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Developing A theoretical model for adoption of facial recognition payment for senior citizens in Tangshan City, Hebei, China

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Abstract

Facial recognition payment (FRP) is an emerging biometric authentication technology that enables seamless and contactless transactions. Despite its rapid global adoption, senior citizens in offline settings are often reluctant to embrace FRP due to psychological resistance and technological barriers. This study aims to investigate the key determinants influencing FRP adoption among senior citizens in Tangshan City, Hebei, China. A theoretical model is developed by integrating the Belief-Attitude-Intention (B-A-I) framework with the extended Technology-Organization-Environment-Individual (TOE-I) framework. The model explores the effects of convenience, familiarity, social support, and perceived privacy risk on trust and satisfaction, which subsequently shape the intention to use FRP. Moreover, technology anxiety is examined as a moderating factor that may weaken or strengthen the relationship between trust, satisfaction, and intention to use. This framework provides theoretical insights into digital payment adoption behavior and practical guidance for policymakers and service providers aiming to promote inclusive, age-friendly financial technologies in China and other aging societies.

Keywords: B-A-I framework, Facial recognition payment, Senior citizens, Technology anxiety, TOE-I framework.

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1. Introduction

Facial recognition payment (FRP) is an advanced payment method that uses biometric technology to authenticate users' identities for transactions [1]. This technology requires users to scan their faces; the resulting images are then linked to a digital payment platform or bank account, enabling quick and seamless transactions without additional steps. With the integration of Artificial Intelligence (AI), FRP has gained widespread acceptance and is now commercially available in physical retail fields on a large scale [2]. This technology significantly improves service efficiency and security, enabling faster check-ins and transactions [3].

The first facial recognition payment system, Unique Pay, was developed by the Finnish company Uniqul in 2003. Since then, FRP has been gradually adopted globally. In 2019, SnapPay introduced its FRP system to North American merchants, and countries like Japan, South Korea, Australia, Canada, Russia, and the UK have also integrated FRP into their commercial activities [4]. While, China has emerged as a global leader in adopting innovative payment systems, driven by the rapid growth of financial technology. By 2019, third-party payment platforms like Alipay and WeChat Pay dominated China's payment market, accounting for 90% of transactions and accelerating the country's transition toward a cashless society [5, 6]. The concept of a cashless society, first proposed by Alvin Toffler in 1980, has become a reality in China, primarily through mobile payment technologies like Alipay and WeChat Pay [7]. In 2017, Alipay piloted FRP at a KFC outlet in Hangzhou, marking the beginning of widespread offline adoption [5]. By late 2018, Alipay launched its FRP terminal, Dragonfly, followed by WeChat Pay's Frog and UnionPay's FRP system [4]. These advancements have made FRP a popular choice in supermarkets, convenience stores, shopping malls, and vending machines, with 40% of China's population [8, 9]. Despite the success, FRP adoption among senior citizens remain low. Data shows that only 12.9% of mobile payment users in China are over 50 years old [10]. This is concerning, given China's rapidly aging population, which is the largest in the world [11]. Many elderly individuals struggle with modern payment technologies, leading to exclusion from essential services. For example, some seniors have been denied service when attempting to pay medical bills in cash during bad weather [12] and some businesses in Shanghai now refuse cash payments altogether [13]. This digital divide exacerbates social isolation and inequality, particularly for those who lack access to or understanding of technology. While modern payment methods offer convenience, they also highlight the need for inclusive financial technology solutions that cater to all age groups.

Facial Recognition Payment combines the convenience of mobile payments with advanced biometric technology [14], making it a user-friendly option for elderly individuals [15]. The facial recognition payment is considered as a particularly suitable payment method for seniors, as it eliminates the need to remember passwords or carry physical currency [16]. Moreover, promoting FRP adoption among the elderly aligns with China's aging-friendly digital technology initiatives, which aim to help seniors share the benefits of technological advancements [17]. By addressing the challenges faced by elderly users, FRP can contribute to a more inclusive and equitable society.

Facial recognition payment has revolutionized the payment industry, offering speed, security, and convenience. Although China leads in FRP adoption, the elderly population still remains underrepresented. Addressing this gap is crucial for achieving an age-friendly society. By promoting FRP among seniors, it is helpful for China to bridge the digital divide and foster a harmonious society.

China's rapid technological advancements and the widespread adoption of cashless payment methods have transformed consumer behavior, with many businesses transitioning away from accepting cash [18]. While this shift reflects progress toward a more efficient payment infrastructure, it poses significant challenges for senior citizens, who may be less familiar or comfortable with digital payment methods like facial recognition payment (FRP). This trend risks widening the digital divide and further alienating senior citizens from mainstream society, underscoring the need for inclusive policies to support their integration into the digital economy [18].

Although some research has explored digital financial inclusion for senior citizens in China [19-21]. And numerous studies have examined the adoption of FRP [1, 5, 22-26]. There is a notable lack of research focusing on offline FRP adoption and broader demographic group, especially the senior citizens [1, 2, 25, 27, 28]. Existing findings have been subject to scrutiny, highlighting the need for studies that address practical and population gaps, particularly among senior citizens aged 50 and above in China. This study aims to fill this gap by developing a theoretical model for senior citizen's adoption of FRP by using an integrated B-A-I and TOE-I frameworks.

2. Theoretical Background

2.1. Belief-Attitude-Intention (B-A-I) Framework

Fishbein and Ajzen [29] proposed that individual behavior is systematically constructed through beliefs, attitudes, and behavioral intentions. Beck [30] demonstrated support for Fishbein and Ajzen's theory: beliefs predicted attitudes, while attitudes predicted intentions. Madrigal [31] further elaborated that the B-A-I framework provides a structured explanation of how individuals form specific behavioral decisions. This framework illustrates the hierarchical influence of beliefs on attitudes, which ultimately shape behavioral intentions. Beliefs are categorized into descriptive and inferential types, where descriptive beliefs stem from direct observation and experience, while inferential beliefs are derived from descriptive beliefs through reasoning [29]. Attitudes reflect an individual's emotional assessment of a specific action or event, encompassing both positive and negative evaluations [32-34]. The expectancy-value model [35, 36] Further explains the relationship between beliefs and attitudes. Behavioral intention refers to the subjective probability of an individual performing a particular action and serves as a mechanism through which attitudes translate into actual behavior [37].

The B–A–I framework has been extensively applied in the field of information systems. For instance, José Liébana-Cabanillas, Sánchez-Fernández and Muñoz-Leiva [38] developed a model to enhance the market penetration of mobile payments. Lee, Qu and Kim [39] employed this framework to analyze variations in consumers' online travel shopping behavior and how personal innovativeness influences their purchasing decisions. Additionally, in the context of mobile payment, Mu and Lee [40] explored factors influencing consumers' adoption of third-party payment platforms such as Alipay and WeChat Pay using the B-A-I framework. Notably, the operationalization of constructs and their implications vary depending on the specific research context and objectives.

Fishbein and Ajzen [29] argued that directly measuring behavioral intention is the simplest and most effective way to predict actual behavior. However, the strength of this relationship depends on three key factors: the stability of intention, the specificity of the intention-behavior link, and the individual's volitional control over the action.

In the context of offline facial recognition payment, three conditions are largely met. First, since this payment method is commonly used in daily transactions, users' adoption intentions tend to remain stable. Second, in offline settings, consumers make immediate payment decisions, minimizing the time gap between intention and behavior and ensuring high specificity. Third, while facial recognition payment is not the only option (alternatives like QR codes or NFC exist), consumers still have full volitional control over their choice.

Thus, in this specific payment scenario, intention serves as a reliable predictor of actual behavior, as the intention-behavior relationship remains strong due to stable intentions, high specificity, and sufficient volitional control.

2.2. Technology-Organization-Environment-Individual (TOE-I) Framework

The Technology-Organization-Environment (TOE) framework, initially developed by Tornatzky, Fleischer and Chakrabarti [41] provides a comprehensive model for predicting consumer adoption of electronic commerce (e-commerce) by considering three key dimensions: technology, organization, and environment. Due to its flexibility and context-sensitive nature, the TOE framework has been widely utilized to identify the critical determinants influencing the adoption of innovative technologies across various domains [42-44]. Its strong theoretical foundation and extensive empirical validation have established it as a reliable framework in the field of information systems (IS) research [45]. Over time, scholars have refined and expanded the framework, further enhancing its applicability and theoretical robustness [46].

Despite its strengths, the original TOE framework has certain limitations, particularly in addressing complex adoption behaviors. One key critique is its primary focus on the organizational level, making it less suitable for analyzing technology adoption at the individual level [47, 48]. To address this limitation, researchers have suggested integrating individual-level factors to improve the framework's explanatory power [47, 49]. Several studies have demonstrated that individual characteristics, including those of employees, corporate decision-makers, and consumers, significantly influence technology adoption decisions [48, 50-52]. Recognizing the importance of individual perceptions in decision-making processes, scholars have progressively incorporated personal-level variables into the TOE model.

Building on this refinement, alternative frameworks have been proposed to better capture individual adoption behaviors. For instance, Jiang, Chen and Lai [53] introduced the technological-personal-environmental framework to analyze individual-level technology acceptance. Similarly, Hunafa, Hidayanto and Sandhyaduhita [54] applied this model to examine users' intention to adopt mobile payment systems, while Handayani, et al. [55] developed the human-technological-organizational framework to explore the adoption of hospital information systems. These extensions underscore the growing recognition of individual perceptions as a crucial component in understanding technology adoption.

In the context of offline facial recognition payment systems, this study adopts an extended TOE-I framework from Shiau, et al. [4], which integrates the technological, environmental, organizational, and individual dimensions. Within this framework, key perceived factors that shape adoption decisions are identified as salient beliefs. Specifically, convenience reflects users' perceptions of the technological benefits of facial recognition payment, while familiarity is shaped by prior experiences with offline merchants. Social support captures the influence of family, friends or community on adoption, whereas perceived privacy risk represents individual concerns regarding security and data protection. By incorporating these dimensions, this study provides a more nuanced understanding of the factors driving the adoption of facial recognition payment systems in offline settings.

2.3. Technology Anxiety as Moderator

According to social cognitive theory, anxiety is a significant factor that can generate negative emotions, thereby reducing an individual's likelihood of engaging in a particular behavior. As noted by Compeau, Higgins and Huff [56], this occurs because anxiety undermines individuals' confidence in their ability to perform a task, leading to emotional change and diminished expectations of achieving their goals. Anxiety can be categorized into two main types: trait anxiety and state anxiety [57]. Trait anxiety refers to a persistent, personality-driven tendency to experience negative feelings toward specific external stimuli or events. In contrast, state anxiety is a temporary emotional response triggered by specific situational factors or events [58, 59]. In the context of technology adoption, technology anxiety—a form of state anxiety—plays a critical role affecting users' attitudes and behavioral intentions towards the technology.

Compeau and Higgins [60] posits that anxiety disrupts individuals' self-efficacy and emotional stability, which in turn affects their behavioral intentions. In the context of facial recognition payment, technology anxiety can undermine senior citizens' confidence in their ability to use the technology effectively, thereby weakening the positive relationship between attitude (e.g., satisfaction, trust) and intention to use. By positioning technology anxiety as a moderator between attitude and intention to use, It is aligned with the B-A-I framework's emphasis on the interplay between emotional states and behavioral outcomes [61]. Technology anxiety is a situational emotional response triggered by the use of new or complex technologies. It primarily influences users' affective responses (attitudes) rather than their cognitive evaluations (beliefs). For instance, users with high technology anxiety may experience reduced satisfaction or trust in a technology, even if they perceive it as useful or convenience to use. Given its affective nature, technology anxiety is more likely to moderate the relationship between attitudes (e.g., satisfaction and trust) and intentions (e.g., intention to use), as it directly impacts how users emotionally evaluate the technology.

Consumer differences and situational factors can moderate the relationships between attitudes and intentions [62]. In facial recognition payment offline scenarios, senior citizens are required to scan their faces in front of a device, often

without assistance from cashiers. This situation serves as a stimulus that triggers technology anxiety among them. For senior citizens, who may already exhibit high levels of technology anxiety and resistance to adopting new technologies [63], this anxiety can significantly influence their attitudes and intentions. Existing literature supports the moderating role of technology anxiety in the attitude-intention relationship. For example, Celik [63] found that senior citizens tend to exhibit high levels of computer anxiety, which negatively impacts their willingness to adopt new technologies. Steele, et al. [64] and Cimperman, et al. [65] reported that technology anxiety negatively moderates the impact of effort expectancy on seniors' willingness to use home telehealth services. Yang and Forney [66] demonstrated that consumers with high anxiety about using mobile shopping are more significantly influenced by others' opinions, further highlighting the role of anxiety in shaping behavioral intentions. These studies provide a strong foundation for positioning technology anxiety as a moderator between attitude and intention.

In the context of offline facial recognition payment, senior citizens often face unique challenges, such as unfamiliarity with the technology or fear of making mistakes. These challenges can trigger technology anxiety, which moderates their affective responses (e.g., satisfaction) and, consequently, their behavioral intentions. For instance, senior citizens with high technology anxiety may feel less satisfied with the payment process, even if they perceive the technology as beneficial, thereby reducing their intention to use it. This contextual relevance further justifies the placement of technology anxiety as a moderator between attitudes and intention. This design aligns with social cognitive theory, leverages the affective nature of technology anxiety, and is supported by prior research and contextual relevance. By focusing on the attitude-intention relationship, we provide a nuanced understanding of how contextually relevant factors like technology anxiety shape users' behavioral intentions, particularly among senior citizens in the context of facial recognition payment.

3. Development of Hypothesis

3.1. Convenience, Trust and Satisfaction

Convenience significantly influences the adoption of new technology by making users' lives easier [67]. According to Collier and Sherrell [68], convenient technology helps consumers save time and effort, reduces concerns, and builds trust. Similarly, Zhang [69] observed that convenience positively correlates with sustained trust in both online and offline tourism settings.

Furthermore, several studies suggest that the ease of adopting new technologies has a positive effect on customer satisfaction [70, 71]. Duarte, e Silva and Ferreira [72] explored the benefits of using innovative technologies to support this idea. In the realm of mobile payments, Liébana-Cabanillas, et al. [70] detailed how convenience boosts consumer satisfaction with NFC payment systems. Facial recognition payments excel in efficiency and simplicity, even obviating the need for mobile phones. It involves just two steps, taking around 10-15 seconds, whereas QR code payments take nearly three times longer [73]. Hence, such pioneering innovation is likely to enhance consumer trust and satisfaction. Therefore, the researcher proposes the following hypothesis:

H_1: Convenience has a positive effect on trust in using an offline facial recognition payment system.

H_2: Convenience has a positive effect on satisfaction with an offline facial recognition payment system.

3.2. Familiarity, Trust and Satisfaction

Familiarity refers to how well a consumer knows a merchant, including their stores and shopping processes [74]. Kumar [75] proposed that familiarity with events, causes, and parties involved builds trust in business relationships. Consistent with this view, Gefen [76] stated that familiarity reduces confusion and complexity, positively affecting trust. This connection has also been studied in mobile payment contexts [74, 77-79]. Therefore, being familiar with a merchant could similarly enhance trust in offline facial recognition payment.

Additionally, when customers visit familiar stores, they often feel more relaxed and content, which enhances their satisfaction. Previous studies have highlighted a strong and positive link between familiarity and satisfaction in sectors like hospitality [80] and mobile applications [81]. In interviews with users of online biometric systems, Moriuchi [82] discovered that over 80% felt more comfortable using the system in physical stores than online. Hence, in offline facial recognition payment scenarios, familiarity with the merchant could similarly trigger initial feelings of satisfaction. As a result, the following hypotheses are proposed:

H_3: Familiarity has a positive effect on trust in using an offline facial recognition payment system.

H_4: Familiarity has a positive effect on satisfaction with an offline facial recognition payment system.

3.3. Social Support, Trust and Satisfaction

Shumaker and Brownell [83] define social support as the mutual exchange of resources between two persons, with the intention of improving the well-being of the recipient. Social support is a context specific construct [84].

For senior citizens, facial recognition payment contactless service in offline scenarios is crucial context in which social support may happen. Social support has been investigated in the studies of psychology, sociology and health. Under the context of handling health issue or work stress, Yahia, Al-Neama and Kerbache [85] indicated that social support enhances trust in social commerce sellers. Moreover, it has been examined that social support has a positive effect on the trust of mobile social commerce [86]. Social support can promote trust between buyers and sellers on social commerce platforms. Trust is an influential element in many commercial activities. When the trusting party lacks control over the trusted party, trust can function as a substitute for formal exchanges in commercial transactions [87]. Hence, social support may also contribute to the development of trust in facial recognition payment.

Sigursteinsdottir and Karlsdottir [88] examined social support at work amongst the employees of Icelandic municipalities and its relationship to job satisfaction. The research of Bi, et al. [89] established a positive association between perceived social support and adolescent life satisfaction. Trepte, Dienlin and Reinecke [84] recognized that online and offline social support has similar effect on increasing satisfaction, and they also found offline social support can contribute to overall life satisfaction. Furthermore, It is found that in the context of online brand communities, social support significantly affects customer satisfaction [90].

Hence, social support may lead to senior citizens' satisfaction on facial recognition in offline scenarios. Therefore, the researcher formulates the following hypothesis:

$H_{5:}$ Social support has a positive effect on trust in using an offline facial recognition payment system.

$H_{6:}$ Social support has a positive effect on satisfaction with an offline facial recognition payment system.

3.4. Perceived Privacy Risk, Trust and Satisfaction

Perceived privacy risk denotes consumers' assessment of the potential exposure of personal information and the vulnerability of their financial security [91]. Given the sensitive nature of personal data involved in electronic payments, users may have concerns regarding the technology security. Risk perceptions may vary among consumers with different characteristics.

Some scholars suggested that the first reason for diminishing trust in a system is the uncertainty about how system collect and utilize information [92]. Dinev and Hart [93] investigated how perceived privacy risk adversely impacts customers trust in e-commerce transactions.

In addition, individuals who believe that a service or technology jeopardizes the confidentiality of their personal information often experience frustration and dissatisfaction. In the realm of e-commerce, Cheng and Jiang [94] highlighted that users' perception of privacy risk has an adverse impact on their satisfaction with chatbot services.

Similarly, Tran [95] discovered that customers who perceive greater privacy risks tend to be less satisfied with online shopping experiences. Likewise, perceived privacy risk associated with facial recognition payment systems may diminish trust and satisfaction levels. Hence, the following hypotheses are deposited:

H7. Perceived privacy risk has a negative effect on trust in using an offline facial recognition payment system.

H8. Perceived privacy risk has a negative effect on satisfaction with an offline facial recognition payment system.

3.5. Trust, Satisfaction and Intention to Use

Ajzen and Cote [96] utilized a deliberative approach to link attitude with intention to use, explaining its impact. Trust, satisfaction, and intention to use have been extensively investigated, revealing strong correlations. Trust and satisfaction constitute fundamental components of attitude.

Trust can directly influence intention to use and also indirectly through satisfaction [97]. Trust has long been emphasized in the mobile payment service domain to enhance satisfaction [74, 98]. Dwyer, Schurr and Oh [99] defined satisfaction as the comprehensive evaluation of dependable correlations. Social exchange theory posits that satisfaction forms when outcomes meet expectations and surpass alternatives. Individuals engage in activities only when outcomes meet their satisfaction criteria [100].

However, in situations lacking guaranteed rewards, trust shapes individuals' expectations [79, 101-103]. Facial recognition payment is in the phase of market expansion and faces intense competition from other payment methods. Consequently, exploring the impact of trust on satisfaction rather than the reverse becomes urgent.

Moreover, the positive correlation between trust and intention to use in mobile payment services are investigated. When users perceive a mobile payment system as widely available and providing reliable services, their intention to use it tends to increase [104-106]. Furthermore, as asserted by Nguyen [107], trust in the intricate IS field represents an pre-adoption disposition that encourages consumers to experiment with new technology [108].

Satisfaction serves as a holistic assessment following adoption [109, 110]. The precedence of trust over satisfaction and its favorable impact on satisfaction has been explored within the IS domain [111-114]. Hence, as consumers grow more confident in facial recognition payment, their satisfaction levels are likely to strengthen. Additionally, numerous studies have revealed that consumer satisfaction fosters enduring relationships between consumers and businesses [115]. Serving as a crucial attitude, satisfaction consistently predicts users' willingness to use mobile payment services [106, 116].

Therefore, customers who possess trust and satisfaction may exhibit a greater inclination to use facial recognition payment. Building upon this foundation, the researcher formulates the following hypotheses:

$H_{9:}$ Trust has a positive effect on satisfaction with using an offline facial recognition payment system.

$H_{10:}$ Trust has a positive effect on the intention to use an offline facial recognition payment system.

$H_{11:}$ Satisfaction has a positive effect on the intention to use an offline facial recognition payment system.

3.6. Technology Anxiety as Moderator

Simonson, et al. [117] defined technology anxiety as an individual's apprehension, or even fear, when she/he is faced with the possibility of using technologies. i.e., whether older adults could accept and smoothly operate and comfortably use innovative technology against negative psychological perception of nervousness, fear, and self-doubt when learning new skills [118]. Huang, et al. [119] reported that Mobile technology anxiety would moderate the link between attitude toward mobile learning and mobile learning continuance intention.

Specifically, college students with higher levels of mobile technology anxiety are likely to have a weaker relationship between attitude toward mobile learning and mobile learning continuance intention than those with lower levels of mobile technology anxiety. In the context of mobile shopping, Yang and Forney [66] indicated that consumers with a high level of technology anxiety rely more on social influence in the use of mobile shopping than consumers with a low level of technology anxiety. Hence, technology anxiety may also moderate senior citizens intention to use facial recognition payment in offline settings. On this basis, the following hypotheses are deposited:

$H_{12:}$ The effect of trust on the intention to use an offline facial recognition payment system is negatively moderated by technology anxiety.

$H_{13:}$ The effect of satisfaction on the intention to use an offline facial recognition payment system is negatively moderated by technology anxiety.

3.7. Intention to use and Actual Usage

Actual usage is regarded as the real use of technology by individuals in real-world environments, influenced by behavioral intention and facilitating conditions [120]. Intention to Use typically refers to an individual's willingness or plan to use a specific technology, product, or service in a given context. Thus a person's intention is viewed as the immediate determinant of behavior of responding behavior [29]. Hogarth [121] proposed that one approach to establishing a theoretical framework for comprehending the constructs and the processes about an individual's adoption or rejection towards innovative technology is looking into individual's intention. This connection between cognitive perceptions of behavior and the formation of attitudes, intentions, or both, of behavior has been a central focus for many social psychologists.

Specifically, Fishbein and Ajzen [61] utilized this connection for the foundation for their Theory of Reasoned Action (TRA). According to their theory, behavior (actual usage) is most accurately forecasted by intentions, which are influenced by the individual's attitude as well as subjective norm regarding the behavior. Moreover, Davis [122] found a strong correlation between the intention to use a system and actual usage, identifying intention as a key determinant of user behavior. Similarly, Hill, Smith and Mann [123] noted that behavioral intentions effectively predict action. On this basis, the following hypotheses are deposited:

$H_{14:}$ Intention to use has a positive effect on actual usage of facial recognition payment system.

4. Theoretical Framework

Based on insights from prior literature, this study presents a research framework illustrated in Figure 1. The focal variable is the actual usage, while convenience, familiarity, social support, perceived privacy risk serves as independent variable. Trust, and satisfaction serve as attitudes, both are the following consequences of beliefs, also the antecedents of intention to use, the intention to use serve as the antecedent of actual usage. However, the hypothesized connections are not straightforward; the link between attitudes (trust and satisfaction) and intention to use is moderated by technology anxiety.

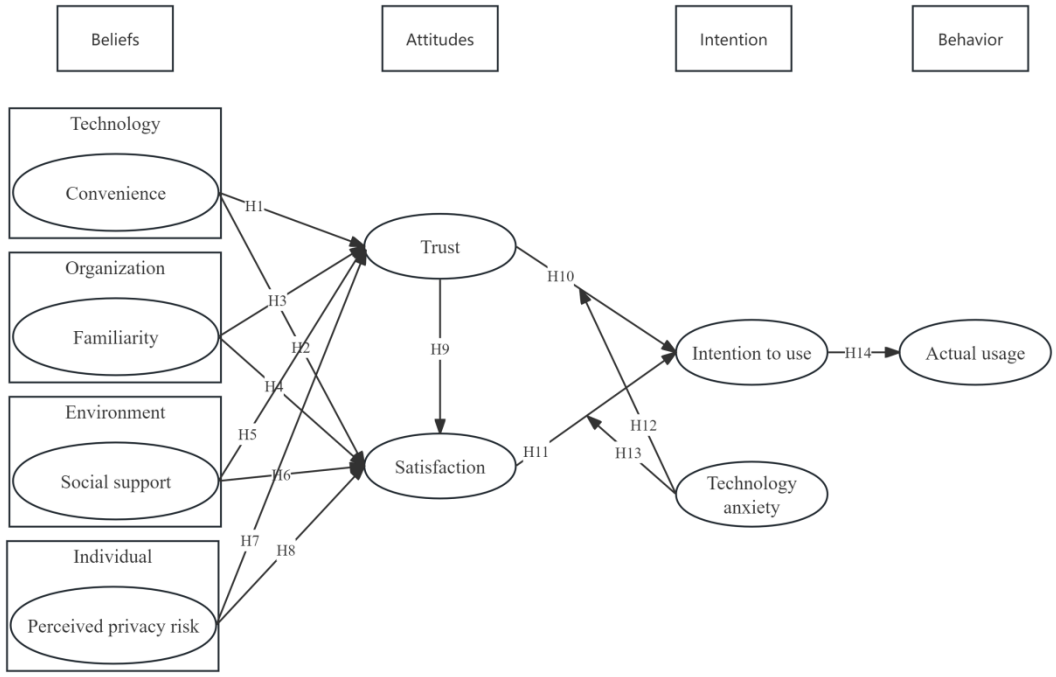

Figure 1.
Research Framework.
Source: Fishbein and Ajzen [29]

5. Conclusion

Prior research has emphasized the importance of understanding the factors that influence the adoption of new technologies, particularly among demographic groups that may face unique challenges, such as senior citizens. The focus of this study is on the adoption of offline facial recognition payment (FRP) among senior citizens in Tangshan City, Hebei, China, a group that has been largely underrepresented in the existing literature on FRP adoption. By integrating the B-A-I and TOE-I frameworks, this study provides a comprehensive theoretical framework that explores the role of convenience, familiarity, social support, perceived privacy risk, trust, satisfaction, and technology anxiety in shaping senior citizens' intention to use and the actual usage of FRP.

The proposed model highlights the significance of social and psychological factors in technology adoption, particularly in the context of FRP in offline settings. Technology anxiety is identified as a key moderator that influences the relationship between attitudes (trust and satisfaction) and intention to use. This study contributes to the existing body of knowledge by addressing the theoretical and population gaps in the literature, particularly the lack of research on FRP adoption among senior citizens.

By focusing on the unique challenges faced by senior citizens, this study underscores the need for inclusive financial technology solutions that cater to all age groups. The findings suggest that promoting FRP adoption among senior citizens requires not only addressing technological barriers but also fostering trust, satisfaction, and reducing technology anxiety. Future research should empirically validate the proposed model and explore additional factors that may influence FRP adoption among senior citizens, thereby contributing to a more inclusive and equitable digital economy.

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