executive Yuan, R.O.C. (Taiwan). (2012). *2010 Population and Housing Census*. Retrieved March 10, 2023, from https://ws.dgbas.gov.tw/Download.ashx?u=LzAwMS9VcGxvYWQvNDY0L3JlbGZpbGUvMTE3MTYvMjI2ODQzL2ZiOWI5NzVmLWY0NmUtNGMwZS1iZGVjLTJkMDcwN2MwMmVmNS5wZGY%3d&n=NzExMzE0Mzg1MVBOSFNOSlBVLnBkZg%3d%3d&icon=.pdf

Eisenmann, T., Parker, G., & Van Alstyne, M. W. (2006). Strategies for two-sided markets. *Harvard business review*, *84*(10), 92.

Elliott, C. 2022. The best translation apps and services for travelers. Retrieved April 11, 2023, from https://www.washingtonpost.com/travel/2022/06/22/travel-translation-apps/

Erway, C. (2015). *The Food of Taiwan: Recipes from the Beautiful Island*. Houghton Mifflin Harcourt.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics*, *5*(1), 1-4.

Evans, D. S., & Schmalensee, R. (2016). *Matchmakers: The new economics of multisided platforms*. Harvard Business Review Press.

Evers, V., & Day, D. (1997). The role of culture in interface acceptance. In *Human-Computer Interaction INTERACT'97: IFIP TC13 International Conference on Human-Computer Interaction, 14th–18th July 1997, Sydney, Australia* (pp. 260-267). Springer US.

Fink, Arlene. *How to conduct surveys: A step-by-step guide*. Sage Publications, 2015.

Fuentes-Luque, A. (2017). An approach to analysing the quality of menu translations in southern Spain restaurants. *Journal of multilingual and multicultural development*, *38*(2), 177-188.

Groves, M., & Mundt, K. (2015). Friend or foe? Google Translate in language for academic purposes. *English for Specific Purposes*, *37*, 112-121.

Gupta, A., Dogra, N., & George, B. (2018). What determines tourist adoption of smartphone apps? An analysis based on the UTAUT-2 framework. *Journal of Hospitality and Tourism Technology*, *9*(1), 50-64.

Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Partial least squares structural equation modeling (PLS-SEM) using R: A workbook* (p. 197). Springer Nature.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing theory and Practice*, *19*(2), 139-152.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European business review*, *31*(1), 2-24.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science*, *43*, 115-135.

Huo, C., Du, X., & Gu, W. (2020). A study of English translation of literature on diet in taihang mountainous areas from the perspective of skopos theory of translation. *Creative Education*, *11*(7), 979-984.

Jeon, H. M., Sung, H. J., & Kim, H. Y. (2020). Customers' acceptance intention of self-service technology of restaurant industry: Expanding UTAUT with perceived risk and innovativeness. *Service Business*, *14*, 533-551.

Kim, J. (2014). Platform business and network strategy. *STI Policy Review*, *5*(1), 57-74.

Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration (ijec)*, *11*(4), 1-10.

Liu, C. H., Gan, B., Ko, W. H., & Teng, C. C. (2022). Comparison of localized and foreign restaurant brands for consumer behavior prediction. *Journal of Retailing and Consumer Services*, *65*, 102868.

Lupton, D. (2021). 'All at the tap of a button': Mapping the food app landscape. *European Journal of Cultural Studies*, *24*(6), 1360-1381.

Morosan, C., & DeFranco, A. (2016). It's about time: Revisiting UTAUT2 to examine consumers' intentions to use NFC mobile payments in hotels. *International Journal of Hospitality Management*, *53*, 17-29.

National Development Council, Ministry of Education, Directorate-General of Personnel Administration, Ministry of Examination, Civil Service Protection and Training Commission. (2021). *Bilingual 2030* [PDF file]. Retrieved March 9, 2023, from https://bilingual.ndc.gov.tw/sites/bl4/files/news_event_docs/bilingual_nation_2030.pdf

Nordhoff, S., Louw, T., Innamaa, S., Lehtonen, E., Beuster, A., Torrao, G., ... & Merat, N. (2020). Using the UTAUT2 model to explain public acceptance of conditionally automated (L3) cars: A questionnaire study among 9,118 car drivers from eight European countries. *Transportation research part F: traffic psychology and behaviour*, *74*, 280-297.

Osterwalder, A., Pigneur, Y., & Tucci, C. L. (2005). Clarifying business models: Origins, present, and future of the concept. *Communications of the association for Information Systems*, *16*(1), 1.

Osterwalder, A., Pigneur, Y., Bernarda, G., & Smith, A. (2014). *Value proposition design: How to create products and services customers want*. John Wiley & Sons.

Palau-Saumell, R., Forgas-Coll, S., Sánchez-García, J., & Robres, E. (2019). User acceptance of mobile apps for restaurants: An expanded and extended UTAUT-2. *Sustainability*, *11*(4), 1210.

Parker, G. G., Van Alstyne, M. W., & Choudary, S. P. (2016). *Platform revolution: How networked markets are transforming the economy and how to make them work for you*. WW Norton & Company.

Pleco. (n.d) *About Pleco*. Retrieved March 5, 2023, from https://www.pleco.com/about /

Reinecke, K., & Bernstein, A. (2013). Knowing what a user likes: A design science approach to interfaces that automatically adapt to culture. *Mis Quarterly*, 427-453.

Ringle, C. M., Wende, S., and Becker, J.-M. 2022. *SmartPLS* 4 [Computer software]. Oststeinbek: SmartPLS GmbH,=. Retrieved from http://www.smartpls.com.

Rochet, J. C., & Tirole, J. (2003). Platform competition in two-sided markets. *Journal of the european economic association*, *1*(4), 990-1029.

Rogers, D. L. (2016). *The digital transformation playbook: Rethink your business for the digital age*. Columbia University Press.

Sarstedt, M., Hair, J. F., Pick, M., Liengaard, B. D., Radomir, L., & Ringle, C. M. (2022). Progress in partial least squares structural equation modeling use in marketing research in the last decade. *Psychology & Marketing*, *39*(5), 1035-1064.

Sarstedt, M., Ringle, C.M., Cheah, J.-H., Ting, H., Moisescu, O.I. and Radomir, L. (2019), Structural model robustness checks in PLS-SEM, TourismEconomics, Forthcoming.

Schweiger, A., Nagel, J., Böhm, M., & Krcmar, H. (2016). Platform business models. *Digital Mobility Platforms and Ecosystems*, *66*.

Shaikh, A. A., & Karjaluoto, H. (2015). Mobile banking adoption: A literature review. *Telematics and informatics*, *32*(1), 129-142.

Shmueli, G., Ray, S., Estrada, J. M. V., & Chatla, S. B. (2016). The elephant in the room: Predictive performance of PLS models. *Journal of business Research*, *69*(10), 4552-4564.

Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J. H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: guidelines for using PLSpredict. *European journal of marketing*, *53*(11), 2322-2347.

Srinivasan, R. (2021). *Platform Business Models*. Springer Singapore.

Srnicek, N. (2017). *Platform capitalism*. John Wiley & Sons.

Statistic Taiwan. (2022). *2022 December Visitor Arrivals Statistics Release*. Retrieved from https://eng.stat.gov.tw/ct.asp?xItem=34657&ctNode=1614&mp=5

Sun, X. Q., & Sun, J. L. (2017, September). A Study of Chinese-English Menu Translation in Light of Skopos Theory. In *3rd Annual International Conference on Social Science and Contemporary Humanity Development (SSCHD 2017)* (pp. 95-96). Atlantis Press.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478.

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS quarterly*, 157-178.

Wang, S.-F., Yu, H.-H., & Lee, H.-Y. (2023, February 24). Taiwan planning cash incentives to attract foreign tourists. Focus Taiwan. Retrieved March 14, 2023, from https://focustaiwan.tw/business/202302240010

Waygo. (n.d) *About Waygo*. Retrieved March 5, 2023, from http://www.waygoapp.com/about/

Zhong, J. (2020). Analysis of business English translation in hospitality industry based on Skopos theory. *Int J Culture Hist*, *6*, 29-32.
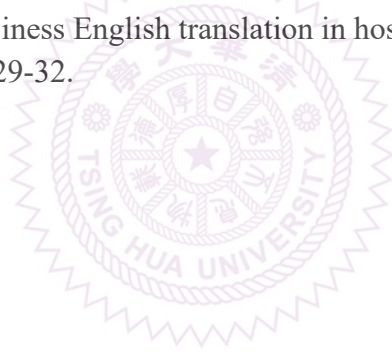
Appendices

Appendix 1: Survey Items ▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬

Note: The following survey items only represent the main features of the questionnaire sent to participants, but the actually questionnaire contained significantly more details surrounding these questions. .

Screening Questions

Have you ever made use of a translation application that has the functionality of translating Chinese to English? (e.g., Google Translate, Waygo, etc.)

Please rate your proficiency in reading and understanding Mandarin Chinese:
1. None
2. Limited (I can read a few words or phrases)
3. Intermediate (I can read many words or phrases)
4. Advanced (I can read most words or phrases)
5. Fluent

Frequency

How often do you encounter food service establishments with Chinese-only menu items?
1. Never
2. Rarely
3. Occasionally
4. Frequently
5. Very frequently

How often do you encounter food service establishments with bilingual menus (Chinese-to-English translations) with unclear or poorly translated items?
1. Never
2. Rarely
3. Occasionally
4. Frequently
5. Very frequently

Demographics

What is your gender?

What is your age?

What is your country of citizenship?

Please select the category that best describes your status in Taiwan.
- o Tourist
- o International student
- o Professional worker (non-teaching)
- o Teacher (including language instructors)
- o Other (Please specify)

UTAUT - 2

Actual Usage

AU1	How often do you use CEMTA when dining at a food service establishment with Chinese-only menus?
AU2	In which situations do you use CEMTA? (Select all that apply)

- o Dining at a food service establishment
- o Ordering takeout
- o Learning about Chinese Cuisine
- o Making recommendations
- o Other (please specify)

Intentions to Use

IT1	I will always try to use CEMTA when dining at food service establishments with Chinese-only menus.
IT2	I plan to continue using CEMTA frequently.
IT3	I intend to continue using CEMTA in the future.

Performance Expectancy

PE1	I find CEMTA useful in my daily life when ordering food.
PE2	I believe that using CEMTA helps me make correct menu choices.
PE3	I believe that using CEMTA helps me avoid allergy related issues when ordering food.
PE4	I believe using CEMTA would improve my overall dining experience at food service establishments with Chinese-only menus.

Effort Expectancy

EE1   I believe that learning how to navigate and use CEMTA is easy for me.

EE2   I believe my interaction with CEMTA is clear and understandable.

EE3   I find CEMTA easy to use.

EE4   I believe it is easy for me to become skillful at using CEMTA.

Facilitating Conditions

FC1   I believe I have the necessary smartphone to use CEMTA.

FC2   I believe that I have the necessary knowledge to use CEMTA.

FC3   I feel comfortable using CEMTA.

FC4   I believe CEMTAs are compatible with the other technologies I use.

Social Influence

SI1   People who are important to me think that I should use CEMTA.

SI2   People who influence my behavior think that I should use CEMTA.

SI3   People whose opinions that I value prefer that I use CEMTA.

SI4   Online reviews, including social media, affects my choice of CEMTA.

Price Value

PV1   I believe more specialized CEMTA (e.g. Waygo) is reasonably priced given its benefits (More accurate translations, more user friendly).

PV2   I believe specialized CEMTA is good value for money.

PV3   I am willing to pay more for specialized CEMTA if it offers better features than free alternatives (e.g. Google Translate).

PV4   I will pay more for a CEMTA if its interface adapts to match my cultural preferences and expectations.

Habit

HT1   The use of CEMTA has become a habit for me when dining at food service establishments with Chinese-only menus.

HT2   I am in favor of using CEMTA when dining at food service establishments with Chinese-only menus.

HT3   I feel the need to use CEMTA when dining at food service establishments with Chinese-only menus.

HT4   I believe I will use CEMTA consistently over time.

Hedonic Motivation

HM1   I believe using CEMTA is fun.

HM2   I believe using CEMTA is enjoyable.

HM3   I believe using CEMTA is very entertaining.

Perceived Credibility

PC1   When using CEMTA on a smartphone, I believe that my information is kept confidential.

PC2   I believe that my privacy will not be breached.

PC3   I believe that the environment provided by CEMTA is safe.

Translation Accuracy

TA1   I expect CEMTA to provide accurate translations of menu items.

TA2   I believe CEMTA interprets the meaning of Chinese menu items accurately.

TA3   I believe CEMTA content maintains the original meaning of the menu items text.

TA4   I believe CEMTA minimizes errors related to the menu items.

Cultural Adaptability

CA1   I believe that CEMTA takes my cultural preferences and characteristics into account.

CA2   I believe CEMTA provides an opportunity for a greater appreciation of Chinese cuisine.

CA3   I believe CEMTA helps me discover new and authentic Chinese dishes.

Appendix 2: The Shapiro-Wilk test ▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬

Note: The following code snippet is written in R programming language and formatted in R Markdown. It represents the implementation of the Shapiro-Wilk test for normality assessment of the study. All p-values are less than 0.05, indicating that the data is not normal.

```
# Testing the normality by applying the Shapiro-Wilk test to each measurement item in the dataset
normality_test_results <- sapply(cemta[measurement_items], function(x)
    { shapiro_test_result <- shapiro.test(x) return(shapiro_test_result$p.value)
})
# Table
kable(normality_test_results, caption = "Normality Test P-values", digits = 1000, align = "c") # Print table
    of p-values)
```

Normality Test P-values	
AU1	1.329573e-15
IU_1	7.372253e-18
IU_2	2.109137e-16
IU_3	8.193341e-20
PE_1	2.728184e-19
PE_2	3.495341e-18
PE_3	1.703762e-18
PE_4	2.960372e-18
EE_1	2.455713e-17
EE_2	6.294754e-18
EE_3	1.626510e-18
EE_4	6.910200e-19
FC_1	3.115004e-20
FC_2	2.983246e-17
FC_3	9.318654e-20
FC_4	8.813846e-20
SI_1	1.651396e-16
SI_2	1.039559e-14
SI_3	3.655770e-17
SI_4	5.201295e-17
PV_1	1.479448e-16
PV_2	4.118228e-16
PV_3	1.427442e-18
PV_4	6.688445e-16
HT_1	1.387844e-19
HT_2	2.381710e-17
HT_3	1.456839e-19
HT_4	1.422277e-18
HM_1	1.064306e-15
HM_2	4.935576e-15
HM_3	1.908084e-16
PC_1	3.031410e-15
PC_2	4.529168e-15
PC_3	1.196761e-15
TA_1	2.365308e-18
TA_2	1.270331e-16
TA_3	1.695952e-18
TA_4	3.150862e-16
CA_1	3.049962e-16
CA_2	2.371072e-17
CA_3	5.538173e-19

Appendix 3: Herman's single-factor test ▬▬▬▬▬▬▬▬▬

Note: The following code snippet is written in R programming language and formatted in R Markdown. It represents the implementation of Herman's single-factor test for common method bias assessment of the study.

```r
# Checking for Common Method Bias (CMB)
library(psych)
harman_test <- principal(cemta, nfactors = 1)

total_variance <- sum(harman_test$values)
single_factor_variance <- harman_test$values[1]
proportion_explained <- single_factor_variance/total_variance

cat("Proportion of variance explained by the single factor:",
    proportion_explained)
```

```
## Proportion of variance explained by the single factor: 0.3702635
```