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Extending the Valence Framework: Factors Influencing Malaysians' Intention to Adopt Facial Recognition Payment Systems

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Abstract. This study examines factors influencing Malaysians' intention to adopt facial recognition payment systems by extending the Valence Framework. Despite increasing global adoption of this technology, Malaysia has shown slower uptake, creating a need to understand the specific factors shaping consumer acceptance in this market. Data were collected through an online survey from 250 respondents across Malaysia's Central, Eastern, Northern, and Southern regions. The survey instrument measured seven potential adoption factors: perceived risk, technophobia, perceived complexity, relative advantage, initial trust, perceived playfulness, and need for uniqueness. Multiple linear regression analysis was employed to test the hypothesized relationships using SPSS software. The regression model explained 73.1% of variance in adoption intention. Five factors—perceived risk (β=-0.236, $p<0.001$), relative advantage (β=0.193, $p=0.002$), initial trust (β=0.443, $p<0.001$), perceived playfulness (β=0.161, $p=0.002$), and need for uniqueness (β=0.130, $p=0.001$)—significantly influenced intention to use facial recognition payment systems. Contrary to expectations, technophobia and perceived complexity showed no significant relationship with adoption intention. Initial trust emerged as the strongest positive predictor, while perceived risk was the most significant barrier to adoption. This study contributes to technology adoption literature by empirically testing an extended Valence Framework in the context of biometric payment systems in Malaysia. The findings reveal that emotional and social factors (perceived playfulness and need for uniqueness) play significant roles alongside traditional adoption factors, providing a more comprehensive understanding of consumer decision-making in emerging financial technologies. These insights offer practical guidance for financial service providers and technology developers seeking to increase adoption of facial recognition payment systems in the Malaysian market.

Keywords: Facial Recognition Payment System, Perceived Risk, Technophobia, Perceived Complexity, Relative Advantage, Initial Trust.

1. Introduction

In recent years, the rapid advancement of digital technologies has significantly transformed consumer behavior and business operations worldwide. Innovations such as artificial intelligence (AI), big data, the Internet of Things (IoT), and biometric systems have reshaped how individuals interact with financial services. Among these, facial recognition payment (FRP) systems have emerged as a novel and increasingly adopted method within the broader category of digital payments. Unlike traditional online payment methods that rely on QR codes, passwords, or PINs, FRP enables users to authenticate and complete transactions using only their facial features—offering a seamless, contactless, and secure payment experience (Zhong et al., 2021). This technology integrates AI, 3D sensing, and biometric verification to match a user's facial data with pre-registered payment credentials, eliminating the need for physical devices or cards during transactions (Zhang & Kang, 2019). Globally, the adoption of FRP systems has grown by approximately 25% annually since 2020, with the Asia-Pacific region accounting for 63% of global transactions. However, Malaysia's adoption rate remains relatively low at 12%, compared to Singapore (34%) and China (57%), despite the country's broader digital payment penetration reaching 88% in 2024. This discrepancy highlights a critical research gap: while Malaysia has embraced digital wallets and online banking, the uptake of biometric-based payment systems like FRP remains limited. This study seeks to address this gap by exploring the barriers and enablers of FRP adoption in the Malaysian context, particularly among different demographic groups. Theoretically, this research contributes to the growing body of literature on technology acceptance by extending existing models to include biometric payment systems. Practically, it offers insights for policymakers, financial institutions, and technology developers aiming to enhance the adoption of secure and user-friendly payment innovations in Malaysia. Hence, this study aims to investigate the factors influencing the adoption or lack thereof of facial recognition payment systems in Malaysia.

2. Literature Review

2.1. Related Theory

2.1.1. Valence Framework

This study applies the valence framework (Peter & Tarpey, 1975) to examine factors influencing Malaysian consumers' intention to adopt facial recognition payment (FRP) systems. The framework is based on a cognitive-rational model of decision-making, where behavior is shaped by expected positive utility (e.g., perceived benefits), unexpected negative utility (e.g., perceived risks), and expected net utility (e.g., net return). The concept of net valence the balance between perceived benefits and risks captures the overall evaluation that drives consumer behavior. To adapt the model to the context of biometric payment systems, the study integrates constructs from the Innovation Diffusion Theory (IDT), including relative advantage and perceived complexity. Additionally, the model incorporates individual difference variables such as technophobia, perceived playfulness and need for uniqueness. These additions address gaps in the original framework by accounting for personal traits that influence technology acceptance. The model also includes initial trust, recognizing its critical role in digital environments where users face uncertainty and potential loss of control especially relevant for biometric systems like FRP. By extending the valence framework with constructs from IDT and individual difference theory, this study offers a comprehensive model for understanding both the technological and psychological drivers of FRP adoption in Malaysia.

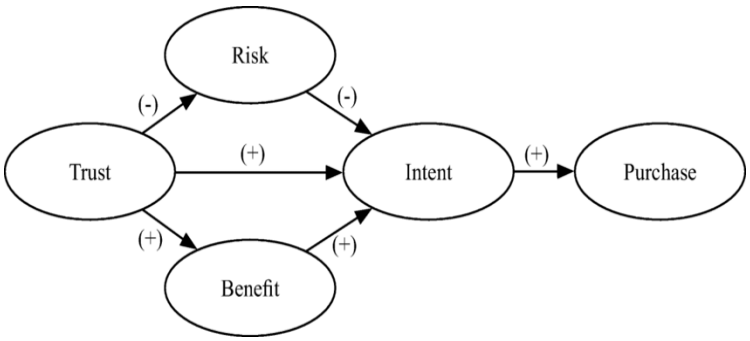

Fig. 1: Valence Framework.

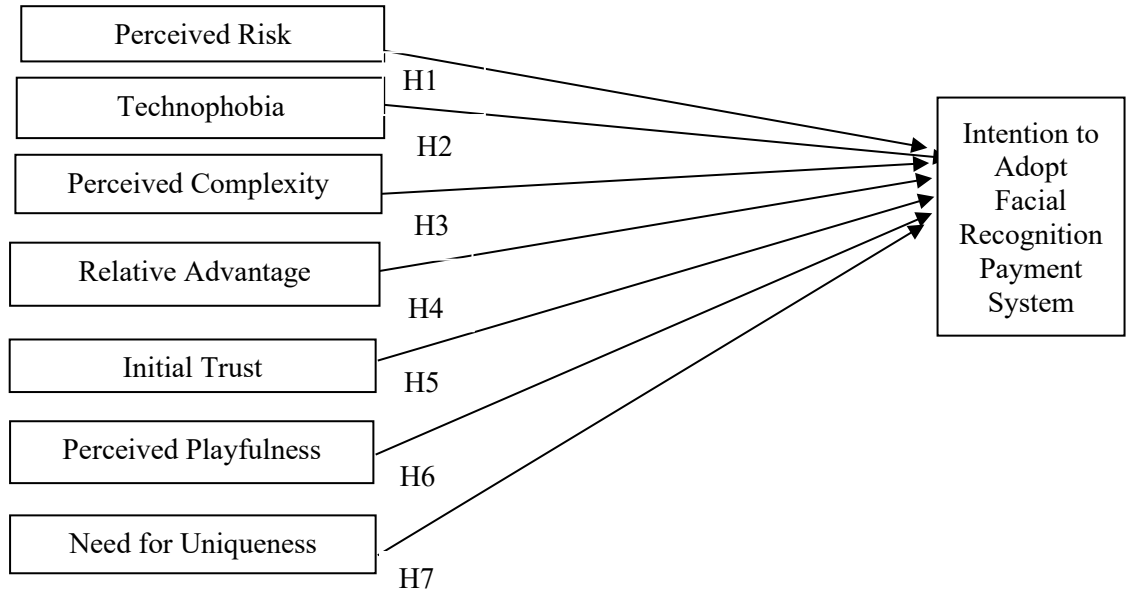

Fig. 2: Conceptual Framework

2.2. Dependent Variable

2.2.1 Intention to adopt

Intention to adopt was defined as the psychological decision made once people think that it was convenient, useful and easy to use that innovative product or service (L.-L. Zhang, Zhang, et al., 2021). While Davis's (1989) Technology Acceptance Model provides a foundation for understanding adoption, more recent extensions such as Venkatesh et al.'s (2016) cultural dimensions in UTAUT2 and Lim et al.'s (2023) biometric-specific acceptance factors offer more relevant frameworks for understanding facial recognition payment systems in non-Western contexts. In essence, user intention has been used to predict the adoption of products or services and the potential acceptance of new technologies. Additionally, both the intention to use and customer satisfaction are influenced by system quality, which is recognized as a key factor in shaping user behavior. Ariyanto et al. (2020) investigated how information quality, system quality, and service quality affect users' willingness to adopt a system and their satisfaction. Their findings confirmed that system quality significantly impacts both willingness to use and user satisfaction. System quality was defined as the extent to which users effectively utilize the system. In today's digital age, many companies especially in China have adopted facial recognition

payment systems, making them a mainstream payment method. However, in countries like Malaysia, this technology is still emerging within the financial sector. To keep pace with more technologically advanced nations, Malaysia should accelerate the adoption of facial recognition payment systems. L.-L. Zhang, Xu, et al. (2021) emphasized that in the field of management information systems, two key factors in studying user attitudes toward technology adoption are intention to use and actual usability. These factors are equally relevant to facial recognition payment systems. Therefore, this research explores the factors influencing Malaysians' willingness to adopt facial recognition payment systems, treating them as independent variables.

2.3. Independent Variable

2.3.1 Perceived Risk

Within the valence framework, perceived risk is identified as a negative valence (Palash et al., 2022). Bauer was the first to introduce the concept of perceived risk in the context of consumer behavior (W. K. Zhang & Kang, 2019). According to Ho et al. (2020) and Hu et al. (2023), perceived risk encompasses several dimensions, including psychological, privacy, social, performance, financial, and time risks. Among these, financial and privacy risks were found to be the most influential in the context of e-payment systems. Besides, Ho et al. (2020) found that users are more concerned about privacy risks in e-payment services compared to other online services like search engines or email. Similarly, Y. Cheng and Jiang (2020) discovered that perceived privacy risk negatively affects user satisfaction in chatbot services. Supporting this, Shiau et al. (2023) and Tran (2020) reported that increased privacy risks in online shopping reduce both customer satisfaction and purchase intention. Facial recognition payment systems are becoming increasingly widespread globally. However, they involve highly sensitive biometric data, making them riskier than other technologies. Unlike passwords or PINs, biometric data such as facial features are immutable and cannot be changed once compromised (Li & Li, 2023). Therefore, if such data is misused by malicious actors, the consequences can be severe and irreversible. Privacy concerns significantly impact biometric payment adoption, particularly in Malaysia where Zolkepli et al. (2022) found that 73% of consumers expressed anxiety about facial data storage, compared to only 45% for fingerprint data. This discrepancy suggests that facial biometrics are perceived as more intrusive or vulnerable, possibly due to their association with surveillance technologies and the difficulty of changing one's facial features if data is compromised. In contrast, fingerprint data, which has been used in security systems for a longer time, may be viewed as more familiar and less susceptible to misuse. These findings underscore the importance of addressing privacy perceptions and data protection measures in the design and implementation of biometric payment systems, especially in culturally and contextually sensitive markets like Malaysia. Therefore, perceiving risk has a significant influence on the intention to use facial recognition payment systems in Malaysia.

H1: There is a significant relationship between perceived risk and intention to adopt facial recognition payment system in Malaysia.

2.3.2 Technophobia

Technophobia is a multidimensional construct encompassing social, attitudinal, and expressive elements (Palash et al., 2022). It refers to the irrational fear or anxiety toward adopting and using new technologies, particularly among individuals who struggle to adapt to rapid technological changes and complexity (Kotzé et al., 2016). This fear can significantly alter how individuals perform tasks, often leading them to avoid new systems in favor of familiar methods. Historically, public attitudes toward technology have been mixed. Over time, researchers have explored related psychological responses through concepts such as cyberphobia, technostress, computer anxiety, and computer aversion (Koul &

Eydgahi, 2020; Subero-Navarro et al., 2022). Studies have shown that females tend to report higher levels of computer anxiety than males, and educational background plays a role in shaping comfort with technology (McClure, 2018). Additionally, about 50% of adults over 60 experience moderate to high levels of anxiety when using computers (Dincher & Wagner, n.d.), indicating that older adults are particularly vulnerable to technophobia. In the context of facial recognition payment systems, technophobia presents a significant barrier to adoption—especially among older populations. Many older individuals lack familiarity with IT and AI-based technologies, often feeling disconnected from digital advancements. As a result, they tend to prefer traditional payment methods, such as cash transactions at physical counters, over digital or biometric alternatives. This psychological resistance to technology, driven by fear and lack of confidence, negatively influences the intention to adopt FRP systems. Therefore, technophobia must be considered a critical factor when evaluating the challenges to broader FRP adoption, particularly in aging populations.

H2: There is a significant relationship between technophobia and intention to adopt facial recognition payment system in Malaysia.

2.3.3 Perceived Complexity

The two factors of the Technology Acceptance Model (TAM) were found to have a connection with the degree of complexity (Salloum et al., 2023). They found that the benefit that predicts user intention and encourages their adoption to technology was significantly represented by perceived ease of use and perceived usefulness which was the opposition of perceived complexity (Salloum et al., 2023). The degree of relatively hard to use and understand to the extent to which an innovation was known as perceived complexity by Rogers & Shoemaker (1971) (Guo et al., 2022a). Negative behavioral belief was known as perceived complexity, and it may lead to consumer attitudes distort to adopting an innovation (Palash et al., 2022). This means that it may lead consumers to be more frustrated because it becomes more complex by increasing some number of features leading to the effort needed from consumers also increasing then further lead to the increase on the difference between abilities and expectations (Palash et al., 2022). According to past research, they also found that the high complexity of new technologies will lead to the bafflement of their adoption because inefficiencies and uncertainty was associated to complexity (Guo et al., 2022a). Thence, this was the reason why the study of the impact of ease of use on usage and adoption was emphasized in the technology adoption and post-adoption literature (Palash et al., 2022).

H3: There is a significant relationship between perceived complexity and intention to adopt facial recognition payment system in Malaysia.

2.3.4 Relative Advantage

Relative advantage, as defined by Rogers (1962), refers to the extent to which an innovation is perceived as superior to the idea or method it replaces. This concept has consistently been shown to influence the adoption of new technologies (Erskine et al., 2019). For instance, mobile wallets are widely adopted because they offer greater convenience, enabling users to conduct financial transactions anytime and anywhere an improvement over traditional payment method (Matemba & Li, 2018; Mombeuil, 2020). In the context of facial recognition payment (FRP) systems, relative advantage is reflected in two key areas which are use advantage (features like low theft risk and smooth, frictionless transactions); and technological advantage (fast processing and automated recognition that eliminates the need for physical devices) (Palash et al., 2022). Consumers are more inclined to adopt technologies that offer clear, practical benefits and minimal complexity. In competitive markets, the presence of viable alternatives also influences consumer decisions, making perceived advantage a critical factor in

technology adoption (Junglas et al., 2019a).

H4: There is a significant relationship between relative advantage and intention to adopt facial recognition payment system in Malaysia.

2.3.5 Initial Trust

In the context of digital services such as online banking and e-commerce, initial trust is often shaped by brand trust (Y. Zhang et al., 2018). In technology adoption, trust plays a crucial role in strengthening the source-target relationship. For example, in facial recognition payment (FRP) systems, trust in the hardware provider (e.g., the facial recognition device) represents trust in the source, while trust in the payment platform (e.g., WeChat or Alipay) represents trust in the target (Palash et al., 2022). Research by Shiau et al. (2023) highlights that trust reduces consumer uncertainty and perceived complexity and is positively influenced by familiarity. Supporting this, Moriuchi (2021a) and Shiau et al. (2023) found that over 80% of users felt more comfortable using biometric systems in offline settings, likely due to their familiarity and trust in store personnel. These findings suggest that initial trust significantly influences consumers' intention to adopt FRP systems. Familiarity with the environment or service provider can foster trust, which in turn enhances the likelihood of adopting new technologies.

H5: There is a significant relationship between initial trust and intention to adopt facial recognition payment system in Malaysia.

2.3.6 Perceived Playfulness

Perceived playfulness is defined as a psychological state that reflects hedonism and personal identity, characterized by feelings of enjoyment, curiosity, and focused attention during interaction with a technology (Palash et al., 2022). It is a multidimensional construct comprising three key elements are focused attention on the interaction, curiosity during the experience, and intrinsic enjoyment or interest (Balkaya & Akkucuk, 2021). Playfulness is considered a temporary emotional experience that arises from engaging interactions between users and technology. In the context of facial recognition payment (FRP) systems, perceived playfulness can significantly influence user behavior. Research shows that when users find the interaction enjoyable and engaging, their intention to continue using the technology increases (Palash et al., 2022). This is supported by findings in the tourism sector, where positive service experiences driven by enjoyment lead to favorable consumer feedback. Moreover, studies based on the Technology Acceptance Model (TAM) have identified perceived playfulness as a strong predictor of perceived usefulness, ease of use, and behavioral intention (S. Wang et al., 2021). In fact, it has been found to be a stronger antecedent of behavioral intention than both perceived ease of use and perceived usefulness (Balkaya & Akkucuk, 2021).

H6: There is a significant relationship between perceived playfulness and intention to adopt facial recognition payment system in Malaysia.

2.3.7 Need for Uniqueness

The need for uniqueness is a psychological trait where individuals seek to express their identity and differentiate themselves from others through distinctive behaviors, products, or technologies. This concept was first introduced by Snyder and Fromkin (1977) through the theory of uniqueness (Palash et al., 2022). It is often driven by the perception of exclusivity and rarity (Blazquez et al., 2020). In the context of facial recognition payment (FRP) systems, Palash et al. (2022) found that the need for uniqueness plays a key role in influencing adoption, as users may perceive FRP as a modern, advanced,

and socially prestigious method of payment. Y. Wang et al. (2022a) further observed that consumers with a high need for uniqueness are more attracted to supply-based scarcity, while those with lower uniqueness needs respond more to demand-based scarcity. This suggests that perceived uniqueness can either increase or decrease purchase intention, depending on the individual's psychological profile. FRP systems, which allow users to complete transactions simply by facial scanning—without the need for physical interaction or waiting, are seen as cutting-edge and futuristic. For individuals with a strong need for uniqueness, adopting such technology enhances their social image, portraying them as tech-savvy and forward-thinking. In conclusion, the need for uniqueness significantly influences the intention to adopt FRP systems, especially among consumers who value innovation and social distinction.

H7: There is a significant relationship between need for uniqueness and intention to adopt facial recognition payment system in Malaysia.

3. Methodology

This study employed a mixed-method approach, incorporating both primary and secondary data sources to comprehensively investigate the factors influencing Malaysians' intention to adopt facial recognition payment (FRP) systems. Primary data was collected directly from respondents through a structured questionnaire, while secondary data was obtained from existing literature, including journal articles, books, and previous empirical studies relevant to biometric payment systems and technology adoption models. The target population for this study consisted of Malaysian residents aged 18 and above. To determine the minimum required sample size, a G*Power analysis was conducted, which indicated that at least 153 respondents were necessary to achieve sufficient statistical power. However, to enhance the robustness and generalizability of the findings, a total of 250 responses were collected. The questionnaire was distributed via Google Forms to respondents across four major regions of Malaysia—Central, Eastern, Northern, and Southern—ensuring geographic diversity. A convenience sampling method was employed, guided by quota controls to ensure balanced representation across key demographic variables such as age, income level, and prior exposure to facial recognition technology. This approach, recommended by Etikan and Bala (2017) for technology adoption studies, was chosen due to practical constraints while still maintaining demographic diversity, as detailed in Table 2. The survey instrument consisted of closed-ended questions measured on a five-point Likert scale, ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). This format was selected for its simplicity, ease of administration, and ability to capture the intensity of respondents' attitudes and perceptions with minimal cognitive burden. Data collection was conducted online, allowing for efficient and cost-effective outreach. The data collected was analyzed using the Statistical Package for the Social Sciences (SPSS) software. The statistical techniques were employed are frequency analysis is to summarize demographic characteristics and response distributions; descriptive analysis is to understand the central tendencies and variability of key variables; reliability testing is using Cronbach's Alpha to assess the internal consistency of the measurement scales; and multiple linear regression is to examine the relationships between independent variables (perceived risk, technophobia, perceived complexity, relative advantage, initial trust, perceived playfulness, and need for uniqueness) and the dependent variable (intention to use FRP systems). These analytical methods were chosen to rigorously test the research hypotheses and identify the significant predictors of FRP adoption among Malaysian consumers.

4. Finding and Results

4.1. Frequency Analysis

Based on the frequency analysis, the majority of respondents were female, accounting for 131

individuals (52.4%), while male respondents made up 119 individuals (47.6%). In terms of age distribution, the largest group of respondents fell within the 18 to 29 years age range, comprising 128 individuals (51.2%) of the total sample. Regarding ethnicity, the Chinese community represented the highest proportion, with 154 respondents (61.6%). Respondents were categorized into four regional groups based on their state of residence: Southern Region (Melaka and Johor), Eastern Region (Pahang, Terengganu, Kelantan, Sabah, and Sarawak), Central Region (Selangor and Negeri Sembilan), Northern Region (Perlis, Kedah, Pulau Pinang, and Perak), and The Southern Region had the highest representation, with 120 respondents (48%). In terms of educational background, the majority held a Bachelor's degree, totaling 146 respondents (58.4%). Conversely, the smallest group consisted of those with a Doctorate (PhD), with only 2 respondents (0.8%). For employment status, most respondents were full-time employed, accounting for 111 individuals (44.4%), while the unemployed represented the smallest group, with 12 individuals (4.8%).

4.2. Descriptive Analysis

Table 1: Total Mean and Standard Deviation

Independent Variables	Mean	Standard Deviation
Perceived Risk (PR)	3.3913	0.86922
Technophobia (TP)	3.6187	0.87984
Perceived Complexity (PC)	2.6680	1.21367
Relative Advantage (RA)	4.0040	0.75715
Initial Trust (TR)	3.6380	0.79118
Perceived Playfulness (PP)	4.0747	0.60765
Need for Uniqueness (NU)	3.5	0.90230
Dependent Variable		
Intention to Use (IU)	3.8950	0.79641

Based on the results summarized from the descriptive analysis, the PP was the highest among all the independent variables with the mean value of 4.0747. Then, it was followed by RA with the mean value of 4.0040 as the second highest mean value among all the independent variables and followed by TR with the mean value of 3.6380, TP with the mean value of 3.6187, NU with the mean value of 3.5 and PR with the mean value of 3.3913. Whereas PC was the lowest among all of the independent variables with the mean value of 2.6680. As for the mean value of dependent variable, IU, it was shown that it was 3.8950. As for the standard deviation, it was shown that PC was the highest among all of the independent variables with the standard deviation value of 1.21367. Then, it was followed by NU with the standard deviation value of 0.90230 as the second highest standard deviation value among all of the independent variables and followed by TP with the standard deviation value of 0.87984, PR with the standard deviation value of 0.86922, TR with the standard deviation value of 0.79118 and RA with the standard deviation value of 0.75715. While PP was the lowest among all of the independent variables with the standard deviation value of 0.60765. As for the standard deviation value of dependent variable, IU, it was shown that it was 0.79641

4.3. Reliability Test

The reliability of the measurement instruments was assessed using Cronbach's Alpha, a widely accepted

indicator of internal consistency. The results indicate that all seven independent variables, as well as the dependent variable, achieved Cronbach's Alpha values exceeding the threshold of 0.70, which is generally considered acceptable for social science research (Nunnally & Bernstein, 1994). This suggests that the items used to measure each construct are internally consistent and reliable. Among the independent variables, Perceived Complexity (PC) demonstrated the highest internal consistency with a Cronbach's Alpha of 0.941, indicating excellent reliability. This was followed by Perceived Risk (PR) with a value of 0.918, and Initial Trust (IT) at 0.892. Other constructs also showed strong reliability: Need for Uniqueness (NU) (0.882), Relative Advantage (RA) (0.878), Perceived Playfulness (PP) (0.863), and Technophobia (TP) (0.776). The dependent variable, Intention to Use (IU), also exhibited high reliability with a Cronbach's Alpha of 0.881. These findings confirm that all constructs used in this study possess good internal consistency, thereby supporting the reliability of the measurement model and ensuring the robustness of subsequent analyses.

4.4. Multiple Regression Analysis

Table 2: Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.855[a]	.731	.723	.41923	1.907

a. Predictors: (Constant), NU, TP, PP, PR, TR, PC, RA

b. Dependent Variable: IU

According to Table 1, it had shown that the value of R square was 0.731. This means that the independent variables, PR, TP, PC, RA, TR, PP and NU had a 73.1% impact on the dependent variable, which was the intention to adopt facial recognition payment system.

Table 3: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	.664	.263		2.524	.012		
	PR	-.216	.049	-.236	-4.429	<.001	.391	2.556
	TP	.039	.038	.043	1.029	.305	.625	1.601
	PC	.048	.038	.073	1.246	.214	.325	3.080
	RA	.203	.065	.193	3.107	.002	.287	3.482
	TR	.446	.054	.443	8.181	<.001	.380	2.632
	PP	.211	.068	.161	3.090	.002	.411	2.433
	NU	.115	.035	.130	3.239	.001	.694	1.442

a. Dependent Variable: IU

Table 3 presents the coefficient results generated using SPSS software. In the context of multiple linear regression, a p-value of 0.05 or less indicates a statistically significant relationship between the

independent and dependent variables. Conversely, a p-value greater than 0.05 suggests no significant relationship. The analysis revealed that perceived risk (PR) and initial trust (TR) both had a highly significant relationship with the dependent variable, intention to use (IU), with p-values of less than 0.001. Similarly, need for uniqueness (NU), relative advantage (RA), and perceived playfulness (PP) also showed statistically significant relationships with IU, with p-values of 0.01, 0.02, and 0.02, respectively. In contrast, technophobia (TP) and perceived complexity (PC) did not exhibit significant relationships with the intention to use FRP systems, as their p-values were 0.305 and 0.214, both exceeding the 0.05 threshold.

5. Discussion

5.1. Determination of the relationship between perceived risk and intention to adopt facial recognition payment system in Malaysia.

The multiple regression analysis identified a statistically significant relationship between perceived risk and the intention to adopt facial recognition payment (FRP) systems in Malaysia. The p-value was less than 0.001, well below the standard threshold of 0.05, thereby confirming that perceived risk plays a critical role in shaping consumers' willingness to adopt FRP technology. Participants expressed notable concerns regarding the security and privacy of their facial data, particularly how it might be stored, accessed, or misused. These concerns are consistent with prior research. For example, Slade et al. (as cited in Palash et al., 2022) highlighted that security concerns are widespread in the mobile payment landscape, as users become increasingly aware of the risks associated with digital transactions. Similarly, Talwar et al. (2020a) found that biometric authentication technologies often trigger anxiety due to fears of privacy breaches and unauthorized access. This heightened sense of vulnerability can lead to negative attitudes toward adopting such technologies. Johnson et al. (2018) also reported that fears of account hacking significantly reduce consumers' intention to engage with FRP systems. The more intense the perceived risk, the lower the likelihood of adoption and the greater the delay in acceptance. Palash et al. (2022) further noted that as awareness of digital security vulnerabilities grows, consumers become increasingly cautious and risk-averse when considering new payment technologies. This heightened sensitivity reinforces the negative impact of perceived risk on FRP adoption in the Malaysian context. Both statistical evidence and supporting literature confirm that perceived risk is a major barrier to the adoption of FRP systems. To encourage broader acceptance, it is essential to implement robust security measures and transparent data handling practices that foster consumer trust.

5.2. Determination of the relationship between technophobia and intention to adopt facial recognition payment system in Malaysia.

The multiple regression analysis revealed no statistically significant relationship between technophobia and the intention to adopt facial recognition payment (FRP) systems in Malaysia. The p-value of 0.305 exceeds the conventional threshold of 0.05, indicating that the hypothesis proposing a significant link is not supported by the data. This result may be influenced by the age distribution of the sample. A majority of respondents (51.2%) were aged 18 to 29, followed by 30–39 (20%) and 40–49 (16.4%), with only 12.4% aged 50 and above. Prior research by Dincher and Wagner (n.d.) found that nearly half of individuals over 60 experience moderate to high levels of anxiety when using digital technologies. The underrepresentation of older adults in this study may have contributed to the non-significant findings. While earlier studies, such as Palash et al. (2022), identified technophobia as a barrier to technology adoption, the current results suggest a shift. One possible explanation is the accelerated digital adoption during the COVID-19 pandemic, which compelled individuals across age groups to engage with digital platforms for communication, shopping, and financial transactions. This shift is supported by Troisi et al. (2022), who found that the pandemic fostered greater trust in technology and broader acceptance of digital innovations. In the Malaysian context, consumers are already familiar with digital payment systems, such as QR code-based transactions, which may have reduced

psychological resistance to newer technologies like FRP. As digital engagement becomes more normalized, technophobia may no longer be a dominant barrier to adoption. The hypothesis suggesting a significant relationship between technophobia and the intention to adopt FRP systems was not supported. This may be attributed to the younger demographic profile of respondents and the increased digital confidence fostered by the pandemic. Future research should aim for a more age-diverse sample to better assess the influence of technophobia across different population segments.

5.3. Determination of the relationship between perceived complexity and intention to adopt facial recognition payment system in Malaysia.

The multiple regression analysis found no statistically significant relationship between perceived complexity and the intention to adopt facial recognition payment (FRP) systems in Malaysia. The p-value of 0.214 exceeds the conventional threshold of 0.05, indicating that the hypothesis proposing a significant relationship is not supported by the data. This outcome may be influenced by several contextual and demographic factors. While some respondents, particularly older individuals expressed a need for more time to understand the system, many others, especially those aged 18 to 29 (who made up 51.2% of the sample), found FRP intuitive and easy to use. This younger demographic is generally more technologically proficient, which may explain the overall low perception of complexity. Additionally, the COVID-19 pandemic accelerated digital literacy across age groups. For example, smartphone ownership among older adults rose significantly between 2014 and 2017 (Sixsmith et al., 2022) and likely continued to grow during the pandemic as digital tools became essential for communication and transactions. In the Malaysian context, consumers are already familiar with QR code-based payments, which often involve multiple steps. In contrast, FRP systems typically require only a facial scan, making them more streamlined and efficient. Palash et al. (2022) noted that this simplicity may explain why perceived complexity does not significantly impact adoption. Similarly, Shiau et al. (2023) reported that FRP transactions can be completed in 10–15 seconds, compared to significantly longer times for QR code payments. Moreover, facial recognition technology has become increasingly integrated into everyday devices, such as smartphones. Since the launch of Apple's Face ID in 2017 (Gavin, 2023), users have become more familiar with facial recognition as a secure and convenient method of authentication, further reducing perceptions of complexity. The hypothesis that perceived complexity significantly influences the intention to adopt FRP systems is not supported. This may be due to the tech-savviness of the sample, increased digital familiarity post-pandemic, and the inherent simplicity of FRP systems compared to traditional payment methods. These findings suggest that perceived complexity is no longer a major barrier to FRP adoption in Malaysia.

5.4. Determination of the relationship between relative advantage and intention to adopt facial recognition payment system in Malaysia.

The multiple regression analysis revealed a statistically significant relationship between relative advantage and the intention to adopt facial recognition payment (FRP) systems in Malaysia. With a p-value of 0.020, which falls below the conventional threshold of 0.05, the results support the hypothesis that perceived relative advantage positively influences consumers' adoption intentions. The findings indicate that consumers are more likely to adopt FRP systems when they perceive clear benefits over traditional payment methods. Respondents highlighted several advantages, including greater convenience, time efficiency, ease of use, and shorter waiting times. Unlike conventional methods that may involve physical contact or multiple steps (e.g., entering a PIN or scanning a QR code), FRP enables users to complete transactions simply by presenting their face, thereby streamlining the payment process. This perception aligns with prior research. Zhang and Kang (2019) explain that FRP systems authenticate users by capturing and matching facial images with those stored in a secure database, enabling fast and seamless transactions. Palash et al. (2022) further emphasize that relative advantage is a key determinant in assessing whether the benefits of a new technology outweigh its perceived risks. Additionally, the COVID-19 pandemic has accelerated the demand for contactless technologies, further

enhancing the appeal of FRP systems. Relative advantage significantly influences the intention to adopt FRP systems. The perceived benefits ranging from efficiency and hygiene to innovation and future utility play a crucial role in shaping consumer willingness to adopt this emerging technology. These insights highlight the importance of emphasizing practical and comparative benefits in marketing strategies and policy efforts aimed at promoting widespread adoption.

5.5. Determination of the relationship between initial trust and intention to adopt facial recognition payment system in Malaysia.

The multiple regression analysis revealed a statistically significant relationship between initial trust and the intention to adopt facial recognition payment (FRP) systems in Malaysia. With a p-value of less than 0.001, this result strongly supports the hypothesis that initial trust is a key factor influencing consumers' willingness to adopt FRP technology. Trust plays a crucial role in reducing perceived uncertainty and risk, particularly in the early stages of adopting new technologies (Y. Zhang et al., 2018). In digital contexts such as mobile banking, initial trust has been shown to significantly influence user behavior, shaped by factors like trust propensity and social presence (Palash et al., 2022). While perceived risk can undermine trust, elements such as brand reputation and positive user experience can enhance it, ultimately increasing adoption intention. In the case of FRP systems, trust operates on two levels are trust in the technology provider (e.g., the facial recognition hardware), and trust in the service platform (e.g., digital wallets like WeChat Pay or Alipay) (Gong et al., 2020; Palash et al., 2022). When consumers have confidence in both the source and the target, their intention to adopt the technology increases significantly. Initial trust is a critical predictor of consumers' intention to use FRP systems. To foster broader adoption, it is essential to build and maintain trust through transparent data practices, reliable system performance, and strong brand credibility.

5.6. Determination of the relationship between perceived playfulness and intention to adopt facial recognition payment system in Malaysia.

The multiple regression analysis revealed a statistically significant relationship between perceived playfulness and the intention to adopt facial recognition payment (FRP) systems in Malaysia. With a p-value of 0.002, which is below the standard threshold of 0.05, the results support the hypothesis that perceived playfulness positively influences consumers' willingness to adopt FRP technology. Respondent feedback indicated that many users found FRP systems to be novel, engaging, and even enjoyable. This aligns with findings by Balkaya and Akkucuk (2021), who identified perceived playfulness as a stronger predictor of behavioral intention than even perceived usefulness or ease of use. These results highlight the importance of emotional and experiential factors in shaping user acceptance of emerging technologies. In contexts involving hedonic technology use, playfulness serves as a key driver of user engagement. Palash et al. (2022) also found that in service-oriented sectors like tourism, positive emotional experiences—such as enjoyment and satisfaction—are strong predictors of continued use and favorable feedback. Similarly, when users perceive FRP systems as both enjoyable and efficient, they are more likely to adopt and continue using them. Perceived playfulness significantly influences the intention to use FRP systems. The emotional appeal, novelty, and interactive nature of technology enhance its attractiveness, especially among users who value engaging and enjoyable experiences. These insights underscore the importance of designing user-friendly and stimulating interfaces to boost adoption of emerging payment technologies.

5.7. Determination of the relationship between need for uniqueness and intention to adopt facial recognition payment system in Malaysia.

The results of the multiple regression analysis demonstrate a statistically significant relationship between the need for uniqueness and the intention to adopt facial recognition payment (FRP) systems in Malaysia. With a p-value of 0.001, which is well below the 0.05 threshold, the findings support the hypothesis that individuals with a stronger desire to stand out are more inclined to adopt FRP technology. Respondents indicated that using a novel and less widely adopted payment method like FRP enhances

their sense of individuality and social distinction. This aligns with Palash et al. (2022), who emphasized that the need for uniqueness plays a pivotal role in shaping users' social image and reputation in the context of FRP. Supporting this, Y. Wang et al. (2022a) found that consumers with a high need for uniqueness are more responsive to supply-based scarcity (e.g., limited availability), while those with lower uniqueness needs are more influenced by demand-based scarcity. This distinction underscores how exclusivity and innovation can drive adoption among consumers who value being perceived as different or ahead of trends. Furthermore, the novelty and limited exposure of FRP systems in Malaysia may enhance their appeal to uniqueness-seeking individuals, who view early adoption as a symbol of modernity and social prestige. The findings confirm that the need for uniqueness significantly influences the intention to adopt FRP systems. Marketing strategies that highlight innovation, exclusivity, and social differentiation may be particularly effective in attracting consumers motivated by a desire to express their individuality.

6. Conclusion

This study advances our understanding of the factors influencing Malaysian consumers' intention to adopt facial recognition payment systems by extending the Valence Framework to include emotional and social dimensions. Our findings reveal a complex interplay of factors shaping adoption intentions, with several important theoretical and practical implications. From a theoretical perspective, our results validate the utility of the extended Valence Framework in explaining biometric payment adoption, explaining 73.1% of the variance in intention to use. The findings confirm that adoption decisions are influenced by both traditional technology acceptance factors (relative advantage, perceived risk) and social-emotional factors (perceived playfulness, need for uniqueness). Notably, initial trust emerged as the most powerful predictor (β=0.443), suggesting that building consumer confidence is paramount in the early stages of this technology's diffusion in Malaysia. The non-significance of technophobia and perceived complexity contradicts some previous findings but aligns with research suggesting that Malaysian consumers' increasing familiarity with digital payment methods and biometric authentication (particularly after COVID-19) may have reduced these barriers. From a practical standpoint, our findings offer several actionable insights for stakeholders in Malaysia's financial technology ecosystem. For financial institutions and technology developers, the strong influence of initial trust highlights the need for transparent data handling policies, clear communication about security measures, and gradual trust-building through limited trials and demonstrations. The significant negative impact of perceived risk (β=-0.236) suggests that providers should invest in robust security infrastructure and clearly communicate how facial biometric data is protected. The significant influence of perceived playfulness (β=0.161) and need for uniqueness (β=0.130) offers innovative directions for marketing and user experience design. Payment system providers could enhance the user interface to incorporate enjoyable elements and emphasize the innovative nature of facial recognition technology as a way for early adopters to differentiate themselves. For policymakers, our findings underscore the importance of developing clear regulatory frameworks for biometric data protection that can enhance consumer trust while enabling innovation. Educational campaigns highlighting both the security features and convenience benefits of facial recognition payments could also help accelerate adoption. This study has several limitations that suggest directions for future research. The cross-sectional design cannot capture changes in adoption intentions over time, making longitudinal studies valuable for understanding how these factors evolve as the technology diffuses. Our convenience sampling approach may limit generalizability, particularly to older demographics who were underrepresented in our sample. Future studies could employ more representative sampling methods and investigate how demographic factors moderate the relationships we identified. Additionally, research comparing adoption factors across different Southeast Asian markets could yield valuable insights about cultural differences in biometric payment acceptance. Despite these limitations, this study makes a meaningful contribution to understanding the dynamics of facial recognition payment adoption in Malaysia, offering evidence-

based guidance for stakeholders seeking to promote this technology in an emerging market context.

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