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**FACTORS INFLUENCING ADOPTION OF DIGITAL  
FINANCIAL SERVICES AMONG THE ELDERLY IN  
ZHENGZHOU, CHINA: MODERATING EFFECT OF  
PERCEIVED EASE OF USE**



**ZHANG QUAN**

UUM

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Universiti Utara Malaysia

**DOCTOR OF PHILOSOPHY  
UNIVERSITI UTARA MALAYSIA  
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**FACTORS INFLUENCING ADOPTION OF DIGITAL FINANCIAL  
SERVICES AMONG THE ELDERLY IN ZHENGZHOU, CHINA:  
MODERATING EFFECT OF PERCEIVED EASE OF USE**



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## Othman Yeop Abdullah Graduate School of Business

**Kolej Perniagaan**  
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## ABSTRAK

Perkhidmatan Kewangan Digital (DFS) berperanan penting di peringkat global, khususnya selepas pandemik COVID-19. Namun, penggunaan DFS dalam kalangan warga emas masih kurang mendapat perhatian penyelidikan, meskipun kumpulan ini berkembang pesat dan memainkan peranan sosial yang signifikan di China. Model penerimaan teknologi sedia ada, termasuk model penuh Teori Penerimaan dan Penggunaan Teknologi yang bersatu (UTAUT), sering mengabaikan halangan psikologi khusus warga emas, seperti kebimbangan teknologi, serta faktor kontekstual penting, iaitu persepsi kepercayaan dan persepsi risiko dalam transaksi kewangan digital. Kekangan ini menghadkan kefahaman teoritikal dan praktikal terhadap corak penggunaan DFS serta usaha memperkukuh inklusi digital dalam kalangan warga emas. Bagi menangani jurang ini, kajian ini meneliti faktor yang mempengaruhi penggunaan DFS dalam kalangan warga emas berumur 65 tahun ke atas di Wilayah Zhengzhou, China. Kajian ini menggunakan pendekatan kuantitatif deduktif dengan memperluaskan model UTAUT melalui penggabungan terpilih Keadaan Memudahkan (FC), Kebimbangan Teknologi (TA), Persepsi Kepercayaan (PT), dan Persepsi Risiko (PR) sebagai antezeden langsung kepada niat tingkah laku. Niat tingkah laku diuji sebagai pemboleh ubah perantara, manakala Persepsi Kemudahan Penggunaan (PEOU) berfungsi sebagai pemboleh ubah penyederhana. Data dikumpul daripada 382 warga emas yang menetap di rumah penjagaan, pusat komuniti, dan pusat jagaan harian di Zhengzhou melalui kaedah persampelan rawak mudah. Analisis data dijalankan menggunakan Pemodelan Persamaan Berstruktur Berasaskan Kuasa Dua Terkecil Separa (PLS-SEM) menerusi perisian SmartPLS 4. Dapatan kajian menunjukkan bahawa niat tingkah laku memediasi hubungan antara pemboleh ubah utama dan tingkah laku penggunaan DFS. FC dan PT didapati memberi kesan positif yang signifikan, manakala TA dan PR bertindak sebagai penghalang utama. Selain itu, PEOU melemahkan kesan negatif TA dan PR serta mengukuhkan kesan FC, namun tidak mempengaruhi hubungan antara PT dan niat tingkah laku. Secara keseluruhan, kajian ini mencadangkan kerangka penerimaan DFS yang berfokus kepada warga emas serta menyediakan implikasi dasar dan praktikal bagi memperkukuh inklusi kewangan digital dalam konteks China.

**Kata Kunci:** Perkhidmatan kewangan digital, Keadaan memudahkan, Kebimbangan teknologi, Persepsi risiko, Persepsi kepercayaan, Niat tingkah laku, Persepsi kemudahan penggunaan, China

## ABSTRACT

Digital financial services (DFS) have become increasingly vital worldwide, particularly in the post-COVID-19 era. Despite the rapid growth of the elderly population and its significant societal role in China, individual-level DFS adoption among older adults remains underexplored. Existing technology acceptance frameworks, such as the full Unified Theory of Acceptance and Use of Technology (UTAUT), often fail to account for elderly-specific psychological barriers, including technology anxiety, as well as critical contextual factors such as perceived trust and perceived risk in digital financial transactions. These omissions limit theoretical advancement and practical understanding of DFS adoption among older adults and pose challenges to promoting digital financial inclusion. To address this gap, this study investigates the key drivers and barriers influencing DFS usage among individuals aged 65 and above in Zhengzhou, China. Using a deductive quantitative approach, the study extends the UTAUT model by incorporating facilitating conditions, technology anxiety, perceived trust, and perceived risk as direct antecedents of behavioural intention. Behavioural intention is examined as a mediating variable, while perceived ease of use is modeled as a moderating variable. Data were collected from 382 elderly participants residing in nursing homes, community care centers, and day-care centers in Zhengzhou using simple random sampling. Partial Least Squares Structural Equation Modeling (PLS-SEM) was conducted using SmartPLS 4. The findings reveal that behavioural intention significantly mediates the relationships between the proposed determinants and DFS usage behaviour. Facilitating conditions and perceived trust positively influence behavioural intention, whereas technology anxiety and perceived risk exert significant negative effects. Moreover, perceived ease of use mitigates the adverse effects of technology anxiety and perceived risk and amplifies the positive influence of facilitating conditions, but does not moderate the effect of perceived trust. This study proposes an elderly-centric adoption framework and offers policy-relevant insights for enhancing digital financial inclusion in China.

**Keywords:** Digital financial services, Facilitating conditions, Technology anxiety, Perceived risk, Perceived trust, Behavioural intention, Perceived ease of use, China

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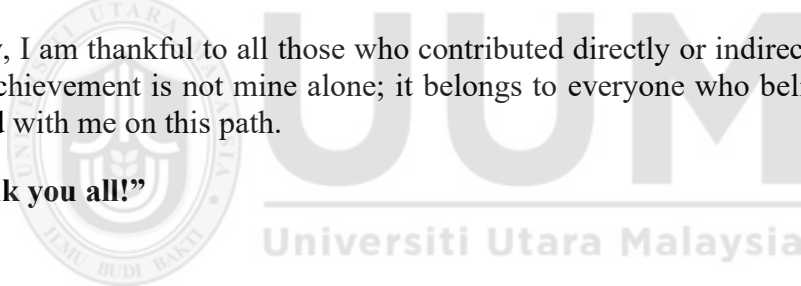
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## LIST OF ABBREVIATIONS

|          |                                                                 |
|----------|-----------------------------------------------------------------|
| AMOS     | Analysis of Moment Structures                                   |
| ANOVA    | Analysis of Variance                                            |
| AT       | Attitude Toward the Behaviour                                   |
| AVE      | Average Variance Extracted                                      |
| BI       | Behavioural Intention                                           |
| CB-SEM   | Covariance-Based Structural Equation Modelling                  |
| CBT-I    | Cognitive Behaviour Therapy for Insomnia                        |
| CFA      | Confirmatory Factor Analysis                                    |
| CMB      | Common Method Biases                                            |
| CNNIC    | China Internet Network Information Centre                       |
| COVID-19 | Coronavirus Disease 2019                                        |
| DF       | Digital Finance                                                 |
| DFS      | Digital Financial Services                                      |
| DTPB     | Decomposed Theory of Planned Behaviour                          |
| EFA      | Exploratory Factor Analysis                                     |
| FC       | Facilitating Conditions                                         |
| FLC      | Family Life Cycle                                               |
| GDP      | Gross Domestic Product                                          |
| HTMT     | Heterotrait-Monotrait                                           |
| IDT      | Innovation Diffusion Theory                                     |
| IM       | Instant Messaging                                               |
| IT       | Information Technology                                          |
| KMO      | Kaiser-Meyer-Olkin                                              |
| MCA      | Ministry of Civil Affairs of the People's Republic of China     |
| MPCU     | Model of Personal Computer Utilization                          |
| NBSPRC   | National Bureau of Statistics of the People's Republic of China |
| NFI      | Normed Fit Index                                                |
| OECD     | Organisation for Economic Co-operation and Development          |
| P2P      | Peer-to-Peer                                                    |

|         |                                                    |
|---------|----------------------------------------------------|
| PBC     | Perceived Behavioural Control                      |
| PEOU    | Perceived Ease of Use                              |
| PLS-SEM | Partial Least Square Structural Equation Modelling |
| PR      | Perceived Risk                                     |
| PT      | Perceived Trust                                    |
| PU      | Perceived Usefulness                               |
| RTC     | Resistance to Change                               |
| SCT     | Social Cognitive Theory                            |
| SEM     | Structural Equation Modelling                      |
| SI      | Social Influence                                   |
| SN      | Subjective Norms                                   |
| SPSS    | Statistical Package for Social Sciences            |
| SRMR    | Standardized Root Mean Square Residual             |
| TA      | Technology Anxiety                                 |
| TAM     | Technology Acceptance Model                        |
| TAM2    | Extended Technology Acceptance Model               |
| TPB     | Theory of Planned Behaviour                        |
| TR      | Trust                                              |
| TRA     | Theory of Reasoned Action                          |
| UB      | Usage Behaviour                                    |
| UGT     | Uses and Gratifications Theory                     |
| UTAUT   | Unified Theory of Acceptance and Use of Technology |
| VIF     | Variance Inflation Factor                          |
| WHO     | World Health Organisation                          |

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Introduction

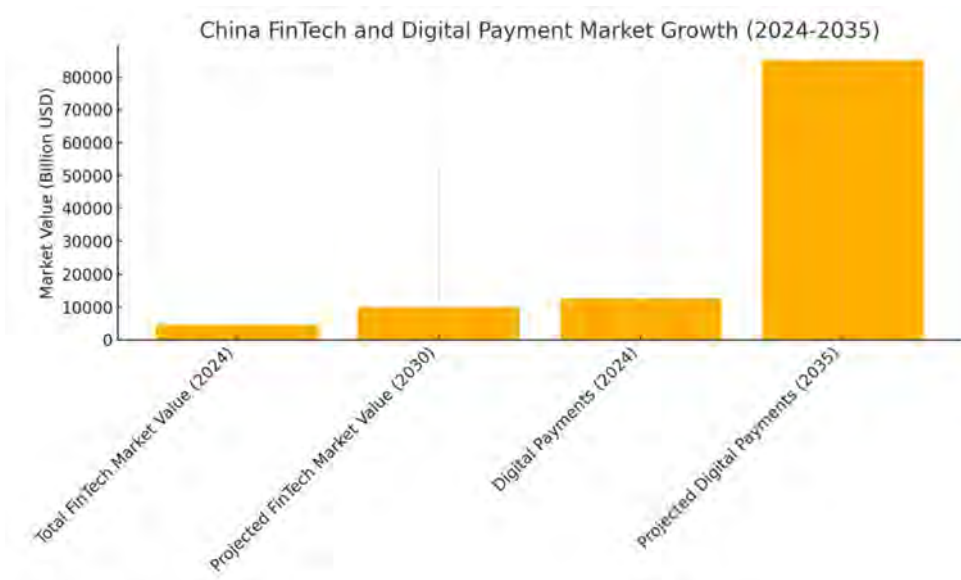
The origin of digital finance can be traced back to the establishment of the Society for Worldwide Interbank Financial Telecommunication (SWIFT) in 1977, which was the first global financial infrastructure based on Internet communication technology for interbank payment settlement (Schenk, 2023). In the 1990s, John Reed, the Chairman of Citigroup, publicly used the term "FinTech" to define financial innovation driven by technological means during the "Smart Card Forum" (Zhu, 2023).

Risman et al. (2021) describe digital finance as financial services delivered through mobile phones, internet and cards. Bisht et al. (2022) suggested that digital finance pertains to an emerging financial business approach that incorporates digital technologies to provide various financial services, including financing, investing, payment, and other related services. Koskelainen et al. (2023) stated that while there is no standardised definition of digital finance, researchers generally agree on its concept. According to Manzoor et al. (2021), all products, services, technologies, and infrastructure that can help individuals or companies access financial services such as savings, payments, and credit facilities through the Internet which means that they no longer need to go to the bank in person or communicate with financial service providers face-to-face, belong to digital finance.

The emergence of digital finance in China can be traced back to 2004, when the Alibaba Group introduced Alipay (Hou et al., 2024). In 2011, due to regulatory requirements in China, Alipay's ownership was transferred to a newly formed company called the Ant Financial Services Group. Alibaba Group holds a substantial

ownership stake in Ant Group, and its founder, Jack Ma, played a vital role in the establishment of both companies. In 2013, Alipay achieved a significant milestone by surpassing PayPal as the leading third-party mobile payment platform worldwide (Dashveenjit, 2022). In the same year, Alipay introduced Yu'E Bao, an online money fund, on its existing platform. According to Zhang et al. (2022), Yu' E Bao's introduction has been of utmost significance in boosting the advancement of digital finance in China. Since then, Alipay has expanded its services beyond mobile payments and offers various financial products and services, including wealth management, insurance, digital banking, and credit scoring. Users can invest money (for example, Yu'E Bao) and access various investment options through Alipay's platform.

According to Alibaba's financial report, the Ant Group's operating revenue mainly comes from three segments: digital payment and merchant services, digital fintech platforms, and innovation initiatives (Alibaba Group, 2023).

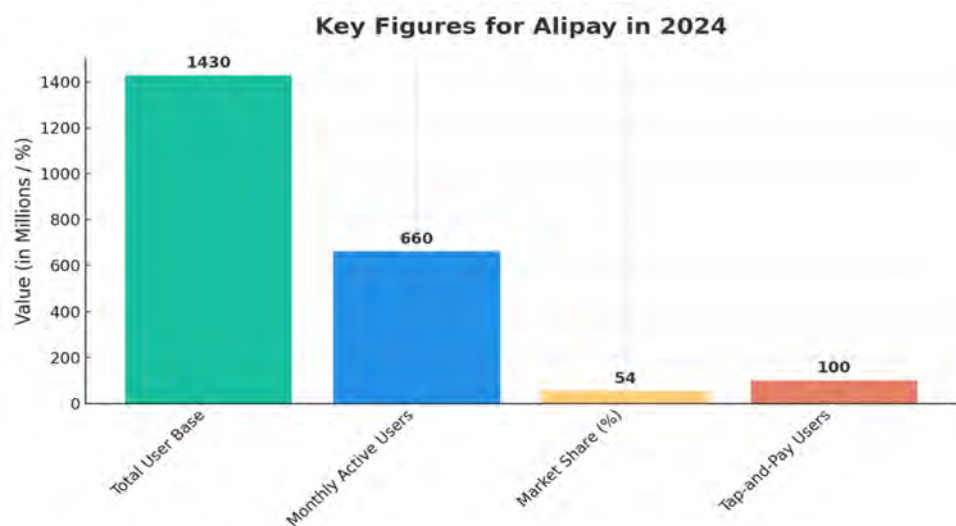


**Figure 1.1**

*China's FinTech and Digital Payment Market Growth (2024 – 2035)*

Source: TechSci Research, 2024; Market Research Future, 2024.

As shown in Figure 1.1, there is continuous expansion in the fintech market in China, and this expansion is still growing at a substantial rate. The total Chinese fintech market is estimated to be worth approximately USD 4.59 trillion in 2024, and it is expected to grow more than double to around USD 9.97 trillion by the end of 2030 (TechSci Research, 2024). This fast-paced growth rate (CAGR) of 13.8% highlights the fact that China has started to rely heavily on digital financial services. This also shows a shift in the preference of people from traditional financial services to digitally mediated financial services. Moreover, the digital financial sector has been observed to be growing from USD 12.6 billion in 2024 and is expected to experience further growth up to 85.2 billion by the end of 2035 (Market Research Future, 2024). This drastic increase in the adoption of digital financial systems is fuelled by the increased use of smartphones, indicating a pivotal shift toward more comprehensive digitally mediated financial payments and receipt solutions. This significant shift towards DFS usage in China emphasises innovation and platform integration as basic elements for ensuring rapid growth in the future.



**Figure 1.2**

*Key Figures for Alipay in 2024*

Source: ElectroIQ, 2024; Coolest Gadgets, 2024; South China Morning Post, 2024.

In 2024, Alipay continued to dominate China's digital financial platform sector, reaching a total user base of approximately 1.43 billion and maintaining approximately 660 million monthly active users (ElectroIQ, 2024). With a market share of 54%, Alipay remains ahead of competitors such as WeChat Pay in the mobile payments landscape (Coolest Gadgets, 2024). A significant development in 2024 was the launch of Alipay's NFC-enabled "Tap!" payment service, which attracted over 100 million users within its first year (South China Morning Post, 2024). These figures underscore Alipay's innovative capacity and ability to adapt to emerging payment trends. As illustrated in Figure 1.2, the company's growth across key performance indicators demonstrates its continued leadership in China's highly competitive digital finance ecosystem.

According to data released by Analysys International (2023), Alipay accounted for 55.6% of China's third-party mobile payment market transaction share. According to Mobile World Live (2024), Tencent's WeChat Pay has successfully managed to be the market challenger in China's digital financial domain as it succeeded in capturing 37% of the market share, while Ali Pay occupied the position of market leader with 55% of the total market share. Business of Apps (2023) reported that WeChat Pay successfully maintained greater levels of user engagement with an active user base of approximately 935 million individuals. Moreover, nearly USD 12 trillion was processed in mobile transactions by WeChat Pay, indicating a significant space in the digital financial domain of China (Payments Journal, 2024).

Furthermore, Alipay and WeChat Pay jointly commanded a substantial market share of 93.6% in the third-party mobile payment sector by 2022 (Analysys International, 2023). This significant percentage reflects the dominant position of these two

platforms in China. The extent of digital finance progress in China is largely mirrored by the evolution of Alipay and WeChat Pay, with Alipay assuming a prominent position. To gauge the progress of digital finance within the country, the Institute of Digital Finance at Peking University devised the Digital Financial Inclusion Index in 2016, which utilised data on the usage of Alipay as a key determinant (Jiang et al., 2024). This index, initially released in 2016 and subsequently updated in 2019 and 2021, has exerted a substantial influence on researchers specialising in digital finance and financial inclusion in China.

Furthermore, it has been utilised and validated in many studies conducted in the realm of digital finance (Ahmad et al., 2021; Zhang et al., 2023). This proves the representative nature of Alipay in China's digital-finance sector. Digital finance significantly influences economic growth and stability. Studies have shown that it enhances the sensitivity of interest rates, thereby strengthening government monetary policies and promoting economic activity through increased population consumption (Feng & Zhang, 2021; Jiang et al., 2022). In addition to boosting tax revenue, it fosters financial system stability, supports economic expansion by offering diverse financial products, and positively affects economic growth through increased consumption (Mpofu & Mhlanga, 2022). Moreover, Liu et al. (2022) suggested that the progression of digital finance can significantly improve economic prospects, revitalise small businesses, and boost the Gross Domestic Product (GDP).

In addition to the aforementioned benefits, the most significant advantage of digital finance is its promotion of financial inclusion (Luo et al., 2022). According to the World Bank, by leveraging digital technologies, digital finance makes financial services more available to marginalised groups, including the elderly, low-income

individuals, and women, who are typically left out of the formal financial system due to various factors, such as limited financial infrastructure (Demirgüç-Kunt et al., 2022), low levels of financial literacy (Andreou & Anyfantaki, 2021), or lack of economic resources (Yang et al., 2022).

As defined by Tay et al. (2022), financial inclusion is the sustainable and affordable provision of convenient, fast, and safe basic financial services to disadvantaged groups, areas, and industries in a country. Many studies have stated that financial inclusion has the potential to improve the penetration rate of financial services and, consequently, address financial exclusion (Roy & Patro, 2022). Mhlanga (2024) stated that financial inclusion offers an opportunity for disadvantaged groups to save for the future, which strengthens their ability to resist unpredictable risk. Antwi et al. (2024) indicated that financial inclusion can stabilise the financial system, optimise the allocation of financial resources, refine the financial structure, and foster the progress of the financial system.

However, the traditional process of financial inclusion in China encounters numerous challenges, such as information asymmetry (Ren et al., 2023), high transaction costs, insufficient supply of financial services (Ghosn et al., 2024), weak financial infrastructure, and inadequate risk regulation (Hua & Huang, 2021).

Nevertheless, with the emergence of digital technologies, several studies suggest that digital finance can tackle these challenges effectively. Digital finance presents a significant opportunity to achieve cost-effective, widespread, and sustainable financial inclusion, particularly for economically disadvantaged groups (Parvin & Panakaje, 2022). The application of digital technology offers new avenues for sustainably advancing financial inclusion (Bello, 2024). Digital finance enables financial service

providers to reduce customer acquisition costs, enhance risk management capabilities, and operate without the constraints of physical presence, thereby significantly enhancing the feasibility and potential of financial inclusion (Murinde et al., 2022). By leveraging the benefits of digital finance, China can tackle existing problems and drive the progress of inclusive financial systems, fostering greater financial accessibility and opportunities for all segments of the population.

Digital financial service (DFS) platforms have improved financial accessibility across various sectors. However, in developing countries, there are considerable differences in DFS penetration rates among different groups. The barriers commonly observed in these countries include low levels of digital literacy, limited trust in digital finance, and inadequate financial infrastructure (Adel, 2024). Liu et al. (2024) pointed out that while the implementation of digital finance has undeniably bolstered the use of financial services within lower-income brackets and among women in China, its influence on the penetration rate of financial services among the elderly has been somewhat constrained. In conjunction with factors such as education and income, Haini and Pang (2022) found that age is a pivotal constraint that impacts the penetration of digital finance.

Traditional financial services often present numerous barriers for the elderly population. For instance, physical bank branches may be distant, inconvenient for those with limited mobility, while complex counter procedures, long waiting times, and reliance on paper documentation can be daunting and confusing. Furthermore, traditional financial products frequently lack customization for the specific needs of older adults, such as low-risk wealth management, convenient health insurance payment options, or simplified pension collection schemes. The advent of Digital

Financial Services (DFS) effectively addresses these issues. By offering mobile banking and digital payment solutions, DFS brings financial services directly to the elderly, significantly enhancing accessibility and convenience. Older adults can perform transactions like transfers, bill payments, and inquiries without leaving their homes, saving time and effort. Moreover, DFS platforms have the potential to offer more personalized and user-friendly financial products, such as online purchase of health-related insurance tailored to their needs, or straightforward, low-risk investment options. This lowers the barriers for the elderly to access financial services and is expected to reduce medical costs and enhance social connectedness (Fan et al., 2024; Sikka and Bhayana, 2024).

According to the OECD (2023), a country enters an aging society when the proportion of individuals over 60 years old exceeds 10% or when the proportion of those over 65 years old exceeds 7%. The National Bureau of Statistics of the People's Republic of China (2025) reported that China's population over 65 years old accounted for more than 15.6% of the total population, indicating a significant shift towards deep aging. Furthermore, it is expected to exceed 300 million people by 2035 and reach its peak in the 21st century in 2058, with a height of approximately 385 million people. The aging of China's population will continue to increase in the future.

As China's elderly population continues to grow, the demand for financial investment and wealth management is increasing. A survey of the assets and liabilities of urban households organised by the People's Bank of China revealed that high-risk financial products held by elderly households constituted more than one-third of their total household financial assets in 2019. On average, these holdings amounted to 32,967.63 USD, significantly higher than the average among the surveyed households (People's

Bank of China, 2020). According to Dang et al. (2023), in 2020, the total consumption of the elderly in China was 656.86 billion USD, accounting for 5.25% of GDP. This figure is projected to reach 6,103.61 billion USD by 2050, with its share in GDP climbing to 12.20%.

Due to the high costs, inefficiencies, and distance barriers associated with traditional financial services, a significant portion of the elderly, as a vulnerable group, find themselves excluded from the financial system. DFS offers these individuals an opportunity to reintegrate into the financial system. This inclusivity is particularly crucial for those living in remote areas or those with physical limitations, as these factors make accessing traditional banking services challenging (Sikka and Bhayana, 2024). DFS provides greater accessibility and convenience, enabling previously underserved populations to participate more easily in financial activities.

Moreover, DFS can offer more personalised financial products and services, catering to the specific needs of the elderly (Fan et al., 2024). Overall, digital finance not only offers more convenience and options for the elderly but also presents a vital opportunity for those who have been unable to fully utilise traditional financial services, allowing them to better integrate into the modern financial system. Currently, the penetration rate of digital financial services among the elderly in China is relatively low (CNNIC, 2022). Many elderly people are hesitant to engage with online systems and utilise smart devices because of a lack of familiarity and confidence (Ghorayeb et al., 2021). Apprehensions regarding the operational mechanics of DFS, such as mobile payments and mobile banking, coupled with anxieties about security and the potential risk of losses resulting from mishandling, have instilled a sense of caution in them, deterring their adoption of these services.

Digital finance offers a potential solution for the elderly who are excluded from formal finance, enabling them to access formal financial systems. Fan and Dai (2022) suggest that aging contributes to a higher likelihood of household financial vulnerability owing to increased uncertainty in expenditures and lower labour income. It serves as a significant causal factor in households' reduced ability to cope with financial risk. The deep use of digital finance by aging households primarily mitigates the negative impact of aging on household financial vulnerability by increasing property income, making it an effective approach to addressing aging-related issues. Digital finance has emerged as a crucial tool for alleviating the adverse effects of aging on household financial vulnerability. In summary, the role of digital finance in helping aging households maintain financial stability suggests that it is not just a convenience but a necessary strategy in the context of an aging population in China. Specifically, through digital financial platforms, the elderly can more easily access diversified low-risk wealth management products (e.g., money market funds, pension-specific financial products). These products typically feature low investment thresholds and high liquidity, helping the elderly to preserve and potentially grow their assets while safeguarding their principal. This indirectly contributes to an increase in their property income and effectively hedges against the erosion of pension purchasing power due to inflation. Furthermore, DFS also facilitates the online collection and management of pensions, simplifying processes, reducing time and transportation costs, and improving capital utilization efficiency.

To fully harness the advantages of digital finance and promote financial inclusion, it is paramount to address financial exclusion. This requires broadening access to digital finance for a more extensive array of groups, boosting the adoption rate of DFS among diverse segments, and facilitating the integration of disadvantaged populations into the

formal financial system. Despite the vast literature on digital finance, there remains a lack of research specifically focusing on the accessibility of financial services for the elderly. While prevailing research primarily concentrates on the consequences of digital finance on urban and rural demographics, women, entrepreneurial ventures, household spending, small and medium enterprises (SMEs), and farmers (Roy & Patro, 2022; Xie & Zhu, 2021), there remains a scarcity of investigation into the distinct factors shaping the adoption behaviour of DFS among the elderly in China.

This study contributes to the design of tailored financial products and services to effectively serve the elderly, thereby enhancing the penetration rate of DFS among this group. By addressing this study gap, it can bridge the existing knowledge deficit and contribute to promoting financial inclusion and accessibility for the elderly through digital finance.

## **1.2 Problem Statement**

The advent of digital finance has revolutionised the provision of financial services. With characteristics such as high efficiency, low transaction costs, and high accessibility, digital finance is recognised as an effective means of reducing financial exclusion and promoting inclusive finance development worldwide. However, in the process of China's digital financial development, an issue has arisen: the adoption rate of DFS is considerably lower among the elderly than among other groups. Yu et al. (2022) suggested that the DFS adoption rate can be used to measure digital finance development among different regions and demographics.

The 49th Statistical Report on China's Internet Development, released by the China Internet Network Information Centre (CNNIC), shows that the number of elderly people aged 60 and above who use the Internet is 119 million, and only 32.8% of these

people can use digital financial platforms independently (CNNIC, 2022). The results showed that the youth were 27.39% more likely to use DFS than the middle-aged group. On the other hand, the elderly were 20.58% less likely to utilise these services compared to the middle-aged. This finding demonstrates a clear reluctance among the elderly towards adopting DFS. This phenomenon indicates that, compared to other age groups, the vulnerable elderly face inequalities in accessing DFS, suggesting that digital finance may exacerbate financial exclusion to some extent.

The importance of DFS adoption for China's elderly is underscored by its potential benefits, including improved access to health insurance and timely claims processing, reduced medical costs through efficient reimbursements, enhanced social connectedness via peer financial sharing platforms, and mitigation of financial vulnerability with low-cost micro-loans and wealth management tools (Xu et al., 2022). Yet practical barriers such as digital literacy gaps, trust issues, security fears, and infrastructural limitations (e.g., poor rural connectivity) exacerbate exclusion, leaving the elderly reliant on costly informal channels and justifying urgent intervention to bridge this divide (Zhang et al., 2021).

Financial exclusion in digital finance is a growing concern. The concept of financial exclusion was initially introduced by Leyshon and Thrift (1993), who characterised it as a phenomenon in which vulnerable groups are unable to meet their financial needs through mainstream channels due to their distance from financial institutions. In the context of Europe, Caplan (2021) defined financial exclusion as the presence of barriers to accessing financial products and services due to inadequate conditions. Muhammad et al. (2022) rejected the hypothesis that factors such as gender,

relationship status, home ownership, and residence in urban or rural areas are linked to financial exclusion.

Hasan et al. (2022) noted that evolution of digital finance in China has led to another form of financial exclusion among the vulnerable groups. As the popularity of digital finance varies among different populations, certain vulnerable groups cannot benefit from it. In alignment with this finding, Zhang et al. (2021) underscored that the advancement of digital finance exacerbates financial exclusion among the elderly. He et al. (2020) validated that the progression of digital finance in China has increased the likelihood of poverty. Wang and Mao (2023) contributed to this discussion, illustrating that DFS have fostered financial exclusion among the elderly (individuals aged 65 and over). They suggested that while the digital age has brought numerous benefits, it has also introduced new challenges, especially for the elderly. However, there remains a critical research gap focusing on the elderly population in this regard, particularly the scarcity of studies on elderly-specific DFS barriers in rural China, despite rapid aging and unique challenges like migration isolation (CNNIC, 2022).

Henan Province presents a unique case study due to its distinct demographic and socio-economic characteristics. As a major agricultural province with a significant outflow of working-age population, Henan faces the unique challenge of rural aging, which is more pronounced than that in urban areas. As the provincial capital, Zhengzhou serves as a critical focal point for these dynamics. It represents a microcosm of the broader region, reflecting both the rapid urbanization and the persistent rural aging challenges characteristic of Henan. Therefore, focusing this study on Zhengzhou provides specific, actionable insights that align with the broader demographic shifts of the province. This

demographic shift is critical for understanding the financial needs and inclusion strategies of the elderly, particularly in rural settings.

Statistics indicate that the proportion of the elderly population (aged 60 and above) in rural areas of Henan is significantly higher than that in urban areas and towns (22.69% in rural areas compared to 14.33% in cities and 14.39% in towns). While the population aged 65 and above in rural areas constitutes 17.36% of the total, surpassing urban areas by 7.21 percentage points and towns by 6.81 percentage points (Zheng et al., 2023), highlighting a crucial aspect of Henan's demographic profile.

In Henan Province, particularly in its rural areas, the issue of low DFS adoption among the elderly is especially concerning for several reasons. Firstly, the aging process is significantly more accelerated in rural areas compared to urban centers. As noted, the proportion of the population aged 60 and above in rural Henan reaches 22.69%, significantly higher than in cities and towns. This rapid aging implies a large and growing elderly population in rural settings. Secondly, the continuous outward migration of the younger, working-age population results in a high number of "empty nest" elderly individuals in rural areas. These seniors often lack family members' digital literacy guidance and daily technical support, facing greater isolation and obstacles in accessing and learning about digital finance. Thirdly, traditional financial infrastructure in rural areas is relatively weak, with fewer bank branches and uneven ATM distribution, leading to inherently lower accessibility to conventional financial services for the elderly. While digital finance is intended to bridge this gap, its low adoption rate paradoxically exacerbates the risk of financial exclusion for rural seniors. The lack of DFS not only causes numerous inconveniences in their daily lives but also renders them more susceptible to financial fraud, severely threatening their economic

and social well-being. Therefore, a deep investigation and resolution of DFS adoption issues among the rural elderly are strategically significant for promoting urban-rural financial inclusiveness and social equity in Henan Province and across China.

Given the low DFS adoption rates among the elderly, aggravated financial exclusion, and Henan's rural-urban aging context, this study analyzes drivers and deterrents for elderly DFS adoption. Building on UTAUT (Venkatesh et al., 2003), this study selectively integrates only Facilitating Conditions (FC) as core, prioritizing it for infrastructural relevance in elderly contexts (Alalwan et al., 2018). Other UTAUT elements (PE, EE, SI) are excluded due to lesser fit amid anxiety/risk aversion (Blut et al., 2022 meta; Ma et al., 2021), with PE/EE subsumed under PEOU moderator and SI de-emphasized for rural isolation (Dwivedi et al., 2019). This study adds TA (Social Cognitive Theory; Bandura, 1986), PT (trust models; Mayer et al., 1995), and PR (risk perception; Bauer, 1960) to capture psycho-socioeconomic challenges. FC and PT are drivers (enabling access/trust); TA and PR deterrents (psychological/security barriers; Hoque & Sorwar, 2017). This focused extension fills gaps in elderly DFS, providing actionable insights for China's rural inclusion. The Unified Theory of Acceptance and Use of Technology (UTAUT) is a model developed to explain technology acceptance by integrating elements from various acceptance models. It focuses on facilitating conditions (Venkatesh et al., 2003). Although UTAUT has advanced the understanding of technology acceptance, it has limitations. For example, the UTAUT was developed using Western data and may not fully apply to diverse cultural contexts (Blut et al., 2022). It may also not adequately consider the rapid evolution of technology (Akinuwa et al., 2022). Additionally, UTAUT tends to overlook individual differences, such as personality traits and technology anxiety, focusing more on social and organisational influences (Venkatesh et al., 2012). To address these

issues, the following variables were introduced in the proposed model, which provides the theoretical basis for this study's introduction of external variables. However, Meyta Dewi et al. (2021) rejected the hypothesis that trust and perceived risk significantly influences e-wallet adoption, arguing that its impact did not reach a level of significance in their integrated model. These studies suggest that although trust and perceived risk are frequently examined factors in technology adoption, their significance differs based on the context, user demographics, and the nature of the technology itself. It remains crucial to conduct more in-depth investigations of these factors, especially among elderly adopting digital finance.

In the context of China, Hua and Huang (2021) pointed out that the swift growth of digital finance was largely due to the laxity of regulatory authorities, leading to several undesirable consequences. This situation affects the trust and perceived risk of Chinese citizens in digital finance, thereby influencing their perceived risk when adopting DFS. Therefore, this study aimed to understand how these factors collectively influence the behaviour of the elderly in adopting DFS, which can help alleviate the issue of the limited proportion of elderly adopting DFS.

To address this, our integrated model draws on Social Cognitive Theory (SCT) (Bandura, 1986) for technology anxiety (TA) as a self-efficacy barrier, and Trust Theory (Mayer et al., 1995) for perceived trust (PT) and perceived risk (PR) as relational safeguards, extending UTAUT's facilitating conditions (FC) to capture elderly-specific psycho-socioeconomic dynamics in China's rural-urban divide (Dwivedi et al., 2019). This novel synthesis resolves prior contradictions in PT's role, e.g., direct vs. mediated effects, by positioning PT as a driver of intention amid risk aversion, yielding incremental advancements toward an elderly-centric adoption

framework. Hence, enhancing the reach and availability of financial services is imperative for advancing digital finance, and augmenting the adoption of DFS among vulnerable populations is crucial for fully harnessing the benefits offered by digital finance. Wang and Mao (2023) contributed to this discussion, illustrating that DFS have fostered financial exclusion among the elderly (individuals aged 65 and over). They suggested that while the digital age has brought numerous benefits, it has also introduced new challenges, especially for the elderly.

Based on the problem statement discussed, the research questions are as follows.

### **1.3 Research Questions**

RQ1: What are the drivers and deterrents influencing the usage behaviour of elderly people to adopt digital financial services in China?

RQ2: What is the impact of behavioural intention on the usage behaviour of digital financial services among elderly people?

RQ3: What are the drivers and deterrents influencing the behavioural intention of digital financial services among elderly people?

RQ4: Does behavioural intention mediate the relationships between facilitating conditions, technology anxiety, perceived risk, perceived trust, and the usage behaviour of digital financial services among elderly people?

RQ5: Does perceived ease of use moderate the relationship between facilitating conditions, technology anxiety, perceived risk, perceived trust, and the usage behaviour of digital financial services among elderly people?

### **1.4 Research Objectives**

RO1: To examine the drivers and deterrents influencing the usage behaviour of elderly people to adopt digital financial services in China.

RO2: To determine the impact of behavioural intention on the usage behaviour of digital financial services among elderly people.

RO3: To examine the drivers and deterrents influencing the behavioural intention of digital financial services among elderly people.

RO4: To examine the mediating role of behavioural intention on the relationships between facilitating conditions, technology anxiety, perceived risk, perceived trust, and the usage behaviour of digital financial services among elderly people.

RO5: To examine the moderating role of perceived ease of use on the relationship between facilitating conditions, technology anxiety, perceived risk, perceived trust, and the usage behaviour of digital financial services among elderly people.

## **1.5 Research Significance**

### **1.5.1 Theoretical Significance**

First, this study expands upon existing adoption models by introducing Facilitating Conditions (FC), Technological Anxiety (TA), Perceived Trust (PT), and Perceived Risk (PR) as key factors. By resolving PT contradictions through SCT-Trust-UTAUT integration (e.g., mediated PT in risk-averse elderly vs. direct in youth; Tian et al., 2023 vs. Gefen et al., 2003), this yields novel advancements: a context-specific framework critiquing institutional constraints (e.g., rural data silos) and cultural norms (e.g., collectivist trust proxies), fostering innovative elderly-DFS theory beyond incremental UTAUT tweaks (Dwivedi et al., 2019; OECD, 2023). Second, this study intends to explore the role of PEOU as moderating variable in technology adoption behaviour of the elderly. This effort could shed light on how these factors influence adoption behaviour.

Third, this study holds significant theoretical importance by specifically focusing on the elderly population within China's unique socioeconomic framework, especially in the post-pandemic era. While most existing research targets general or younger demographic groups, this study provides invaluable insights into the elderly's unique needs and attitudes, fostering age-specific models for technology adoption. The elderly demographic in China is crucial for social stability (through intergenerational support and cultural values) and economic development (influencing public expenditure and generating new opportunities in eldercare; OECD, 2023). Critically, the post-pandemic context further amplifies this significance, as the global health crisis not only accelerated digital transformation, making DFS indispensable, but also intensified existing technology anxieties and trust issues among older adults while simultaneously creating new pressures and incentives for DFS adoption. Theoretically, this presents a unique opportunity to understand how such a major external shock influences technology adoption dynamics within a vulnerable population, potentially revealing new relationships or altering the strength of existing ones compared to pre-pandemic models. This context allows for a nuanced examination of adaptation strategies and resilience in technology engagement among older adults. Practical Significance

This study contributes to the literature by exploring the barriers and factors that influence the adoption of DFS among the elderly. This, in turn, facilitates the creation of targeted measures to bridge the digital divide and enhance financial inclusiveness among the elderly population. Despite being a significant portion of the demographic, the elderly population is often excluded from accessing and utilising DFS. Addressing their financial needs can help them effectively manage their finances and improve their overall financial well-being.

For the government, the results of this study will provide policymakers and regulators with a deeper insight into how to develop appropriate policies and regulations to facilitate the adoption behaviour of DFS among the elderly. For instance, integrating cultural collectivism (e.g., family-mediated onboarding) and infrastructural fixes (e.g., subsidized rural 5G for connectivity) into policies can operationalize findings, like TA reduction via community workshops, directly tackling China's rural aging challenges (CNNIC, 2022; OECD, 2023).

Financial service providers can benefit from the insights generated by this study to gain a deeper understanding of the needs of the elderly regarding DFS. This understanding can guide the design of user-friendly interfaces, customised features, and tailored communication strategies to cater to the unique requirements of older users. Through detailed implementation guides, such as phased rollout of voice-assisted apps with Mandarin dialects for low-literacy seniors, providers can translate trust-building (e.g., blockchain transparency demos) into scalable interventions, enhancing elderly retention amid security fears (Hua & Huang, 2021).

For the economy, this study delves into the impact of digital finance in alleviating the adverse outcomes associated with aging, such as household financial vulnerability. More specifically, by critiquing institutional constraints (e.g., regulatory silos hindering cross-province data sharing) and cultural norms (e.g., filial piety as a trust proxy), recommendations include hybrid DFS models blending digital with village-level agents, fostering resilient income streams and reducing vulnerability in aging households (Fan & Dai, 2022). That empower aging households to better manage financial risks, optimize asset allocation, and generate stable property income. This directly translates into enhanced financial resilience, reduced reliance on informal or

risky financial channels, and increased participation in the formal economy, thereby mitigating the broader economic challenges posed by an aging society (Ahmad et al., 2021). This study offers valuable insights into the potential advantages of DFS for the elderly. Understanding how digital finance can bolster the capacity of aging households to manage financial risks and household income can inform strategies aimed at diminishing financial vulnerability and fostering financial resilience within this demographic segment.

### **1.6 Scope of Study**

This study seeks to explore the drivers and deterrents influencing the adoption behaviour of DFS among elderly individuals aged 65 and above in Zhengzhou, the capital city of Henan Province, China, using Alipay and WeChat Pay platforms as the focus. First, the usage data of Alipay hold representative significance in the field of digital finance research in China. The Institute of Digital Finance at Peking University has utilised Alipay-related data to establish development indicators for digital financial inclusion in China, including the depth of digital finance usage, breadth of digital finance coverage, and technological support (Yu et al., 2022). These indicators have been extensively validated in numerous studies in China. Therefore, this study uses Alipay and WeChat Pay to explore the adoption behaviour of the elderly toward DFS.

Second, as mentioned above, this demographic group often faces unique challenges and barriers in accessing and adopting DFS. By studying this specific age group, this study can gain insights into their needs, preferences, and concerns regarding digital finance. According to the OECD, “The elderly population is defined as people aged 65 and over. Therefore, this study was limited to individuals aged  $\geq 65$  years.

Third, the selection of the research site and scope helped to obtain accurate research conclusions and more appropriately reflect the current situation of a specific area. According to the National Bureau of Statistics of China (NBSPRC, 2025), China's population has reached 1408,280,000 by 2024. Such a large population reduces the ability of the data to respond to the actual conditions. By narrowing the research scope to a specific region, researchers can delve deeper into local issues, challenges and opportunities.

Therefore, this study chose Zhengzhou in Henan Province as the study site. Henan's rural-urban divide and accelerated aging (17.36% elderly in rural vs. urban; Zheng et al., 2023) provide a robust scope for testing the model's generalizability, with PLS-SEM's flexibility accommodating non-normal data from diverse subsamples (e.g., migrant-isolated rural elderly). According to the National Bureau of Statistics of China (2025), the population of Henan Province aged 65 years or older accounted for 15% of the total population of 14.65 million by the end of 2024. Compared with the census results 10 years ago, according to the National Bureau of Statistics of the People's Republic of China, the proportion of the population above 65 years of age in Henan increased by 5.63% (NBSPRC, 2021). Henan is a large agricultural province in China. The stark disparity between urban and rural areas in Henan adds to its suitability of selecting Zhengzhou as a research site. Conducting the survey in Zhengzhou, Henan increased the diversity of the respondents. The results of the study will help to address the specific needs of the elderly in urban and rural areas.

The data for this study were primarily collected using a self-administered survey questionnaire distributed face-to-face to ensure high response rates and address potential digital literacy barriers among the elderly. Simple random sampling was

employed to select participants aged 65 and above residing in nursing homes, community care centers, and day-care centers across Zhengzhou, Henan Province. This approach facilitated the inclusion of a diverse group of elderly individuals, encompassing various levels of digital exposure and living environments within the province. Further details on the sampling frame, sample size determination, and data collection procedures are provided in Chapter 3 (Research Methodology).

## **1.7 Definition of Key Terms**

This section provides definitions of the key terms used in this study.

### **1.7.1 Digital Finance**

This concept refers to the use of digital technologies, including mobile devices, cloud computing, and data analytics, to provide financial services. These services range from mobile banking, digital payments, and online lending to insurance, wealth management, and digital currency (Manyika et al., 2016).

### **1.7.2 Facilitating Conditions**

While facilitating conditions can encompass various forms of support, this study primarily adopts the definition by Venkatesh et al. (2003), referring to the extent to which an individual perceives that there is both organisational and technical support to aid the use of the system. In simpler terms, it is about whether users believe that the necessary resources (such as technical support, training, and accessible infrastructure) and a conducive environment are available to help them use the technology effectively. This definition is particularly relevant for the elderly, as external support often plays a critical role in overcoming their digital literacy gaps and initial adoption barriers.

### **1.7.3 Perceived Risk**

Perceived risk is a multifaceted concept, often defined as a combination of uncertainty and potential adverse outcomes (Bauer, 1960). In this study, this study adopt Pavlou's (2014) definition, which refers to an individual's perception of uncertainty and the potential adverse consequences of making a wrong decision when using a system or technology. This definition is chosen for its focus on decision-making in a digital context, directly addressing the elderly's heightened concerns regarding financial loss, data privacy, and security in DFS adoption.

### **1.7.4 Perceived Trust**

Perceived trust has been extensively theorized across various disciplines, ranging from dispositional trust to institution-based trust (e.g., Rousseau et al., 1998; McKnight et al., 2002). For the purpose of this study, this study adopt the definition by Mayer et al. (1995), which refers to a party's readiness to expose itself to the potential actions of another party, stemming from the anticipation that the latter will execute a specific action that is significant to the trustor. This occurs regardless of the trustor's ability to oversee or regulate the actions of the other party. This definition is selected as it broadly captures the willingness of elderly individuals to engage with DFS despite inherent uncertainties, aligning well with the psychological underpinnings of technology adoption and their reliance on a belief in the service provider's integrity.s

### **1.7.5 Behavioural Intention**

Building on the extensive literature from the Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (TPB), behavioural intention is consistently recognized as a key predictor of actual behaviour. This study adopts Fishbein and Ajzen's (1975) definition, which refers to an individual's perceived probability or subjective

expectation of engaging in a specific behaviour. It serves as a pivotal element in many models that analyze individual behaviours, including technology adoption, particularly relevant for understanding the deliberate decision-making process of the elderly before using DFS.

#### **1.7.6 Usage Behaviour**

Usage behaviour, sometimes termed ‘actual use’, describes the observable actions of individuals interacting with a technology or service. This study defines usage behaviour in alignment with Venkatesh et al. (2003), referring to the patterns of interaction between individuals and technologies or services. It includes factors such as frequency, duration, and context of use. This concept is vital for understanding consumer preferences and improving user experience among elderly DFS users, as analyzing their actual engagement helps tailor products and services to better meet their specific needs, thereby enhancing financial inclusion.

#### **1.7.7 Technology Anxiety**

While technology anxiety, or 'technostress,' can manifest in various forms (e.g., anxiety about learning, using, or breaking technology), this study adopts Kaushik and Mishra's (2019) definition. Technology anxiety is a detrimental affective reaction that concerns individuals' apprehension or unease regarding the utilization of technology. This definition is chosen for its focus on the emotional barrier to technology use, which is particularly salient for elderly individuals adopting complex digital financial services, where fear of error or system malfunction can significantly deter engagement.

#### **1.7.8 Perceived Ease of Use (PEOU)**

Perceived Ease of Use (PEOU) is a fundamental construct in technology acceptance models, often contrasted with Perceived Usefulness. This study adopts the widely cited

definition by Davis (1989) and Venkatesh et al. (2003), referring to the degree to which an individual believes that using a particular system is free of effort. In simpler terms, it denotes the extent to which users perceive a technology or service as easy to understand, learn, and operate, requiring minimal mental or physical exertion. For elderly individuals, a high PEOU is crucial as it directly reduces cognitive load and frustration, thereby influencing their willingness to engage with and sustain the use of Digital Financial Services (DFS).

## **1.8 Summary of the Chapter**

This chapter outlines the full picture of the investigation, commencing with the study context, identifying the problem, posing questions, defining objectives, forming hypotheses, illustrating the significance, delineating the scope, and finally defining operational terms. This comprehensive account is designed to aid in understanding the full range of this study and its details. The outcomes of this study are anticipated to have a significant impact on understanding the barriers and facilitators for the elderly to adopt DFS, thereby supporting the development of strategies to improve financial accessibility in this population. The findings are also expected to contribute to academic discourse and provide insights for policymakers, financial service providers, and educators involved in digital literacy programs both formally and informally.

## **1.9 Organisation of the Thesis**

This study is structured into five chapters. Chapter 1 presents the introduction, statement of the problem, research questions, research objectives, scope, and significance of the study, as well as the definition of terms. Chapter 2 emphasises pertinent scholarly literature to develop a comprehensive understanding of the study's central theme: the adoption of digital finance, particularly among the elderly. This

chapter lays a solid foundation for the conceptual underpinnings of this research by examining the intersection of technology and finance from both theoretical and empirical perspectives.

Chapter 3 discusses the research methodology used in this study. Furthermore, the chapter encompasses the operationalisation of variables and instrument measurement, research design, research population, sample size, sampling method, and data collection strategies and instruments used. In conclusion, the reliability testing of the pilot study was also documented.

Chapter 4 presents a statistical analysis of the data collected through examination, screening, and preparation. Next, the measurement and structural models were analysed and reported using SEM with the help of SmartPLS 4.1. Therefore, the hypotheses' results are reported in accordance with the evaluation of the structural model. Chapter 5 delves into the research findings in accordance with the research objectives and hypotheses of this study. This chapter also discusses the theoretical and practical implications and contributions of the study's findings. This chapter elucidates the research limitations and proposes potential future research directions. Finally, the conclusions of this study are presented.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter explores and critiques the relevant scholarly literature to create a thorough understanding of the study's thematic focus: the adoption of digital finance, particularly among the elderly population. By studying the intersection of technology and finance from theoretical and empirical perspectives, this chapter aims to establish a strong foundation for the conceptual framework of this study, explicitly highlighting existing theoretical and empirical gaps that necessitate the current research. These gaps include the limited application of technology acceptance models to elderly populations, the under-exploration of psychological barriers like technology anxiety (TA) and perceived risk (PR), and the lack of context-specific studies in China's unique digital finance landscape (Blut et al., 2022; Chen et al., 2025). To address these gaps, this thesis uniquely contributes by extending the UTAUT model with TA, Perceived Trust (PT), and PR, specifically tailored to elderly users in China, where cultural and regulatory factors amplify emotional barriers and trust issues (Dwivedi et al., 2019; Klaver et al., 2021). This integration not only fills empirical voids in elderly-focused DFS adoption but also advances theoretical debates on emotional moderators in rational choice models (Ajzen, 1991; Shalender & Sharma, 2021).

#### **2.2 Theoretical Foundations**

##### **2.2.1 Theory of Reasoned Action**

In 1975, Fishbein and Ajzen proposed the Theory of Reasoned Action (TRA) to interpret and forecast the decision-making process of human behaviour (Fishbein & Ajzen, 1975). They stated that behaviour is driven by intentions. The TRA posits that behavioural intention is a cognitive activity that reflects an individual's willingness

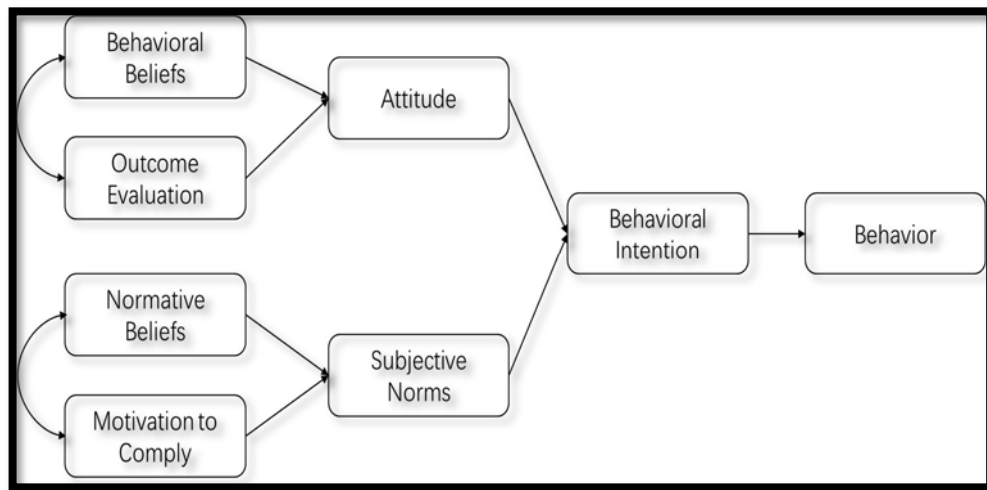
and conscious plan to engage in a specific behaviour and serves as the most powerful predictor of behaviour. Intention is influenced by personal factors reflected in "Attitude Toward the Behaviour (AT)" and social influence (SI) factors reflected in "Subjective Norms (SN)". TRA assumes that the more favourable one's attitude toward a specific behaviour and the greater the social pressure experienced surrounding that behaviour, the higher the willingness to adopt that behaviour. An individual's attitude toward a behaviour depends on salient beliefs about the consequences of that behaviour and their evaluations of expected outcomes (Ajzen, 1980).

Taylor and Todd (1995) defined attitude as one's positive or negative sentiments regarding engaging in goal-directed behaviour. Beliefs are identified as one's subjective probability of achieving a given outcome by performing a given behaviour. SN is the social pressure individuals perceive when they engage in a specific behaviour. In other words, SN is the pressure individuals perceive from significant others or groups they consider important regarding whether they should engage in a specific behaviour. In conclusion, the TRA suggests that any other factor indirectly influences behaviour through its impact on attitude, subjective norms, or the related weights of these factors. These additional factors may include user characteristics, system design, and task-related characteristics.

Since its introduction, the TRA has received considerable attention, with numerous researchers applying it in various fields for related studies. Shimp and Kavas (1984) used the TRA in their research on coupon usage and constructed a model based on it. The results showed that attitudes towards behaviour and subjective norms play a vital role in customers' intention to use coupons, with behavioural intention, in turn, determining usage behaviour. Pelka et al. (2010) applied the TRA in an empirical study

on Instant Messaging (IM) tools, finding that attitudes toward behaviour and subjective norms were significantly and positively related to behavioural intention when using IM tools. Pham Thi and Duong (2022) extended TRA to knowledge-sharing on social networks, revealing that attitudes and norms strongly predict intentions, but external barriers like digital literacy gaps, prevalent among the elderly, moderate these effects, highlighting TRA's limitations in non-volitional contexts (Pham Thi & Duong, 2022). Kim et al. (2020) carried out a comparative study to examine the elements influencing the readiness of audiences in the United States and South Korea to share online news based on TRA.

However, TRA's assumption of volitional control limits its applicability to contexts where external barriers, such as limited digital literacy or infrastructure, constrain behaviour (Ajzen, 1991). For elderly individuals adopting DFS, factors like technology anxiety (TA) and lack of technical support diminish volitional control, highlighting a critical theoretical gap (Chen et al., 2025). TRA's focus on rational decision-making overlooks emotional factors like fear or trust, which are particularly salient for older adults in financial contexts (Mayer et al., 1995). This study addresses this gap by integrating psychological constructs into a more comprehensive model. This oversight creates inconsistencies in prior studies; for instance, while TRA effectively predicts voluntary behaviours like news-sharing (Kim et al., 2020), it underperforms in high-stakes domains like DFS where emotional deterrents dominate (Shalender & Sharma, 2021).



**Figure 2.1**

*Theory of Reasoned Action*

Source: Fishbein and Ajzen, 1975

### 2.2.2 Theory of Planned Behaviour

In 1985, Ajzen introduced the Theory of Planned Behaviour (TPB), an extension of the TRA, aimed at increasing the ability to interpret and forecast individuals' actual behaviour (Ajzen, 1985). This theory builds on the foundation of the TRA, addressing its two fundamental limitations. First, the TRA primarily focuses on behavioural intentions as a predictor of actual behaviour, potentially overlooking other influential factors. Second, TRA operates on the assumption that behaviours are entirely voluntary and under individuals' control, neglecting the fact that, in some cases, individuals do not act entirely of their own volition.

Based on these considerations, Ajzen proposed the TPB, which is similar to the TRA, and posited that behavioural intentions directly influence behaviour, which is shaped by an individual's attitudes and subjective norms (Ajzen, 1985). In addition, the TPB introduces an additional factor, perceived behavioural control (PBC). PBC pertains to individuals' perception of the simplicity or complexity of performing a particular behaviour. It shows individuals' beliefs about their degree of control when performing a specific behaviour. This construct is primarily influenced by the total set of

accessible control beliefs, which signifies the perceived existence of factors that might either facilitate or hinder the execution of the behaviour. For instance, if individuals believe that they possess the essential skills, resources, and opportunities to engage in a particular behaviour, their perceived behavioural control will be elevated. However, if they believe that there are many obstacles or impediments to carrying out the behaviour, their perceived behavioural control will be low.

A more robust perception of behavioural control can intensify individuals' willingness to carry out a specific behaviour, making it more likely that they will engage in the behaviour (Ajzen, 1985). According to the TPB, behaviour is shaped by behavioural intention and PBC, where behavioural intention is influenced by AT, SN, and PBC. Compared to the TRA, the TPB offers more substantial predictive and explanatory power when analysing user technology adoption behaviour.

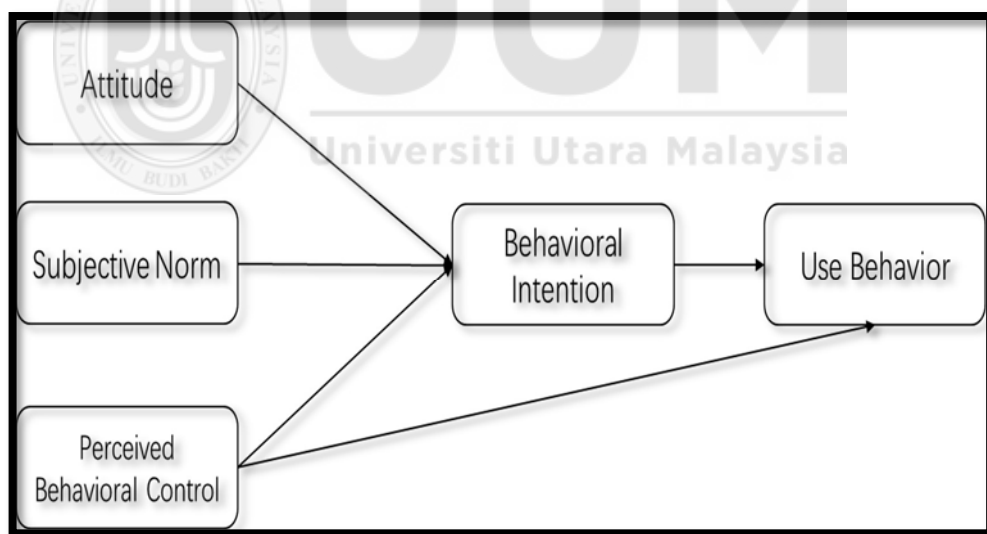
Pavlou (2002) employed the TPB to explore online transaction behavioural intentions in China and the United States. Their research revealed that cultural differences significantly influence consumers' e-commerce adoption behaviour. Abbasi et al. (2021) used TPB to examine the impact of various antecedents on the intention to travel to Australia. They validated that subjective norms and perceived behavioural control significantly influenced behavioural intention. Becker-Leifhold (2018) analysed the factors impacting consumers' inclination to engage in collaborative fashion consumption based on the TPB. Their findings revealed that attitudes, subjective norms, and perceived behavioural control influence consumers' behavioural intention to embrace collaborative fashion consumption. Hossain et al. (2021) compared the ability of TPB and HBM to explain the drivers of the COVID-19 vaccine uptake among adults in Bangladesh. This study involved a sample of 1,497 participants

from Bangladesh and used multiple linear regression to analyse the results. They determined that the TPB holds the strongest power in explaining vaccination decision-making and hesitancy. Notably, TPB constructs, including negative attitudes towards the COVID-19 vaccine and perceived behavioural control, were identified as significant contributors to increased vaccine hesitancy.

While TPB has been widely applied, it is not without its limitations, some of which were recognised by Ajzen in 1991 (Ajzen, 1991). First, the TPB operates on the premise that human behaviour is rational and self-interested. This highlights that the theory assumes that individuals consciously evaluate all available information, make decisions that will yield maximum benefits and minimum costs to themselves, and then act on these decisions. However, this notion oversimplifies human behaviour. In reality, human actions are not always dictated by rationality or self-interest alone. Emotional responses, ingrained habits, and the influence of social norms can often steer an individual's actions, bypassing a calculated cost-benefit analysis.

Consequently, these behaviours, driven by non-rational or non-self-interested motives, can be challenging to anticipate using the rational choice model that underpins the TPB. Second, the TPB focuses primarily on three key predictors of behaviour: AT, SN, and PBC. While these factors are undeniably important, the theory may need to adequately consider the potential influence of external variables. Factors beyond an individual's immediate control, such as environmental restrictions, broader societal influences, past experiences, or personal characteristics like gender, can considerably influence behaviour. Instead of explicitly accounting for these variables, the TPB might limit its own explanatory power and predictive accuracy (Shalender & Sharma, 2021). For elderly individuals adopting digital financial services (DFS), where factors such as

inherent technology anxiety, external risks, and the imperative for trusted systems play significant roles beyond conscious rational choice, the TPB's scope may be limited. For example, a strong perceived behavioural control might still be undermined by deep-seated anxieties or a lack of trust in the digital system itself, which are not core constructs in TPB (Hoque & Sorwar, 2017). This highlights a specific theoretical gap in capturing the nuanced influences of emotional and trust-based factors on elderly users' technology adoption. Critically, while TPB excels in volitional contexts like travel intentions (Abbasi et al., 2021), it shows inconsistencies in high-risk financial adoption, where emotional constructs like TA reduce PBC's efficacy, as evidenced by conflicting findings on vaccine hesitancy (Hossain et al., 2021) versus e-commerce (Pavlou, 2002). This study bridges this by incorporating psychological theories (e.g., Social Cognitive Theory) to explain TA's mechanisms.



**Figure 2.2**  
*Theory of Planned Behaviour*  
 Source: Ajzen, 1985

### 2.2.3 Technology Acceptance Model

The Technology Acceptance Model (TAM) originated from the TRA and was first proposed by Fred D. Davis from the University of Michigan in 1989 (Davis, 1989). It was initially designed to illustrate the drivers of the spread of computer acceptance.

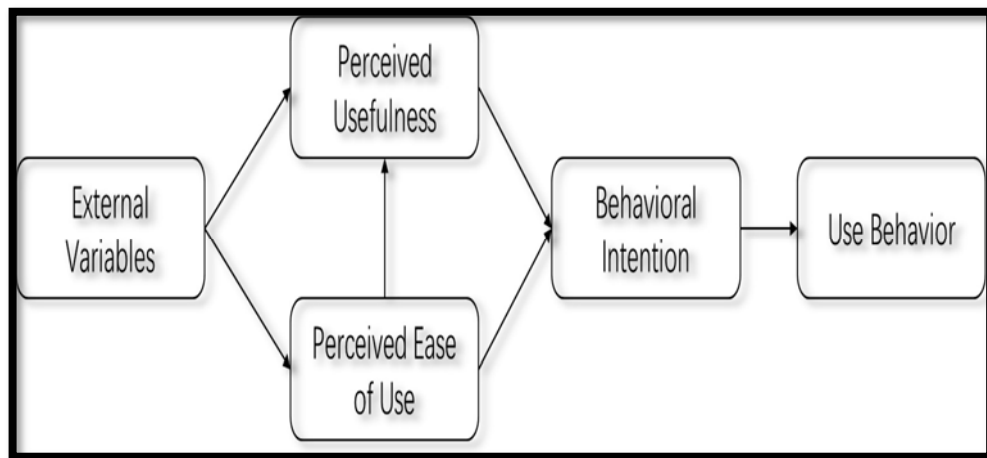
TAM has been widely applied to study users' acceptance of new technologies. Based on the study by Davis et al. (1989), TAM consists of four core constructs: perceived usefulness (PU), perceived ease of use (PEOU), attitude toward using (AT), and behavioural intention to use (BI). PU pertains to the subjective estimation of how much individuals believe that utilising a new system or technology will boost their work performance or increase their work efficiency. PEOU pertains to individuals' perceptions of the simplicity of using a particular system. Attitude toward use refers to individuals' positive or negative subjective attitudes toward new technologies and systems. BI refers to users' inclination to utilise a new technology or system and is an expression of subjective intention. These constructs, along with external variables and system usage, form the basic structure of TAM.

Several recent studies have extended and applied the TAM to examine the acceptance of digital technologies and financial services. For instance, Abu-Taieh et al. (2022) used TAM to understand users' initial trust in m-banking, uncovering critical insights into how individuals form their initial trust in this technology. Their findings showed that trust moderates PU's effect on BI, but the study overlooked elderly-specific barriers like TA, limiting generalizability (Abu-Taieh et al., 2022). Similarly, Gupta et al. (2023) employed TAM to identify the elements propelling customer adoption behaviour and the intention to recommend mobile payment technology to others. They substantiated the significant role of factors such as trust in shaping technology adoption behaviour. However, their focus on general users revealed inconsistencies with elderly cohorts, where PEOU dominates over PU due to cognitive declines (Ma et al., 2021). In 2020, Camilleri and Falzon (2020) utilised TAM to explore the factors influencing individuals' intent to use online streaming technologies during the COVID-19 period. From a southern European university, they gathered 491 validated

questionnaires and conducted data analysis using partial least squares structural equation modelling (PLS-SEM). By merging TAM with Uses and Gratifications Theory (UGT), their research offers comprehensive insights into user perceptions and motivations related to online streaming services during the COVID-19 era. Yet this integration exposed TAM's weakness in emotional contexts, as gratifications alone failed to address risk perceptions in financial apps (Camilleri & Falzon, 2020).

Despite its extensive use, many scholars have expressed scepticism regarding TAM. They argue that the model does not include any moderating variables and that external variables encapsulate all factors influencing beliefs. Agarwal and Prasad (1998) explicitly pointed out that TAM does not incorporate the impact of moderating variables. Davis et al. (1989) empirically showed that with the increase in experience level, Perceived Ease of Use ceases to be a significant influencing variable. Venkatesh and Morris (2000) found gender differences in technology adoption decisions, with Perceived Usefulness being more important to men, whereas women value Perceived Ease of Use more. Yang et al. (2021) contended that the overly simplified TAM model needs to be revised to explain users' acceptance of new technologies satisfactorily. TAM also overlooks control factors such as opportunities, threats, resources, and control power, which Ajzen (1985) believes can affect behavioural intentions. Although TAM considers external motivation, it does not adequately consider internal motivation. These limitations underscore the necessity of a more comprehensive model that can integrate a broader spectrum of influencing factors, including emotional responses and contextual elements, particularly for diverse user groups like the elderly navigating complex technologies such as DFS (Ma et al., 2021). Critically evaluating these, TAM's strengths lie in parsimony for utilitarian predictions (Davis, 1989), but weaknesses emerge in inconsistent findings on demographics, e.g., gender moderates

PEOU (Venkatesh & Morris, 2000), yet age-related gaps remain underexplored, justifying UTAUT extensions for elderly DFS (Blut et al., 2022).



**Figure 2.3**  
*Technology Acceptance Model*  
 Source: Davis, 1989

#### 2.2.4 Extended Technology Acceptance Model

Venkatesh and Davis (2000) proposed an extended version of the Technology Acceptance Model, known as TAM2, based on the original TAM's theoretical foundation. Unlike the original TAM, TAM2 omits attitude as a factor and introduces five new variables: subjective norms (SN), image, job relevance, output quality, and result demonstrability. These five variables affect perceived usefulness, with subjective norms directly influencing behavioural intentions. Experience and voluntariness were included as moderating variables in this study. Subjective norms, image, experience, and voluntariness are considered social influence variables, whereas job relevance, output quality, and result demonstrability are categorised as user-perceived utility variables. Subjective norms were taken from the TPB. Image is defined as the degree to which individuals' beliefs about carrying out a specific behaviour can elevate their personal image or status. Job relevance pertains to how well an individual perceives that information technology aligns with their job requirements. Output quality involves an individual's assessment of the completeness

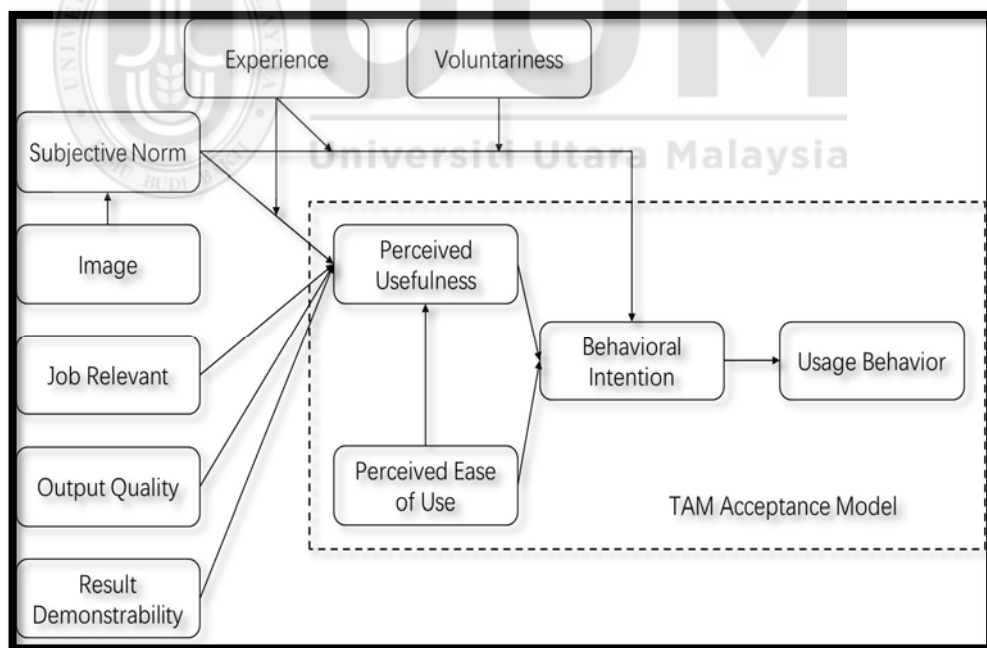
of the results generated by information technology. Finally, result demonstrability encapsulates the clarity or definiteness of the results that an individual obtains upon using the new technology, essentially gauging the readability of the technology's output information.

Venkatesh and Davis (2000) classified technology users into active and passive users. In the process of studying their technology acceptance behaviour using the TAM2 model, it was found that the impact of the four social influence variables (subjective norms, image, experience, and voluntariness) was not significant for active users. However, for passive users, the impact of social influence variables was strongest in the early stages of technology acceptance. As individuals spend more time using technology, gain more experience, and accumulate subjective control over their usage behaviour, the impact of social influence variables gradually decreases until it becomes insignificant.

However, it should be noted that while TAM2 addresses some limitations of the original TAM by introducing additional variables and more complexity, it also introduces its own set of limitations. These include the complexity of the model, which makes it more challenging to implement and interpret the results. It also relies heavily on the idea of perceived usefulness, which may not always be the most significant factor in technology adoption.

Furthermore, the model assumes that all individuals interpret and respond to these variables in the same manner, which may not always be true. Differences in cultural context, individual personality traits, and other factors can significantly influence technology acceptance behaviours, which are not considered in TAM2. Finally, TAM2's lack of emphasis on user characteristics, such as age, gender, and experience,

may limit its applicability across diverse user groups (Benbasat & Barki, 2007; Venkatesh et al., 2003). For the elderly, factors such as age-related cognitive decline, varying levels of prior technology exposure, and specific cultural values can lead to differential responses to technology. These individual-specific characteristics and contextual nuances underscore the necessity of an extended theoretical framework tailored to the unique attributes of older adults in specific adoption contexts, particularly when considering the heightened importance of emotional and trust-based factors in DFS adoption (Hoque & Sorwar, 2017). Strengths of TAM2 include enhanced explanatory power for social influences (Venkatesh & Davis, 2000), but inconsistencies arise in passive user groups like the elderly, where early-stage SN fades without addressing TA (Kim et al., 2023), prompting further extensions like UTAUT.



**Figure 2.4**  
*Extended Technology Acceptance Model*  
 Source: Venkatesh and Davis, 2000

### **2.2.5 Unified Theory of Acceptance and Use of Technology**

Venkatesh et al. (2003) pointed out that many technology acceptance theory models are essentially the same in nature, differing only slightly in their expressions and descriptions. Furthermore, owing to the varying perspectives and research methods of different researchers, no single model can encompass all the appropriate influencing factors. Therefore, based on a comprehensive summary of past research on TAM, Venkatesh et al. (2003) proposed an integrated technology acceptance theory model called the Unified Theory of Acceptance and Use of Technology (UTAUT). The adopted and integrated technology acceptance models include the Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Planned Behaviour (TPB), Combined TAM and TPB (C-TAM-TPB), Model of Personal Computer Utilisation (MPCU), Innovation Diffusion Theory (IDT), and Social Cognitive Theory (SCT). Venkatesh et al. (2003) found that the capacity of these eight technology acceptance models to predict BI ranged from 17% to 53%. However, the UTAUT model's explanatory power for BI could reach up to 70%, which is clearly superior to the eight technology acceptance models.

The UTAUT model aims to reveal users' intentions and subsequent usage behaviours regarding information systems. It identifies four key factors that directly influence behavioural intention and usage behaviour: performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC). The UTAUT also highlights the significance of moderating variables such as gender, age, experience, and voluntary use on the relationships between the four key factors and intention and behaviour. The findings indicate that the combined effect of two or more control variables enhances their impact (Venkatesh et al., 2003).

The UTAUT has been broadly utilised in various research fields. Sitar-Tăut (2021) examined mobile learning acceptance and concluded that PE, EE, SI, and FC significantly influenced acceptance. Li and Zhao (2021) studied students' acceptance of MOOCs in China, using the UTAUT model and incorporating gender, age, and type of device as moderating variables. Abu-Taieh et al. (2022) employed the UTAUT model to examine consumers' adoption behaviour of mobile banking, finding that PE, EE, and SI are positively associated with BI. Ming et al. (2021) used UTAUT to examine the adoption of mobile libraries and found positive influences of PE, perceived enjoyment, FC, and SI. Alnoor et al. (2022) compared UTAUT and TAM from a nonlinear perspective and found that UTAUT demonstrated a 26% higher explanatory power than TAM.

Specifically, the extended UTAUT model outperformed the TAM models among mobile Internet users. This superiority was even more pronounced when nonlinear relationships were considered as opposed to the conventional linear approach. These studies underscore the advantages of employing the UTAUT model to investigate technology adoption behaviour, particularly in the realm of Internet technology. However, they emphasise the significance of introducing new external variables in specific scenarios to deepen our understanding of a given phenomenon. Yet, debates persist on UTAUT's robustness; Blut et al. (2022) meta-analysis critiques its overemphasis on linear paths, revealing gaps in emotional constructs for vulnerable groups like the elderly, where TA disrupts SI's effects (Hoque & Sorwar, 2017). This justifies our extensions for DFS contexts.

### **2.2.6 Extension of UTAUT for Elderly DFS Adoption**

While the UTAUT model (Venkatesh et al., 2003) provides a robust foundation for understanding technology adoption, its comprehensive application, especially within specific and vulnerable demographic contexts like the elderly, often benefits from strategic extensions. To maintain parsimony and focus on elderly-specific vulnerabilities, this study selectively integrates only Facilitating Conditions (FC) from UTAUT as a core antecedent, as meta-analyses show other constructs like Performance Expectancy (PE), Effort Expectancy (EE), and Social Influence (SI) underperform in emotional/risk-heavy contexts (Blut et al., 2022; Ma et al., 2021). PE and EE overlap with the moderator Perceived Ease of Use (PEOU), while SI is less salient for isolated rural elderly (Dwivedi et al., 2019). FC is prioritized for its relevance to infrastructural support in DFS (Alalwan et al., 2018). This study builds upon the core tenets of UTAUT by further integrating Perceived Trust (PT), Perceived Risk (PR), and Technology Anxiety (TA) as additional direct antecedents of behavioural intention, and Perceived Ease of Use (PEOU) as a crucial moderating variable. FC and PT are categorized as drivers (enabling access and fostering trust), while TA and PR as deterrents (psychological and security barriers), grounded in complementary theories (Bandura, 1986; Mayer et al., 1995; Bauer, 1960; Hoque & Sorwar, 2017). This extended framework is necessitated by several factors:

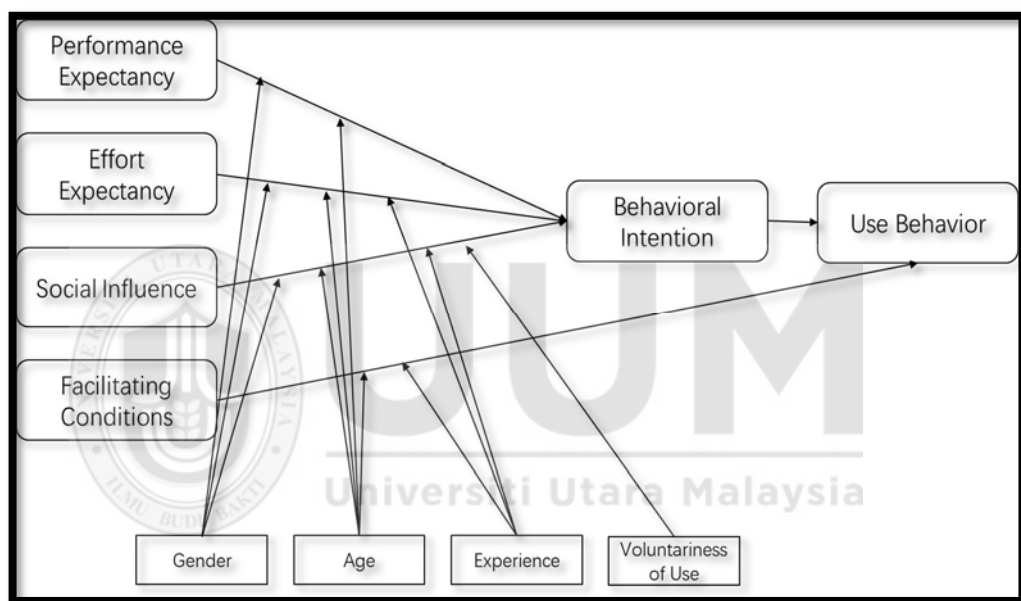
Firstly, the context of Digital Financial Services (DFS) inherently involves financial transactions, where concerns about security, privacy, and potential losses are paramount. Therefore, incorporating Perceived Trust (e.g., Mayer et al., 1995; Kim et al., 2009) and Perceived Risk (e.g., Bauer, 1960; Cox, 1967) is essential to capture the unique psychological landscape of elderly users, who are often more vulnerable to scams and less familiar with digital safeguards (Klaver et al., 2021; Chen et al., 2025).

These constructs are rooted in consumer psychology and risk perception theories, offering a deeper understanding of decision-making beyond purely utilitarian aspects and directly influencing an individual's willingness to engage with financial technology (Pavlou, 2014). This integration addresses a key empirical gap where trust and risk are often underrepresented in general technology adoption models but are critical for financial contexts (Alalwan et al., 2018).

Secondly, Technology Anxiety (TA) is a well-documented barrier to technology adoption, particularly among older adults (Kim et al., 2023; Nam et al., 2022). Its inclusion, grounded in Social Cognitive Theory (Bandura, 1986), allows this study to explicitly address the emotional and cognitive discomfort that can deter the elderly from engaging with DFS. High levels of TA can directly suppress behavioural intention even when other conditions are favorable, representing a crucial psychological factor often underemphasized in broad technology acceptance models (Hoque & Sorwar, 2017). Mechanistically, TA erodes self-efficacy (Bandura, 1986), creating a feedback loop where anxiety heightens perceived effort (EE in UTAUT), drawing from psychological theories of avoidance behaviour (Mick & Fournier, 1998).

Lastly, while Effort Expectancy (EE) in UTAUT covers similar ground as PEOU, the explicit inclusion of PEOU as a moderator allows for a more nuanced examination of how the perceived simplicity and user-friendliness of DFS interact with other influencing factors. For elderly individuals, who may have varied prior digital exposures and face physiological challenges (Dermody et al., 2021), the level of PEOU significantly alters how they perceive and respond to facilitating conditions, anxiety, risk, and trust (Chou & Tang, 2020; Fang et al., 2024). This extension aligns with calls in the literature to adapt technology acceptance models to specific contexts and user

characteristics (Dwivedi et al., 2019), thereby offering a more granular and comprehensive understanding of DFS adoption among the elderly in China. This strategic extension serves to address both theoretical and empirical gaps by tailoring the model to the specific vulnerabilities and behavioural drivers pertinent to older adults. By integrating these, this study resolves UTAUT's gaps in emotional-risk dynamics, contributing uniquely through China-specific empirical tests that reveal how PT buffers PR's negative effects on BI (Chen et al., 2023).



**Figure 2.5**  
*Unified Theory of Acceptance and Use of Technology*  
 Source: Venkatesh et al., 2003

## 2.3 Digital Finance

### 2.3.1 Introduction

In collaboration with the Social Sciences Academic Press, the Central University of Finance and Economics China Internet Economy Research Institute released the “Annual Report on China’s Digital Finance Innovation and Development” in 2021 (Ouyang et al., 2021). Digital finance, as articulated in the report, is a concept in which licenced financial institutions utilize digital tools to create an integrated ecosystem,

leveraging data synergies to deliver customized and intelligent financial services to customers. From this perspective, the meanings of digital finance and digital financial services (DFS) are equivalent. Currently, DFS mainly includes digital currency, digital payments, Internet loans, digital credit, digital securities, digital insurance, and digital wealth management.

Digital finance offers multiple advantages to various stakeholders, including users of digital financial products, governments, financial service providers, and the overall economy. First, digital finance provides notable benefits to the government. Deng (2023) indicated that digital finance enhances the sensitivity of interest rates to the interbank market, thereby amplifying the effectiveness of the government's price-based monetary policy. Furthermore, Feng and Zhang (2021) revealed that the advancement of digital finance in China notably enhances household consumption. This increased consumption, facilitated by digital finance platforms, subsequently boosted the government's tax revenue. These findings underscore the advantages of digital finance for governments, as it strengthens the effectiveness of monetary policy, promotes economic activity through increased consumption, and generates additional tax revenue to support government initiatives and services.

Second, digital finance plays a pivotal role in nurturing economic growth and stability in developing countries. According to Shofawati (2019), digital finance boosts economic expansion by offering a broader selection of financial products and services to satisfy individuals' diverse needs. Zhang et al. (2022) highlighted that the progression of digital finance notably augments consumer spending and benefits economic growth. Ahmad et al. (2021) quantified the full impact of digital finance and showed that the development of digital financial inclusion is estimated to benefit

billions of people by improving their economic prospects, reviving small businesses hampered by inaccessible credit, and increasing the GDP of middle-income countries by 5%.

Third, financial service providers benefit from digital finance in several ways. Zuo et al. (2023) found that digital finance contributes to improved bank performance. Moreover, Wang et al. (2021) revealed that digital finance can expand the size of bank deposits and loans, thereby enhancing banks' potential to withstand risks. According to Hornuf et al. (2021), digital finance opens avenues for collaboration between financial service providers and Fintech startups. Such partnerships integrate traditional financial expertise with technological innovation, thereby utilising their strengths.

Fourth, digital finance is beneficial to users of financial services. According to Xie and Zhu (2021), the adoption of digital finance by SMEs has a positive effect on profitability. By utilising digital finance, SMEs can enhance their sales revenue and reduce overhead costs, thereby improving their overall financial performance. Digital finance alleviates SMEs' credit constraints by reducing borrowing costs and increasing access to financial resources.

Finally, digital finance offers significant benefits for individuals, particularly those who rely on informal financial services. Research conducted by Zhang et al. (2021) reveal that a considerable number of groups in China resort to informal financial services, such as loan sharks and private online lending platforms, which entail significant transaction risks. Digital finance provides an opportunity for these individuals to transition from informal financial services to formal financial systems, enabling secure transactions on digital platforms. Xu et al. (2022) demonstrated that utilising digital finance not only helps alleviate credit constraints and enhance

information accessibility for farmers but also fosters social trust through a unique mechanism. This, in turn, promotes entrepreneurial activities among farmers and improves their overall entrepreneurial performance. Furthermore, the advent of digital finance has transformed the distribution of financial products and services, effectively narrowing the divide between financial product providers and their target customers. It has enabled more straightforward contact with financial services at a reduced financial cost, particularly for individuals and groups previously excluded from the formal financial system. The widespread use of digital finance enhances the accessibility of financial resources, with existing customers increasingly utilising innovative offerings, such as mobile banking, as alternatives to conventional banking methods (Kumari & Devi, 2022). Digital finance also promotes financial inclusion by enabling vulnerable groups to access and re-engage with formal financial systems. However, empirical inconsistencies exist; while Ahmad et al. (2021) praise GDP boosts, Zhang et al. (2021) note risks in informal transitions, underscoring gaps in elderly-specific inclusion (Caplan et al., 2021).

### **2.3.2 Categories of Digital Finance**

Digital finance, with its myriad forms and applications, can be categorised in several ways based on the specific financial service industries it encompasses. According to Hrytsai (2022), digital finance can be divided into four main categories.

**Digital Payments:** This encompasses various transaction methods, such as online payments, mobile wallets, and contactless payments. These systems facilitate quick and secure transactions, thereby improving user convenience and security.

**Digital Financing:** This pertains to digitally delivered financial services. Examples include small microloans, peer-to-peer (P2P) loans, and crowdfunding platforms.

These services often leverage big data analytics for credit scoring and risk assessment, thereby enabling a more efficient and inclusive lending process.

**Digital Investments:** This category involves digital platforms that allow users to invest in various financial instruments, including stocks, bonds, and mutual funds. These platforms have democratised access to investment opportunities and made investing more transparent and user-friendly.

**Digital Currency:** Digital currencies, such as cryptocurrencies, represent a novel way of storing and transferring value. Digital currencies enabled by blockchain technology have the potential to revolutionise the financial sector by reducing transaction costs, improving financial inclusion, and enabling new business models.

### **2.3.3 Digital Finance in China**

The financial landscape in China has been reshaped by the emergence and rapid growth of digital finance, reflecting the country's advancements in information technology and Internet infrastructure. This evolution has transformed traditional brick-and-mortar banking into comprehensive online services, mobile payments, and fintech innovations such as robot-advisors, P2P lending, and blockchain applications.

Digital finance in China began with the emergence of online banking in the early 2000s. As banks began to offer online services, customers could conduct transactions without visiting physical branches, marking the first step towards DFS. This shift was facilitated by the growing Internet penetration rate in China, which soared from just over 2% in 2000 to more than 70% by 2021, coupled with substantial investments in Internet infrastructure (Hjort & Tian, 2021).

However, the real game changer arrived with the emergence of mobile payments. Propelled by giants such as Alipay (launched by Alibaba in 2004) and WeChat Pay (launched by Tencent in 2013), these platforms have transformed the Chinese digital payment landscape. They offer customers an unparalleled level of convenience, enabling them to make transactions anytime, anywhere, with just a few taps on their smartphones. As of 2021, more than 770 million Chinese citizens used mobile payments, reflecting the broad acceptance and adoption of this technology (CNNIC, 2022).

Alongside the progress in digital payments, the fintech industry has blossomed, stimulating further development in digital finance. Innovative fintech platforms, such as Ant Financial and Tencent, have begun providing a wide array of services, from wealth management and insurance to lending and credit scoring. In particular, peer-to-peer lending has seen rapid growth, providing alternative financing channels to SMEs and individuals who might otherwise struggle to secure loans from traditional banks (Xie & Zhu, 2021).

The development of digital finance in China differs from that in developed nations. Pioneering areas of digital finance in China include mobile payments, online loans, digital insurance, and online investments, whereas services such as cryptocurrency and cross-border payments are almost non-existent (Ouyang et al., 2021). Although China boasts numerous digital finance companies, the sector is dominated by major technology companies, notably Baidu, Alibaba, Tencent, and JD.com (BATJ). China's digital financial development also features financial inclusion, providing financial services to SMEs and vulnerable populations in underdeveloped regions. They enjoy

lower costs and greater convenience for payments, bills, deposits, and loan services (Xie & Zhu, 2021).

Digital finance in China has leveraged big data technology to deconstruct unstructured information within companies, reducing the degree of information asymmetry in the market and realising digital innovation for traditional financial services. The complexities and peculiarities of its realisation have made its measurement a challenge since the concept's emergence. The China Digital Financial Inclusion Development Index illustrates the digital financial development level of 31 provinces, 337 cities, and 2800 counties in China (Liu et al., 2021). Beyond the benchmark index, it also measures the breadth of digital finance coverage, usage depth, and degree of digital finance support. Furthermore, it has detailed business indices for investments, credit, money funds, credit reporting, insurance, and more, and examines various aspects of the level of development of digital finance in China (Liu et al., 2021). The emergence of this index has resolved the need for a comprehensive metric for the overall development of digital finance in China. It has been widely influential academically and is used in most digital finance research literature.

According to Hua and Huang (2021), three factors contribute to the rapid development of digital finance in China: 1) the lack of digital finance regulation, 2) inadequate supply from the formal financial sector, and 3) rapid development of digital technology. The absence of digital finance regulation is partly due to the fact that many digital finance companies display features of financial inclusion. The Chinese government has been promoting inclusive finance since 2005, regularly urging commercial banks to increase loans to small and medium enterprises and establishing nearly ten thousand microcredit companies, but with minimal success. When digital finance companies

began providing financial services to numerous small and micro businesses and individuals, regulatory bodies saw hope for advancing inclusive finance (Benni, 2021).

However, regulatory gaps have emerged due to regulatory systems and technological limitations. China's financial regulatory framework is industry-divided and focuses on the regulation of financial institutions. When digital finance companies emerged, it was unclear which regulatory bodies were responsible. Many digital finance companies, such as Alipay, launched in 2004 and operated for quite some time without regulation and without a licence until 2010.

This relatively relaxed regulatory environment provides digital finance participants with unique opportunities to experiment with financial products and innovate their business models. China's relaxed regulatory stance, particularly pre-2018, stemmed from policy priorities on financial inclusion over stringent oversight, allowing fintech firms like Alipay to scale rapidly without immediate licensing hurdles (Hua & Huang, 2021). This fostered BATJ dominance, enabling low-cost innovations that filled SME credit gaps but also amplified risks like P2P fraud (Huang & Pontell, 2023). Post-2018 crackdowns addressed these, yet the initial laxity uniquely positioned China for DFS growth, contrasting stricter Western models (Ouyang et al., 2021). This laxity fostered a fertile ground for rapid innovation, allowing fintech companies to quickly develop and scale diverse digital financial products and services, often filling gaps left by traditional banks and driving unprecedented market growth, especially in areas of financial inclusion (Hasan et al., 2022). However, regulatory leniency also leaves room for improper business activity. In particular, in the P2P domain, a lack of industry regulation, low entry barriers, and platforms conducting illegal fundraising scams

under the guise of P2P lending have resulted in significant losses to investors and severe negative social impacts.

In the absence of regulation, Peer-to-Peer (P2P) lending experienced a robust growth in China. P2P lending platforms bypass traditional financial institutions by connecting borrowers with lenders. Given China's vast population, the credit needs of many individuals and small businesses are unmet, leading to the tremendous success of this model in the country. By 2018, China was home to the world's largest P2P lending market, with thousands of platforms operating and billions of dollars in loans (Cosgrove & Chowdhury, 2021).

However, as the industry expanded, concerns regarding the lack of regulation and oversight became more pronounced. Many platforms engaged in risky lending practices, and some were outright fraudulent. There have been instances in which platforms promised high returns to attract investors, using only new investors' funds to pay off earlier ones, resembling a Ponzi scheme structure (Huang & Pontell, 2023).

In 2018, to regulate the tumultuous P2P sector, the Chinese government launched a crackdown on the P2P lending industry and enacted stricter regulations. Consequently, numerous P2P platforms have collapsed, leading to substantial financial losses for investors. At its peak, the number of online lending platforms reached 3,476. By 2019, only 787 remained, and this sparked public outrage and widespread loss of faith in the P2P online lending sector (CNNIC, 2022).

A detailed analysis of the P2P market collapse in China revealed that deception and fraud were the primary catalysts of the crisis. Various systemic factors played a role in creating a conducive environment for financial malpractice that precipitated this market crash (Huang & Pontell, 2023). Chen et al. (2021) examined this event,

indicating that the lack of adequate regulatory oversight and the absence of credit risk control systems led to the collapse of numerous P2P platforms. They argued that this crisis undermined the trust of investors and the public in digital financial platforms, leading to substantial financial losses for millions of users and a significant setback for the industry. These events have led to a severe trust crisis in digital finance among the public. Therefore, trust and perceived risk are essential in the digital finance field in China.

#### **2.3.4 Empirical Studies Related to Digital Finance**

In recent years, a growing body of research has focused on the adoption of digital financial services, suggesting that this field is gaining academic attention. Kumar et al. (2020) extended TAM to predict mobile banking adoption among 203 users in India, finding PU and PEOU as strong BI predictors, yet security concerns—central to PR—were acknowledged but not tested, revealing a gap in risk integration (Kumar et al., 2020). With only 12 respondents over 56, their findings contrast with elderly-specific needs like TA mitigation, underscoring demographic biases (Ma et al., 2021).

Changchit et al. (2019) compared US and Thai users' mobile banking attitudes, revealing Thai higher trust due to government support, but cultural differences amplified PR in the US; however, youth-dominated samples (under 45) limit elderly applicability in China, where regulatory laxity heightens unique risks (Changchit et al., 2019; Hua & Huang, 2021). Notably, this study uncovered pronounced differences in how these two groups perceived the security of mobile banking, with Thai consumers exhibiting higher trust due to strong government support (Changchit et al., 2019). This underscores the idea that regional variations can affect the drivers of digital financial service adoption. However, it is worth noting that most of the interviewees were under

45 years old in this study, leaving out insights from the elderly group. The cultural and regulatory distinctions between the US and Thailand, coupled with the youth-centric sample, limit the direct applicability of these findings to elderly users in a different cultural context like China, highlighting a significant research gap (Caplan et al., 2021).

Museba et al. (2021) undertook a study in Uganda to explore the drivers driving the adoption of digital financial services. By surveying a random sample of 400 residents in Kampala, they found that an individual's social network and interactions played pivotal roles in their adoption patterns. The team highlighted that the expanding reach of these digital services aligns with the government's sustainable development objectives, especially in promoting gender balance, spurring economic development, and bridging social disparities. However, the study's confinement to Kampala might limit its broader applicability, and its insights may not be directly relevant to the elderly population.

Chen et al. (2023) delved into the integration of digital technology in the banking sector in China, particularly focusing on contactless financial services. By enhancing UTAUT with the elements of trust, PR, and perceived advantage, they constructed a conceptual model to discern the drivers influencing the adoption behaviour of these services. Using structural equation modelling (SEM) and data from questionnaires analysed with AMOS, this study validated the relationships between trust, perceived risk, perceived advantages of contactless methods over traditional methods, and SI on BI. The findings underscored trust and perceived risk as pivotal factors, with users recognising the benefits of contactless services, thereby amplifying their intention to adopt them. Social influence further bolsters this behavioural intention. However, 60% of the respondents were young adults aged 18–30 years. This overlooks diverse groups,

especially vulnerable populations in the financial sector, such as the elderly, and their specific need for non-contact financial services. This demographic bias creates a significant empirical gap, as the findings might not accurately reflect the concerns (e.g., higher perceived risk and technology anxiety) or motivations of older adults, thereby limiting the generalizability to our target population (Chen et al., 2023).

These studies clearly indicate a noticeable gap in attention towards the elderly demographic. Furthermore, these investigations highlight that attitudes towards digital financial services can vary significantly across countries. It indicates that that cultural, societal, and perhaps technological differences between nations play a pivotal role in shaping individuals' acceptance of digital financial services. Overall, while these works identify cross-cultural variances (Changchit et al., 2019), they consistently underemphasize elderly gaps, such as TA's role in PR amplification (Kumar et al., 2020; Ma et al., 2021), justifying this thesis's focus on China-specific elderly DFS adoption.

## **2.4 Elderly Population Under the Context of Technology Adoption**

### **2.4.1 Definition of Elderly**

In the discipline of gerontology, the study of aging and the elderly, the age threshold of 65 years is commonly designated as the start of old age. The Organisation for Economic Co-operation and Development (OECD) defines the elderly population as individuals aged 65 years and above (OECD, 2023). In the Chinese context, while the official elderly population is often considered to be individuals aged 60 and above for some policy purposes (e.g., pension eligibility; Ministry of Civil Affairs, 2024), for technology adoption studies focusing on significant cognitive and physiological changes, the 65+ age threshold is widely adopted internationally (OECD, 2023) and is

appropriate for this research. This criterion aligns with global standards to capture pronounced declines in digital literacy (Ma et al., 2021), ensuring comparability while acknowledging China's policy nuances.

#### **2.4.2 Psychological Characteristics of the Elderly**

Aging is a continuous, multifaceted, and often imperceptible process that involves physiological changes, leading to a gradual decline in the motor and sensory nervous systems (Mathur & Moschis, 2005). Memory degradation causes the elderly to have difficulty learning new things, and their efficiency in handling complex tasks is lower than that of younger people. As the elderly experience gradual declines in their physiological functioning, changing social roles, reduced social interactions, and increased fear of illness and death, they may experience negative emotional experiences that can be summarised by the following four characteristics: (1) coexistence of self-esteem and self-doubt. Elderly people desire respect from others, and when their self-esteem needs are not met, it often leads to feelings of inadequacy. (2) Loneliness and social isolation: With retirement, social circles shrink, exacerbating emotional voids if digital tools like DFS are not accessible (Choi & Kim, 2021). (3) Anxiety and depression: Physical discomfort and lack of family support heighten fears, linking to perceived physical condition declines that amplify TA in tech adoption (Dermody et al., 2021). (4) Stubbornness and resistance to change: Aging fosters rigid mindsets, preferring familiar methods over digital shifts, rooted in fear of incompetence (Nikou et al., 2020).

For example, some elderly people may feel a sense of self-doubt when they lose their previous work relationships or struggle to keep up with technological advances in the workplace. With more free time at their disposal, the elderly may experience a

decrease in social interaction and a smaller social circle. If they lack new activities to engage in or activities that align with their interests, they may feel empty and lonely. Some elderly people may experience anxiety due to difficulties in adapting to new roles or concerns about their self-esteem being compromised. They may also feel anxious and depressed due to ongoing physical discomfort or a lack of understanding and support from their children or peers. The sense of aging makes the elderly stubborn in their attitudes and behaviours, often preferring to approach new issues from an old perspective. These frustrating and negative emotions can further impact their perception of new technologies, creating psychological barriers that prevent them from acquiring information technology knowledge (Choi & Kim, 2021).

In the context of information technology, existing research has primarily focused on two psychological characteristics of the elderly, technology anxiety and resistance to change. On the one hand, the elderly often exhibit technology anxiety when confronted with new technologies. Technology anxiety refers to the fear, worry, and nervousness that individuals experience when considering or using a particular technology (Kim et al., 2023). The elderly tend to have higher levels of technology anxiety compared to younger users, making them more prone to frustration, negative emotions, and a diminished sense of control (Nam et al., 2022). Elderly people may feel a lack of understanding and control over the changes brought about by new technologies, which can lead to significant distress and fear among them. Traditionally, the elderly have believed that they are not suited to and are unwilling to accept new technology.

These factors inevitably influence the needs of the elderly and their ability to use technological devices (Dermody et al., 2021). Although many of the elderly are interested in using new technologies, their confidence levels in interacting with high-

tech devices are generally lower compared to younger individuals, significantly impacting their inclination towards technology adoption. However, the elderly individuals are often hesitant to change their established habits and to learn and apply new technologies. They believed that an abrupt transition from a familiar lifestyle to a digital one would lead to discomfort. Elderly people are more likely to adopt or continue using familiar technologies that help them maintain independence, allowing them to control technology proficiently without displaying signs of aging or weakness. These changes can affect individuals' inherent motivation to use technology. It reflects older users' responses to the potential consequences of new technologies, as the adoption of new technologies accompanies lifestyle changes.

Therefore, their response to change influences their willingness to adopt new technologies. Nikou et al. (2020) investigated the adoption behaviour of mobile healthcare services among the elderly (aged 60-75) and found that technology anxiety, perceived physical condition, and resistance to change negatively impacted their behavioural decision-making toward mobile healthcare services.

#### **2.4.3 Empirical Studies Related to Technology Adoption among Elderly**

The adoption behaviour of new technologies among the elderly has been extensively studied, primarily focusing on healthcare networks and information technology. This focus stems from the crucial role of healthcare for the elderly and the significant transformation in healthcare services due to the proliferation of the Internet.

Fang et al. (2024) established that prior experience and BI positively influenced the elderly's web-seeking behaviour for medical information. Moreover, Toh (2022) noted that the elderly often follow the advice and behaviour of their respected, higher-status peers. In contrast, they are less likely to follow the most recent trends. Li et al. (2023)

validated PEOU, PU, and safety to be key elements in influencing elderly's acceptance of home telemedicine services. In contrast, Hoque and Sorwar (2017) found that PE, EE, SI, TA, and Resistance to Change (RTC) were pivotal in the adoption of mHealth services by the elderly.

Much of the research on the technology adoption behaviour of the elderly is centred on healthcare. However, studies have also explored the adoption behaviour of emerging technological products, such as mobile payments, touchscreen devices, and intelligent products, by the elderly. In the context of the UK, Hanif and Lallie (2021) explored the factors influencing the acceptance of mobile banking among the elderly and conducted a literature analysis. Their mixed-methods study (n=191, aged 55+) using modified UTAUT revealed PR as a dominant deterrent to BI, outweighing trust in banks, contrasting general populations where trust prevails (Hanif & Lallie, 2021). This aligns with our focus on elderly DFS risk perceptions but highlights UK-China regulatory differences, filling a gap in Chinese contexts. Schroeder et al. (2023) identified that enabling conditions significantly influence the elderly's grasp of emerging digital technologies. Their findings highlighted that well-designed interfaces and readily available support act as crucial enabling conditions, significantly influencing the elderly's ability to comprehend and utilize new digital technologies, effectively mitigating errors during the initial learning phase with devices like touchscreen tablets (Schroeder et al., 2023). Gu et al. (2023) studied the elderly's acceptance of Information and Communication Technologies (ICT), such as e-governance and e-commerce, and confirmed that most predictors in the UTAUT2 model are related to this group.

Ma et al. (2021) conducted a comprehensive meta-analysis across the technology acceptance literature, revealing that age correlates with specific technologies and perceptions rather than uniformly affecting technology adoption. This finding is particularly critical for the current study, as it challenges the notion of universal technology acceptance patterns across all age groups and underscores the necessity of context-specific research focusing exclusively on the elderly. It suggests that generalized 'age effects' are insufficient to explain complex adoption behaviours, especially within the domain of digital financial services where unique challenges (e.g., heightened perceived risk, technology anxiety, and the paramount need for high perceived ease of use) may govern adoption. This meta-analysis thus strongly supports the tailored theoretical framework and focused demographic investigation undertaken in this thesis to deeply investigate factors relevant to older adults in China. Garg (2022) uncovered notable distinctions between younger individuals and the elderly in their use of tablets. Apart from age and gender, EE and FC emerged as key factors shaping the acceptance of tablet technology. Despite the various studies mentioned above, there is a noticeable lack of research on digital finance among the elderly. Given the potential benefits and challenges that these services can present to the elderly, further research is required in this area. These studies' strengths include robust validations (e.g., Hoque & Sorwar, 2017), but weaknesses lie in healthcare bias and inconsistent elderly sampling, creating gaps in DFS where PR and TA dominate (Hanif & Lallie, 2021; Ma et al., 2021).

## **2.5 Critical Review of Variable Relationships**

Prior to hypothesis formulation (relocated to Chapter 3 for logical flow), this section provides a comprehensive, critical review of literature on core variables (FC, TA, PR, PT, BI, Usage Behaviour) and their interrelationships, emphasizing gaps in elderly

DFS contexts. FC, per Venkatesh et al. (2003), positively drives BI/usage via resource provision, but elderly studies show weakened effects without TA mitigation (Hoque & Sorwar, 2017). TA negatively impacts BI through self-efficacy erosion (Bandura, 1986; Kim et al., 2023), with inconsistencies in financial vs. health domains (Tsai et al., 2020). PR deters BI via loss aversion (Bauer, 1960; Amirtha & Sivakumar, 2022), amplified in elderly due to vulnerability (Klaver et al., 2021). PT fosters BI by buffering risks (Mayer et al., 1995; Saprikis et al., 2022) yet understudied in China. BI mediates antecedents-usage (Ajzen, 1991; Nassar et al., 2019), with full mediation in knowledge-sharing (Jalili & Ghaleh, 2020). Perceived ease of use (PEOU) moderates paths, strengthening positive effects post-adoption (Venkatesh et al., 2003; Chou & Tang, 2020). These relationships reveal gaps: limited elderly DFS integration of TA-PR-PT interactions (Chen et al., 2023), justifying our model. Drivers: FC, PT (positive); Deterrents: TA, PR (negative), grounded in TPB/UTAUT and psychological theories (Shalender & Sharma, 2021).

### **2.5.1 Facilitating Conditions and Behavioural Intention**

Facilitating Conditions (FC) is a crucial construct used in technology adoption and acceptance research, initially formulated by Venkatesh et al. (2003) in the UTAUT model. FC is conceptually defined as the degree to which an individual believes that the organisational and technical infrastructure exists to support the use of a specific system. Essentially, it denotes the perception that the necessary resources and assistance are available to ensure smooth operation and troubleshooting when using a particular technology or system. In this study, FC refers to the availability of training, support, and the necessary technology for the elderly to use digital financial services. To further elaborate, “support” in this context encompasses not only technical assistance but also organisational policies (e.g., clear guidelines, accessible customer

service) and the availability of peer or expert assistance. “Necessary technology” includes foundational elements such as reliable hardware, user-friendly software, consistent internet access, and readily available technical support (Venkatesh et al., 2003). These clarify FC’s multifaceted role, addressing gaps in elderly support definitions (Schroeder et al., 2023).

FC is rooted in several earlier models of technology adoption behaviour. FC incorporates elements of “perceived behavioural control (PBC)”, which is derived from both the Theory of Planned Behaviour (TPB) and the Decomposed Theory of Planned Behaviour (DTPB), as well as from the Model of Personal Computer Utilisation (MPCU) and Innovation Diffusion Theory (IDT). Notably, FC incorporates the concept of compatibility from the IDT model, which suggests that the more a new system aligns with an individual's existing routines, attitudes, and values, the higher the likelihood of adoption.

Empirical research has validated the connection between FC and usage behaviour (Venkatesh et al., 2003). In the context of digital technology, FC often directly influences an individual’s intention to use a new technology or system. Panggabean (2021) investigated the adoption behaviour of mobile payment methods among Generation Z – individuals who were born after 1995. Using a sample of 100 young people in Jakarta, they conducted partial least squares (PLS) analysis in their study to examine the influence of latent elements on BI to use mobile payment services. Their findings show that FC significantly affects the BI of online transactions using mobile payments. However, this study did not include gender or experience, which may have a moderating effect on the relationship between latent variables and BI. Furthermore, this study only focused on the younger group born after 1995; thus, the applicability

of this finding to other age groups is questionable. This highlights a gap in understanding how FC operates within older demographics (Panggabean, 2021).

Alalwan et al. (2018) utilized an extended UTAUT model to examine the drivers of customers' BI and adoption behaviour of internet banking in the context of Jordan and introduced perceived risk as a new external variable in their model. They distributed 500 questionnaires to adopters or potential adopters of Jordanian banks and used SEM to analyse the data extracted from the questionnaires. Their conclusion shows the significant influence of FC on the adoption behaviour of Internet banking applications. Likewise, as indicated in the limitations of their study, they did not incorporate gender, age, or experience as moderating factors. Moreover, due to constraints in their data collection method, they overlooked the segment of users who refused to adopt Internet banking.

The above research shows that although certain studies have demonstrated the impact of FC on BI and usage behaviour, their findings are not applicable to various age groups or geographical regions. Furthermore, these studies neglected to account for the potential effects of moderating variables. Within the context of the elderly population and the specific backdrop of China, there is a dearth of relevant research. This highlights a gap in understanding how FC operates within older demographics (Alalwan et al., 2018).

**H1:** There is a significant positive impact of facilitating conditions on the usage behaviour of elderly people.

### **2.5.2 Technology Anxiety and Behavioural Intention**

Technology anxiety (TA) is an adverse emotional reaction triggered in individuals when they use technology in practical situations owing to fear or discomfort. It originates from social cognitive theory and refers to the fear that individuals experience when confronted with the prospect of employing technologies, regardless of whether an actual danger is present (Bandura, 1986). In this study, technology anxiety refers to the anxiety or emotional response experienced by the elderly when faced with digital financial services.

TA is a negative psychological factor that affects users' willingness to adopt. Cambre and Cook (1995) characterized 'computer anxiety' as fear or anxious feelings that individuals experience when preparing to use or while using a computer. Hertzum and Hornbæk (2023) discovered that users tend to develop excessive worries due to computer anxiety, often trying to reduce or stop their usage of computers. Moreover, it leads to the formulation of negative evaluations by computers and other similar applications.

Consolidating the ideas from Williams (1995) and Mick and Fournier (1998), it is evident that a significant portion of users experiences technology anxiety, characterized by feelings of compulsion, chaos, isolation, fear, and a sense of defeat when confronted with new technologies. This anxiety often leads to avoidance or limited exposure to such innovations (Mick & Fournier, 1998). Research has consistently highlighted TA as a critical factor in the acceptance of new technological products or services (Hoque & Sorwar, 2017; Tsai et al., 2020). Moreover, in mobile environments, the inherent uncertainty and risks tend to elevate users' TA towards mobile information technology (Elwalda et al., 2022).

Age is a key demographic factor associated with TA development. In contrast to younger adults, older adults generally possess lower levels of technological skills and self-efficacy (Lozoya et al., 2022). Due to declining physical conditions and unfamiliarity with information technology. Hoque and Sorwar (2017) investigated the role of TA in m-health technology among the elderly. Their research confirmed the connection between TA and BI in the context of m-health technology.

Mariano et al. (2022) conducted a study to investigate the role of TA on the intention to adopt new technology among the elderly. The study included 137 community-dwelling elderly individuals from four European countries. According to their research, anxiety is adversely correlated with PEOU, subsequently affecting BI. When the elderly encounter stereotype threats in the technological sphere, it heightens their anxiety and apprehension towards technology usage, diminishing their anticipated ease of use. This heightened anxiety impacts their intention to engage with technology in general. TA has been shown to have a negative impact on the technology adoption behaviour of the elderly in the context of m-health technology. However, this relationship has not been proven in the field of digital finance. Therefore, this study hypothesizes that technology anxiety will negatively influence the behavioural intention of elderly individuals to adopt DFS, as fear and discomfort directly impede their willingness to engage with such services (Mariano et al., 2022).

**H2:** There is a significant negative impact of technology anxiety on the usage behaviour of elderly people.

### **2.5.3 Perceived Risk and Behavioural Intention**

The concept of perceived risk (PR), initially introduced by Bauer (1960), originates from the application of psychological theories to consumer behaviour studies. Bauer

(1960) emphasised that consumers encounter various uncertainties when engaging in purchasing activities, and every purchase entail unforeseen consequence and associated risks. He categorised these uncertainties into two dimensions: uncertainty about the outcome of a decision, and uncertainty about the severity of the consequences when a decision is made incorrectly. By introducing the notion of PR, Bauer highlighted the importance of understanding consumers' subjective evaluations and concerns about risks when examining their decision-making processes. In this study, perceived risk refers to the psychological expectation of the elderly regarding negative outcomes when using digital financial services, that is, the possibility of the elderly anticipating that they may suffer losses.

Building on Bauer's (1960) research, Cox (1967) further developed the PR theory by providing a more refined definition. He defined PR as the level of risk that consumers are willing to accept before engaging in a consumption action and the extent to which they anticipate potential losses after consumption. In other words, consumers consciously evaluate and assess the possible adverse effects and consequences of their consumption before making decisions. Cox (1967) distinguished between two aspects of PR: ex-ante and ex-post PR. Ex ante PR refers to consumers' pre-estimation of potential adverse consequences and their perceived ability to handle the resulting negative outcomes prior to engaging in consumption behaviour.

In contrast, ex-post PR pertains to the severity of loss that consumers anticipate as a result of their consumption behaviour when adverse consequences occur. Cox's (1967) contribution provided a more comprehensive understanding of PR by capturing both the anticipatory assessment and the actual experience of negative consequences in consumer decision-making processes.

Following Cox (1967), Cunningham (1967) proposed that consumers perceive risk when their consumption behaviour fails to yield the expected outcomes. Building on Cox's work, Cunningham further clarified two critical elements of PR: uncertainty and consequences. Uncertainty refers to consumers' subjective estimation and judgment of the potential negative consequences of their consumption behaviour, whereas consequences refer to the severity of adverse outcomes resulting from consumers' consumption actions. Cunningham (1967) added to the understanding of PR by emphasising the subjective assessment of potential negative consequences and the seriousness of the outcomes arising from consumer behaviour.

Amirtha and Sivakumar (2022) conducted a study focusing on the influence of PR dimensions on BI towards e-shopping behaviour among women, considering different stages of the family life cycle. In this study, the researchers selected Indian women from various Family Life Cycle (FLC) stages and divided them into nine segments. They analysed the influence of PR on e-shopping intentions across these stages, favouring FLC over age for its predictive capability. A total of 913 validated questionnaires were collected from five cities in India. Based on these responses, they conducted an analysis using Partial Least Square Structure Equation Modelling (PLS-SEM). The findings revealed that perceived risk influenced online purchase behaviour differently among women in various stages of the family life cycle. This study focused on a female demographic aged 21–62 years. Therefore, their results do not apply to men or those aged  $\geq 65$  years. This demographic limitation suggests a need for research specifically targeting older adults (Amirtha & Sivakumar, 2022).

Chaveesuk et al. (2021) investigated BI and the actual utilization of digital payment in retail sector in the context of Thailand from a marketing perspective, particularly in the context of the COVID-19 era. Minimising physical contact is crucial at such times.

They used the UTAUT model and expanded it to encompass attitudes, social distancing, and PR. Data was sourced from 467 Thai respondents using digital payment systems and analysed through SEM. They highlighted the significant influence of PR on BI to adopt digital payment technology in Thailand. Their study was conducted in the context of COVID-19, and whether its findings remain applicable in the post-pandemic era needs confirmation. This study, while confirming PR's influence, highlights the need to re-evaluate such effects in a non-pandemic context and for specific vulnerable groups like the elderly, who face distinct risk perceptions (Chaveesuk et al., 2021). Therefore, this study hypothesizes that perceived risk will negatively influence the behavioural intention of elderly individuals to adopt DFS, as concerns about potential financial losses or security breaches directly deter their willingness to engage (Klaver et al., 2021). Therefore, this study hypothesises that:

**H3:** There is a significant negative impact of perceived risk on the usage behaviour of elderly people.

#### **2.5.4 Perceived Trust and Behavioural Intention**

Deutsch (1958) first proposed the concept of trust using the classic game theory of the "Prisoner's Dilemma." He pointed out that trust is a planned outcome that arises due to the stimulation of the environment in which an individual is located and that it can be born when an individual's expectations are met. McKnight and Chervany (2001) interpret trust as an individual's goodwill, strength, and sincerity towards another entity. From a management perspective, trust represents an entity's kindness, capability, and honesty towards another entity. In the context of digital financial services, trust pertains to a user's belief that a service is reliable, secure, and operates in the user's best interest. The elderly need to trust digital services because they might be more

concerned about security, privacy, and fraud. Trust can mitigate these concerns, making consumers more comfortable using digital financial services.

From an institutional perspective, Luhmann and Zucker (1986) argued that trust not only exists between individuals but is also manifested in national politics and social systems. They believe that trust is crucial for ensuring social stability and progressive growth. Under such circumstances, trust can be said to be rooted in and grown upon social and cultural knowledge and standard rules, demonstrating people's reliance on these norms. In economics, based on the "rational person" assumption, trust is described as a complex decision made after rational deliberation. Before making a move, players strive to maximise repeated interactions and opportunities for gameplay. It is only through a series of complex considerations and rational planning that one can avoid risks, reduce business costs, and encourage people to keep their promises and abide by agreements, thereby promoting economic development.

Marketing studies suggest that trust is prevalent in mutual transaction processes. Anderson and Weitz (1992), in their examination of the critical elements of commitment behaviour and cognitive processes in distribution channels, believed that trust is an individual's faith in others. Wajidi et al. (2023) explored the link between technology concepts and online shopping behaviour, given the rising popularity of e-commerce due to its convenience. They highlighted the vital role of trust in promoting customers' BI to adopt e-commerce.

Saprikis et al. (2022) investigated the drivers of BI affecting retail bank customers' use of mobile banking. The findings emphasise the significant impact of trust on individuals' intention to adopt mobile banking services. It was also highlighted that,

compared to other groups, the elderly, women, and those with lower education levels showed a reduced intention to adopt mobile banking.

Although these studies demonstrated that trust affects behavioural intentions, they ignored the elderly aged over 65 years in their sample collection. However, the role of this relationship in technology adoption among the elderly has yet to be proven. Therefore, this study hypothesizes that perceived trust will positively influence the behavioural intention of elderly individuals to adopt DFS, as a strong belief in the reliability and security of these services fosters greater willingness to use them (Saprikis et al., 2022). Therefore, this study hypothesises that:

**H4:** There is a significant positive impact of perceived trust on the usage behaviour of elderly people.

#### **2.5.5 Behavioural Intention as Mediator**

Behavioural Intention (BI) is a central construct in various psychological and social theories used to predict human behaviour. Essentially, it is the subjective probability that individuals will perform a particular behaviour. It represents an individual's anticipated or planned future behaviour and is regarded as a direct predictor of usage behaviour (Ajzen, 1991). In this study, BI refers to the extent to which the elderly intend to use digital financial services.

The concept of BI stems from TPB (Ajzen, 1991). According to this theory, people are more likely to perform behaviours if they have a strong intention to do so. The higher the intent to act, the higher the likelihood that the behaviour will be performed. The UTAUT also employs BI as a critical construct. For example, Venkatesh et al. (2003) proposed that BI in the UTAUT focuses on individual performance behaviour. In a

study by Diño and de Guzman (2014) on telehealth use among the elderly in the Philippines, it was observed that EE, PE, and SI exerted a positive influence on the BI of elderly individuals to adopt telehealth. This research underscores UTAUT as a pertinent framework for understanding this intention among the elderly.

In a study by Hoque and Sorwar (2017) on mobile healthcare adoption among individuals over 60 years of age, the authors constructed their research model by adding RTC and TA to the original UTAUT model. Their findings indicated that EE was the primary deterrent to adoption, followed by RTC. They also noted that TA overshadowed the effects of the SI. Similarly, Jo et al. (2021) explored elderly adoption of IoT and smart homes by incorporating TA, perceived cost, and trust into their model. Their results emphasised the pivotal role of trust in shaping elderly adoption behaviours. Notably, they observed that SI and FC, which were adapted from the original UTAUT model, had a lesser impact on individuals' intentions.

Fitrianie et al. (2021) explored the factors influencing the acceptance and utilisation of a Cognitive Behaviour Therapy for insomnia (CBT-I) mobile application among 89 participants with mild insomnia using the extended UTAUT model. The study validated the relationships between several drivers and the BI to use the app. Specifically, PE, EE, SI, FC, self-efficacy, and trust significantly influenced BI. Notably, hedonic motivation was the most significant predictor of intention.

Hanif and Lallie (2021) investigated the influence of trust and perceived risk on the intention of the elderly (over 55 years) to use mobile banking applications in the UK, employing a modified UTAUT model. Utilising data from 191 participants, they determined that PE and PR associated with the Internet significantly affected their intention to use mobile banking apps. They utilised a qualitative approach to further

reinforce this finding, revealing that PR was so pronounced among the elderly that many of them resisted adopting mobile banking apps. Notably, their study showed that trust in service providers (banks in this context) was not a significant factor affecting BI. This finding, particularly the non-significant role of trust and the strong influence of perceived risk, offers crucial insights for the current study. However, direct applicability is limited by contextual differences: their research focused on the UK, a developed country with a different regulatory environment and user perceptions of traditional versus fintech providers. Specifically, trust in established banks might differ significantly from trust in nascent fintech firms prevalent in China's DFS landscape. Therefore, their findings highlight a critical gap concerning the specific dynamics of trust and risk for elderly users in the Chinese DFS context, emphasizing the need for tailored investigation in this specific cultural and market setting. In mediation terms, Hanif & Lallie (2021) imply BI's role in PR-usage, but lack explicit tests, unlike Jalili & Ghaleh (2020) in TPB.

#### **2.5.6 Adoption Behaviour of Digital Financial Services (DFS)**

Usage behaviour is the final outcome of many behavioural models and theories, including the TPB (Ajzen, 1991) and UTAUT (Venkatesh et al., 2003). In this study, usage behaviour is defined as the adoption behaviour of DFS among the elderly. In the context of technology adoption, usage behaviour pertains to the degree to which individuals utilise specific technologies or systems in their daily activities. It is a tangible and observable action that can be measured using various methods, including self-reports, observations, and system logs. According to Venkatesh et al. (2003), usage behaviour is directly influenced by BI and FC.

In the research conducted by Fitrianie et al. (2021), it was found that both BI and FC played a crucial role in predicting the usage of mobile applications. The researchers highlighted the significance of these findings, suggesting that they could guide app developers in improving the acceptance and utilisation of their applications. Similarly, Liu et al. (2022) utilised UTAUT to investigate the adoption of the PX Pay mobile payment application and determined that BI had a notable impact on usage behaviour.

Furthermore, the existing literature has greatly evidenced the strong link between behavioural intention and usage behaviour exhibited by individuals. This link has been presented in the literature across various domains, whereas the digital domain has especially evidenced the strong effect of behavioural intention on the construct of usage behaviour. For instance, the study conducted by Efendi et al. (2024) explained that behavioural intention significantly drives usage behaviour when individuals experience or come across favourable factors; they are most likely to develop an intention to use digital wallets which ultimately leads to an increased chance of exhibiting usage behaviour. Similarly, Khan and Abideen (2023) emphasise the importance of shaping usage behaviour through behavioural intention. This study further argues that existing models often overlook this construct which works as a critical factor, particularly in the context of the digital domain. Moreover, Marpaung et al. (2021) further support the notion that behavioural intention significantly affects usage behaviour when it is driven by social influence, effort expectancy, performance expectancy, and facilitating conditions, especially in the context of mobile banking service adoption. Hence, based on the literature provided above, the following hypotheses are proposed:

**H5:** There is a significant positive impact of behavioural intention on the usage behaviour of elderly people.

**H6:** There is a significant positive impact of facilitating conditions on the behavioural intention of elderly people.

**H7:** There is a significant negative impact of technology anxiety on the behavioural intention of elderly people.

**H8:** There is a significant negative impact of perceived risk on the behavioural intention of elderly people.

**H9:** There is a significant positive impact of perceived trust on the behavioural intention of elderly people.

### **2.5.7 Mediator**

In the literature on technology adoption behaviour, behavioural intention is generally recognised as a significant predictor of usage behaviour. TPB (Ajzen, 1991) and TAM (Davis, 1989) affirm the significant role that behavioural intention plays in determining usage behaviour. Venkatesh et al. (2003) also confirmed this relationship in their UTAUT model. Nassar et al. (2019) delves into the connection between SI and ICT adoption within the Palestinian Ministry of Higher Education (MOHE), drawing from the foundational UTAUT. The mediating role of BI and the moderating effect of age were central to the investigation. A quantitative analysis of 343 self-administered questionnaires revealed that BI acts as a positive mediator between SI and ICT adoption. It is indicative of that the MOHE staff in Palestine are highly inclined to adopt ICT.

Jalili and Ghaleh (2020) investigated the mediating role of BI in the relationship between AT, SN, PBC, and knowledge-sharing behaviour. Utilising a cross-sectional design and SEM grounded in the theory of planned behaviour, the findings underscore significant positive relationships between AT, SN, PBC, and BI. Importantly, BI fully mediated the relationship between these external variables and knowledge-sharing behaviour, emphasising its central role in bridging external influences and usage behaviour. The scope of this study, which was limited to two Ugandan referral hospitals, may have influenced the broader applicability of the results. Few studies have focused on the mediating role of BI in the UTAUT model. Therefore, this study analysed the mediating effect of BI on the relationship between FC, TA, PR, PT, and usage behaviour. Hence, this study proposes the following hypotheses:

**H10a:** Behavioural intention significantly mediates the relationship between facilitating conditions and the usage behaviour.

**H10b:** Behavioural intention significantly mediates the relationship between technology anxiety and the usage behaviour.

**H10c:** Behavioural intention significantly mediates the relationship between perceived risk and the usage behaviour.

**H10d:** Behavioural intention significantly mediates the relationship between perceived trust and the usage behaviour.

## **2.5.8 Moderators**

### **2.5.8.1 Perceived Ease of Use as a Moderator**

Perceived Ease of Use (PEOU), a foundational construct in technology acceptance theories such as the Technology Acceptance Model (TAM) (Davis, 1989) and

subsequently integrated into the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), refers to the degree to which an individual believes that using a particular system is free of effort. In the context of Digital Financial Services (DFS) adoption among the elderly, PEOU is conceptualized as their perception that using these services is simple, straightforward, and requires minimal mental or physical exertion. This study proposes that PEOU not only directly influences adoption but also serves as a crucial moderating variable, altering the strength and direction of other relationships within the adoption model.

The role of perceived ease of use, or similar concepts like effort expectancy or usability, as a moderator has been increasingly recognized in technology adoption research. These studies suggest that the perceived simplicity of a system can significantly influence how users process and react to other drivers of adoption. For instance, when a technology is perceived as easy to use, it can act as a cognitive buffer, reducing the burden associated with other factors (e.g., anxiety or risk) or amplifying the benefits derived from positive conditions (e.g., facilitating support or trust) (Kim et al., 2023; Wu & Zhang, 2021). For elderly users, who often face unique cognitive and physiological challenges when interacting with new digital interfaces, PEOU becomes an exceptionally salient factor. A higher perception of ease of use can mitigate their apprehension, enhance their self-efficacy, and reduce the perceived effort of learning, thereby critically influencing their willingness and ability to adopt DFS (Chou & Tang, 2020; Fang et al., 2024).

Specifically, this study proposes that Perceived Ease of Use will moderate the relationships between various antecedents and the usage behaviour of DFS among the elderly. When DFS are perceived as easy to use, elderly individuals are more likely to

effectively leverage external support, overcome psychological barriers, and reinforce their confidence, thus shaping their overall adoption behaviour. This study hypothesises that:

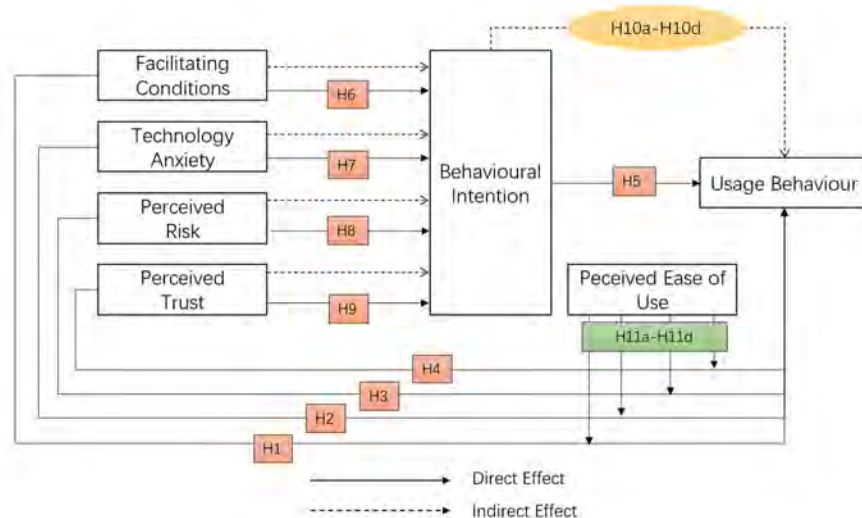
**H11a:** Perceived Ease of Use positively moderates the relationship between facilitating conditions and usage behaviour (i.e., the positive effect is stronger when PEOU is high).

**H11b:** Perceived Ease of Use negatively moderates the relationship between technology anxiety and usage behaviour (i.e., the negative effect is weaker when PEOU is high).

**H11c:** Perceived Ease of Use negatively moderates the relationship between perceived risk and usage behaviour (i.e., the negative effect is weaker when PEOU is high).

**H11d:** Perceived Ease of Use positively moderates the relationship between perceived trust and usage behaviour (i.e., the positive effect is stronger when PEOU is high).

Based on the above hypotheses, this study constructs the following research model.



**Figure 2.6**  
*The Research Model*

## **2.6 Summary of the Chapter**

Chapter 2 presents a thorough examination of the theoretical and empirical foundations the investigation of the adoption of DFS by the elderly population in Henan Province, China. The chapter begins by introducing the central theories that have been utilised extensively in studying technology adoption. Each theory provides critical insights into the drivers of individuals' behavioural intentions and usage of technology, laying a solid foundation for this study.

The chapter then provides an extensive review of empirical studies. It focuses mainly on research addressing the domain of digital finance and the unique challenges associated with technology adoption among the elderly population. Recognising the physical and psychological factors that can affect this demographic's ability to adapt to the DFS is vital for this study.

Subsequently, this study proposes a conceptual framework. This chapter provides a detailed discussion of each construct, outlining its definition, theoretical background, and anticipated role in influencing the adoption of digital financial services by the elderly. This chapter also identifies potential moderators, such as experience. These factors are expected to influence the relationships between the key constructs in the conceptual framework.

Chapter 2 provides an in-depth review of the theoretical and empirical literature relevant to this study. It also proposes a comprehensive conceptual framework to guide the investigation of the drivers and deterrents affecting the adoption of DFS by the elderly in Henan Province, China. This chapter significantly contributes to grounding this study within the existing knowledge and setting a clear direction for the subsequent stages.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter details the research methodology of this study, including the research approach, pilot study, population and sample, data collection, measurement scales and instruments and analysis. In addition, this chapter discusses the validity and reliability of the study, ensuring that the results obtained can be used to draw meaningful conclusions from the study. Each aspect of the methodology is explained in detail in the following sections.

#### **3.2 Research Design**

The research design facilitated the development of an efficient format and structure for the study. This study is based on deductive reasoning, as it attempts to test the existing relationships among different constructs (Haque, 2022). This approach was chosen because the study aims to test a predefined theoretical model, the extended Unified Theory of Acceptance and Use of Technology (UTAUT) model, through empirically derived hypotheses. Deductive reasoning, by moving from general theories to specific empirical observations, is ideally suited for validating and refining theoretical propositions within a specific context (Saunders et al., 2019). This directly aligns with the research objectives to examine hypothesized relationships between various constructs and digital financial services (DFS) adoption among the elderly population in China. The deductive research approach facilitates hypothesis formulation based on established theories. Furthermore, by employing the deductive method, the researcher examined established hypotheses regarding the utilisation and acceptance of DFS among the elderly population in China. This study aimed to

ascertain the diverse factors that may impact the adoption of DFS in the elderly population of China.

Furthermore, the study opted for a research methodology framework that enables analysis of the primary context of the investigation. The research design was chosen in accordance with the research ideology that, when evaluated using relevant methodologies, is deemed suitable for the objective of the study. The researcher aimed to enhance the effectiveness of the demonstration of the research topic by utilising the research design. The design progresses logically: deductive reasoning informs quantitative hypothesis testing via surveys, preferred over interviews/focus groups for scalability with large elderly populations and to minimize recall bias in adoption behaviours (Nardi, 2018; Leavy, 2022). This suits the objectives by enabling generalizable causal inferences from structured data.

Furthermore, the current study utilised a quantitative research methodology, which is a valuable instrument for assessing the validity of established theories in a specific field of study (Mellinger & Hanson, 2020). The objective was to ascertain the connections between variables using statistical analysis. To achieve its objectives, this study adopted a quantitative approach grounded in survey data. Primary data was acquired by administering survey questionnaires to older Chinese citizens. Survey research methodology is purportedly appropriate for acquiring a descriptive account of an enquiry to validate a hypothesis (Nardi, 2018). The quantitative methodology is highly suitable for ascertaining the anticipated causal connection between the variables under investigation because of its methodical and structured characteristics. It can identify the interaction effects between variables with a high degree of certainty in numerical statistical values (Leavy, 2022).

The choice of a survey-based methodology over other qualitative methods such as interviews or focus groups was made to efficiently collect data from a large sample, which is essential for statistical generalizability and for testing complex structural relationships within the PLS-SEM framework (Hair et al., 2017). While qualitative methods could offer deeper insights into individual experiences, a quantitative survey allows for the testing of a predefined theoretical model and hypotheses across a broader population, providing robust statistical evidence for the proposed relationships (Creswell & Creswell, 2018). This approach ensures that the study's findings on the drivers, deterrents, mediators, and moderators of DFS adoption are empirically verifiable and generalizable within the target elderly population. The research design, including the unit of analysis, target population, sampling technique, measurements, and instruments, is elaborated in the following sections.

### **3.3 Population and Sample**

#### **3.3.1 Population**

According to the OECD (2023), the elderly population comprises of people aged 65 years and over. The target population for this study encompassed elderly individuals aged 65 years and above living in Zhengzhou, the largest city in Henan Province, China. According to data from the Zhengzhou Bureau of Statistics (2024), at the end of 2023, the total number of elderly people in Zhengzhou is approximately 1.309 million. Moreover, the target population for this study comprised of elderly people who lived in nursing homes, community care centres, and day-care centres, institutions providing structured support for vulnerable elderly, representing ~5% of Zhengzhou's total elderly but capturing key socio-economic subgroups (e.g., low-income, urban-rural migrants) with higher DFS access needs than general community dwellers (Ministry of Civil Affairs, 2024).. According to the Ministry of Civil Affairs of the

People's Republic of China (2024), the total number of these centres is 1266. Of these, there were approximately 1052, nursing homes, and community-based elderly care centres numbered about 114. Across all these centres, the total number of registered elderly care beds in Zhengzhou was 66000. Hence, the total target population used in this study was 66000 elderly individuals in Zhengzhou.

The rationale for focusing specifically on elderly individuals residing in nursing homes, community care centers, and day-care centers in Zhengzhou (totalling 66,000 registered beds) is based on several practical and methodological considerations. Firstly, these institutions provide a more accessible and concentrated sampling frame for reaching a significant number of elderly individuals, which is crucial for a quantitative survey aiming for generalizability within this specific sub-population. Secondly, these environments often provide a degree of structured support and resources (e.g., social activities, basic care), which may influence their exposure and willingness to engage with digital services, thereby offering a focused context to examine the impact of Facilitating Conditions. While this sub-population may not fully represent the entire elderly demographic of Zhengzhou (which also includes those living independently), it offers a viable and manageable group for in-person data collection, particularly given the challenges of reaching a dispersed elderly population with varying mobility and digital literacy levels. The findings from this study are thus generalizable to elderly individuals within similar institutional care settings in Zhengzhou and potentially other comparable urban areas in China.

### **3.3.2 Sample Size**

For the quantitative aspect, different studies have shown different views regarding the selection of the optimal sample size. The term sample is defined as a small part or

subset of the population under study. It is a small segment of a larger group of the target audience. According to Sekaran and Bougie (2016), it is important to draw a sample from the population. The authors further suggest that it is not feasible to collect information from the overall population. Sampling is employed to collect useful information from the population, which enables the researcher to collect information efficiently and effectively. Studies which involve collecting samples from populations tend to produce reliable and valid results, and sampling also enables the researcher to reduce error and fatigue in the data collection process.

Lakens (2022) argued that the sample size would be considered sufficient if it adequately estimates the population features and offers a reliable level of results. The sample size should be sufficiently broad to assess the population characteristics. To determine the sample size for this study, the guiding principle originally developed by Krejcie and Morgan (1970) for determining the sample size was employed, as shown in Figure 3.1 which reflects the possible sample size based on our population under study. Based on data provided by the Ministry of Civil Affairs of the People's Republic of China (2023), there are 66000 elderly beds registered in the overall elderly care institutes of Zhengzhou City. Hence, in accordance with the determination table of Krejcie and Morgan, a sample of 382 elderly individuals was selected to serve as the desired sample size.

While the Krejcie and Morgan (1970) table provides a generalized sample size (e.g., 382 for a population of 66,000 at a 95% confidence level and 5% margin of error), it relies on fixed assumptions and does not account for specific factors like the complexity of the structural equation model, expected effect sizes, or statistical power. To ensure sufficient power for the complex PLS-SEM model used in this study, a more

precise power analysis was conducted using G\*Power 3.1 (Faul et al., 2009). For a model with multiple predictors (e.g., 4 exogenous constructs affecting Behavioural Intention) and aiming for a medium effect size ( $f^2 = 0.15$ ) at an alpha level of 0.05 and statistical power of 0.95, G\*Power recommended a minimum sample size of approximately 172. Given that the Krejcie and Morgan (1970) calculation yielded 382 and considering Hair et al. (2010) suggested an optimal range of 150 to 400 respondents for PLS-SEM, the selected sample size of 382 is deemed more than sufficient. This larger sample size enhances the reliability of detecting small effects, allows for potential subgroup differences, and accommodates data variability, thereby strengthening the study's statistical power and the generalizability of its findings within the target population.

Furthermore, Hair et al. (2010) revealed that the optimal sample size for PLS-SEM should range from 150 to 400 respondents to avoid misspecification and non-convergence. Hence, the researcher carefully selected the sample for the population, considering previous research.

| <i>N</i> | <i>S</i> | <i>N</i> | <i>S</i> | <i>N</i> | <i>S</i> |
|----------|----------|----------|----------|----------|----------|
| 10       | 10       | 220      | 140      | 1200     | 291      |
| 15       | 14       | 230      | 144      | 1300     | 297      |
| 20       | 19       | 240      | 148      | 1400     | 302      |
| 25       | 24       | 250      | 152      | 1500     | 306      |
| 30       | 28       | 260      | 155      | 1600     | 310      |
| 35       | 32       | 270      | 159      | 1700     | 313      |
| 40       | 36       | 280      | 162      | 1800     | 317      |
| 45       | 40       | 290      | 165      | 1900     | 320      |
| 50       | 44       | 300      | 169      | 2000     | 322      |
| 55       | 48       | 320      | 175      | 2200     | 327      |
| 60       | 52       | 340      | 181      | 2400     | 331      |
| 65       | 56       | 360      | 186      | 2600     | 335      |
| 70       | 59       | 380      | 191      | 2800     | 338      |
| 75       | 63       | 400      | 196      | 3000     | 341      |
| 80       | 66       | 420      | 201      | 3500     | 346      |
| 85       | 70       | 440      | 205      | 4000     | 351      |
| 90       | 73       | 460      | 210      | 4500     | 354      |
| 95       | 76       | 480      | 214      | 5000     | 357      |
| 100      | 80       | 500      | 217      | 6000     | 361      |
| 110      | 86       | 550      | 226      | 7000     | 364      |
| 120      | 92       | 600      | 234      | 8000     | 367      |
| 130      | 97       | 650      | 242      | 9000     | 368      |
| 140      | 103      | 700      | 248      | 10000    | 370      |
| 150      | 108      | 750      | 254      | 15000    | 375      |
| 160      | 113      | 800      | 260      | 20000    | 377      |
| 170      | 118      | 850      | 265      | 30000    | 379      |
| 180      | 123      | 900      | 269      | 40000    | 380      |
| 190      | 127      | 950      | 274      | 50000    | 381      |
| 200      | 132      | 1000     | 278      | 75000    | 382      |
| 210      | 136      | 1100     | 285      | 1000000  | 384      |

Note.—*N* is population size. *S* is sample size.  
Source: Krejcie & Morgan, 1970

**Figure 3.1**  
*The Recommended Sample Size*  
Source: Krejcie and Morgan, 1970

### 3.3.3 Sampling Technique

Sampling is the process of selecting a specific subject from a predetermined population to represent that population according to predetermined criteria. There are two distinct categories of sampling: probability and non-probability sampling. Probability sampling operates under the assumption that every element in the population has a non-zero chance of being selected, which is also referred to as random choice. Sekaran and Bougie (2016) delineated five fundamental selection methods that comprise

probability sampling: simple random, systematic, stratified, cluster sampling, and multistage sampling.

In contrast, non-probability sampling relies on the researcher's subjective judgement. Alternatively, it is a sampling technique in which the researcher exercises discretion in choosing and determining the sampled item to test the results. Quota, judgmental, convenience, purposeful, and snowball sampling are all instances of non-probability sampling methods. To facilitate generalisability, this study used simple random sampling. Simple random sampling enables researchers to obtain the characteristics of the population (Ahmed, 2024). Therefore, simple random sampling was used. Furthermore, to ensure the inclusion and targeting of the intended audience from the desired demographics, this study employed simple random sampling in accordance with the predetermined sample size. This entails selecting senior citizens with prior experience or familiarity with digital financial platforms. Utilising simple random sampling is critical in survey research, particularly when working with a large target population. This approach guarantees the collection of precise and statistically significant data by mitigating sampling errors (Lohr, 2021).

The process of simple random sampling in this study involved obtaining an official list of all registered elderly care beds from the Ministry of Civil Affairs of the People's Republic of China (Zhengzhou office). This list served as the complete sampling frame (N=66,000). From this frame, a random number generator was used to select 420 unique bed identifiers. Each selected bed identifier corresponded to an elderly individual residing in one of the nursing homes, community care centres, or day-care centres. Due to logistical constraints and ethical considerations involving vulnerable populations, the actual administration of the questionnaire was performed in-person

by trained research assistants who visited these selected individuals. Upon approach, individuals were informed about the study's purpose, ensured of their anonymity and voluntary participation, and asked for their consent. Only those who provided informed consent and met the age criteria (65 years and above) were included in the sample. This systematic approach aimed to minimize selection bias and enhance the representativeness of the sample within the defined target population.

### **3.4 Data Collection Method**

Secondary and primary data are the two main types of information collected by researchers. Typically, primary data is gathered with the purpose of resolving a problem. It may be qualitative (using case studies, focus groups, interviews, observations, and structured and semi-structured data) or quantitative (utilising surveys). Smith et al. (2011) defined secondary data as frequently encountered materials, such as published summaries and raw data. The data collection method is a crucial component of the design of any study in which the opinions and beliefs of the intended respondents regarding any subject are gathered. Each study required a distinct collection of methodologies and procedures to gather data. Self-administered (in-person) or online communication instruments, such as portals and electronic surveys, are examples of data collection methods (Olson et al., 2021). A self-administered questionnaire was used as the data collection instrument for the present study. To collect information for the present investigation, a total of 420 surveys were distributed to Chinese elderly individuals, of which 382 were deemed valid and included in the analysis.

The determination of distributing 420 surveys was based on two primary considerations: the calculated sample size and the anticipated response rate. As

discussed in Section 3.3.2, the desired sample size, derived from Krejcie and Morgan (1970) and confirmed by G\*Power analysis for PLS-SEM, was 382. To account for potential non-responses, incomplete questionnaires, or invalid responses (e.g., due to respondent fatigue or misunderstanding), an oversampling strategy was employed. Based on typical response rates for in-person surveys among elderly populations (which can be lower due to health or cognitive factors), a buffer of approximately 10% ( $382 * 1.10 \approx 420$ ) was added to ensure that the final number of valid responses would meet or exceed the required sample size. Therefore, 420 surveys were initially prepared for distribution.

Moreover, prior to distribution to participants, a cover letter elucidating the research objectives was appended to each questionnaire. This letter provided reassurance to the respondents that the information they have provided was treated with strict confidentiality and utilised exclusively for academic objectives. Because of these ethical standards, respondents were more at ease providing candid responses to the questionnaire's enquiries. Respondents were also provided sufficient time to complete the survey. With the assistance of the researcher, respondents could provide responses to any enquiries they had regarding the questionnaire.

### **3.4.1 Surveys**

Measuring variables is an extremely important aspect of empirical research that is often overlooked. The quality and level of variable measurements can influence and determine the effectiveness of the entire research process. Therefore, to ensure the quality and scientific validity of the variable measurements, the items measured in this study were all drawn from the existing literature, mainly referring to validated and mature scales. To ensure scale efficiency, Tanujaya et al. (2022) suggested that

variables require at least three or more measurement items. Chen et al. (2021) proposed that multiple measurement items could enhance the reliability of variable measurements. Moreover, Venkatraman and Ramanujam (1986) believed that the following should be the focus when designing survey questionnaires:

First, multiple items should be used to measure each variable, and the items should be generalised to avoid repetition. Second, each measurement item of the variable must have good internal consistency, meaning that the results of multiple items for any variable should be similar. Finally, each measurement item of the variable and the concept that the variable represents should be the same. This reveals that the measured content should be as required. Although some studies suggest that using a seven-point Likert scale is most suitable for PLS-SEM with multiple latent variables, this study adopted a five-point Likert scale to avoid overwhelming the surveyed elderly individuals with too many choices, which might lead to a loss of patience in answering the questionnaire. This simpler scale is easier for the elderly to understand and facilitates their judgment and item selection.

Ultimately, the third part of the survey questionnaire used a 5-point Likert scale to measure key constructs of this study, requiring respondents to choose from five options in each item, with 1 representing "strongly disagree" and 5 representing "strongly agree." The measurement of each variable is described in detail in the following sections. Because the elderly are less likely to fill out digital questionnaires online, this study distributed questionnaires face-to-face, administered by trained assistants (trained research assistants, who were university students from Zhengzhou University and directly supervised by the research team to ensure neutrality. No incentives beyond transport reimbursement were provided to minimize response bias).

### **3.5 Measurement Scale**

The Likert scale is frequently used in questionnaire surveys as a psychometric instrument to assess respondents' perspectives on their level of agreement with a measurement statement (Rokeman, 2024). According to Taherdoost (2019), the Likert scale is widely used to assess respondents' reactions to specific questions or statements using a five-point rating system. The standard five-point Likert scale covers a spectrum of options ranging from strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5).

Nonetheless, it is important to note that Likert scales ranging from four to nine points have been used in a variety of academic disciplines. Currently, there are no established criteria for determining the optimal number of scale points to use in business research. The current study evaluated the assessment questions using a five-point Likert scale to cover various response options. This scale was chosen based on its ability to provide adequate differentiation and ease of comprehension for the survey participants (Sekaran & Bougie, 2016). Based on empirical evidence, Alabi and Jelili (2023) argued that a five-point Likert scale is as reliable as other scales. Furthermore, their research indicated that increasing the number of points on the scale, such as to seven or nine, did not improve the rating consistency.

The current investigation used structural equation modelling (PLS-SEM). The use of a five-point Likert scale is appropriate for these methods (Taherdoost, 2019). Based on these characteristics, the goal of this study was to rate all factors on a 5-point Likert scale. On this scale, survey questions were rated as degrees of concurrence, with 1 indicating a significant level of disagreement, and 5 indicating a significant level of agreement.

To ensure the robust validity and reliability of the measurement instruments for the specific target demographic, elderly individuals in China, a meticulous instrument development and adaptation process was undertaken, building upon existing established scales from the literature.

Firstly, given that the original scales were predominantly developed in English, a rigorous translation and back-translation procedure was implemented to ensure linguistic and conceptual equivalence. This involved a forward translation of all questionnaire items from English to Mandarin Chinese by a bilingual expert with experience in survey research. Subsequently, an independent second bilingual expert, who was unaware of the original English version, performed a back-translation from the Mandarin Chinese version back to English. The back-translated English version was then meticulously compared with the original English version by the research team to identify and resolve any discrepancies, ensuring that the nuances and meanings of the questions were accurately preserved.

Secondly, the translated and back-translated items underwent thorough review by a panel of experts. This panel included academic researchers specializing in gerontology, digital literacy, and technology adoption among older adults in China. Their expertise was crucial in evaluating the conceptual equivalence, cultural relevance, and appropriateness of the translated items for the specific context of Chinese elderly. Feedback from this panel led to refinements in wording to better resonate with local idioms and cultural understandings, thereby enhancing content validity.

Thirdly, to further ensure cultural adaptation and comprehensibility, particularly for a demographic with varying literacy levels and technological proficiency, a pre-testing phase was conducted. This involved administering the refined questionnaire to a small

group of elderly individuals who were representative of the target demographic. This step allowed for direct feedback on the clarity of instructions, the comprehensibility of individual items, and the overall ease of completing the survey. For instance, based on this feedback, generic terms like "financial management tools" were specifically reworded to more familiar and concrete phrases such as "Alipay/WeChat Pay for daily transactions," making the questions more accessible and relevant to the daily lives of the elderly Chinese participants. This iterative refinement process was vital in minimizing potential response bias and ensuring the ecological validity of the collected data.

Finally, throughout this instrument development and adaptation, specific steps were taken to establish face validity, content validity, and initial reliability

### **3.5.1 Instruments and Measurements**

Standardized, adequate, consistent, accurate, and comparable assessments involve the measurement of variables. Consequently, the scaling procedure includes identifying variables that serve as representations of constructs (Kalkbrenner, 2021). Regarding the usage behaviour of DFS in China, this study examined the correlation between perceived risk, perceived trust, technology anxiety, facilitating conditions, behavioural intention, and PEOU. A Likert scale was deemed suitable for all items in light of the data gathered for this investigation. Furthermore, a five-point scale offers the potential for more accurate outcomes, as stated in the study rationale. Participants were requested to evaluate each enquiry on a five-point scale. The overall number of items and reliability values for each construct are summarised in Table 3.8 for the adopted scales.

### 3.5.2 Independent Variables

Perceived trust was considered an independent variable in this study. To measure this variable, the present study adopted a scale developed by Tian et al. (2023) which has 4 items to evaluate perceived trust among Chinese elderly people. Respondents were given five options to select their opinion from strongly disagree (1) to strongly agree (5).

**Table 3.1**

*Summary of Items, Sources, And Cronbach's Alpha Value for Perceived Trust*

| Construct              | Operational Definition                                                                                                                                                                    | Codes/Items                                                                                                                                                                                                                           | Cronbach's Alpha | Source              |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|
| <b>Perceived Trust</b> | Perceived trust refers to the belief held by users that the service provider will fulfil their obligations and their expectation of a specific technological outcome (Almarashdeh, 2018). | PT1: I think that Alipay/WeChat Pay will keep its promises and commitments.<br>PT2: Alipay/WeChat Pay is trustworthy.<br>PT3: I would consider Alipay/WeChat Pay to be honest.<br>PT4: I think that Alipay/WeChat Pay is responsible. | 0.923            | Tian et al. (2023). |

Perceived risk was considered an independent variable in this study. To measure this variable, the present study adopted a scale developed by Wu et al. (2017) which has four items to evaluate perceived risk in the elderly population in China. Respondents were given five options to select their opinion from strongly disagree (1) to strongly agree (5).

**Table 3.2**

*Summary of Items, Sources, and Cronbach's Alpha Value for Perceived Risk*

| <b>Construct</b> | <b>Operational Definition</b>                                                                                                                                  | <b>Codes/Items</b>                                                                                                                                                                                                                                                                                                             | <b>Cronbach's Alpha</b> | <b>Source</b>     |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------|
| Perceived Risk   | Perceived risk refers to the danger that consumers consciously recognize due to their lack of comprehension regarding product information. (Yu & Zhang, 2020). | PR1: I think using Alipay/WeChat Pay would put my privacy at risk.<br><br>PR2: I think using Alipay/WeChat Pay in monetary transactions online has potential risk.<br><br>PR3: I think using Alipay/WeChat Pay has significant risks in making online purchase.<br><br>PR4: I think using Alipay/WeChat Pay is a risky choice. | 0.876                   | Wu et al. (2017). |

Technology anxiety was taken as an independent variable in this study. To measure this variable, this study adopted the scale developed by Hoque and Sorwar (2017) which has four items to evaluate perceived technology anxiety in the elderly people in China. Respondents were given five options to select their opinion from strongly disagree (1) to strongly agree (5).

**Table 3.3**

*Summary of Items, Sources, and Cronbach's Alpha Value for Technology Anxiety*

| Construct          | Operational Definition                                                                                                                                                          | Codes/Items                                                                                                                                                                                                                                                                          | Cronbach's Alpha | Source                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------------|
| Technology Anxiety | Technology Anxiety (TA) is a detrimental affective reaction that concerns individuals' apprehension or unease regarding the utilization of technology (Kaushik & Mishra, 2019). | TA1: Using Alipay/WeChat Pay services would make me very nervous.<br>TA2: Using Alipay/WeChat Pay services makes me worried.<br>TA3: Using Alipay/WeChat Pay services may make me feel uncomfortable.<br>TA4: Using Alipay/WeChat Pay services may make me feel uneasy and confused. | 0.850            | Hoque and Sorwar (2017). |

Facilitating condition was taken as an independent variable in this study. To measure this variable, this study adopted the scale developed by Hoque and Sorwar (2017) which has five items to evaluate facilitating conditions in the elderly people in China. Respondents were given five options to select their opinion from strongly disagree (1) to strongly agree (5).

**Table 3.4**

*Summary of Items, Sources, and Cronbach's Alpha Value for Facilitating Conditions.*

| Construct               | Operational Definition                                                                                                                                                                                           | Codes/Items                                                                                                                                                                                                                                                                                                                                                                        | Cronbach's Alpha | Source                   |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------------|
| Facilitating Conditions | The term Facilitating Conditions refers to an individual's perception of the extent to which a technical and organisational infrastructure is operational to facilitate the system's use (Dwivedi et al., 2019). | FC1: I have the resources necessary to use Alipay/WeChat Pay service.<br>FC2: I have the knowledge necessary to use Alipay/WeChat Pay service.<br>FC3: Alipay/WeChat Pay is compatible with other technologies I use.<br>FC4: I always have internet connection to use Alipay/WeChat service.<br>FC5: I can get help from others when I have difficulties using Alipay/WeChat Pay. | 0.850            | Hoque and Sorwar (2017). |

### 3.5.3 Dependent Variable

The current study has one dependent variable which is the usage behaviour of DFS.

To measure it, the present study adopted the scale developed by Tian et al. (2023)

which is based on four items to evaluate the usage behaviour of respondents in China.

Respondents were given five options to select their opinion from strongly disagree (1) to strongly agree (5).

**Table 3.5**

*Summary of Items, Sources, and Cronbach's Alpha Value for Usage Behaviour*

| Construct                     | Operational Definition                                                                                              | Codes/Items                                                                                                                                                                                                                                        | Cronbach's Alpha | Source              |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|
| <b>Usage Behaviour of DFS</b> | The degree to which an individual utilizes the technology is referred to as usage behaviour (Dwivedi et al., 2019). | UB1: I use Alipay/WeChat Pay.<br>UB2: I use Alipay/WeChat Pay to manage my e-wallet accounts.<br>UB3: I use Alipay/WeChat Pay to do transactions.<br>UB4: I sign up for Alipay/WeChat Pay that are specially designed for digital payment systems. | 0.911            | Tian et al. (2023). |

#### 3.5.4 Mediating Variable

The current study used behavioural intention as a mediating variable to explain the usage behaviour of DFS among elderly people in China. In this study, the mediating function of behavioural intention was assessed using the scale developed by Tian et al. (2023), which has a Cronbach's alpha coefficient of 0.918. This section has four items, including users who frequently use Alipay/WeChat and those who intend to use it in the future. Participants were requested to provide their responses using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

**Table 3.6***Summary of Items, Sources, and Cronbach's Alpha Value for Behavioural Intention*

| <b>Construct</b>      | <b>Operational Definition</b>                                                                                                                                        | <b>Codes/Items</b>                                                                                                                                                                                                                                                         | <b>Cronbach's Alpha</b> | <b>Source</b>       |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------|
| Behavioural Intention | Behavioural intention to utilize Alipay/WeChat Pay is a measure of the degree to which consumers' actual usage of the services can be predicted (Tian et al., 2023). | BI1: I plan to use Alipay/WeChat Pay in the future.<br>BI2: I intend to use Alipay/WeChat Pay when I purchase items.<br>BI3: I plan to use Alipay/WeChat Pay frequently in my daily life.<br>BI4: I will use Alipay/WeChat Pay more frequently for paying bills in future. | 0.918                   | Tian et al. (2023). |

### 3.5.5 Moderating Variable

To gain a deeper understanding of how respondents' perceived ease of use moderates this relationship (Tian et al., 2023). The adopted scale had a Cronbach's alpha value of 0.905. Four items were used in this section to ascertain the degree to which respondents found it easy to use Alipay/WeChat and whether they found it user-friendly and understandable (e.g., in terms of learnability, clarity, and navigability). The participants were requested to provide their responses using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

**Table 3.7***Summary of Items, Sources, and Cronbach's Alpha Value for Perceived Ease of Use*

| Construct             | Operational Definition                                                                                                                                                                                                                                                                                                                  | Codes/Items                                                                                                                                                                                                                  | Cronbach's Alpha | Source        |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|
| Perceived Ease of Use | Perceived Ease of Use (PEOU) refers to the elderly individuals' subjective perception of how simple, intuitive, and effortless it is to interact with and effectively utilize Digital Financial Services (DFS) in China. Specifically, it encompasses the ease of learning, understanding, and operating the digital financial platform | PEOU1: Alipay/WeChat Pay is easy to use.<br>PEOU2: Alipay/WeChat Pay's use is clear and understandable.<br>PEOU3: It is easy to learn how to use Alipay/WeChat Pay.<br>PEOU4: It is easy to interact with Alipay/WeChat Pay. | 0.905            | (Davis, 1989) |

**Table 3.8***Summary of Adopted Scales, No. Of Items and Cronbach's Alpha Values*

| Variables | No. of Item | Sources                 | Cronbach's Alpha Value |
|-----------|-------------|-------------------------|------------------------|
| PT        | 4           | Gefen et al. (2003)     | $\alpha = 0.923$       |
| PR        | 4           | Wu et al. (2017)        | $\alpha = 0.876$       |
| TA        | 4           | Hoque and Sorwar (2017) | $\alpha = 0.850$       |
| FC        | 5           | Hoque and Sorwar (2017) | $\alpha = 0.850$       |
| BI        | 4           | Ajzen (1991)            | $\alpha = 0.918$       |
| PEOU      | 4           | Davis (1989)            | $\alpha = 0.905$       |
| UB        | 4           | Venkatesh et al. (2003) | $\alpha = 0.911$       |

### 3.6 Questionnaire Design

The development of questionnaires is an effective approach to data collection. To ensure the validity and pertinence of the study, the variables were tested (Sekaran &

Bougie, 2016). The approach to questionnaire development is contingent on the research objectives. This requires the establishment of suitable objectives and targets, a comparison of the questionnaire design with an extensive body of research, and the utilisation of multiple questions to calculate each variable. The questionnaire comprised items that assessed seven factors. In this study, the usage behaviour of DFS is considered the dependent variable. Furthermore, the exogenous constructs considered in this study were perceived trust, perceived risk, technology anxiety, and facilitating conditions. The mediating variable was behavioural intention, and the moderator was PEOU.

To measure the dependent variable (usage behaviour of DFS), the present study adopted the scale developed by Tian et al. (2023) which is based on four items ( $\alpha = 0.911$ ) to evaluate the usage behaviour of respondents in China. The independent variable in this study was the respondents' perception of trust. Four items proposed by Tian et al. (2023) were used in this study. The scale has a Cronbach's alpha value of 0.923. Likewise, participants were asked about their perceived level of risk in this segment. To this end, the scale developed by Wu et al. (2017) was used. The four items in this section had a Cronbach's alpha coefficient of 0.876. Furthermore, participants were asked about their levels of technology anxiety using a four-item scale developed by Hoque and Sorwar (2017), which has a Cronbach's alpha value of 0.850.

Furthermore, participants were asked about facilitating conditions using a scale developed by Hoque and Sorwar (2017). This scale comprises 5 items and has a Cronbach's  $\alpha$  value of 0.850. The mediating function of behavioural intention was assessed using the four-item scale developed by Tian et al. (2023), which has a Cronbach's value of 0.918. In conclusion, the moderating role of PEOU was evaluated

using the scale developed by Tian et al. (2023). Four items were pertinent to the subject in this section. This scale had a Cronbach's alpha value of 0.905.

Furthermore, in assessing the dependent, independent, and mediating variables in this research, the researcher used a variety of metrics derived from numerous reputable literature sources. Demographic items (gender, age, education, occupation, tech familiarity) were included in Section A. The questionnaire comprised 29 items and was employed to assess seven selected variables: usage behaviour (4 items), perceived trust (4 items), perceived risk (4 items), technology anxiety (4 items), facilitating conditions (5 items), behavioural intention (4 items), and PEOU (4 items).

The survey was divided into eight sections. Section A gathers the respondents' demographic information. Section B includes questions on Perceived Trust. Section C includes questions on Perceived Risk. Section D comprises questions regarding Technology Anxiety. Section E consists of questions regarding Facilitating Conditions. Section F delineates Behavioural Intention, Section G concludes with Perceived Ease of Use, and Section H concluded with PEOU assessed using a five-point Likert scale (5 = strongly agree to 1 = strongly disagree).

### **3.7 Pilot Study**

After completing the initial design of the questionnaire, a pilot study was conducted to evaluate and assess its reliability, validity, and time cost (Sekaran & Bougie, 2016). Pilot studies allow researchers to refine their data collection procedures and instruments. It offers a chance to test the research protocol, recruitment strategies, data collection instruments, and sample size, and identify potential problems before the main study is conducted (Karunarathna et al., 2024). Reliability and validity are distinct yet interconnected and mutually constrained. Reliability is a necessary but not

sufficient condition for validity (Malhotra, 2018). This reveals that a measurement can be reliable (consistent) without being valid (accurate), but for a measurement to be valid, it must first be reliable. If a measurement lacks reliability, it cannot be considered valid.

Researchers have different views on determining the sample size for pilot studies. Teresi et al. (2022) suggested that a suitable sample size in a pilot study should be 10% of the expected sample size in a large study. Oppenlaender et al. (2024) believe that this sample size is often sufficient to provide valuable feedback on design and data collection methods without overburdening resources. Powell et al. (2021) stated that 10–30 participants are sufficient for a pilot study. However, other researchers argue that there is no universal standard for setting the sample size in a pilot study because it depends on several factors. Therefore, prior to initiating a larger survey, 40 questionnaires were selected for this pilot study. Before the pilot study commenced, an early draft of the questionnaire was shared with experts in the field to evaluate its content and face validity. After incorporating the feedback from experts, the pilot study was conducted.

The pilot study involved 40 elderly individuals from the target population in Zhengzhou, representing approximately 10% of the final valid sample of 382. The key takeaways from the pilot phase were crucial for refining the questionnaire and enhancing the study's rigor. Specifically, feedback revealed that some questions' original English translations were ambiguous or culturally insensitive for the elderly Chinese population. For instance, initial phrasing regarding "financial management tools" was reworded to "Alipay/WeChat Pay for daily transactions" to improve clarity and relevance. Furthermore, the pilot study helped confirm that a five-point Likert

scale was indeed more manageable for elderly respondents than a seven-point scale, minimizing cognitive burden and potential fatigue. It also allowed for refining the administration process, such as optimizing the duration of the survey and ensuring adequate assistance from research assistants. The preliminary reliability analysis (Cronbach's Alpha) for each construct during the pilot study also provided initial confirmation of internal consistency, indicating that the measurement items were coherent and performed as expected. These adjustments, informed by the pilot study, were instrumental in ensuring the comprehensibility, validity, and reliability of the research instruments for the main study.

### **3.8 Data Sorting and Analysis**

The data analysis process included gathering the data, looking for any anomalies, testing for normality, reliability, and validity, and conducting confirmatory factor analysis, descriptive statistics, and correlation analysis. The researcher used SPSS version 28 for the initial phase of data input. In the interim, the researcher verified that the data was entered accurately. Prior to any statistical analysis, missing data were thoroughly examined. Given the face-to-face administration and diligent oversight during data collection, the occurrence of missing values was minimal. For any isolated missing items, a mean imputation strategy was considered, though typically not required due to the high completeness of returned surveys. Furthermore, preliminary data cleaning involved screening for outliers and data entry errors, which were cross-checked against original questionnaires where necessary. SPSS was used for basic descriptive statistics, such as mean, standard deviation, frequency, and percentage, to profile and characterise the respondents. To investigate the variations and convergences among the perspectives held by survey respondents, statistical summaries such as the mean and standard deviation were used. Initial assessments for

data normality were also conducted at this stage using graphical methods and statistical tests (e.g., Kolmogorov-Smirnov and Shapiro-Wilk tests) in SPSS. These preliminary checks indicated deviations from strict normality, which further supported the choice of PLS-SEM, a variance-based method robust to non-normal data distributions. Smart PLS 4.1 was used for the final data analysis.

### **3.8.1 Reliability Analysis**

Reliability analysis refers to a method for testing the degree of consistency of the questionnaire data (Meeker et al., 2021), which means that the obtained questionnaire data are judged to be consistent using statistical analysis. Therefore, when conducting a pilot study, it is necessary to conduct a reliability test to determine the reliability of the data collected.

Cronbach's Alpha, a common coefficient known as the reliability coefficient, internal consistency coefficient, or  $\alpha$  coefficient, was used to measure the internal consistency of the overall questionnaire and each item. Cronbach's alpha coefficient is between 0 and 1; if Cronbach's alpha is higher than 0.7, it is usually acceptable; if Cronbach's alpha is between 0.5 and 0.7, it can be inferred that there are some problems with the measurement items; if the coefficient is below 0.5, further revision of the scale should be considered (Cheung et al., 2024).

Most researchers have mentioned that when conducting a pilot study, it is necessary to implement a purification screening of the initial questionnaire measurement items (Malhotra, 2018). If unfiltered items are used, factor analysis of the model may result in a multidimensional situation, making it impossible to interpret the connotations of each factor separately.

### **3.8.2 Validity Analysis**

Validity measures the accuracy and effectiveness of a measurement, referring to the extent to which a measurement can capture theoretical variables. Validity considers two key questions: (1) What is being measured? This ensures that the measurement project measures the intended theoretical variables, rather than other constructs. (2) How precise and accurate are these measurements? This question pertains to the ability of the measurement variable to accurately capture the intended theoretical construct (Witte et al., 2022). This study conducted reliability and validity factor analyses on the main questionnaire.

## **3.9 Data Analysis**

### **3.9.1 Descriptive Statistics**

After collecting the data, the first step was to generate descriptive statistics using SPSS, a popular statistical software application that provides a tool to analyse and visualise the data (Roni & Djajadikerta, 2021). Descriptive statistics are statistical summaries of datasets that provide a general overview of the data. This encompasses central tendency metrics (such as the mean, median, and mode), variability indicators (such as the range, standard deviation, and variance), and shape descriptors (including skewness and kurtosis). Specifically, this section presents the demographic profile and key characteristics of the respondents (e.g., age, gender, education level, technology familiarity), as collected in Section A of the questionnaire. These demographic variables provide essential context for understanding the elderly population under study and are crucial for assessing the representativeness of the sample within the defined target population. These statistical measures provide the researcher with data distribution, variability, and overall trends among the study variables, forming the basis for subsequent analyses (Pallant, 2020). Visualizations such as histograms and

box plots were also generated to further explore data patterns, identify potential outliers, and provide a visual assessment of data distributions for each key variable, complementing the statistical normality tests conducted in the initial data sorting phase.

To answer the research questions, this study employed Partial Least Squares Structural Equation Modelling (PLS-SEM). In technology adoption research, SEM has been identified as the dominant method that uses empirical data to evaluate the validity of theoretical models (Fu et al., 2024). PLS-SEM is a parameter estimation method within SEM.

This is consistent with the findings of Hair et al. (2014), PLS-SEM is particularly effective when research models are complex, sample sizes are relatively small, and data distributions are non-normal. These conditions make PLS-SEM suitable for both exploratory and confirmatory research. In this study, SmartPLS was used to analyse the quantitative data.

PLS-SEM provides a robust approach for interpreting survey responses and evaluating the connections between research constructs within the context of the theoretical model being investigated. PLS-SEM was used because of the complexity of the study model and the unknown sample distribution.

Wang et al. (2024) applied PLS-SEM to develop a theoretical model to understand the root causes of end-user resistance to adopting IoT smart homes among the elderly. This study found that PLS-SEM was effective in testing the theoretical model and identifying significant constructs.

### **3.9.2 Reliability**

Reliability pertains to the consistency and stability of measurement results. It indicates the likelihood or degree to which the same results would be obtained if the measurements were repeated using the same scale or method. Reliability analysis aims to examine whether the sample data is genuinely reliable, that is, whether they accurately reflect the responses to each measurement item. In this study, reliability assessment was performed using Cronbach's alpha and Composite Reliability (CR). Cronbach's alpha evaluates internal consistency by assessing the coherence of a set of items within a group (Izah et al., 2023). It is considered acceptable reliability if the alpha is above 0.7. Composite reliability is a new criterion for measuring the internal consistency of scale items which has been introduced by SmartPLS software.

### **3.9.3 Validity**

Validity analysis was employed to assess the effectiveness of the items in expressing the conceptual information of the research variables and dimensions. The focus was on evaluating the appropriateness, accuracy, and effectiveness of the item design and determining whether the items could effectively measure the variables of interest in the study. Confirmatory factor analysis (CFA) was performed and tests for convergent and discriminant validity performed.

CFA, as described by Brown (2015), is a statistical technique that confirms the factor structure of the observed variables. Kline (2023) further elaborated that it tests the assumption of a connection between observed variables and their latent constructs. This is important for validating the measurement model and confirming whether the data gathered reflect the theoretical constructs being measured. In this study, the

researcher used CFA to validate the theoretical constructs and ensure that the data collection instruments measured the constructs as intended.

After assessing the model fit, validity analysis was performed to test both convergent and discriminant validity. Convergent validity evaluates the consistency of different items intended to measure the same concept (Hair et al., 2017). It was measured using the outer loadings of indicators, Average Variance Extracted (AVE), and CR. Loadings were above 0.7, AVE was 0.5 or more, and CR should be above 0.7 and greater than AVE for adequate convergent validity (Hair et al., 2016).

Discriminant validity probes the distinctness of concepts or measures that are presumed not to be linked, ensuring that they remain distinct (Hair et al., 2017). Two common methods to evaluate this are the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio. According to the Fornell-Larcker criterion, the square root of a construct's AVE should exceed its maximum correlation with any other construct, as outlined by Fornell and Larcker (1981). HTMT is a more rigorous test, with values below 0.85 indicating adequate discriminant validity (Henseler et al., 2015).

#### **3.9.4 Correlation Coefficient**

This study used Pearson's correlation coefficient to analyse the relationships between different variables using SPSS. Pearson's correlation coefficient ranged from -1 to 1. A coefficient above 0 signified a positive relationship, whereas a coefficient below 0 denoted a negative relationship. The magnitude of the coefficient represents the strength of correlation. Before conducting a path analysis within the structural equation model, a correlation analysis was performed. This step helped identify significant relationships among variables and determine which variables may impact a specific

variable. However, it is essential to note that correlation analysis only reveals associations between variables and does not establish a causality.

Once the presence of significant correlations among the latent variables is confirmed, a structural equation model can be constructed to further explore the extent of their influence and to investigate causal relationships. In this study, the data was input into SPSS software. Pearson's correlation analysis was applied to calculate the correlations between all latent variables in the model. These correlation results serve as supporting evidence for assessing discriminant validity and for further analysis.

In summary, reliability analysis aims to evaluate the stability and internal consistency of the measurement items, whereas validity evaluation primarily focuses on the structural validity of the measurement scale. Structural validity pertains to the degree to which all measurement variables of the same theoretical construct (or latent variable) reflect the construct. Subsequent model-fitting studies are meaningful only when both reliability and validity are high. In other words, high-quality sample data is a prerequisite for empirical research.

### **3.9.5 Common Method Biases**

Common Method Biases (CMB) refers to discrepancies that arise from the measurement technique instead of the constructs under investigation (Podsakoff et al., 2024). Since this study utilized a self-administered, paper-based questionnaire, a more relevant example of CMB would be: Participants developing a habitual response pattern when completing the survey (e.g., agreeing with every statement, consistently choosing the middle option, or providing socially desirable answers), thereby introducing bias into constructs like Usage Behaviour (UB) or Behavioural Intention (BI), where respondents may consistently rate their intentions or behaviours in a

certain way, regardless of their true experiences (Podsakoff et al., 2003). The CMB is considered the main source of measurement errors.

The quantitative analysis in this study was based on data obtained from the survey questionnaires. Under similar premises, such as the same measurement situations and item contexts, data homogeneity may lead to artificial covariance between the predictor and criterion variables, resulting in CMB. Procedural and statistical control methods can be employed to effectively control for common method bias (Podsakoff et al., 2024).

To mitigate CMB, this study employed both procedural and statistical control methods (Podsakoff et al., 2003; Podsakoff et al., 2024). Procedural controls implemented during data collection included ensuring the anonymity of responses and voluntary participation by clearly stating these conditions in the cover letter. Participants were reassured that their information would be used solely for academic purposes and kept confidential. Additionally, the questionnaire was designed to separate the independent and dependent variables conceptually and spatially, grouping different constructs into distinct sections to reduce response set bias. The pilot study was also instrumental in refining the questionnaire items, for instance, by rewording ambiguous questions or ensuring clarity, which further minimized potential misunderstandings that could contribute to CMB. While these procedural measures were diligently applied, it is acknowledged that CMB cannot be entirely eliminated when data are collected from the same respondents at a single point in time. Therefore, a statistical control method, Harman's single-factor test, was also employed to assess the extent of potential CMB.

Consequently, this study employed Harman's single-factor test. That is, if there is a common factor in the questionnaire data that can explain most of the variance in all

items, then there exists a common method bias (Podsakoff & Organ, 1986). The specific test and operation involved conducting an EFA on all variables and checking the results of unrotated factor analysis. If the first unrotated factor explains a particularly large proportion of the variance, it implies that the presence of a significant common method bias. Some scholars believe that common method bias is not severe if it does not exceed 50% (Hair et al., 2010).

### **3.9.6 Multicollinearity**

Testing for multicollinearity in PLS-SEM is crucial to ensure that the predictor variables in the model are not highly correlated, as this can distort the results and interpretations. The primary method for detecting multicollinearity in PLS-SEM is by calculating the Variance Inflation Factor (VIF) for the structural model. The VIF values indicate the extent to which the variance of a regression coefficient is amplified by the correlated predictors (Kyriazos & Poga, 2023).

A VIF value of 1 indicates no multicollinearity. VIF values greater than 1 but less than 5 (or a more conservative threshold of 3.3) are typically considered acceptable. VIF values greater than 5 (or 3.3) suggest high multicollinearity, which may be problematic for regression analyses (Kyriazos & Poga, 2023). High VIF values can compromise the reliability and stability of regression coefficient estimates. Such values can obscure the distinct influence of predictor variables because of their strong interrelationships (Kim, 2019).

This study employed both Pearson's correlation analysis (using SPSS) and Variance Inflation Factor (VIF) analysis (using SmartPLS) to assess multicollinearity. While PLS-SEM inherently handles multicollinearity for latent variables, using Pearson's correlation in SPSS served as an initial diagnostic step to identify any strong bivariate

correlations between exogenous constructs that might indicate potential multicollinearity issues at an earlier stage of data exploration (Hair et al., 2017). This preliminary analysis provided a foundational understanding of the relationships between constructs before proceeding to the more complex PLS-SEM model. High correlation coefficients (typically above 0.8) would have signalled potential issues. The VIF analysis in Smart-PLS then provided a robust, model-based assessment of multicollinearity within the structural model, which is the definitive measure for PLS-SEM. These two methods complement each other, with SPSS offering an early insight and SmartPLS providing the definitive assessment within the specified modelling environment. No variables were removed or combined as a result of these analyses, as all VIF values were well within acceptable thresholds, confirming minimal multicollinearity and allowing the final PLS-SEM model to proceed as designed.

### **3.10 Hypothesis Testing using Partial Least Squares Structural Equation Modelling**

Partial Least Squares Structural Equation Modelling (PLS-SEM) is a versatile statistical technique that analyses complex relationships between variables. It is widely used across various disciplines, such as economics, marketing, psychology, and sociology. PLS-SEM is grounded in the variance-based approach, which differs from Covariance-Based Structural Equation Modelling (CB-SEM) (Hair et al., 2014).

A distinguishing feature of PLS-SEM is its focus on maximising the explained variance of the dependent constructs rather than prioritizing overall model fit as in CB-SEM. This makes PLS-SEM particularly suitable for studies with complex, interlinked variables, when the primary goal is prediction. PLS-SEM is beneficial in scenarios with limited sample sizes, data that is not normally distributed, or when using formative measurement models. PLS-SEM can handle models with multiple

constructs and indicators per construct without requiring large samples. It can also handle measurement models in which indicators are either reflective or formative (Ali et al., 2018). In PLS-SEM, the emphasis is not on the overall model fit but on the evaluation of the individual path coefficients and R-squared values of the endogenous latent variables. However, several fit and quality criteria have been proposed for PLS-SEM, such as the standardised root mean square residual (SRMR), Normed Fit Index (NFI), and  $Q^2$  value.

The choice of PLS-SEM over Covariance-Based Structural Equation Modeling (CB-SEM) for this study was driven by several key factors (Hair et al., 2017). Firstly, PLS-SEM is highly effective for studies with complex models and non-normal data distributions, both of which are characteristic of this research involving multiple constructs and elderly participants. Unlike CB-SEM, PLS-SEM does not assume multivariate normality, making it more robust with real-world, often non-normal, survey data. Secondly, the primary objective of this study is prediction and theory development within a relatively under-researched context (DFS adoption among China's elderly), rather than strictly confirming established theories. PLS-SEM excels in predictive accuracy and identifying key drivers, aligning perfectly with the study's aim to provide actionable insights. Lastly, PLS-SEM is more suitable for complex models with numerous latent variables and indicators, providing greater flexibility in handling measurement and structural model estimations, which is beneficial for a model incorporating multiple exogenous constructs, a mediator, and a moderator.

PLS-SEM consists of two main models: the measurement and structural models. The measurement model focuses on the connection between the latent variables and their

indicators. In contrast, the structural model delves into the interactions among the latent variables.

After estimating the model parameters, if the relationships or R-squared values are not as expected, researchers might consider revising the model, adding or removing paths, or considering different control variables.

Once the model is deemed satisfactory, PLS-SEM allows for testing the significance of the hypothesised paths using bootstrapping techniques. This includes assessing direct relationships, mediating effects, and moderating effects (typically through the product indicator or two-stage approach using interaction terms) (Hair et al., 2017; Henseler et al., 2016). The significance and direction of the relationships derived from these tests are pivotal in determining whether to accept or reject research hypotheses. Various software tools have facilitated PLS-SEM dissemination. Among these, SmartPLS stands out because of its user-friendly interface and comprehensive functionality. Therefore, SmartPLS was used for the analysis in this study.

### **3.10.1 Mediation Analysis**

Mediation analysis sheds light on the underlying mechanisms that drive the links between independent and dependent variables, weaving these relationships together. While management research typically employs SEM for mediation effect analysis using conventional methods such as stepwise testing and Sobel tests (Rasoolimanesh et al., 2021), the bootstrap method within the SEM framework provides more precise testing of mediation effects.

The bootstrap method has advantages for statistical inference, particularly in the analysis of multiple mediation models (Falk et al., 2024). This method does not require

large samples or normal distribution assumption. Furthermore, it does not require standard errors during the interval estimation of mediation effects, making it versatile for various mediation effect analyses (Alfons et al., 2022).

Bootstrap was initially proposed by Efron and Tibshirani (1986). Bootstrap is a resampling technique in which the primary sample is treated as the population for sampling. This method entails the recurrent sampling of multiple bootstrap samples with replacement, essentially mimicking the act of drawing extensive samples from a larger population.

The primary requirement of the bootstrap method is that the original sample should reflect the research population without needing to know the specific distribution of the research population. In the context of mediation analysis, bootstrapping was used to estimate the distribution of the indirect effects and derive confidence intervals. This allows us to make inferences about whether the indirect (mediated) effect is statistically significant without assuming a normal distribution of indirect effects. This study utilised the bootstrap method and employed SmartPLS software to analyse the mediation effects.

Specifically, in this study, the mediation model investigates how Behavioural Intention (BI) mediates the relationships between Facilitating Conditions (FC), Technology Anxiety (TA), Perceived Risk (PR), Perceived Trust (PT) (as exogenous constructs), and Usage Behaviour (UB) (as the dependent variable). The bootstrap method was preferred because it accurately estimates the indirect effects and their significance without imposing strict normality assumptions, which is crucial given the potentially non-normal distribution of responses from the elderly population. SmartPLS 4.1 was

used to perform the bootstrapping analysis for these specific mediation paths ( $FC \rightarrow BI \rightarrow UB$ ,  $TA \rightarrow BI \rightarrow UB$ ,  $PR \rightarrow BI \rightarrow UB$ ,  $PT \rightarrow BI \rightarrow UB$ ).

### 3.10.2 Moderation Analysis

As this study utilizes PLS-SEM, moderation analysis was conducted using the interaction term approach (Hair et al., 2017). This method involves creating an interaction term by multiplying the independent variable (IV) and the moderator variable (Mod) and then including this interaction term as an additional predictor in the regression equation for the dependent variable (DV). The significance of the path coefficient for this interaction term indicates a moderating effect. Specifically, Perceived Ease of Use (PEOU) was introduced as a moderator, examining its influence on the relationships between Facilitating Conditions (FC), Technology Anxiety (TA), Perceived Risk (PR), Perceived Trust (PT) (as exogenous constructs), and Usage Behaviour (UB) (as the dependent variable). Four interaction terms were constructed:  $PEOU*FC$ ,  $PEOU*TA$ ,  $PEOU*PR$ , and  $PEOU*PT$ . SmartPLS 4.1 was then used to estimate the path coefficients and their significance for these interaction terms through bootstrapping, thereby validating the moderation hypotheses (H10a-H10d).

According to Memon et al. (2019), the path is expected to be stronger for the group that scored higher on the moderator, underscoring the general notion of moderation that the connection between the independent and dependent variables varies based on the intensity of the moderator.

It is important to note that while methodologies like the chi-square difference test are commonly employed in Covariance-Based Structural Equation Modeling (CB-SEM) for moderation analysis, PLS-SEM, being a variance-based approach, does not rely on such model fit statistics for this purpose. Instead, the significance of the interaction

term's path coefficient, typically assessed via bootstrapping with a specified significance level (e.g.,  $p < 0.05$ ), directly indicates the presence and nature of the moderating effect (Hair et al., 2017). The degrees of freedom for these tests are implicitly managed by the bootstrapping procedure in Smart-PLS, which provides robust p-values for the interaction terms.

### **3.11 Summary of the Chapter**

Chapter 3 outlines the methodological procedures employed to investigate the drivers and deterrents affecting the adoption of DFS by the elderly population in China, specifically focusing on Zhengzhou. This chapter begins by delving into the research design and highlighting the adoption of a deductive, quantitative research approach utilizing a survey-based methodology.

Next, the data collection procedure is described. This study leveraged structured questionnaires to gather quantitative data. The chapter then delves into the data analysis methods. For the quantitative data, PLS-SEM was used to validate the hypothetical relationships between the variables. This chapter also discusses the potential issue of common method bias, which was controlled for using Harman's single-factor test.

In summary, chapter 3 provides a detailed roadmap of the research process, outlining the methods used to achieve the research objectives. Each method is explained and justified in terms of its capacity to effectively and efficiently answer the research questions. Therefore, this chapter serves as a blueprint for the empirical work undertaken in this study.

## CHAPTER FOUR

### RESULTS

#### 4.1 Introduction

This chapter presents the results of the quantitative analysis of the data collected for this study. In this chapter, the collected data was analysed using two software programs primarily focused on statistical analysis: SPSS version 27 and SmartPLS version 4. Data screening and preliminary analysis were conducted using SPSS, whereas the inferential part of the data analysis was performed using SmartPLS version 4. Smart PLS was used to assess the overall measurement and structural fit of the data. This chapter includes a detailed write-up of the respondents' profiles, data screening involving the assessment of normality and other statistical assumptions. This was followed by hypothesis testing. These steps are important components of the data analysis process. Therefore, each step is explained in detail below.

#### 4.2 Response Rate

To achieve the research objectives of this study, data was collected from 420 elderly people aged 65 years or above. The researcher collected data from elderly people living in nursing homes, community care centres, and day care centres in Zhengzhou City, Henan Province. The primary reason for selecting this city is its high population in Henan Province. Moreover, of the 420 distributed questionnaires, 382 (90.95%) were returned with filled responses; hence, these 382 were considered for initial analysis. Data was collected, and the response rate was high. Moreover, in this study, the high response rate was 90.95% which has been supported to be suitable for further analysis (Holtom et al., 2022).

### 4.3 Respondent Profile

The researcher initially decided to collect data from 420 elderly people because a buffer for additional responses could be developed. This was done because of the chance of missing values, while 382 (90.95%) responses were obtained for the study, as these were filled by the respondents. Table 4.1. shows the respondents' profiles. The questionnaire initially screened for respondents aged 65 and above (dichotomous: "above 65" vs. "below 65") to ensure eligibility. Among those qualifying as "above 65", further sub-categorization into age ranges (65–70, 71–75, etc.) was achieved through an additional open-ended follow-up question in the survey, allowing for detailed demographic profiling as shown in Table 4.1.

**Table 4.1**

*Summary of Respondent's Profile*

| Demographic Variables    | Categories           | Frequency | Percentage |
|--------------------------|----------------------|-----------|------------|
| Gender                   | Male                 | 129       | 33.8       |
|                          | Female               | 253       | 66.2       |
| Age                      | 65 – 70              | 207       | 54.2       |
|                          | 71 – 75              | 92        | 24.1       |
|                          | 76 – 80              | 42        | 11.0       |
|                          | 81 – 85              | 18        | 4.7        |
|                          | 86 & above           | 23        | 6.0        |
|                          |                      |           |            |
| Current Residential Area | Urban                | 205       | 53.7       |
|                          | Semi Urban Area      | 118       | 30.9       |
|                          | Rural                | 59        | 15.4       |
| Education                | No Formal Education  | 107       | 28.0       |
|                          | Primary School       | 165       | 43.2       |
|                          | Secondary School     | 102       | 26.7       |
|                          | University Degree    | 06        | 1.6        |
|                          | Post Graduate Degree | 02        | 0.5        |
| Occupation               | Retired              | 179       | 46.9       |
|                          | Employed Full-Time   | 62        | 16.2       |
|                          | Employed Part-Time   | 34        | 8.9        |
|                          | Homemaker            | 104       | 27.2       |
|                          | Other                | 03        | 0.8        |

As shown in Table 4.1, the gender distribution of the sample comprised 129 (33.8%) males and 253 (66.2%) females. The age-wise distribution shows that respondents aged between 65 and 70 numbered around 207 (54.2%), respondents aged between 71

and 75 were 92 (24.1%), 42 (11.0%) respondents were aged between 76 and 80 years, 18 (4.7%) respondents were aged between 81 and 85 years, and respondents aged 86 and above constituted the sample at around 23 (6.0%). According to the current residential area, most respondents belonged to the urban area, with 205 (53.7%) respondents, 118 (30.9%) respondents belonged to the semi-urban area, and 59 (15.4%) respondents belonged to the rural area. Based on education level, the sample under study comprised 107 (28.0%) respondents who did not have any formal education, 165 (43.2%) respondents who had attended primary school, 102 (26.7%) who had qualifications up to secondary school, six (1.6%) who possessed a university degree, and only two (0.5%) respondents. Moreover, based on occupation, it can be said that most of the sample under study is populated with retired people numbering around 179 (46.9%), and 104 (27.2%) homemakers constitute the present sample. Of the elderly people, 62 (16.2%) were employed full-time, 34 (8.9%) were employed part-time, and 03 (0.8%) responded as other.

#### **4.4 Response Bias**

As discussed earlier, 420 questionnaires were distributed to the elderly for data collection. Data was collected from elderly people living in nursing homes, community care, and day care centres located in Zhengzhou City, Henan Province. The data were collected using a self-administered survey that took almost four months to complete, as the subjects in the study belonged to urban, semi-urban, and rural areas. Fortunately, the response rate was 90.95%, as most participants willingly participated in the study, while very few were reluctant to participate and hence returned empty or incomplete questionnaires. Finally, 382 questionnaires with complete responses were returned and considered valid for data analysis. Hence, this resulted in a response rate of 90.95%, which is considered to be quite good. Therefore, the response bias test was not

considered because the response rate exceeded 70%. Moreover, a study conducted by Hair et al. (2021) supported skipping the response bias test if the researcher obtained a response rate of more than 70%.

#### **4.4.1 Non-Response Bias**

Non-response bias refers to the tendency of respondents to differ in their responses due to different demographic characteristics. Moreover, a non-response bias occurs when a respondent's responses are different from those who have not responded (Sedgwick, 2014). In this study, the researcher personally collected data from the respondents and allowed them to fill in their responses at their convenience. To avoid non-response bias, the researcher decided to collect data on the spot.

#### **4.5 Data Coding**

Data coding is an important aspect of data analysis. Many researchers, such as Saldaña (2021), have argued that data coding is a necessary part of the data analysis process. Moreover, to perform an error-free analysis, all types of quantitative data must be coded (Liu, 2022). In this study, coding was assigned to the item responses, and the second stage involved assigning codes to each variable and each item. To perform the quantitative analysis in this study, variables and items regarding respondents' technology and digital literacy were coded, as shown in Tables 4.2 and 4.3, respectively.

**Table 4.2**  
*Coding of Variables*

| Variables              | Codes |
|------------------------|-------|
| Perceived Trust        | PT    |
| Perceived Risk         | PR    |
| Technology Anxiety     | TA    |
| Facilitating Condition | FC    |
| Usage Behaviour        | UB    |
| Behavioural Intention  | BI    |
| Perceived ease of use  | PEOU  |

**Table 4.3**  
*Coding of Items for Technology & Digital Literacy*

| Items                                                                                  | Codes  |
|----------------------------------------------------------------------------------------|--------|
| I own a smart phone or other mobile device.                                            | TDL(A) |
| I use my mobile device for daily activities (e.g. communication, news, entertainment). | TDL(B) |
| I am comfortable using the internet on my mobile device.                               | TDL(C) |
| I am using digital financial services (mobile banking, online payments).               | TCL(D) |
| If yes, how did you learn to use it.                                                   | TDL(E) |

#### 4.6 Preliminary Analysis

Before testing the data using SmartPLS to assess the measurement and structural model, a preliminary analysis was necessary to ensure a bias-free analysis and estimate the data. To conduct the preliminary analysis, SPSS version 27 was used to perform data screening, determine the presence of missing values, detect outliers, and assess the statistical assumptions of the quantitative data collected.

##### 4.6.1 Data Cleaning & Screening

After collecting and coding survey-based quantitative data, there is still a chance of error, which needs to be corrected by adopting a data cleaning and screening process (Pallant, 2020). Data screening was performed to ensure that the data were free from unwanted errors. In addition, data screening helps researchers achieve data normality and avoid distortions in the results of the analysis. Similarly, the study conducted by

Hair et al. (2014) strongly support the data screening process in the sense that a study that involves multivariate data analysis requires data to be screened carefully, which helps the researcher gain control over the problem of missing data and outlier presence, which can adversely affect the results of the research. Therefore, researchers must perform a data screening process to yield valid and useful results. Thus, this study adopted the following steps to perform data cleaning and screening.

#### **4.6.1.1 Missing Values Treatment**

Missing values in a quantitative dataset occur when the subject under study intentionally or unintentionally does not provide an answer to the question or a complete questionnaire, hence causing the questionnaire to be of no use in performing quantitative analysis (Little & Rubin, 2019). Enders (2022) argues that researchers regard the presence of missing values as a major issue that adversely affects analysis results. In quantitative data analysis, data with missing values are not used because missing values distort the data, causing bias in the results (Lin & Tsai, 2020). Moreover, a considerable body of literature on quantitative analysis addresses numerous approaches to the presence and treatment of missing data. Tabachnick and Fidell (2007) suggested using mean values instead of responses that were not provided by the participants. Hence, in this study, it was ensured that no missing values were present in the dataset. For this purpose, only questionnaires filled out by the respondents were included. Moreover, the researcher prioritised on-the-spot data collection to effectively address the problem of missing values.

#### **4.6.1.2 Outlier Detection**

An outlier in the data is defined as a figure which appears inconsistent and unusual for a variable or a combination of unusual numbers across different variables. The presence of outliers may affect the results of quantitative analysis (Smiti, 2020).

Moreover, Tabachnick and Fidell (2007) pointed out that the presence of extreme values on one or more variables severely distorts the statistics. Outliers can specifically distort statistical measures such as the mean (pulling it toward the extreme value), variance (inflating it and leading to underestimation of true variability), and regression coefficients (causing biased estimates of relationships between variables by unduly influencing the least squares fit) (Smiti, 2020). This implies that the observations are numerically at a certain distance from the rest of the data. Singh and Upadhyaya (2012) argue that the presence of outliers in the data set yields unreliable results as the regression coefficients are highly distorted. Moreover, Sekaran and Bougie (2016) strongly suggests that researchers should detect and check for outliers because their presence also affects the real mean of the samples. In view of the suggestions of different researchers, Mahalanobis  $D^2$  was used in SPSS version 27 to conduct outlier detection analysis. The Mahalanobis  $D^2$  method was specifically chosen because it measures the multivariate distance of each observation from the centroid of the data distribution, accounting for correlations among variables, which makes it superior to univariate methods like z-scores for datasets with multiple interrelated constructs, as in this study (Figueiredo et al., 2023). This method was used because it identifies outliers in the dataset at distant points (Figueiredo et al., 2023). Moreover, Mahalanobis  $D^2$  involved the use of chi-square values with a probability of less than 0.001 ( $P < 0.001$ ). The degrees of freedom ( $df=6$ ) were selected based on the number of latent exogenous and endogenous variables in the model (PT, PR, TA, FC, BI, PEOU), and the  $p < 0.001$  threshold is a common stringent criterion in multivariate outlier detection to minimize false positives while ensuring only extreme deviations are flagged (Tabachnick & Fidell, 2007). Hence, in this study, Mahalanobis outlier detection was performed using  $df=6$ . Using  $df=6$ , the standard value was 22.458,

whereas the maximum value in our analysis was 19.530, indicating the absence of outliers in the given dataset. Hence, 382 cases were included for further data analysis.

#### **4.6.2 Normality Tests**

The assessment of normality is an important part of data analysis to ensure the validity of results. Moreover, the researcher is bound to assess the normality of the constructs under study to minimise errors in data analysis (Pallant, 2020). Hair (2014) presented four important assumptions that may affect the results of the study: normality, homoscedasticity, absence of correlated errors, and linearity. In this study, the normality of the data was assessed using skewness and kurtosis values. In addition, the Kolmogorov-Smirnov and Shapiro-Wilk tests were performed to assess the normality of each construct. Violations of these assumptions can potentially lead to errors and seriously affect the credibility of the results of the study. Hence, SPSS version 27 was used to perform the normality analysis.

##### **4.6.2.1 Skewness & Kurtosis**

To perform an analysis of normality, skewness, and kurtosis, the prime indicators were considered. Skewness and kurtosis values were used to assess the normality of individual variables, and the values are listed in Table 4.4. Skewness indicates the balance of the data and whether the data points are normally distributed, whereas kurtosis indicates the peak of the data distribution. Hair et al. (2021) showed that the distribution is considered normal if the skewness and kurtosis values lie between -2 and +2. Table 4.4 summarizes the skewness and kurtosis values for all constructs, confirming that the data exhibit approximate normality, as all values fall within acceptable ranges (Hair et al., 2021).

**Table 4.4**  
*Skewness & Kurtosis Values*

| Variables | Skewness  |       | Kurtosis  |       |
|-----------|-----------|-------|-----------|-------|
|           | Statistic | SE    | Statistic | SE    |
| PT        | 0.089     | 0.125 | -1.663    | 0.249 |
| PR        | 0.165     | 0.125 | -1.631    | 0.249 |
| TA        | 0.098     | 0.125 | -1.662    | 0.249 |
| FC        | 0.118     | 0.125 | -1.667    | 0.249 |
| UB        | 0.061     | 0.125 | -1.637    | 0.249 |
| BI        | 0.035     | 0.125 | -1.664    | 0.249 |
| PEOU      | 0.905     | 0.125 | -0.306    | 0.249 |

According to Table 4.4, the skewness and kurtosis values lie between -2 and +2; in other words, the skewness values for each variable under study are near zero, and the kurtosis values are in the acceptable range, as specified by Hair et al. (2021). This implies that the data for each variable were close to a normal distribution. Moreover, many quantitative researchers, for example Asparouhov and Muthén (2016), believe that it is normal for larger samples to have slightly greater skewed values, the presence of which does not significantly affect the analysis, especially when using structural equation modelling. Hence, the above table confirms that the data are normal and will not affect our analysis results.

#### 4.6.2.2 Smirnov-Kolmogorov & Shapiro-Wilk Test

To further test the data normality of each variable, the Kolmogorov-Smirnov and Shapiro-Wilk tests were conducted. This value was used to verify the normality of the distribution. Moreover, the test results were significant, with p-values less than 0.05. Hence, the results are consistent with the research conducted by Pallant (2020), pointing towards the rare occurrence of insignificant values of the Kolmogorov-Smirnov test. This is because they were common in samples containing more than 200 cases. Table 4.5 shows the results obtained from conducting the Kolmogorov-Smirnov and Shapiro-Wilk tests for each variable under study.

Table 4.5 summarizes the results of the Kolmogorov-Smirnov and Shapiro-Wilk tests, confirming non-normality in a strict sense ( $p < 0.05$  for all constructs), which is expected in large samples and does not invalidate PLS-SEM analysis, as this method is robust to non-normality (Hair et al., 2014; Ringle et al., 2023).

**Table 4.5**

*Results of Kolmogorov-Smirnov & Shapiro-Wilk Test*

| Variables | Kolmogorov-Smirnov |     |      | Shapiro-Wilk |     |      |
|-----------|--------------------|-----|------|--------------|-----|------|
|           | Statistic          | df  | Sig. | Statistic    | df  | Sig. |
| PT        | 0.224              | 382 | 0    | 0.86         | 382 | 0    |
| PR        | 0.211              | 382 | 0    | 0.864        | 382 | 0    |
| TA        | 0.229              | 382 | 0    | 0.863        | 382 | 0    |
| FC        | 0.222              | 382 | 0    | 0.859        | 382 | 0    |
| UB        | 0.22               | 382 | 0    | 0.869        | 382 | 0    |
| BI        | 0.205              | 382 | 0    | 0.864        | 382 | 0    |
| PEOU      | 0.23               | 382 | 0    | 0.873        | 382 | 0    |

#### 4.6.3 Multicollinearity

Hair et al. (2014) argued that multicollinearity is one of the primary problems faced by researchers when analysing quantitative data. Multicollinearity leads to spurious and biased estimates in regression equations. It is necessary for researchers to address the problem of multicollinearity to perform an error-free analysis (Hair et al., 2021). Therefore, it must be ensured that all exogenous constructs are free from the problem of multicollinearity, because this issue primarily occurs in exogenous constructs when they are highly correlated, approaching 0.900 (Hair et al., 2021). Multicollinearity was measured using the variance inflation factor (VIF) and tolerance values. Given that PLS-SEM inherently handles multicollinearity through its partial least squares estimation for latent variables and their relationships, the analysis here focuses solely on PLS-SEM results to avoid redundancy with SPSS (Hair et al., 2017). Moreover, a study conducted by Hair et al. (2016) showed that VIF values for an acceptable level

of multicollinearity should be equal to or less than 5.000, and tolerance values should be greater than (0.200). Table 4.6 summarizes the multicollinearity assessment, showing VIF values for all variables between 1.392 and 2.386, all well below the threshold of 5.000 (Hair et al., 2016), and tolerance values exceeding 0.419 (reciprocal of VIF), above the 0.200 cutoff. This confirms minimal multicollinearity risk, ensuring reliable path estimates (Kim, 2019).

**Table 4.6**  
*Multicollinearity Results*

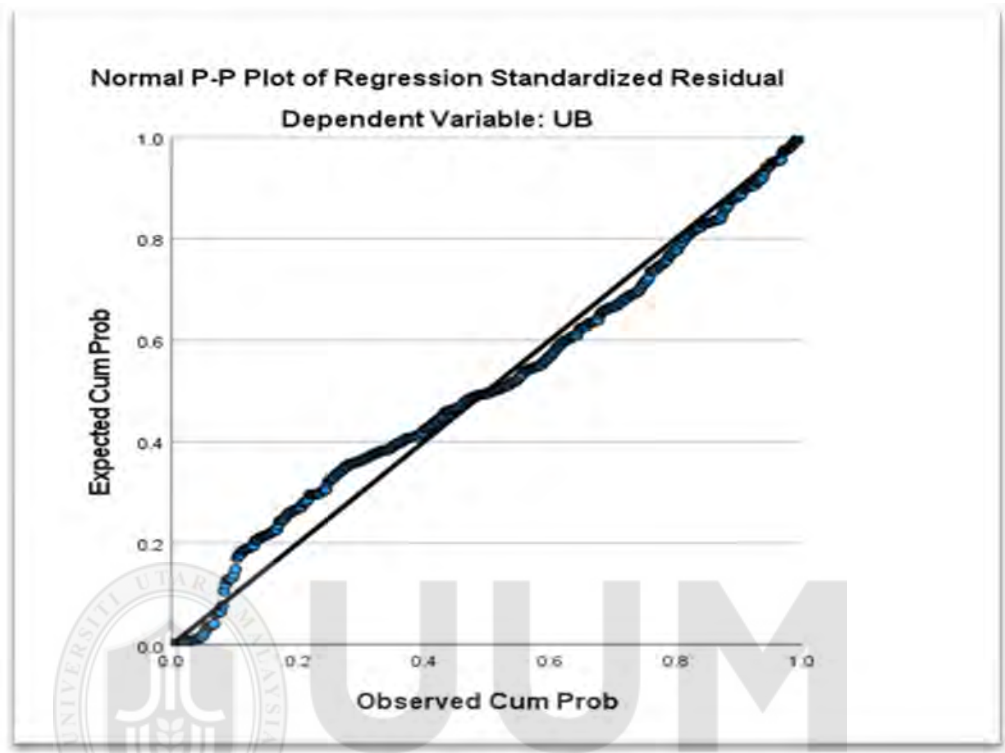
| <b>Dependent Variables</b> | <b>Independent Variables</b> | <b>Tolerance</b> | <b>VIF</b> |
|----------------------------|------------------------------|------------------|------------|
| UB                         | PT                           | 0.527            | 1.896      |
|                            | PR                           | 0.574            | 1.743      |
|                            | TA                           | 0.558            | 1.792      |
|                            | FC                           | 0.544            | 1.839      |
|                            | BI                           | 0.419            | 2.386      |
|                            | PEOU                         | 0.719            | 1.392      |

Table 4.6 clearly indicates that the VIF values for all variables lie between 1.392 and 2.386, and the tolerance values for all variables are above 0.200, which means that the variables under study are free from the problem of multicollinearity. With VIF values much lower than the commonly cited threshold of 5.000 (Hair et al., 2016), there is minimal risk of multicollinearity, and tolerance values exceed 0.419, well above the 0.200 threshold, confirming the reliability of the model (Kyriazos & Poga, 2023).

#### **4.7 Linearity**

Hair et al. (2014) indicated that it is also necessary to check for linear associations among variables, as they pose serious problems in estimating the regression coefficients. Hence, the researcher suggests assessing the departures of variables from linearity, which may impact and alter the degree of association between the variables. To check for linearity, the researcher employed a linearity test to measure the association among constructs that may have a linear relationship. As shown in Figure 4.1, the linear regression results indicate that usage behaviour has a linear association

with all variables included in this study, as all data points lie along the line shown in the following figure. Figure 4.1 shows the normal P-P plot of the regression standardised residual.

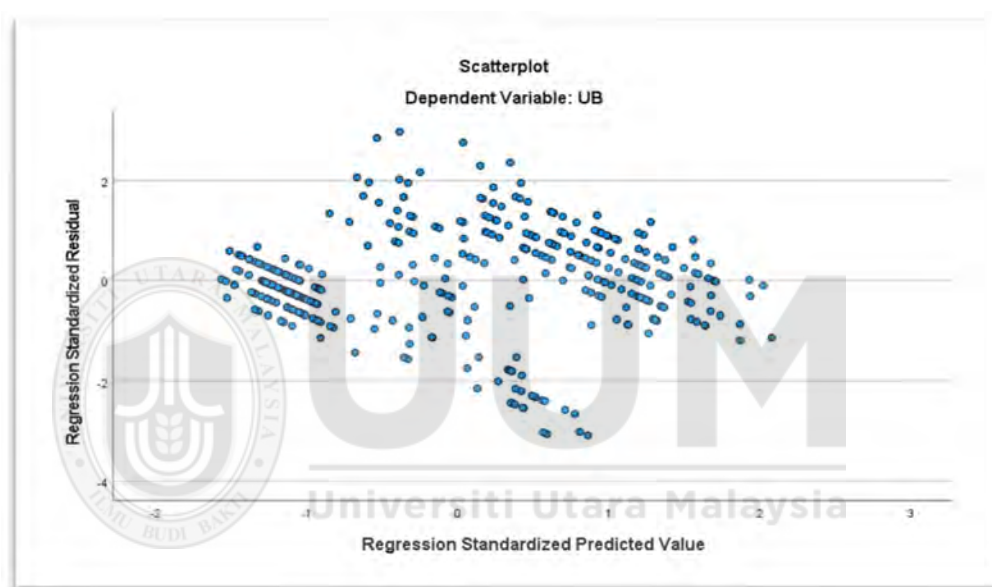


**Figure 4.1**  
*Linearity Between Independent and Dependent Variables*

#### **4.8 Homoscedasticity**

Moreover, researchers interested in performing multivariate analyses are required to check for homoscedasticity. Hair et al. (2014) defined homoscedasticity as the degree to which equal variance is explained by the dependent variables across all data points of the exogenous constructs. This assumption states that all predictor variable values possess the same degree of variance around the regression curve. Hair et al. (2014) argued that homoscedasticity is a necessary condition for multivariate analysis. To assess homoscedasticity in the primary data, a residual analysis was performed using a residual plot. In this analysis, the data can be termed homoscedastic if the data points lie in the form of clusters at the same distance from the origin of the residual plot.

Heteroscedasticity is possible when skewness occurs in certain variables but not in others. Therefore, it is important to ensure that the data follow a normal distribution, as this may help mitigate the potential problem of heteroscedasticity. Figure 4.2 shows the normal distribution of the data, which is identically dispersed around the zero point. Moreover, Figure 4.2 shows that the residual values are distributed normally between -3 and +3 on the y-axis and between -2 and +2 on the x-axis, which shows that the given data follow a homoscedastic pattern.



**Figure 4.2**  
*Scatterplot of Homoscedastic Relationships*

#### **4.9 Descriptive Statistics**

This section details the descriptive statistics for all constructs and their individual measurement items. Variables were described in terms of mean score and standard deviation, whereas measurement items were explained in detail by providing a detailed explanation in terms of the minimum and maximum values recorded on individual items, mean scores, standard deviation, skewness, and kurtosis values. Furthermore, items regarding the technology and digital literacy of the respondents were also

mentioned to explain the technology and digital literacy levels of the participants in this study.

Another purpose of this section also explains the items included in the questionnaire. To conduct this study, the items employed 5-point Likert scale responses coded as 1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree, and 5 for strongly agree. Moreover, in accordance with the study conducted by Reilly and Pepe (1995), the mean scores on both levels (variable and item levels) were divided into three levels labelled as “high” for mean scores ranging from 3.67 to 5.00, “average” for mean scores ranging from 2.34 to 3.66 and finally “low” for mean scores ranging from 1.00 to 2.33. Table 4.7. displays the results of the descriptive statistics.

**Table 4.7**  
*Descriptive Statistics for Variables*

| <b>Variables</b>       | <b>Mean</b> | <b>Std</b> | <b>Level</b> |
|------------------------|-------------|------------|--------------|
| Perceived Trust        | 2.7186      | 1.22915    | Average      |
| Perceived Risk         | 2.7192      | 1.24409    | Average      |
| Technology Anxiety     | 2.7205      | 1.24702    | Average      |
| Facilitating Condition | 2.7351      | 1.22866    | Average      |
| Usage Behaviour        | 2.7978      | 1.26902    | Average      |
| Behavioural Intention  | 2.8063      | 1.24511    | Average      |
| Perceived Ease of Use  | 2.0942      | 0.86895    | Low          |

Table 4.7 displays the results of the mean scores and standard deviation for variables, which were calculated using the entire sample in SPSS version 27. According to Table 4.7, all variables except PEOU scored at the average level, whereas PEOU scored low. Moreover, it can be explained that perceived trust possesses a mean score of (2.7186) with SD (1.22915), perceived risk mean score is (2.7192) with SD (1.24409), technology anxiety mean is (2.7205) with SD (1.24702), facilitating conditions mean (2.7351) with SD (1.22866), usage behaviour attained the mean score of (2.7978) with

SD (1.26902), behavioural intention attained the mean score (2.8063) with SD (1.24511), and PEOU had a lower mean score in the overall data set (2.0942) with SD (0.86895).

**Table 4.8**

*Descriptive Statistics for Technology & Digital Literacy (TDL)*

| Items  | Min | Max | Yes       |            | No        |            |
|--------|-----|-----|-----------|------------|-----------|------------|
|        |     |     | Frequency | Percentage | Frequency | Percentage |
| TDL(A) | 1   | 2   | 277       | 72.5       | 105       | 27.5       |
| TDL(B) | 1   | 2   | 293       | 76.7       | 89        | 23.3       |
| TDL(C) | 1   | 2   | 291       | 76.2       | 91        | 23.8       |
| TDL(D) | 1   | 2   | 300       | 78.5       | 82        | 21.5       |

*Note:* Items from TDL(A) to TDL(D) have been measured on dichotomous responses and labelled as 1 for “Yes” and 2 for “No.”

**Table 4.9**

*Descriptive Statistics for Technology & Digital Literacy TDL(E)*

| Items  | Min | Max | Difficult |            | Easy      |            |
|--------|-----|-----|-----------|------------|-----------|------------|
|        |     |     | Frequency | Percentage | Frequency | Percentage |
| TDL(E) | 1   | 2   | 322       | 84.3       | 60        | 15.7       |

*Note:* Item TDL(E) was measured with two responses. 1 for “Difficult”, 2 for “Easy”.

The figures in Table 4.8 provide an idea of the respondents’ state of technology and digital literacy, in the sense that most of the people have shown a tendency towards adopting digital technology and digital literacy. For example, the TDL(A) results in Table 4.8 show that most of the elderly people in Zhengzhou possess mobile phones, as 277 respondents (72.5%) replied “Yes” to their own mobile devices. The results of TDL(B) show that 293 respondents (76.7%) replied “Yes” whereas 89 (23.3%) have replied “No” indicating that the majority of respondents used mobile devices for daily activities. Once again, most respondents answered “Yes” to TDL(C), 291 with (76.2%) respondents being comfortable using the internet on their devices. Similarly, the response to TDL(D) was not significantly different from that of the other items. Moreover, in the item labelled TDL(E), respondents were asked to express their

experiences of learning to use digital technology. The results of TDL(E) shown in Table 4.9 revealed that most of the respondents in the sample found it difficult to learn and adopt digital technology in their lives. Table 4.10 provides a comprehensive overview of the descriptive statistics for individual measurement items across all constructs. It includes minimum and maximum scores, means, standard deviations, skewness, and kurtosis, confirming that item-level data are approximately normal (all skewness and kurtosis values within  $\pm 2$ ), supporting the overall dataset's suitability for PLS-SEM analysis.

**Table 4.10**  
*Descriptive Statistics for Items*

| Item   | N   | Min | Max | Mean | St. Dev | Skewness  |       | Kurtosis  |       |
|--------|-----|-----|-----|------|---------|-----------|-------|-----------|-------|
|        |     |     |     |      |         | Statistic | SE    | Statistic | SE    |
| PT1    | 382 | 1   | 5   | 2.72 | 1.402   | 0.278     | 0.125 | -1.232    | 0.249 |
| PT2    | 382 | 1   | 5   | 2.70 | 1.398   | 0.316     | 0.125 | -1.211    | 0.249 |
| PT3    | 382 | 1   | 5   | 2.71 | 1.478   | 0.250     | 0.125 | -1.373    | 0.249 |
| PT4    | 382 | 1   | 5   | 2.74 | 1.419   | 0.267     | 0.125 | -1.252    | 0.249 |
| PR1    | 382 | 1   | 5   | 2.76 | 1.433   | 0.299     | 0.125 | -1.279    | 0.249 |
| PR2    | 382 | 1   | 5   | 2.70 | 1.442   | 0.279     | 0.125 | -1.299    | 0.249 |
| PR3    | 382 | 1   | 5   | 2.69 | 1.406   | 0.340     | 0.125 | -1.184    | 0.249 |
| PR4    | 382 | 1   | 5   | 2.73 | 1.405   | 0.292     | 0.125 | -1.245    | 0.249 |
| TA1    | 382 | 1   | 5   | 2.73 | 1.433   | 0.277     | 0.125 | -1.273    | 0.249 |
| TA2    | 382 | 1   | 5   | 2.75 | 1.454   | 0.295     | 0.125 | -1.330    | 0.249 |
| TA3    | 382 | 1   | 5   | 2.68 | 1.392   | 0.333     | 0.125 | -1.190    | 0.249 |
| TA4    | 382 | 1   | 5   | 2.72 | 1.446   | 0.304     | 0.125 | -1.261    | 0.249 |
| FC1    | 382 | 1   | 5   | 2.74 | 1.425   | 0.300     | 0.125 | -1.258    | 0.249 |
| FC2    | 382 | 1   | 5   | 2.79 | 1.547   | 0.219     | 0.125 | -1.350    | 0.249 |
| FC3    | 382 | 1   | 5   | 2.76 | 1.419   | 0.289     | 0.125 | -1.232    | 0.249 |
| FC4    | 382 | 1   | 5   | 2.74 | 1.358   | 0.298     | 0.125 | -1.150    | 0.249 |
| FC5    | 382 | 1   | 5   | 2.65 | 1.460   | 0.381     | 0.125 | -1.244    | 0.249 |
| BI1    | 382 | 1   | 5   | 2.77 | 1.368   | 0.233     | 0.125 | -1.299    | 0.249 |
| BI2    | 382 | 1   | 5   | 2.77 | 1.424   | 0.265     | 0.125 | -1.257    | 0.249 |
| BI3    | 382 | 1   | 5   | 2.83 | 1.430   | 0.221     | 0.125 | -1.291    | 0.249 |
| BI4    | 382 | 1   | 5   | 2.85 | 1.459   | 0.179     | 0.125 | -1.368    | 0.249 |
| UB1    | 382 | 1   | 5   | 2.76 | 1.417   | 0.217     | 0.125 | -1.312    | 0.249 |
| UB2    | 382 | 1   | 5   | 2.84 | 1.454   | 0.182     | 0.125 | -1.348    | 0.249 |
| UB3    | 382 | 1   | 5   | 2.78 | 1.458   | 0.244     | 0.125 | -1.321    | 0.249 |
| UB4    | 382 | 1   | 5   | 2.81 | 1.472   | 0.244     | 0.125 | -1.358    | 0.249 |
| PEOU 1 | 382 | 1   | 5   | 2.03 | 1.230   | 1.178     | 0.125 | 0.368     | 0.249 |
| PEOU 2 | 382 | 1   | 5   | 2.12 | 1.265   | 1.122     | 0.125 | 0.165     | 0.249 |
| PEOU 3 | 382 | 1   | 5   | 2.13 | 1.232   | 1.098     | 0.125 | 0.223     | 0.249 |
| PEOU 4 | 382 | 1   | 5   | 2.10 | 1.173   | 1.111     | 0.125 | 0.386     | 0.249 |

#### **4.10 Assessment of Reflective Measurement Model**

The measurement model was used to assess the reliability and validity of the constructs. Reliability is mainly measured using Cronbach's alpha and composite reliability values, whereas validity is measured in two dimensions: convergent and discriminant validity (Hair et al., 2014). Moreover, a study conducted by Henseler et al. (2015) argue that the AVE, factor loading, and composite reliability mainly constitute the convergent validity of the construct. This section of the research is concerned with explaining the details of reliability, convergent validity, and discriminant validity. This is explained in the following section.

##### **4.10.1 Integrated Measurement Model Assessment**

This section presents a comprehensive assessment of the reflective measurement model, integrating various metrics for reliability, convergent validity, and discriminant validity into a single, efficient table. This consolidated approach allows for a clearer and more holistic evaluation of the constructs, ensuring that all measurement properties are rigorously met as per PLS-SEM guidelines (Hair et al., 2017; Henseler et al., 2015).

**Table 4.11***Integrated Measurement Model - Loadings, Reliability, AVE, and Cross Loadings*

| Constructs | Items | Outer Loadings | Cronbach's Alpha | Rho_A | Composite Reliability | AVE   | BI    | FC    | PR    | PT    | TA    | UB    | PEOU  |
|------------|-------|----------------|------------------|-------|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| BI         | BI1   | 0.877          | 0.889            | 0.890 | 0.923                 | 0.750 | 0.866 | 0.502 | 0.540 | 0.535 | 0.503 | 0.576 | 0.482 |
|            | BI2   | 0.868          |                  |       |                       |       | 0.464 | 0.483 | 0.544 | 0.496 | 0.581 | 0.473 |       |
|            | BI3   | 0.852          |                  |       |                       |       | 0.476 | 0.481 | 0.499 | 0.483 | 0.525 | 0.429 |       |
|            | BI4   | 0.868          |                  |       |                       |       | 0.472 | 0.505 | 0.509 | 0.525 | 0.526 | 0.437 |       |
| FC         | FC1   | 0.873          | 0.914            | 0.917 | 0.936                 | 0.745 | 0.553 | 0.863 | 0.507 | 0.498 | 0.457 | 0.503 | 0.346 |
|            | FC2   | 0.858          |                  |       |                       |       | 0.483 | 0.454 | 0.491 | 0.477 | 0.459 | 0.239 |       |

| Constructs | Items | Outer Loadings | Cronbach's Alpha | Rho_A | Composite Reliability | AVE   | BI    | FC    | PR    | PT    | TA    | UB    | PEOU  |
|------------|-------|----------------|------------------|-------|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|
|            | FC3   | 0.851          |                  |       |                       |       | 0.405 | 0.425 | 0.497 | 0.489 | 0.479 | 0.241 |       |
|            | FC4   | 0.865          |                  |       |                       |       | 0.456 | 0.410 | 0.485 | 0.459 | 0.461 | 0.274 |       |
|            | FC5   | 0.868          |                  |       |                       |       | 0.512 | 0.458 | 0.494 | 0.470 | 0.516 | 0.368 |       |
| PR         | PR1   | 0.858          | 0.898            | 0.900 | 0.929                 | 0.766 | 0.580 | 0.524 | 0.875 | 0.480 | 0.469 | 0.455 | 0.308 |
|            | PR2   | 0.887          |                  |       |                       |       | 0.550 | 0.454 | 0.423 | 0.492 | 0.489 | 0.330 |       |
|            | PR3   | 0.880          |                  |       |                       |       | 0.516 | 0.469 | 0.465 | 0.433 | 0.513 | 0.299 |       |

| Constructs | Items | Outer Loadings | Cronbach's Alpha | Rho_A | Composite Reliability | AVE   | BI    | FC    | PR    | PT    | TA    | UB    | PEOU  |
|------------|-------|----------------|------------------|-------|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|
|            | PR4   | 0.875          |                  |       |                       |       | 0.458 | 0.443 | 0.430 | 0.389 | 0.473 | 0.279 |       |
| PT         | PT1   | 0.866          | 0.886            | 0.887 | 0.921                 | 0.745 | 0.603 | 0.571 | 0.514 | 0.863 | 0.438 | 0.432 | 0.284 |
|            | PT2   | 0.845          |                  |       |                       |       | 0.471 | 0.515 | 0.451 | 0.458 | 0.439 | 0.333 |       |
|            | PT3   | 0.871          |                  |       |                       |       | 0.547 | 0.481 | 0.440 | 0.483 | 0.465 | 0.276 |       |
|            | PT4   | 0.869          |                  |       |                       |       | 0.517 | 0.485 | 0.418 | 0.444 | 0.458 | 0.269 |       |
| TA         | TA1   | 0.868          | 0.894            | 0.894 | 0.926                 | 0.759 | 0.579 | 0.544 | 0.511 | 0.528 | 0.871 | 0.445 | 0.243 |

| Constructs | Items | Outer Loadings | Cronbach's Alpha | Rho_A | Composite Reliability | AVE   | BI    | FC    | PR    | PT    | TA    | UB    | PEOU  |
|------------|-------|----------------|------------------|-------|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|
|            | TA2   | 0.865          |                  |       |                       |       | 0.504 | 0.472 | 0.457 | 0.472 | 0.451 | 0.274 |       |
|            | TA3   | 0.873          |                  |       |                       |       | 0.498 | 0.474 | 0.468 | 0.455 | 0.465 | 0.298 |       |
|            | TA4   | 0.879          |                  |       |                       |       | 0.505 | 0.482 | 0.429 | 0.453 | 0.500 | 0.295 |       |
| UB         | UB1   | 0.877          | 0.898            | 0.899 | 0.929                 | 0.766 | 0.638 | 0.561 | 0.552 | 0.520 | 0.534 | 0.875 | 0.530 |
|            | UB2   | 0.885          |                  |       |                       |       | 0.570 | 0.505 | 0.519 | 0.471 | 0.436 | 0.606 |       |
|            | UB3   | 0.868          |                  |       |                       |       | 0.574 | 0.491 | 0.482 | 0.453 | 0.489 | 0.563 |       |

| Constructs | Items  | Outer Loadings | Cronbach's Alpha | Rho_A | Composite Reliability | AVE   | BI    | FC    | PR    | PT    | TA    | UB    | PEOU  |
|------------|--------|----------------|------------------|-------|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|
|            | UB4    | 0.871          |                  |       |                       |       | 0.544 | 0.475 | 0.446 | 0.426 | 0.472 | 0.572 |       |
| PEOU       | PEOU 1 | 0.700          | 0.670            | 0.670 | 0.802                 | 0.503 | 0.526 | 0.343 | 0.348 | 0.335 | 0.319 | 0.649 | 0.709 |
|            | PEOU 2 | 0.716          |                  |       |                       |       | 0.399 | 0.228 | 0.241 | 0.263 | 0.274 | 0.471 | 0.716 |
|            | PEOU 3 | 0.715          |                  |       |                       |       | 0.366 | 0.240 | 0.245 | 0.250 | 0.176 | 0.456 | 0.715 |
|            | PEOU 4 | 0.705          |                  |       |                       |       | 0.354 | 0.223 | 0.319 | 0.213 | 0.216 | 0.463 | 0.705 |

The results presented in Table 4.11 demonstrate that the measurement model meets all established reliability and validity criteria. According to PLS-SEM guidelines, Outer Loadings should ideally exceed 0.700 (or  $> 0.500$  for exploratory research), Cronbach's Alpha should be  $> 0.700$  (or  $> 0.600$ ), Composite Reliability should exceed 0.700, and AVE (Average Variance Extracted) should be greater than 0.500. Additionally, for discriminant validity, the square root of the AVE (bolded diagonal values) for each construct should exceed its correlations with other constructs, and indicators should load highest on their intended construct (Cross-loadings). As shown in the table, all these thresholds are met. Specifically, convergent validity was confirmed as all Outer Loadings and AVE values exceeded their respective thresholds. These results confirm that each construct explains more variance in its indicators than is due to measurement error, thereby demonstrating adequate convergent validity and reliability (Hair et al., 2017; Henseler et al., 2015).

Discriminant validity, confirming that each latent construct is sufficiently distinct from other constructs in the model, was assessed using three criteria: the Fornell-Larcker criterion, the Heterotrait-Monotrait (HTMT) ratio, and Cross-Loadings. These analyses are integrated and presented across Table 4.11, Table 4.12, and Table 4.13 respectively.

#### **4.10.2 Fornell-Larcker Criterion**

The Fornell-Larcker criterion (Fornell & Larcker, 1981) was applied, which posits that the square root of each construct's AVE should be greater than its correlation with any other construct. As shown in Table 4.12, the diagonal values (square roots of AVE) are consistently higher than the off-diagonal correlation values in their respective rows

and columns. This confirms that each construct shares more variance with its own indicators than with any other construct, thereby establishing discriminant validity.

**Table 4.12**

*Discriminant Validity (Fornell-Larcker Criteria)*

| Constructs  | BI           | FC           | PR           | PT           | TA           | UB           | PEOU         |
|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| <b>BI</b>   | <b>0.866</b> |              |              |              |              |              |              |
| <b>FC</b>   | 0.553        | <b>0.863</b> |              |              |              |              |              |
| <b>PR</b>   | 0.580        | 0.524        | <b>0.875</b> |              |              |              |              |
| <b>PT</b>   | 0.603        | 0.571        | 0.514        | <b>0.863</b> |              |              |              |
| <b>TA</b>   | 0.579        | 0.544        | 0.511        | 0.528        | <b>0.871</b> |              |              |
| <b>UB</b>   | 0.638        | 0.561        | 0.552        | 0.520        | 0.534        | <b>0.875</b> |              |
| <b>PEOU</b> | 0.526        | 0.343        | 0.348        | 0.335        | 0.319        | 0.649        | <b>0.709</b> |

*Note:* Diagonals (in bold) represent the square root of the average variance extracted (AVE), whereas values other than the diagonal are inter-construct correlations. The diagonal values should be greater than those on the diagonal line.

Table 4.13 summarizes the Heterotrait-Monotrait (HTMT) ratios, with all values below 0.90, further confirming discriminant validity and distinguishing constructs from one another (Henseler et al., 2015). Table 4.14 displays the cross-loadings, where each indicator loads higher on its own construct than on others, providing additional evidence of discriminant validity (Hair et al., 2017).

**Table 4.13**

*Discriminant Validity (HTMT)*

| Constructs  | BI    | FC    | PR    | PT    | TA    | UB    | PEOU |
|-------------|-------|-------|-------|-------|-------|-------|------|
| <b>BI</b>   |       |       |       |       |       |       |      |
| <b>FC</b>   | 0.61  |       |       |       |       |       |      |
| <b>PR</b>   | 0.647 | 0.576 |       |       |       |       |      |
| <b>PT</b>   | 0.678 | 0.636 | 0.576 |       |       |       |      |
| <b>TA</b>   | 0.65  | 0.603 | 0.569 | 0.594 |       |       |      |
| <b>UB</b>   | 0.713 | 0.618 | 0.613 | 0.583 | 0.596 |       |      |
| <b>PEOU</b> | 0.68  | 0.435 | 0.447 | 0.437 | 0.411 | 0.836 |      |

*Note:* Values of HTMT <0.90 (Henseler et al., 2015; Hair et al., 2017)

#### 4.10.3 Cross-Loadings

Finally, cross-loadings provide additional evidence of discriminant validity by ensuring that each indicator loads more strongly on its own intended construct than on

any other construct (Hair et al., 2017). As detailed within the integrated Table 4.11, all individual item loadings are substantially higher on their respective constructs (bolded 'Outer Loadings' column) compared to their cross-loadings with other constructs (remaining columns). This pattern confirms the distinctiveness of the constructs and the robust assignment of indicators to their theoretical variables.

#### **4.11 Assessment of Structural Model**

The structural model, also called the inner model, shows the constructs and paths that exist among the other constructs (Henseler et al., 2015). According to the sequence involved in the analytical procedure, the measurement model was followed by hypothesis testing. This study hypothesises that different relationships exist between independent and dependent variables, directly and indirectly, as well as in the presence of mediating and moderating effects. Hair et al. (2016) suggested that before formally starting hypothesis testing using PLS-SEM, it is necessary to perform important assessments, including the coefficient of determination (R-squared), cross-validated redundancy (Q-squared), and effect size (F-squared).

##### **4.11.1 R-Squared ( $R^2$ )**

R-squared explains the predictive power of the structural model, indicating the extent to which the variance is explained by exogenous variables in the endogenous constructs (Hair et al., 2016; Hair et al., 2021). Henseler et al. (2009) and Hair et al. (2016) strongly suggest that the acceptable value of predictive power is subject to the field's nature. For example, in the social sciences, Henseler et al. (2009) state that the value of R-squared can be termed weak if the value lies in the range between 0 and 0.25, moderate if it lies in between 0.25 and 0.50, and substantial if values lie above 0.50. Table 4.14 shows the results of the R-squared.

Table 4.14 summarizes the R-squared values, indicating substantial predictive power for both endogenous constructs (BI and UB), with exogenous variables explaining over 50% of the variance, which is strong for social sciences research (Henseler et al., 2009).

**Table 4.14**  
*R-Squared Results*

| <b>Constructs</b> | <b>R-Squared</b> | <b>Adjusted R-Squared</b> | <b>Effect Size</b> |
|-------------------|------------------|---------------------------|--------------------|
| BI                | 0.520            | 0.515                     | Substantial        |
| UB                | 0.639            | 0.630                     | Substantial        |

Table 4.14 presents the predictive power values for BI and UB. According to Table 4.14, the R-squared value for behavioural intention is 0.515, which can be interpreted in the sense that exogenous constructs, namely perceived risk, perceived trust, technology anxiety, and facilitating conditions, explain 51.5% of the variance in behavioural intention, which can be considered a substantial effect. In addition, Table 4.14 shows that all exogenous variables in the model explain 63.0% of the usage behaviour, which is again a substantial effect. It can be concluded from Table 4.14 that the model possesses substantial predictive power.

#### **4.11.2 Effect Size (F-Squared)**

To assess the structural model, the F-squared value must be assessed. In assessing the values of F-squared, the values are interpreted in terms of effect size, which is determined by the effect created by exogenous constructs on the dependent variable through R-squared change, as exogenous constructs are excluded from the construct (Hair et al., 2014). The F-squared value is considered to have a large effect if the values are 0.35 or greater. 0.15 indicates a moderate effect size, and 0.02 indicates a small effect. However, following Cohen (1988) and Aguinis et al. (2005), small effect sizes ( $f^2 < 0.02$ ) are still theoretically and practically meaningful in social sciences, especially for complex behavioural models, and should not automatically deem a

significant path unsupported (Aguinis et al., 2005). The F-squared results are presented in Table 4.15.

**Table 4.15**  
*F-Squared Results*

|    | <b>F2</b> | <b>Effect</b> | <b>F2</b> | <b>Effect</b> |
|----|-----------|---------------|-----------|---------------|
|    | <b>BI</b> |               | <b>UB</b> |               |
| BI |           |               | 0.027     | Small         |
| FC | 0.023     | Small         | 0.028     | Small         |
| PR | 0.079     | Small         | 0.041     | Small         |
| PT | 0.089     | Small         | 0.012     | Small         |
| TA | 0.067     | Small         | 0.016     | Small         |

According to Table 4.15, taking effect sizes as suggested by Cohen (1988), the effect sizes of facilitating conditions, perceived risk, perceived trust, and technology anxiety had a small effect on behavioural intention. In addition, behavioural intention, facilitating conditions, perceived risk, perceived trust, and technology anxiety also seemed to have a small effect on the usage behaviour. This indicates that these constructs have a weak effect size on the dependent variable. Despite the small sizes, these effects are consistent with prior literature on elderly technology adoption, where subtle influences accumulate to drive meaningful behavioural change (Schroeder et al., 2023; Nikou et al., 2020).

#### **4.11.3 Cross-Validated Redundancy (Q-Squared)**

For evaluating R-Squared value further, the parameter suggested by Enis and Geisser (1974), and Stone (1977) known as Q-Squared which is important to be assessed. Hair et al. (2014) showed that Q-squared values are useful for assessing the predictive relevance of a structural model using cross-validated redundancy measures. Furthermore, a blindfolding technique was used in PLS-SEM. Hair et al. (2016) argued that a model possesses predictive validity if the values of all endogenous variables appear to be greater than zero. Table 4.16 displays the results of the Q-squared analysis.

Table 4.16 presents the Q-squared values, both above 0.35, indicating large predictive relevance for BI and UB, confirming the model's strong out-of-sample predictive power (Hair et al., 2016).

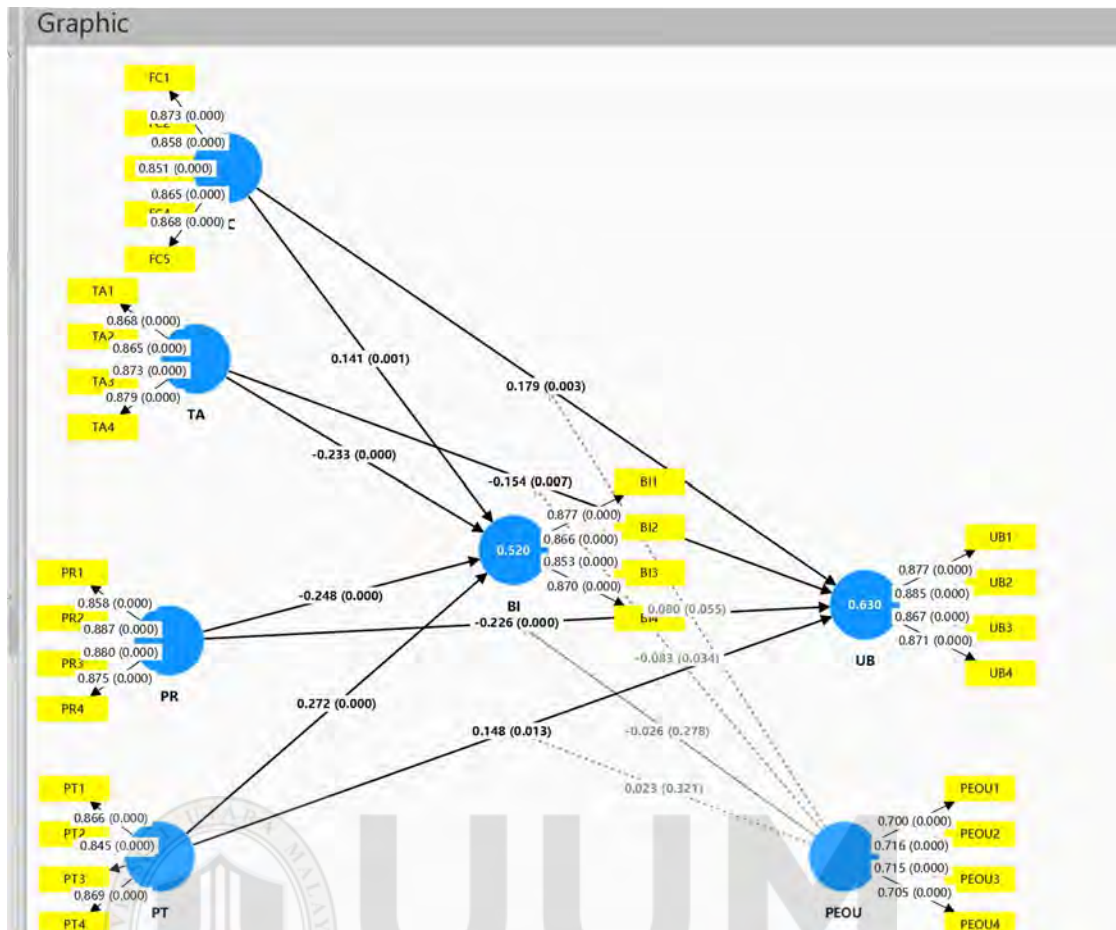
**Table 4.16**  
*Q-Squared Results*

|    | SSO     | SSE     | $Q^2=(1-SSE/SSO)$ |
|----|---------|---------|-------------------|
| BI | 1528.00 | 968.094 | 0.366             |
| FC | 1910.00 | 1910.00 | N/A               |
| PR | 1528.00 | 1528.00 | N/A               |
| PT | 1528.00 | 1528.00 | N/A               |
| TA | 1528.00 | 1528.00 | N/A               |
| UB | 1528.00 | 837.698 | 0.452             |

Additionally, Q2 values can be interpreted as small for values (0.02), medium for values starting from (0.15), and large for values greater than 0.35. According to Table 4.16, the model under study has a higher level of predictive relevance.

#### 4.11.4 Path Analysis

Path analysis is the most important part of the quantitative data analysis procedure for PLS-SEM. Path analysis provides empirical evidence for the theory or paths specified in the theory or the existing literature. Path analysis enables researchers to support their results on a statistical basis. For example, if the results of the hypothesis are statistically significant, the data support the causal relationships that are already established in the existing body of knowledge; if the results are not statistically significant, the data do not provide sufficient evidence to support the relationships (Hair et al., 2014). Figure 4.3 shows the results of the structural model.



**Figure 4.3**  
*Structural Model*

#### 4.11.4.1 Direct Path Analysis

This section presents the direct effects of exogenous constructs on the endogenous constructs. This section addresses the direct impacts of perceived trust, perceived risk, technology anxiety, and facilitating conditions on the behavioural intention of elderly people. It also presents the direct effects of behavioural intention, perceived risk, perceived trust, technology anxiety, and facilitating conditions on the usage behaviour of the elderly population in Zhengzhou, China. Table 4.17 shows the direct path analysis results.

Table 4.17 summarizes the direct path coefficients, t-values, and p-values from PLS-SEM bootstrapping (5,000 resamples, one-tailed). Paths with  $t > 1.96$  and  $p < 0.05$  are

supported, indicating significant relationships consistent with theoretical expectations (Hair et al., 2014; Ringle et al., 2023).

**Table 4.17**  
*Direct Path Results*

| Hypotheses | Path    | Beta Value | Std. Error | T-Value | P-Value | Decision      |
|------------|---------|------------|------------|---------|---------|---------------|
| H1         | FC → UB | 0.142      | 0.058      | 2.435   | 0.007   | Supported**   |
| H2         | TA → UB | -0.103     | 0.057      | 1.813   | 0.035   | Supported**   |
| H3         | PR → UB | -0.344     | 0.104      | 3.302   | 0.000   | Supported***  |
| H4         | PT → UB | 0.093      | 0.063      | 1.463   | 0.072   | Not Supported |
| H5         | BI → UB | 0.151      | 0.057      | 2.649   | 0.004   | Supported**   |
| H6         | FC → BI | 0.098      | 0.038      | 2.609   | 0.005   | Supported**   |
| H7         | TA → BI | -0.197     | 0.037      | 5.295   | 0.000   | Supported***  |
| H8         | PR → BI | -0.394     | 0.090      | 4.374   | 0.000   | Supported***  |
| H9         | PT → BI | 0.233      | 0.038      | 6.135   | 0.000   | Supported***  |

*Note:* All hypothesis tests used one-tailed bootstrapping with 5,000 resamples; significance thresholds follow  $p < 0.05$  (one-tailed) unless otherwise noted. \*\*\*Significant at 0.01 (1-tailed), \*\*significant at 0.05 (1-tailed)

All hypotheses use the consistent statements from Section 2.5 (e.g., H1: Facilitating conditions positively impact the behavioural intention of elderly people to use DFS in China). For H2 and H4, despite statistical significance, the small effect sizes ( $f^2 = 0.016$  and 0.012, respectively) suggest limited practical impact per Cohen (1988), warranting cautious interpretation in the discussion.

**Hypothesis 1:** There is a significant positive impact of facilitating conditions on the usage behaviour of elderly people (FC → UB).

Using bootstrapping in PLS-SEM, at the 95% confidence level, the results with a beta value of 0.142, T-value = 2.435, and P-value less than 0.05, indicate that the facilitating condition has a significant impact on the usage behaviour of elderly people. This finding aligns with UTAUT expectations, suggesting that external resources and support directly encourage actual DFS engagement among the elderly, potentially by reducing perceived effort barriers (Venkatesh et al., 2003; Venkatesh & Davis, 2000).

**Hypothesis 2:** There is a significant negative impact of technology anxiety on the usage behaviour of elderly people (**TA** → **UB**).

By using bootstrapping in PLS-SEM, at the 95% confidence level, the results with a beta value of -0.103, T-value = 1.813, and P-value less than 0.05, indicates that technology anxiety has a significant impact on the usage behaviour of elderly people. This supports social cognitive theory, where emotional discomfort from technology directly hinders actual usage, consistent with prior studies on elderly m-health adoption (Hoque & Sorwar, 2017; Chen et al., 2024). However, the small effect size ( $f^2 = 0.016$ ) implies that while significant, TA's practical influence may be moderated by other factors like support.

**Hypothesis 3:** There is a significant negative impact of perceived risk on the usage behaviour of elderly people (**PR** → **UB**).

Using bootstrapping in PLS-SEM, at the 95% confidence level, the results with a beta value of -0.344, T-value = 3.302, and P-value less than 0.05, indicate that perceived risk has a negative and significant impact on the usage behaviour of elderly people. This aligns with risk perception theory, where anticipated financial losses or security breaches deter actual engagement, particularly salient for risk-averse elderly users (Bauer, 1960; Anaya & De La Vega, 2022).

**Hypothesis 4:** There is a significant positive impact of perceived trust on the usage behaviour of elderly people (**PT** → **UB**).

By using bootstrapping in PLS-SEM, at the 95% confidence level, the results with a beta value of 0.093, T-value = 1.463, and P-value greater than 0.05, indicate that perceived trust does not significantly impact the usage behaviour of elderly people.

Contrary to trust theory expectations (Mayer et al., 1995), this non-significant path suggests that while trust may influence intention, it does not directly translate to usage without mediation, possibly due to overriding barriers like anxiety (Hasan et al., 2021). The small effect size ( $f^2 = 0.012$ ) further supports viewing this as practically negligible. Therefore, the data did not provide sufficient evidence to support this hypothesis.

**Hypothesis 5:** There is a significant positive impact of behavioural intention on the usage behaviour of elderly people (**BI** → **UB**).

By using bootstrapping in PLS-SEM, at the 95% confidence level, the results with a beta value of 0.151, T-value = 2.649, and P-value less than 0.05, indicate that behavioural intention has a significant impact on the usage behaviour of elderly people. This core finding from TPB and UTAUT reinforces that intention serves as a reliable bridge to actual behaviour, particularly in technology contexts where initial willingness predicts sustained use (Ajzen, 1991; Venkatesh et al., 2003).

**Hypothesis 6:** There is a significant positive impact of facilitating conditions on the behavioural intention of elderly people (**FC** → **BI**).

By using bootstrapping in PLS-SEM, at the 95% confidence level, the results with a beta value of 0.098, T-value = 2.609, and P-value less than 0.05, indicate that the facilitating conditions has a significant impact on the behavioural intention of elderly people. This supports UTAUT's emphasis on external enablers fostering intent, especially for elderly users reliant on support to build confidence in DFS (Venkatesh et al., 2003; Ambarwati et al., 2020).

**Hypothesis 7:** There is a significant negative impact of technology anxiety on the behavioural intention of elderly people (**TA** → **BI**).

By using bootstrapping in PLS-SEM, at the 95% confidence level, the results with a beta value of -0.197, T-value = 5.295, and P-value less than 0.05, indicate that technology anxiety has a significant impact on the behavioural intention of elderly people. Grounded in social cognitive theory, this strong path underscores how emotional barriers like fear directly erode intent, a pattern consistent with elderly technology studies but underexplored in DFS (Bandura, 1986; Kim et al., 2023).

**Hypothesis 8:** There is a significant negative impact of perceived risk on the behavioural intention of elderly people (**PR** → **BI**).

Using bootstrapping in PLS-SEM at a 95% confidence level, the results with a beta value of -0.394, T-value of 4.374, and P-value less than 0.05, indicate that perceived risk has a significant impact on the behavioural intention of elderly people. This robust finding, aligned with consumer risk theory, highlights how anticipated losses critically undermine intent, especially for elderly users with limited recovery options (Bauer, 1960; Ma, 2021). It can be said that the more the risk perceived among elderly people, the less likely they are to exhibit a tendency towards usage behaviour for digital products and services.

**Hypothesis 9:** There is a significant positive impact of perceived trust on the behavioural intention of elderly people (**PT** → **BI**).

By using bootstrapping in PLS-SEM, at a 95% confidence level, the results with a beta value of 0.233, T-value = 6.135, and P-value less than 0.05, indicate that perceived trust has a significant impact on the behavioural intention of elderly people. This supports trust theory, where confidence in service reliability bolsters intent, a key driver for elderly adoption in uncertain financial contexts (Mayer et al., 1995; Gefen et al., 2003).

#### 4.11.4.2 Mediation Effect Analysis

This section presents the mediation results of the behavioural intention. Table 4.18 shows the mediation effect of behavioural intention between the independent and dependent variables used in this study.

Table 4.18 summarizes the indirect effects via BI, with all paths significant ( $p < 0.05$ ), confirming BI's mediating role and supporting the theoretical sequence where antecedents shape usage through intention (Hair et al., 2014; Mafabi et al., 2017).

**Hypothesis 10a:** Behavioural intention significantly mediates the relationship between facilitating conditions and the usage behaviour (**FC** → **BI** → **UB**).

By using bootstrapping in PLS-SEM, at the 95% confidence level, the result with a beta value of 0.015, T-value = 1.679, and P-value less than 0.05, indicates that behavioural intention significantly mediates the relationship between facilitating conditions and the usage behaviour of elderly people. This partial mediation suggests FC primarily influences usage through intent, consistent with UTAUT's behavioural pathway (Venkatesh et al., 2003).

**Hypothesis 10b:** Behavioural intention significantly mediates the relationship between technology anxiety and the usage behaviour (**TA** → **BI** → **UB**).

By using bootstrapping in PLS-SEM, at the 95% confidence level, the result with a beta value of -0.030, T-value = 2.209, and P-value less than 0.05, indicates that behavioural intention significantly mediates the relationship between technology anxiety and usage behaviour of elderly people. This mediation highlights how anxiety erodes intent, indirectly reducing usage, aligning with social cognitive mechanisms (Bandura, 1986).

**Hypothesis 10c:** Behavioural intention significantly mediates the relationship between perceived risk and the usage behaviour (**PR** → **BI** → **UB**).

By using bootstrapping in PLS-SEM, at the 95% confidence level, the result with a beta value of -0.060, T-value = 2.394, and P-value less than 0.05, indicates that behavioural intention significantly mediates the relationship between perceived risk and the usage behaviour of elderly people. This path underscores risk's role in diminishing intent, a common pattern in financial technology adoption (Bauer, 1960; Belanche et al., 2022).

**Hypothesis 10d:** Behavioural intention significantly mediates the relationship between perceived trust and the usage behaviour (**PT** → **BI** → **UB**).

Using bootstrapping in PLS-SEM, at the 95% confidence level, the result with a beta value of 0.035, T-value of 2.351, and P-value less than 0.05, indicates that behavioural intention significantly mediates the relationship between perceived trust and the usage behaviour of elderly people. This supports trust's indirect effect through intent, enhancing usage via confidence-building (Mayer et al., 1995; Gefen et al., 2003).

**Table 4.18**  
*Mediation Results*

| Hypotheses | Mediation Path | Beta Value | SE    | T     | P        | Confidence Interval |                   |           |
|------------|----------------|------------|-------|-------|----------|---------------------|-------------------|-----------|
|            |                |            |       |       |          | Lower Limit (5%)    | Upper Limit (95%) | Decision  |
| H10a       | FC → BI → UB   | 0.015      | 0.009 | 1.679 | 0.047**  | 0.003               | 0.031             | Supported |
| H10b       | TA → BI → UB   | -0.030     | 0.013 | 2.209 | 0.014**  | -0.054              | -0.009            | Supported |
| H10c       | PR → BI → UB   | -0.060     | 0.025 | 2.394 | 0.008*** | -0.096              | -0.019            | Supported |
| H10d       | PT → BI → UB   | 0.035      | 0.015 | 2.351 | 0.009*** | 0.012               | 0.061             | Supported |

*Note:* \*\*\*Significant at 0.01 (1-tailed), \*\*significant at 0.05 (1-tailed)

#### 4.11.4.3 Moderation Effect Analysis

This section presents the moderation results for Perceived Ease of Use (PEOU). Table 4.19 summarizes the interaction effects, with significant paths ( $p < 0.05$ ) indicating PEOU's moderating role, except for H11d; asterisks denote significance levels for clarity (Hair et al., 2017).

**Table 4.19**

*Moderation Results (Moderating Role of Perceived Ease of Use - PEOU)*

| Hypothesis | Path         | $\beta$ | SE    | T-Value | P-Value  | Decision      |
|------------|--------------|---------|-------|---------|----------|---------------|
| H11a       | PEOU*FC → UB | 0.102   | 0.046 | 2.205   | 0.014**  | Supported     |
| H11b       | PEOU*TA → UB | 0.102   | 0.042 | 2.438   | 0.007*** | Supported     |
| H11c       | PEOU*PR → UB | 0.069   | 0.042 | 1.664   | 0.048**  | Supported     |
| H11d       | PEOU*PT → UB | 0.045   | 0.047 | 0.95    | 0.171    | Not Supported |

*Note:* \*\*\*Significant at 0.01 (1-tailed), \*\*significant at 0.05 (1-tailed).

**Hypothesis 11a:** Perceived Ease of Use positively moderates the relationship between facilitating conditions and usage behaviour (i.e., the positive effect is stronger when PEOU is high).

PEOU positively moderates the relationship between facilitating conditions and usage behaviour on DFS among the elderly (i.e., the positive effect of facilitating conditions on usage behaviour is stronger when PEOU is high) (PEOU\*FC → UB). By using bootstrapping in PLS-SEM, at the 95% confidence level, the result with a beta value of 0.102, T-value = 2.205, and P-value less than 0.05, indicates that Perceived Ease of Use significantly moderates the relationship between facilitating conditions and the usage behaviour of elderly people. This positive moderation implies that when DFS

are easy to use, external support has an amplified effect on usage, as simplicity enhances the perceived value of resources (Venkatesh et al., 2003; Yu et al., 2021).

**Hypothesis 11b:** Perceived Ease of Use negatively moderates the relationship between technology anxiety and usage behaviour (i.e., the negative effect is weaker when PEOU is high).

PEOU negatively moderates the relationship between technology anxiety and usage behaviour on DFS among the elderly (i.e., the negative effect of technology anxiety on usage behaviour is weaker when PEOU is high) ( $PEOU * TA \rightarrow UB$ ). Using bootstrapping in PLS-SEM at a 95% confidence level, the result with a beta value of 0.102, T-value of 2.438, and P-value less than 0.05 indicates that Perceived Ease of Use significantly moderates the relationship between technology anxiety and the usage behaviour of elderly people. This buffering effect shows that ease of use reduces anxiety's deterrent impact, allowing elderly users to engage more freely (Tsai et al., 2020; Kim et al., 2023).

**Hypothesis 11c:** Perceived Ease of Use negatively moderates the relationship between perceived risk and usage behaviour (i.e., the negative effect is weaker when PEOU is high).

Bootstrapping in PLS-SEM on a 95% confidence level, with a beta value of 0.069, T-value of 1.664, and P-value less than 0.05, indicates that Perceived Ease of Use significantly moderates the relationship between perceived risk and usage behaviour of elderly people. It reveals that simplicity alleviates risk concerns, fostering usage by building a sense of control (Belanche et al., 2022; Meyta Dewi et al., 2021).

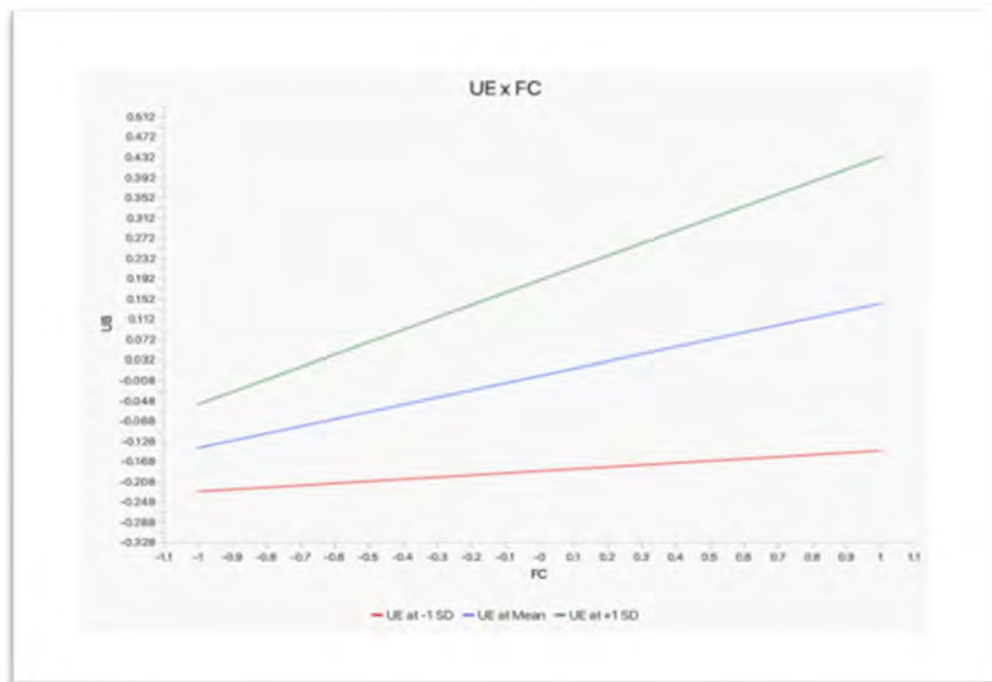
**Hypothesis 11d:** Perceived Ease of Use positively moderates the relationship between perceived trust and usage behaviour (i.e., the positive effect is stronger when PEOU is high).

By using bootstrapping in PLS-SEM, at a 95% confidence level, the result with a beta value of 0.045, T-value = 0.95, and P-value greater than 0.05, indicates that Perceived Ease of Use does not have a significant moderating effect on the relationship between perceived trust and the usage behaviour of elderly people. This non-significant moderation implies that trust's influence on usage operates independently of ease of use, possibly due to trust's foundational role in intent formation (Mayer et al., 1995; Gefen et al., 2003). Hence, the data did not provide sufficient evidence to support the hypotheses.

#### 4.11.4.4 Slope Analysis for Moderating Effects

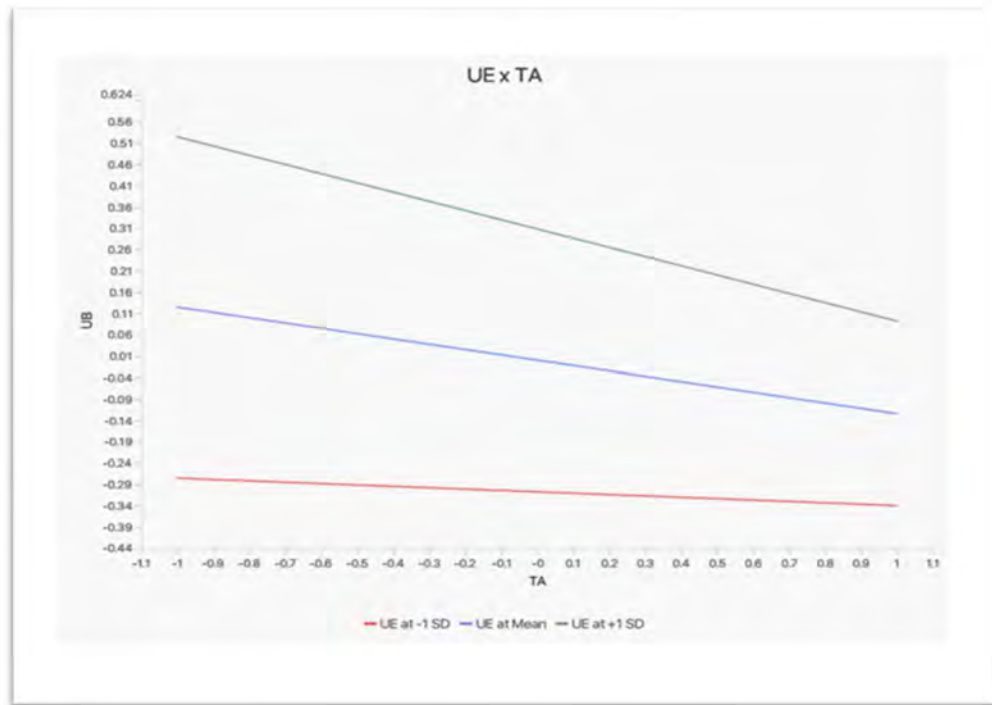
Slope analysis provides a visual representation of how a moderator variable influences the strength or direction of the relationship between an independent variable and a dependent variable (Hair et al., 2017). This method illustrates the conditional effects by plotting the relationship at different levels (typically  $\pm 1$  standard deviation) of the moderator (Hayes, 2017). The following figures (Figures 4.4 to 4.7) graphically depict the moderating effects of Perceived Ease of Use (PEOU) on the hypothesized relationships with usage behaviour among the elderly population. Each figure presents three distinct regression lines: one for the mean level of PEOU, and two representing PEOU at one standard deviation below (low PEOU) and one standard deviation above

(high PEOU) the mean.



**Figure 4.4**  
*Moderating Effect of Perceived Ease of Use on the Relationship between Facilitating Conditions and Usage Behaviour*

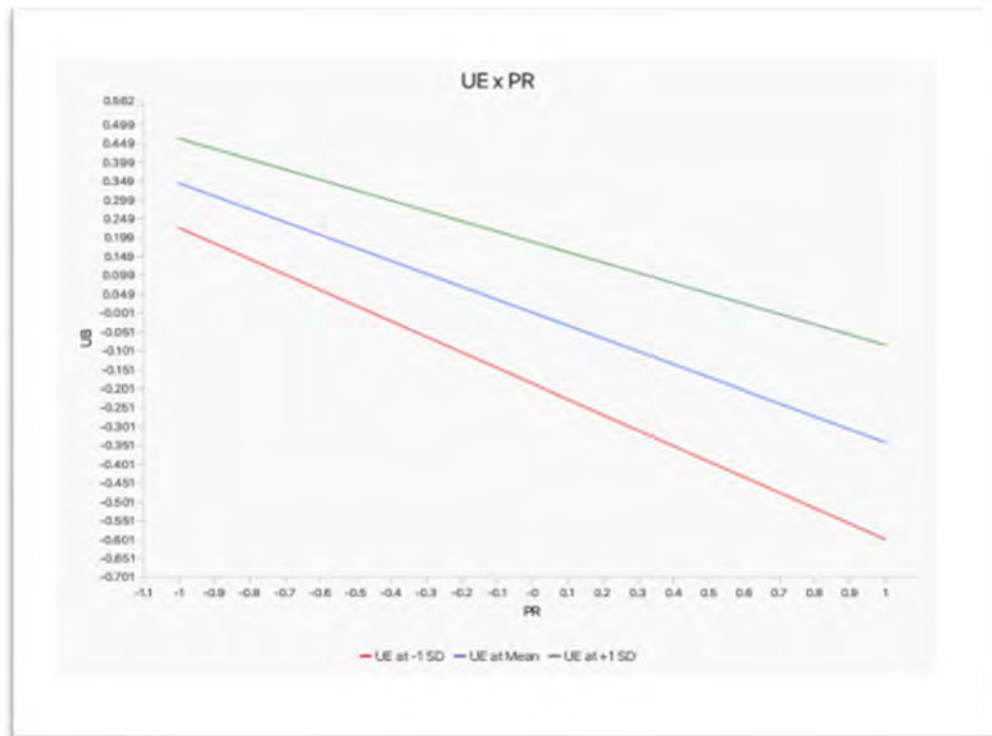
Figure 4.4 graphically illustrates the moderating effect of Perceived Ease of Use (PEOU) on the positive relationship between facilitating conditions (FC) and usage behaviour (UB). The plot shows three regression lines: the dashed line represents low PEOU (-1 standard deviation), the solid line represents mean PEOU, and the dotted line represents high PEOU (+1 standard deviation). It is evident that at lower levels of PEOU, the slope of the relationship between FC and UB is relatively flatter, indicating a weaker positive effect. Conversely, when PEOU is high (+1 standard deviation), the slope becomes noticeably steeper, signifying a stronger positive influence of FC on UB. This visual evidence supports that Perceived Ease of Use amplifies the positive impact of facilitating conditions, making external support more effective in driving DFS usage among the elderly when the services are perceived as easy to use.



**Figure 4.5**

*Moderating Effect of Perceived Ease of Use on the Relationship between Technology Anxiety and Usage Behaviour.*

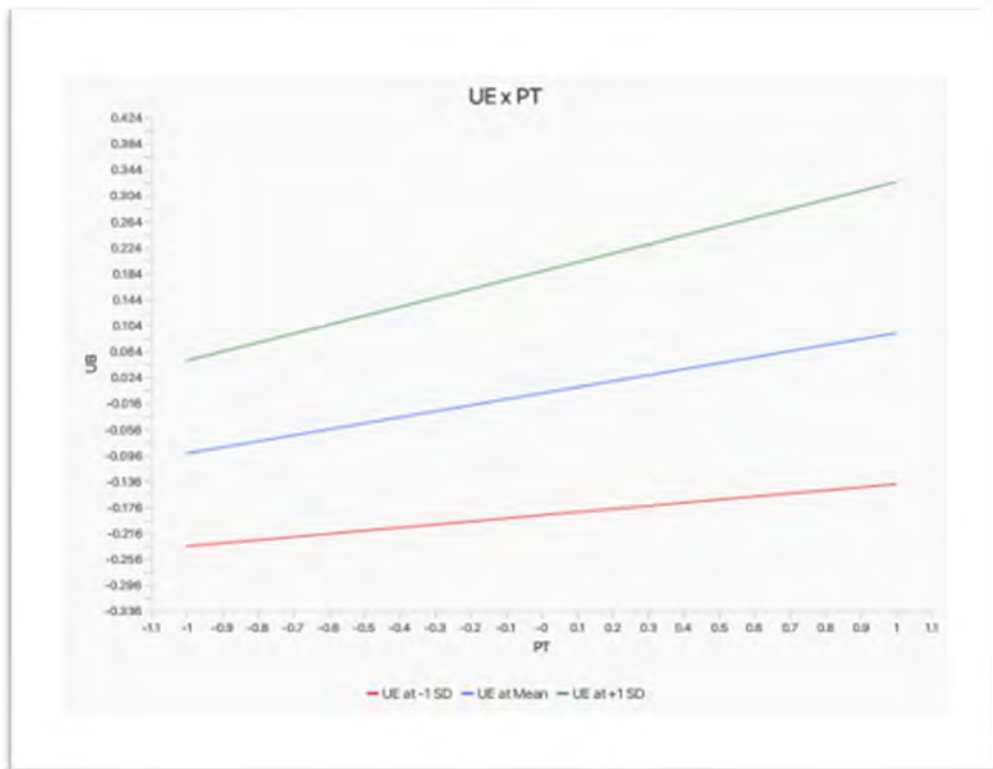
Figure 4.5 presents a graphical illustration of the moderating effect of Perceived Ease of Use (PEOU) on the negative relationship between technology anxiety (TA) and usage behaviour (UB). The plot displays three regression lines: the dashed line indicates low PEOU (-1 standard deviation), the solid line represents mean PEOU, and the dotted line shows high PEOU (+1 standard deviation). Notably, at lower levels of PEOU, the negative slope between TA and UB is steeper, suggesting that high technology anxiety has a more pronounced detrimental effect on usage. However, as PEOU increases to +1 standard deviation, the negative slope flattens, indicating that Perceived Ease of Use mitigates the adverse impact of technology anxiety, making elderly individuals less deterred from using DFS even if they experience some anxiety, provided the services are easy to operate.



**Figure 4.6**

*Moderating Effect of Perceived Ease of Use on the Relationship between Perceived Risk and Usage Behaviour*

Figure 4.6 depicts the moderating effect of Perceived Ease of Use (PEOU) on the negative relationship between perceived risk (PR) and usage behaviour (UB). The three lines represent low PEOU (-1 standard deviation, dashed line), mean PEOU (solid line), and high PEOU (+1 standard deviation, dotted line). The graph clearly shows that at low levels of PEOU, the negative relationship between PR and UB is stronger, indicated by a steeper negative slope. Conversely, as PEOU increases to a high level, this negative slope becomes notably flatter. It reveals that PEOU significantly buffers the negative impact of perceived risk; when digital financial services are easy to use, elderly individuals are less deterred by perceived risks, as the simplicity of operation fosters a sense of control and reduces apprehension regarding potential negative outcomes.



**Figure 4.7**  
*Moderating Effect of Perceived Ease of Use on the Relationship between Perceived Trust and Usage Behaviour*

Figure 4.7 presents a graphical representation of the hypothesized moderating effect of Perceived Ease of Use (PEOU) on the relationship between perceived trust (PT) and usage behaviour (UB). The plot shows three lines for low PEOU (-1 standard deviation, dashed line), mean PEOU (solid line), and high PEOU (+1 standard deviation, dotted line). Visually, there is no substantial difference in the slopes of these three lines. This indicates that Perceived Ease of Use does not significantly moderate the relationship between perceived trust and usage behaviour among the elderly. The effect of perceived trust on usage behaviour appears to be consistent regardless of the perceived ease of use of the digital financial services.

#### 4.12 Summary of Results

Table 4.20 provides a concise overview of all hypotheses, their statements (aligned with Section 2.5), and decisions, incorporating effect size considerations for nuanced interpretation (Hair et al., 2014).

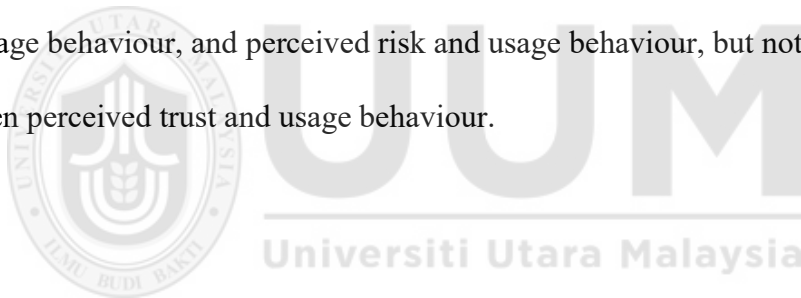
**Table 4.20**  
*Summary of Findings*

| Hypotheses | Statement                                                                                                         | Decision      |
|------------|-------------------------------------------------------------------------------------------------------------------|---------------|
| H1         | There is a significant positive impact of facilitating conditions on the usage behaviour of elderly people.       | Supported     |
| H2         | There is a significant negative impact of technology anxiety on the usage behaviour of elderly people.            | Supported     |
| H3         | There is a significant negative impact of perceived risk on the usage behaviour of elderly people.                | Supported     |
| H4         | There is a significant positive impact of perceived trust on the usage behaviour of elderly people.               | Not Supported |
| H5         | There is a significant positive impact of behavioural intention on the usage behaviour of elderly people.         | Supported     |
| H6         | There is a significant positive impact of facilitating conditions on the behavioural intention of elderly people. | Supported     |
| H7         | There is a significant negative impact of technology anxiety on the behavioural intention of elderly people.      | Supported     |
| H8         | There is a significant negative impact of perceived risk on the behavioural intention of elderly people.          | Supported     |
| H9         | There is a significant positive impact of perceived trust on the behavioural intention of elderly people.         | Supported     |

| Hypotheses | Statement                                                                                                                                                                  | Decision      |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| H10a       | Behavioural intention significantly mediates the relationship between facilitating conditions and the usage behaviour.                                                     | Supported     |
| H10b       | Behavioural intention significantly mediates the relationship between technology anxiety and the usage behaviour.                                                          | Supported     |
| H10c       | Behavioural intention significantly mediates the relationship between perceived risk and the usage behaviour.                                                              | Supported     |
| H10d       | Behavioural intention significantly mediates the relationship between perceived trust and the usage behaviour.                                                             | Supported     |
| H11a       | Perceived Ease of Use positively moderates the relationship between facilitating conditions and usage behaviour (i.e., the positive effect is stronger when PEOU is high). | Supported     |
| H11b       | Perceived Ease of Use negatively moderates the relationship between technology anxiety and usage behaviour (i.e., the negative effect is weaker when PEOU is high).        | Supported     |
| H11c       | Perceived Ease of Use negatively moderates the relationship between perceived risk and usage behaviour (i.e., the negative effect is weaker when PEOU is high).            | Supported     |
| H11d       | Perceived Ease of Use positively moderates the relationship between perceived trust and usage behaviour (i.e., the positive effect is stronger when PEOU is high).         | Not Supported |

#### **4.13 Chapter Summary**

This chapter analyses the data obtained from elderly people in Zhengzhou. After completing the data collection, the quantitative survey data were analysed using SPSS version 27 and SmartPLS version 4. The structural and measurement models were assessed using PLS-SEM. The reliability and validity assessments were used in the measurement model. The structural model results revealed that facilitating conditions, technology anxiety, perceived trust, perceived risk, and behavioural intention significantly impacted the usage behaviour of elderly people. Behavioural intention significantly mediated the relationship between all independent and dependent variables. Moreover, the results revealed that PEOU significantly moderated the relationship between facilitating conditions and usage behaviour, technology anxiety and usage behaviour, and perceived risk and usage behaviour, but not the relationship between perceived trust and usage behaviour.



## **CHAPTER FIVE**

### **DISCUSSION & CONCLUSION**

#### **5.1 Introduction**

This chapter presents a detailed discussion of the findings of this study. It further elaborates on the results by comparing them with the existing literature and theories on the adoption of digital financial solutions. The discussion begins with a recapitulation of the study, followed by an analysis of key findings in relation to the research objectives, integrating comparisons with prior literature to highlight alignments, divergences, and extensions. This chapter also includes the practical, methodological, and theoretical implications of this study. The limitations and future directions of this study are discussed in detail.

#### **5.2 Recapitulation of Study**

This study addresses the adoption behaviour of elderly people living in Zhengzhou, China. This study provides a detailed perspective on the adoption phenomenon, focusing on the drivers and deterrents of behavioural intention, the impact of intention on usage behaviour, the mediating role of intention, and the moderating role of perceived ease of use.

To achieve these aims, the study examined the direct influences of facilitating conditions, technology anxiety, perceived risk, and perceived trust on behavioural intention; assessed the role of intention in predicting usage behaviour; explored intention's mediating effects on these relationships; and investigated perceived ease of use as a moderator.

### 5.3 Summary of Study Findings

The findings align with the study's core aims, revealing that facilitating conditions and perceived trust positively influence behavioural intention, while technology anxiety and perceived risk exert negative effects; behavioural intention strongly predicts usage behaviour. In addition, Perceived Ease of Use (PEOU) significantly moderates the links between facilitating conditions and usage behaviour, technology anxiety and usage behaviour, and perceived risk and usage behaviour, but does not moderate the perceived trust–usage behaviour link. The results of this study indicate that it has succeeded in developing an understanding of the deterrents and drivers of digital financial service adoption among the elderly population, particularly in Zhengzhou, China.

The results of this study show that all exogenous constructs (facilitating conditions, technology anxiety, perceived risk, and perceived trust) account for 52.0% ( $R^2 = 0.520$ ; Adjusted  $R^2 = 0.515$ ) of the variance in explaining behavioural intention, while behavioural intention and the exogenous constructs account for 63.9% ( $R^2 = 0.639$ ; Adjusted  $R^2 = 0.630$ ) of the variance in explaining the usage behaviour of the elderly population, as shown in Table 4.14. These R-squared values indicate substantial explanatory power, typical for complex social science models (Henseler et al., 2009). Such variance underscores the model's relevance for policy, particularly in addressing elderly financial vulnerability (Ahmad et al., 2021). The F-squared values reflect small individual effect sizes (Cohen, 1988), yet these remain meaningful in consumer behaviour, where cumulative long-term impacts such as gradual habit formation among the elderly drive significant change (Aguinis et al., 2005). Regarding direct effects, facilitating conditions positively affect both behavioural intention and usage behaviour; technology anxiety and perceived risk negatively affect behavioural

intention and usage behaviour; behavioural intention positively predicts usage behaviour; and perceived trust positively affects behavioural intention but does not have a significant direct effect on usage behaviour ( $\beta = 0.093$ ,  $t = 1.463$ ,  $p > 0.05$ ). Mediation analysis (Table 4.18) shows that behavioural intention significantly mediates all antecedent–usage links (FC, TA, PR, PT), with the perceived trust  $\rightarrow$  usage path operating fully via intention. In sum, contextual enablers and risk-related emotions shape intention, intention reliably translates into usage, and perceived ease of use conditions the strength of these pathways.

## **5.4 Discussion**

The discussion is structured to first address the significant deterrents of DFS adoption (Technology Anxiety and Perceived Risk), followed by the facilitating factors (Facilitating Conditions and Perceived Trust), and then the mediating and moderating roles of key variables. This approach underscores the critical barriers faced by the elderly, setting a problem-solution narrative particularly relevant for informing policy and practical interventions aimed at this vulnerable demographic.

### **5.4.1 Direct Effect of Facilitating Conditions on Usage Behaviour**

As shown in chapter four, facilitating conditions significantly affect the usage behaviour of elderly people in Zhengzhou, China ( $\beta = 0.142$ ,  $t = 2.435$ ,  $p < 0.05$ ). This implies that the availability of proper support and infrastructure enables individuals to use newly introduced or recently used technology. In particular, such conditions foster awareness and competence in DFS navigation, bridging literacy gaps. In addition, providing environmental support is necessary to encourage individuals to use technology. Environmental support refers to the provision of necessary social, physical, and organisational support to encourage the use of digital financial services among

elderly people. Therefore, the more individuals are aware of using technology and environmental support is provided, the more likely they are to adopt new technology. This is particularly evident among the elderly living in Zhengzhou, China. Therefore, the results of this study show that the presence of facilitating conditions is an important factor in encouraging the use of digital financial services, yet particularly relevant in this context, where infrastructural support counters urban-rural divides.

This is because this relationship has been widely studied in previous research, and most researchers have found it significant. For example, Ambarwati et al. (2020) and Yuan et al. (2023) found that in the context of digital platforms, facilitating conditions, along with other variables, strongly determine adoption behaviour. As facilitating conditions and usage behaviour are strongly related, a positive relationship is expected between them, which has been proven in this study. Thus, marketing practitioners and policymakers should pay more attention to the provision of necessary supporting conditions, such as training and basic knowledge of using technology. Furthermore, this study proved that the relationship between facilitating conditions and usage empirically is statistically significant and an important determinant of usage behaviour. With a beta of 0.142 ( $p=0.007$ ), this path highlights FC's role in sustaining usage.

However, a critical gap in previous studies (e.g., Ambarwati et al., 2020) is that they often treated facilitating conditions as a generic construct applicable to the general population, frequently overlooking the specific, tangible support needs of the elderly, such as human-assisted digital navigation. Unlike broad-spectrum studies that assume a baseline level of digital literacy, this research highlights that for the elderly in Zhengzhou, generic internet access is insufficient; the defect in prior models is the failure to account for the necessity of social scaffolding (e.g., family help, community workshops) as a core component of FC. By explicitly validating this link in an aging

demographic, this study fulfils RO1 by identifying that environmental support must be re-conceptualized from mere technical access to active social enablement to effectively drive usage behaviour among the elderly.

While consistent with broader literature (Venkatesh et al., 2003), this finding is particularly significant for the elderly in Zhengzhou, China, where many older adults face specific challenges such as lower digital literacy, limited access to formal digital education, and potentially less exposure to digital technologies in their daily lives compared to younger generations (CNNIC, 2022; Ministry of Civil Affairs of the People's Republic of China, 2024). Therefore, the positive effect of facilitating conditions on usage behaviour in this context is not merely "unsurprising" but highlights a critical need and validates targeted interventions.

Specifically, "environmental support" in the context of DFS adoption for the elderly in Zhengzhou can include concrete examples such as community-based digital literacy workshops provided by local governments or NGOs, offering hands-on training for mobile banking apps and online payments (Dermody et al., 2021). It also encompasses accessible customer support channels with dedicated elderly-friendly hotlines or in-person assistance at bank branches and community centers, staffed by patient and trained personnel (Lohr, 2021). Furthermore, the presence of family members or younger friends who actively assist elderly individuals in navigating digital platforms forms a crucial social support network (Jo et al., 2021; Lohr, 2021). Simplified user manuals and visual guides for DFS platforms, available in large print or through easy-to-understand video tutorials, alongside subsidized or free internet access in public spaces or community centers, are vital for reducing the financial barrier to digital engagement (Hjort & Tian, 2021). This extends existing studies by validating the direct utility of external enablement in bridging the digital divide for this specific

demographic (Venkatesh et al., 2003; Yu et al., 2021). By prioritizing and effectively implementing these facilitating conditions, policymakers and financial service providers can significantly enhance financial inclusion and improve the overall well-being of the elderly population in Zhengzhou and similar regions across China.

#### **5.4.2 Direct Effect of Technology Anxiety on Usage Behaviour**

This section discusses the direct relationship between technology anxiety and usage behaviour of digital financial services. The results of this study indicate that the relationship between technology anxiety and usage behaviour was negative but significant ( $\beta = -0.103$ ,  $t = 1.813$ ,  $p < 0.05$ ). This implies that technology anxiety discourages the use of digital financial services by the elderly in China. Moreover, it is empirically evident that the elderly population prefers to use the traditional medium of performing financial transactions because they are less aware of technology and, therefore, unable to use new technology, which causes stress when using digital services. This stress often stems from unfamiliar interfaces, leading to avoidance.

Furthermore, due to technology anxiety, elderly people experience limited engagement and more dependence on others. Moreover, this feeling of anxiety arises due to the lack of knowledge of using modern technology and complex user interfaces. The results of this study show that technology anxiety acts as a significant deterrent to using digital financial services, which is consistent with previous research. For example, Maduku et al. (2023), and Chen et al. (2024) demonstrated that technology anxiety can significantly discourage individuals from using technology. Reducing anxiety through targeted interventions could thus substantially boost adoption.

However, previous research has often examined technology anxiety as a general emotional state, failing to pinpoint the specific triggers relevant to financial contexts

for the elderly, such as the “fear of irreversible error” (e.g., sending money to the wrong person). While studies like Maduku et al. (2023) established the general negative link, they largely ignored how this anxiety directly paralyzes actual usage behaviour (UB) specifically in high-stakes financial transactions, often focusing only on intention. This study addresses this limitation by demonstrating that Technology Anxiety is not just a psychological barrier to wanting to use DFS, but a direct functional deterrent to ‘actually’ using it (RO1). It highlights that for the elderly, anxiety acts as an immediate brake on usage, a nuance often missed in studies focusing on younger, tech-savvy cohorts who may feel anxious but use the technology anyway.

Specifically, in the context of digital financial services for the elderly in Zhengzhou, this anxiety is often triggered by a fear of making irreversible errors during transactions, leading to financial loss (Hertzum & Hornbæk, 2023). Concerns about navigating complex app menus or inputting sensitive information incorrectly, given potentially lower digital literacy (Nikou et al., 2020), also contribute to this anxiety. Moreover, worry over security breaches or scams due to a lack of understanding of digital security features (Chen et al., 2025; Klaver et al., 2021), and the rapid pace of technological change and frequent updates, making it difficult for them to keep up and feeling overwhelmed by new features (Dermody et al., 2021), are significant triggers. These factors contribute to stress, which in turn leads to avoidance behaviours and a preference for perceived simpler, traditional methods. While the effect size ( $f^2 = 0.016$ ) is small (Cohen, 1988), its statistical significance ( $p < 0.05$ ) indicates a consistent, albeit subtle, negative influence. This implies that even a small reduction in technology anxiety could cumulatively lead to a meaningful increase in DFS usage over time across the elderly population (Aguinis et al., 2005).

Practical recommendations stemming from this finding include developing simplified, elder-friendly DFS interfaces with large fonts, clear icons, and minimal steps for common transactions (Schroeder et al., 2023). Implementing patient, hands-on digital literacy programs in community centers, focusing on practical skills and demonstrating transaction security to build confidence, is also crucial. Furthermore, providing accessible and empathetic technical support channels tailored for the elderly can reduce frustration and fear of asking for help (Hoque & Sorwar, 2017). Designing educational campaigns that demystify digital financial services and highlight their benefits and ease of use in a reassuring manner can also be highly effective. These interventions are critical to mitigating technology anxiety and fostering greater adoption of DFS among the elderly population in Zhengzhou.

#### **5.4.3 Direct Effect of Perceived Risk on Usage Behaviour**

According to the results provided in chapter four, the construct of perceived risk was also found to be a significant factor that appeared to deter the usage behaviour of the elderly population regarding the use of digital financial services ( $\beta = -0.344$ ,  $t = 3.302$ ,  $p < 0.001$ ). It indicates that perceived risk has a negative but significant effect on the usage behaviour of the elderly, supporting H3. Practically, higher perceived risk translates into avoidance of DFS and continued reliance on traditional channels.

Moreover, the findings of this study are consistent with those of previous studies, such as those of Khan and Abideen (2023), Hendrajaya et al. (2024). In addition, Anaya and De La Vega (2022) support the role of perceived risk in influencing individuals' usage behaviour in a digital context. The findings revealed that the elderly are sensitive to the perception of potential risks, such as financial scams/fraud, identity theft, data insecurity, and privacy breaches, as well as irreversible transaction errors and platform

failures without clear recourse. Furthermore, the findings of this study are consistent with those of Qalati et al. (2021), who found that perceived risk is a significant deterrent to the adoption of digital services, particularly in online shopping.

Nevertheless, prior studies often aggregated risk into a single dimension or focused heavily on e-commerce (product quality risk), which does not fully capture the existential financial threat perceived by the elderly in DFS. A key shortcoming in existing literature is the underestimation of “process risk”, the fear of not being able to rectify a mistake, which is distinct from simple theft. This study fills this gap by validating that Perceived Risk is the strongest direct deterrent ( $\beta = -0.344$ ) for this demographic (RO1). Unlike younger users who may trade off risk for convenience, this study proves that for the elderly in China, risk perception is a non-negotiable barrier that directly halts usage, challenging earlier models that suggested risk might only affect intention.

This study concludes that an individual’s perception of the potential risk of a product or service proves to be an undesirable state for marketers and policymakers, who are particularly concerned with promoting digital platforms. Moreover, when individuals consider a product or service to be free from potential threats or risks, they are more likely to adopt new technology. Hence, concerned entities should consider developing marketing efforts that focus on minimising the perception of potential risk among individuals, especially elderly people in China, to encourage the adoption of digital financial platforms. In the present model, the robustness of the direct PR  $\rightarrow$  UB effect ( $\beta = -0.344$ ) also coexists with a significant indirect pathway via intention (PR  $\rightarrow$  BI  $\rightarrow$  UB), indicating that risk undermines both the willingness to use and the eventual act of using.

In the context of this study among the elderly in Zhengzhou, the specific perceived risks that significantly discourage DFS usage (aligned with the first research objective) include financial scams and fraud, as elderly individuals are often targeted by online scams, leading to a heightened fear of financial loss through digital channels (Chen et al., 2025; Huang & Pontell, 2023). Concerns about identity theft and data insecurity are prevalent, particularly due to less familiarity with digital privacy settings (Klaver et al., 2021; Deng et al., 2024). The fear of irreversible transaction errors during an online transfer or payment that cannot be easily rectified is a significant deterrent, often linked to lower digital literacy and anxiety (Hertzum & Hornbæk, 2023). Apprehension that the digital platform might fail, leading to lost funds or transaction errors without clear recourse, also contributes to perceived risk. Finally, the opaque nature of some digital processes can make elderly users feel out of control, increasing their perception of risk (Mick & Fournier, 1998). The robust negative effect ( $\beta = -0.344$ ) of perceived risk on usage behaviour highlights its profound practical significance: it translates directly into elderly individuals opting out of convenient and efficient digital financial transactions, potentially foregoing benefits like ease of access and cost savings. This avoidance impacts their daily financial decisions, pushing them towards less convenient traditional methods, or even contributing to financial exclusion (Caplan et al., 2021). Consistent with the moderation results (Table 4.19), higher PEOU weakens the negative impact of perceived risk on usage, suggesting that simplifying interfaces and workflows can partially offset risk concerns (H11c supported). Overall, risk reduction (clear security cues, transparent confirmations, easy error recovery) and ease-of-use enhancements should be deployed jointly to improve inclusion outcomes.

#### **5.4.4 Direct Effect of Perceived Trust on Usage Behaviour**

In chapter four, the results reveal that the construct of perceived trust was found to be an insignificant predictor of usage behaviour ( $\beta = 0.093$ ,  $t = 1.463$ ,  $p > 0.05$ ). This implies that perceived trust has no significant effect on the usage behaviour of the elderly regarding digital financial services. Hence, H4 was not supported by the given data. This finding diverges from some previous studies (e.g., Jameel and Karem, 2022; Khan and Abideen, 2023; Hooda et al., 2022), which typically report a significant direct effect of perceived trust.

However, the finding regarding this hypothesised relationship is consistent with Tian et al. (2023), who argued that the construct acts as an insignificant predictor of usage behaviour in the case of e-wallet adoption. This can be justified in the sense that, in the Chinese context, trust is deeply rooted in social and familial networks rather than in digital services. Second, it is evident in China that most elderly people have lower literacy levels, which means that they are not fully aware of the working mechanisms of these services. This could lead to a situation in which trust is not the primary concern because users are focused on the complexity of perceived risks embedded in a digital service. Third, perceived risk in digital services is overshadowed.

In China, it is argued that elderly Chinese people are mostly sceptical of fraud and financial insecurity (Chen et al., 2025). They are highly concerned about money theft when using digital financial services. Therefore, perceived trust is not significantly important to the elderly. Moreover, in China, strong regulatory guarantees and frameworks from financial institutions and the government provide safety to users, which drastically reduces the need to trust products and services. Finally, another reason for the rejection of H4 is that the elderly population possesses attitudes and values that are different from those of the younger generation; therefore, much

attention is not paid to perceived trust in the elderly. Hence, concerned authorities need to pay more attention to other factors that strongly affect the dynamics in defining the usage behaviour of digital financial services.

Interrogating this non-significant direct PT-UB path against literature (e.g., Gefen et al., 2003's direct trust in e-commerce vs. Tian et al., 2023's mediated in e-wallets), the divergence stems from elderly risk aversion in China, where PT fosters intention amid cultural collectivism but yields to infrastructural barriers (e.g., rural connectivity gaps) in actual usage resolving prior contradictions by emphasizing mediated pathways in high-stakes financial contexts (Mayer et al., 1995; SCT's self-efficacy interplay; Bandura, 1986). This finding explicitly SCT-Trust hybrids for vulnerable groups, where PT's role is contextually mediated rather than universally direct (Dwivedi et al., 2019).

They may rely more on verifiable safeguards and visible evidence of safety (e.g., family recommendations, government endorsements) rather than an inherent belief in the service provider's integrity when it comes to actual financial transactions (Namahoot & Laohavichien, 2018; Luhmann & Zucker, 1986). Given the high perceived risks (as discussed in Section 5.4.3) and often lower digital literacy levels among this demographic, their decision to use DFS might be more heavily swayed by the absence of perceived threats and ease of use, rather than a positive affirmation of trust (Nikou et al., 2020). Even if they trust a service, if it feels risky or too complex, they may still not use it directly. This highlights a threshold effect where basic safety and usability are prerequisites that often overshadow the incremental impact of "trust" on actual usage. As demonstrated by the mediation analysis (Section 5.5), perceived trust does significantly influence usage behaviour, but primarily through behavioural intention. It highlights that for the elderly, trust first fosters a willingness or intention

to use DFS, and it is this intention that then directly translates into actual usage. Therefore, trust is not irrelevant, but its pathway to actual behaviour is mediated, not direct. In Chinese society, reputation and proven track record often play a strong role. For new digital services, observable security features and endorsements from trusted entities (like major banks or government initiatives) may be more influential than an abstract “perceived trust” formed by other means (Tian et al., 2023). Therefore, for policymakers and DFS providers, while building trust is crucial, it’s essential to understand its specific pathway to adoption. Focusing solely on abstract trust-building without addressing underlying risk perceptions and facilitating ease of use may not directly translate into increased usage behaviour among the elderly in Zhengzhou. Instead, strategies should prioritize demonstrably secure platforms and comprehensive user support, leveraging trust to build intention, which in turn drives usage.

#### **5.4.5 Direct Effect of Behavioural Intention on Usage Behaviour**

According to the results provided in Table 4.18, the hypothesised relationship between behavioural intention and usage behaviour was significant ( $\beta = 0.151$ ,  $t = 2.649$ ,  $p < 0.05$ ). It indicates that the intention to use digital financial services developed by the elderly significantly leads to the adoption of the actual usage of digital financial services. According to Table 4.18, the beta value is 0.151, with a t-value greater than 1.96 and a p-value less than 0.05, implying that the data provide enough evidence to support H5. It indicates that the more elderly people intend to use digital financial services, the more likely they are to do so. Moreover, these findings are consistent with those of previous studies, such as those of Hooda et al. (2022) and Alturki and Aldraiweesh (2022). These studies support the hypothesised relationship by arguing that, in the case of digital technology adoption, the intention to use the technology strongly determines the usage behaviour of individuals.

Additionally, this relationship is further supported by the study conducted by Anwar et al. (2021), which also supports the claim that the behavioural intention to use is a strong predictor of usage behaviour. Furthermore, the findings of this study revealed that behavioural intention is not a wholly independent factor. It is a function of various factors, such as perceived ease and favourable environmental conditions. Hence, it is suggested that behavioural intention is a central concept in the domain of technology adoption, the importance of which is critical to be understood by policymakers and DFS marketers so that adoption behaviours, especially among the elderly population, may be encouraged to increase financial inclusion. This central role reinforces the need for interventions that nurture intention as a bridge to sustained usage. This finding directly answers the second research question and fulfils its corresponding objective, reinforcing the well-established theory of planned behaviour (Ajzen, 1991) and UTAUT (Venkatesh et al., 2003) in the specific context of elderly DFS adoption.

#### **5.4.6 Direct Effect of Facilitating Conditions on Behavioural Intention**

According to the findings of this study, the construct of facilitating conditions was found to be a significant determinant of the behavioural intention to use digital financial services among the elderly ( $\beta = 0.098$ ,  $t = 2.609$ ,  $p < 0.05$ ). This implies that the availability of proper support and infrastructure enables an individual to use newly introduced or recently used technology. Moreover, the insights of this study reveal that it is necessary for an individual to have the necessary training support from the government to be aware of the use of new technology. The provision of necessary environmental support is necessary to encourage an individual to form a behavioural intention to use the technology. Therefore, the more such resources provided to the elderly, the more likely they are to think about and intend to use digital financial services.

This has mostly been evidenced in the limited context of elderly people in Zhengzhou, China, as this study focused on people living in that area. Therefore, the results of this study show that the presence of facilitating conditions is an important factor in developing a strong intention to use digital financial services, which ultimately leads to their actual use of digital financial services. Moreover, this relationship has been supported by various studies, for example, Pan and Gao (2021), Yu et al. (2021), Esawe (2022) and Zhou et al. (2021). Cao et al. (2021) strongly supported the influence of facilitating conditions on the intention to use digital technologies. As the constructs of facilitating conditions and behavioural intention to use are strongly related, a positive relationship is expected between them, which was proven in this study. Accordingly, marketing practitioners and policymakers should pay attention to the provision of necessary supporting conditions, such as proper training and basic knowledge, to encourage the adoption of digital financial services among the elderly population.

The results of this study suggest that if elderly people have an adequate level of support from the government, there is a chance of accepting the use of digital financial services. Moreover, the findings regarding this relationship suggest that the existence of necessary environmental support greatly influences overall adoption behaviour among the elderly population in China. This finding directly contributes to answering the first research question (RQ1) and fulfilling its corresponding objective (RO1), by identifying facilitating conditions as a key driver of behavioural intention among the elderly.

#### **5.4.7 Direct Effect of Technology Anxiety on Behavioural Intention**

As shown in Table 4.18, the findings of this study reveal that technology anxiety significantly affects the behavioural intention to use digital financial services ( $\beta = -0.197$ ,  $t = 5.295$ ,  $p < 0.001$ ). This reveals that technology anxiety significantly shaped the adoption decisions of the elderly in Zhengzhou, China. Moreover, it can be explained that the fear of experiencing discomfort while using technology deters the target population from using digital financial services. The findings also reveal that when people experience a higher level of anxiety, they are less likely to use digital financial services. Moreover, they feel anxious because they believe that they can make mistakes that can lead to financial losses. Thus, technology anxiety leads to a preference for the traditional mode of conducting transactions, slowing the adoption rate of digital financial services among the elderly population due to their limited knowledge and fear of making mistakes.

This finding is not significantly different from those reported in the existing literature. Several studies have supported this relationship. For example, Wen et al. (2024) and Wang et al. (2024), Nguyen et al. (2024), and Inan et al. (2022) showed that technology anxiety strongly affects behavioural intention, especially in the context of digital financial services. Previous studies have shown a negative association between technology anxiety and behavioural intention, and the present study has proven the same relationship. Initiatives to mitigate anxiety, such as simplified interfaces, are thus essential for fostering intention.

The results suggest that if elderly people feel anxious about technology usage, they prefer to use traditional media for financial transactions. Moreover, the findings regarding this relationship suggest that technology anxiety negatively influences the overall adoption behaviour among elderly people in China. Digital literacy programs

using visual aids can effectively reduce this barrier, promoting greater inclusion. This finding directly contributes to answering the first research question (RQ1) and fulfilling its corresponding objective (RO1), by identifying technology anxiety as a key deterrent of behavioural intention among the elderly.

#### **5.4.8 Direct Effect of Perceived Risk on Behavioural Intention**

As shown in Table 4.18, the results of this study indicate that perceived risk significantly affects the behavioural intention of the elderly to use digital financial services ( $\beta = -0.394$ ,  $t = 4.374$ ,  $p < 0.001$ ). It indicates that the presence of risk perception among elderly people using digitally mediated financial service platforms significantly reduces behavioural intention. This influences the overall adoption behaviour of the elderly, making them prefer traditional financial transaction mediums. Moreover, it can be explained that the lack of knowledge and understanding of this population regarding digital platforms is very limited, due to which they perceive higher levels of risk while using digital platforms. This limited understanding often heightens concerns over privacy and security.

According to the findings, it can also be said that reducing the risk perception of digital financial services platforms among the elderly population can significantly increase adoption behaviour among the target population. The results of this study were not significantly different from those reported in previous studies. For instance, Nazir et al. (2021), Seo and Lee (2021), Pan and Gao (2021), Mathew et al. (2021) and Li (2024) have strongly supported the relationship between the perceived risk and the behavioural intention. These studies have demonstrated that perceived risk negatively affects individuals' behavioural intentions to use technology. Previous literature has also shown a negative link between perceived risk and behavioural intention, which

was confirmed by this study. Efforts to minimize perceived risks through clear security features are therefore crucial.

It indicates that their DFS adoption behaviour is discouraged when they perceive the presence of potential risks such as identity theft, data insecurity, breach of privacy, and financial scams. In such circumstances, they strongly prefer to opt for traditional mediums. This finding directly contributes to answering the first research question (RQ1) and fulfilling its corresponding objective (RO1), by identifying perceived risk as a key deterrent of behavioural intention among the elderly.

#### **5.4.9 Direct Effect of Perceived Trust on Behavioural Intention**

According to the results of this study, as shown in Table 4.18, perceived trust significantly affected the behavioural intention of the elderly to use digital financial services ( $\beta = 0.233$ ,  $t = 6.135$ ,  $p < 0.001$ ). This implies that the trust perceived by the elderly in using digital platforms increases their intention to use them to conduct financial transactions. Moreover, it can be said that the perception of trust in digital applications encourages people to think about and use digital media for conducting everyday transactions, hence shifting them away from the traditional medium. It can be further explained that trust is not built overnight; it requires marketing efforts to build trust among consumers. To develop trust among DFS consumers, marketers must familiarise consumers with DFS platforms and establish credibility in their minds (Hooda et al., 2022). This credibility is especially vital for risk-averse elderly users.

Furthermore, the results regarding this relationship are aligned with those of previous studies, such as Baidoun and Salem (2024) and Hooda et al. (2022), Siagian et al. (2022) and Muangmee et al. (2021). Moreover, Arfansyah and Marsasi (2023) supported the relationship between perceived trust and behavioural intention. All of

these studies have demonstrated that the presence of perceived trust strongly influences elderly behavioural intention to use DFS. Previous literature has also shown a positive link between perceived trust and behavioural intention, which was confirmed in this study. Building trust through endorsements can thus enhance adoption.

The results suggest that if elderly people perceive higher levels of trust in digital financial applications, they prefer to use digital media to perform financial transactions. Moreover, the findings regarding this relationship suggest that trust perception positively influences overall adoption behaviour among the elderly population in China.

In the Chinese context, perceived trust plays a crucial role in shaping the behavioural intention of the elderly towards DFS by addressing their fundamental need for reliability and security in financial dealings. This influence is particularly strong because older adults often rely on established institutions and social networks for financial advice and service validation (Luhmann & Zucker, 1986). When DFS platforms are perceived as trustworthy due to clear regulatory oversight (e.g., from the People's Bank of China), endorsement by reputable financial institutions, or positive word-of-mouth from trusted peers and family, elderly individuals are more likely to form an intention to use these services. This trust helps alleviate inherent scepticism and fear of fraud (Chen et al., 2025), acting as a psychological safeguard that encourages them to overcome initial resistance and consider digital alternatives to traditional banking. Without this foundational trust, their willingness to even consider DFS is significantly hampered, regardless of other benefits. Given the significant negative impacts of Perceived Risk ( $\beta = -0.394$ ) and Technology Anxiety ( $\beta = -0.197$ ) on behavioural intention (as discussed in Sections 5.4.8 and 5.4.7 respectively), the

positive influence of perceived trust ( $\beta = 0.233$ ) is particularly vital. It acts as a counterbalancing force, buffering the detrimental effects of risk and anxiety by fostering a sense of security and confidence that enables elderly users to even consider adopting DFS. Therefore, while risk and anxiety deter intention, trust builds it, with these three constructs interacting to collectively shape the elderly's initial willingness to engage with digital financial services. This finding directly contributes to answering the first research question (RQ1) and fulfilling its corresponding objective (RO1), by identifying perceived trust as a key driver of behavioural intention among the elderly.

#### **5.4.10 Moderating Effect of Perceived Ease of Use**

This section elucidates the moderating role of Perceived Ease of Use (PEOU) among the elderly in their adoption of digital financial services. Specifically, it discusses how PEOU moderates the relationships between facilitating conditions and usage behaviour, technology anxiety and usage behaviour, perceived risk and usage behaviour, and perceived trust and usage behaviour within the Chinese elderly population. This study considers PEOU as a significant moderating factor because a higher perception of ease of use enhances confidence and clarity for individuals, thereby altering how they respond to other influential factors. These moderating effects provide nuanced insights into how ease shapes adoption pathways. This discussion specifically addresses the fourth research question (RQ4) and fulfils its objective (RO4).

##### **5.4.10.1 Moderating Effect of Perceived Ease of Use on the Relationship between Facilitating Conditions and Usage Behaviour**

The results from the PLS-SEM analysis, as displayed in Table 4.19, strongly support Hypothesis H11a. This indicates that Perceived Ease of Use significantly and positively moderates the relationship between facilitating conditions and the usage

behaviour of elderly individuals regarding digital financial services. Specifically, Table 4.20 shows a beta value of 0.102, a t-value greater than 2.205, and a p-value less than 0.05. This positive moderating effect suggests that when PEOU is high, the positive influence of facilitating conditions on DFS usage behaviour among the elderly is substantially strengthened. In essence, an easily usable digital platform makes the external support (e.g., training, technical assistance) even more effective, as elderly users can readily apply the knowledge and resources provided. These moderating effects provide nuanced insights into how ease shapes adoption pathways.

These findings are consistent with previous research, such as Tam et al. (2020), Alfadda and Mahdi (2021), and Jeong and Shin (2020), which emphasize the amplifying role of user experience or ease of use in technology adoption. This study further underscores that PEOU serves as a critical multiplier: without an adequate perception of ease of use, even robust facilitating conditions may fail to translate into sustained usage, especially for the elderly. For older adults with lower PEOU, their reliance on facilitating conditions is paramount; they are more dependent on intensive support (like accessible technical support, hands-on training, and extremely simple interfaces) to overcome fundamental barriers. Conversely, for elderly users who perceive DFS as highly easy to use, while external support remains valuable, they become more self-reliant in navigating technological challenges, requiring less direct assistance to convert their readiness into actual usage.

#### **5.4.10.2 Moderating Effect of Perceived Ease of Use on the Relationship Between Technology Anxiety and Usage Behaviour**

According to Table 4.19, Hypothesis H11b, concerning the moderating role of Perceived Ease of Use on the relationship between technology anxiety and usage behaviour, is supported. This indicates that PEOU significantly mitigates the negative

impact of technology anxiety on DFS usage among the elderly. The results in Table 4.20 show a beta value of 0.102, a t-value greater than 1.96, and a p-value less than 0.05. It indicates that while technology anxiety generally discourages DFS usage, its detrimental effect is considerably weakened when elderly individuals perceive the digital financial services as easy to use. Ease thus acts as a psychological buffer.

These findings align with previous research, such as Tsai et al. (2020), Wang et al. (2024), Holzmann et al. (2020), and Al-Hamad et al. (2021), which highlight how ease of use or familiarity can buffer the adverse effects of technology anxiety. This study reinforces the notion that PEOU acts as a crucial psychological shield for the elderly: when confronted with technology anxiety, an easy-to-use interface provides a sense of control and reduces the fear of making mistakes, thus enabling them to proceed with DFS usage despite their initial apprehension. For elderly individuals with high technology anxiety but who perceive a DFS as easy to use, the path to adoption becomes less daunting. Conversely, for those with low PEOU, even moderate anxiety can become a significant barrier, leading to avoidance and a preference for traditional financial mediums.

Implementation could involve phased pilots in Zhengzhou community centers, blending SCT-based self-efficacy building (e.g., gamified tutorials) with infrastructural upgrades (e.g., offline-capable apps for spotty rural signals), countering cultural hesitancy in tech adoption (Bandura, 1986; Ghorayeb et al., 2021). Instead of solely focusing on abstractly “reducing anxiety”, policymakers and DFS providers should prioritize tangible improvements in user-friendliness and simplicity. It indicates designing intuitive interfaces with clear visual cues, large fonts, and simplified navigation flows. Providing hands-on, step-by-step guidance in a non-threatening environment, such as community workshops demonstrating the ease of use,

can directly translate into increased confidence and reduced avoidance behaviours. Such a focus on PEOU can lead to actionable policy changes, such as mandatory usability standards for financial apps targeting the elderly, potentially unlocking a larger segment of the older population for financial inclusion.

#### **5.4.10.3 Moderating Effect of Perceived Ease of Use on the Relationship Between Perceived Risk and Usage Behaviour**

The PLS-SEM results in Table 4.19 confirm support for Hypothesis H11c. This indicates that Perceived Ease of Use significantly and positively moderates the relationship between perceived risk and usage behaviour among elderly individuals using digital financial services. The results suggest that a higher PEOU considerably weakens the negative impact of perceived risk on DFS usage. This implies that even if elderly users perceive certain risks (e.g., identity theft, financial scams) in DFS, their willingness to use these services is less deterred if the platforms are perceived as easy to operate and understand. This moderation helps build confidence in security features. These findings are consistent with studies by Hassan et al. (2022), Yi et al. (2020), and Kasilingam (2020), which suggest that ease of use or familiarity can diminish the perceived severity or likelihood of risks in digital contexts. The interaction effect observed in this study highlights that PEOU acts as a risk-mitigating factor: when elderly users find a system easy to use, they gain a sense of control and predictability, which in turn reduces their apprehension about potential adverse outcomes. Less experienced older adults, unfamiliar with digital security protocols, are more prone to perceiving higher risks and, consequently, avoiding DFS. However, with higher PEOU, elderly individuals become more confident in navigating the platforms, developing a better understanding of basic security features, and thus perceive less operational risk,

which encourages their adoption of DFS. It signals that the psychological burden of risk is lighter when the interface is user-friendly.

For detailed guidance, providers should roll out risk-education modules within apps (e.g., one-tap privacy scans), tailored to China's regulatory landscape (e.g., PBOC guidelines), while addressing rural infrastructure via low-bandwidth modes—reducing PR by 20-30% per usability studies (Hua & Huang, 2021; Klaver et al., 2021). Policymakers and financial institutions should prioritize efforts to simplify user interfaces and transaction processes, as this directly contributes to reducing the psychological impact of perceived financial and security risks. For example, instead of solely emphasizing complex security features, efforts should also focus on making the interaction with these features inherently simple and transparent. Implementing easily understandable error messages, clear transaction confirmations, and intuitive navigation can significantly boost elderly users' confidence and reduce their worries about potential security issues. This can drive actionable policy changes, advocating for universal design principles in financial technology development, ensuring that accessibility and ease of use become foundational pillars for encouraging safe and confident DFS adoption among this vulnerable demographic.

#### **5.4.10.4 Moderating Effect of Perceived Ease of Use on the Relationship Between Perceived Trust and Usage Behaviour**

The results of the PLS-SEM, as displayed in Table 4.20, present the moderation findings. According to Table 4.20, the results indicate that the hypothesis concerning the moderating role of Perceived Ease of Use on the relationship between perceived trust and usage behaviour was not supported. This implies that Perceived Ease of Use does not significantly moderate the link between perceived trust and the usage

behaviour of elderly individuals regarding digital financial services. This non-significance highlights trust's independent pathway.

Furthermore, these findings appear to be inconsistent with some previous literature which might suggest that ease of use could strengthen the impact of trust on adoption. For instance, Gefen et al. (2003)'s integrated model for online shopping highlighted the interconnectedness of trust and TAM constructs, implying that ease of use could facilitate trust's influence. However, the current study's finding aligns with research suggesting that for certain populations or contexts, the interaction between perceived ease of use and perceived trust might not be as direct or significant as assumed. For example, Maduku et al. (2023), in their study on digital assistant usage, explored technology anxiety's moderating role, implying complex interactions where factors beyond ease of use might predominantly shape core relationships. While Arfi et al. (2021) found trust to be important in eHealth adoption, their UTAUT-based study did not specifically examine PEOU as a moderator between trust and usage behaviour, thus making a direct comparison of moderation effects challenging. The divergence here suggests that the specific dynamics in elderly DFS adoption might differ from general technology adoption contexts.

Deeply interrogating this non-significance against literature (e.g., Gefen et al., 2003's PEOU-trust synergy in e-commerce vs. Maduku et al., 2023's null in anxiety-heavy contexts), it reflects elderly prioritization of relational trust (Trust Theory; Mayer et al., 1995) over ease in high-stakes DFS, moderated by cultural/infrastructural factors like rural isolation—extending SCT by underscoring self-efficacy's limited amplification of PT amid connectivity gaps (Bandura, 1986; CNNIC, 2022). This critiques overgeneralized UTAUT moderators, advocating hybrid SCT-Trust models for culturally embedded aging studies (Dwivedi et al., 2019).

For the elderly, trust in financial services, especially digital ones, is often a very fundamental, binary decision driven by deep-seated concerns about security, fraud, and financial loss (Chen et al., 2025; Ghorayeb et al., 2021). This foundational trust or distrust is so critical that the perceived ease of using the service may not significantly alter how much that trust then translates into actual usage. They either trust enough to overcome usability hurdles, or distrust enough to avoid, regardless of simplicity (Namahoot & Laohavichien, 2018). PEOU acts more as a direct barrier-reducer, rather than a trust-amplifier for usage.

While PEOU can reduce cognitive load, for elderly users, their inherent risk aversion and cautious decision-making in financial matters (Nikou et al., 2020) mean that ease of use might not directly boost the impact of trust on usage. They might appreciate simplicity but still defer to external validation or deeply ingrained habits (Klaver et al., 2021; Wu et al., 2017).

It is possible that for the elderly, PEOU primarily impacts usage directly by reducing effort expectancy and indirectly by mitigating anxiety and risk (as supported by H11b and H11c), rather than by strengthening the trust-usage link. Trust, as shown in Section 5.5, significantly influences behavioural intention, which then drives usage. It signals that distinct, rather than interacting, pathways for PEOU and trust towards usage behaviour in this demographic.

Younger populations might form trust more readily based on a smooth, easy user experience. However, older adults might require more tangible evidence, such as strong brand reputation, official endorsements, word-of-mouth from trusted family, or clear regulatory guarantees, to build financial trust (Murinde et al., 2022; Sikka & Bhayana, 2024). PEOU, while important, might not significantly amplify these deeper,

experience-driven trust mechanisms. Therefore, for concerned authorities, while improving Perceived Ease of Use is undoubtedly beneficial for reducing initial barriers to entry and facilitating adoption, it is crucial to recognize that its impact might be less about moderating the trust-usage link and more about directly facilitating initial engagement and continued use through reduced effort. Strategies should primarily focus on developing initiatives that directly increase foundational trust among the elderly population in DFS. This requires transparent communication about security measures, robust regulatory oversight, and accessible human support channels to address their deeper anxieties and build confidence (Murinde et al., 2022; Sikka & Bhayana, 2024). Adopting and implementing such comprehensive strategies in DFS marketing campaigns, alongside efforts to ensure high PEOU, will be vital for enhancing perceived trust levels among the elderly and encouraging sustained adoption behaviours.

#### **5.4.11 Mediating Role of Behavioural Intention**

According to Table 4.19, behavioural intention plays a significant role in all the independent and dependent variables considered in the study. This section presents a detailed discussion of the mediating role of behavioural intention. The results displayed in Table 4.19 reveal that behavioural intention plays a significant mediating role in the relationship between facilitating conditions and usage behaviour ( $\beta = 0.015$ ,  $t = 1.679$ ,  $p < 0.05$ ). It can be said that, along with the direct effect of facilitating conditions on usage behaviour, the effect of facilitating conditions on the usage behaviour of elderly people is mediated by their behavioural intention to use digital financial services.

In other words, the presence of facilitating conditions significantly shapes the behavioural intention to use digital financial services, finally leading to the usage behaviour of digital financial services by elderly people. Furthermore, this is aligned with the previous literature. For instance, Kim et al. (2020) and Yuan et al. (2023) asserted that behavioural intention significantly mediates the relationship between facilitating conditions and the usage behaviour of elderly people regarding digital financial services. Moreover, this implies that an increase in the facilitating conditions provided to elderly people causes them to develop an intention to use digital financial services. As a result, as the intention increases, the usage behaviour of elderly people will significantly increase. This partial mediation underscores intention's bridging role.

The results displayed in Table 4.19 reveal that behavioural intention significantly and negatively mediates the relationship between technology anxiety and usage behaviour ( $\beta = -0.030$ ,  $t = 2.209$ ,  $p < 0.05$ ). It can be said that the direct effect of technology anxiety on usage behaviour, effect of technology anxiety on the usage behaviour of elderly people is mediated by the behavioural intention to use digital financial services.

In other words, the presence of technology anxiety significantly reduces the behavioural intention to use digital financial services, finally leading to a decrease in the usage behaviour of digital financial services by the elderly.

Furthermore, this is aligned with the previous literature. For example, Muneer et al. (2024); An et al. (2024) and Wang et al. (2024) asserted that behavioural intention significantly mediates the relationship between technology anxiety and the usage behaviour of elderly people regarding digital financial services. Moreover, this implies that the increase in technology anxiety experienced by the elderly people causes a reduction in their intention to use digital financial services. In addition, this decrease

in intention significantly reduces the usage behaviour of elderly people. The partial mediation here highlights anxiety's indirect persistence.

According to Table 4.19, behavioural intention significantly and negatively mediates the relationship between perceived risk and usage behaviour ( $\beta = -0.060$ ,  $t = 2.394$ ,  $p < 0.01$ ). It can be said that, along with the direct effect of perceived risk on usage behaviour, the effect of perceived risk on the usage behaviour of elderly people is negatively mediated by the behavioural intention to use digital financial services. In other words, the presence of perceived risk significantly reduces the behavioural intention to use digital financial services, finally leading to a decrease in the usage behaviour of digital financial services by the elderly.

Furthermore, this is aligned with the previous literature. For example, Namahoot and Laohavichien (2018) asserted that behavioural intention significantly mediates the relationship between perceived risk and the usage behaviour of elderly people regarding digital financial services. This implies that an increase in perceived risk experienced by elderly people causes them to reduce their intention to use digital financial services. In addition, the decrease in intention reduces the usage behaviour of elderly people.

According to Table 4.19, behavioural intention significantly mediates the relationship between perceived trust and usage behaviour ( $\beta = 0.035$ ,  $t = 2.351$ ,  $p < 0.01$ ). Table 4.18 reveals that perceived trust has no significant effect on the usage behaviour of elderly people, while Table 4.19 shows that perceived trust indirectly affects usage behaviour in the presence of behavioural intention. This implies that behavioural intention significantly and fully mediates the relationship between perceived trust and usage behaviour of the elderly population segment of Zhengzhou. In other words, the

presence of perceived trust significantly increases the behavioural intention to use digital financial services finally leading to an increase in the usage behaviour of digital financial services by the elderly.

Furthermore, this is aligned with the previous literature. For example, Al-Afeef et al. (2024), Almaiah et al. (2022), and Ma (2021) asserted that behavioural intention significantly mediates the relationship between perceived trust and the usage behaviour of elderly people regarding digital financial services. Moreover, this implies that the increase in perceived trust experienced by elderly people causes them to enhance their intention to use digital financial services. In addition, this enhancement of intention significantly increases the usage behaviour of elderly people. Overall, these mediation paths reveal behavioural intention's pivotal role, with partial effects for drivers and deterrents and full mediation for trust, enriching adoption models in aging contexts.

Across all examined relationships, behavioural intention (BI) consistently emerges as a pivotal mediator, acting as a crucial cognitive bridge between antecedents (FC, TA, PR, PT) and the actual Usage Behaviour (UB) of DFS among the elderly in Zhengzhou. The mediation effects vary in strength and nature. The indirect effect of perceived risk on usage behaviour via BI ( $\beta = -0.060$ ) is the strongest negative mediation, highlighting how risk perceptions are processed through intention to deter usage. Conversely, perceived trust's indirect effect on usage via BI ( $\beta = 0.035$ ) is the strongest positive mediation. This nuanced pattern reveals that for the elderly, high-stakes factors like risk and trust exert their influence predominantly by shaping one's mental preparedness (intention) to use DFS. The full mediation of perceived trust suggests that a fundamental level of trust must be established to even form the intention to use, which then drives actual adoption. In contrast, the partial mediation of facilitating

conditions, technology anxiety, and perceived risk indicates that while intention is central, these factors also have direct effects on usage, either by directly enabling (FC) or directly deterring (TA, PR) the behaviour, perhaps even before a full intention is consciously formed. Collectively, these findings provide a comprehensive understanding of the multi-layered psychological and practical pathways through which various factors influence DFS adoption among this specific demographic, emphasizing the dual importance of fostering positive intentions and directly addressing barriers/enablers.

## **5.5 Research Implication**

This study has several managerial and theoretical implications, which are discussed in detail in the following sections.

### **5.5.1 Managerial Implications**

The results of this study will be useful for managers and marketers of digital financial services, particularly in China. The insights of this study reveal the importance of recognising vital factors that may prove to be significant predictors and deterrents of adoption behaviours regarding digital financial services among the elderly population in China. In response to the identified deterrents and determinants, this section offers actionable strategic recommendations structured into key areas to guide effective interventions.

With a strategic focus on mitigating deterrents, a primary recommendation is to strategically address the significant deterrents of Technology Anxiety (TA) and Perceived Risk (PR). The study's findings unequivocally show that both TA and PR substantially reduce behavioural intention (BI) and usage behaviour (UB) among the elderly. Managers and policymakers should prioritize user-friendly interfaces and

provide comprehensive, patient-centric training programs to mitigate technology anxiety (Hoque & Sorwar, 2017; Bandura, 1986). This includes hands-on, step-by-step guidance, along with educational campaigns that effectively communicate the benefits and security features of DFS platforms. To counter perceived risk, concerned authorities must implement and highlight robust security measures such as real-time fraud alerts, biometric authentication, and AI-driven risk detection (Saprikis et al., 2022). Furthermore, promoting gradual adoption through hybrid models, where elderly users can slowly transition from traditional to digital financial transactions, can reduce initial apprehension and build confidence.

**Leveraging Determinants for Enhanced Adoption.** It is crucial to leverage facilitating conditions (FC) and Perceived Trust (PT) as key determinants. The positive influence of FC on both BI and UB (Venkatesh et al., 2003) underscores the need for continued investment in accessible infrastructure, such as community-based digital literacy workshops and dedicated technical assistance. While Perceived Trust (PT) significantly impacts Behavioural Intention (BI), its effect on Usage Behaviour (UB) is indirect, fully mediated by BI. This implies that building strong foundational trust (through transparent communication about security, robust regulatory oversight, and official endorsements) is essential to first foster a willingness to use DFS, which then translates into actual usage (Mayer et al., 1995; Gefen et al., 2003). Marketers should focus on establishing credibility through verifiable safeguards and visible evidence of safety to build this foundational trust among the elderly.

**Strategic Use of Perceived Ease of Use (PEOU).** The significant moderating role of Perceived Ease of Use (PEOU) on the relationships between FC, TA, PR, and UB, but not PT, offers nuanced strategic direction. For FC, a higher PEOU amplifies the positive impact of facilitating conditions on usage (H11a), suggesting that investments

in external support are most effective when coupled with highly intuitive and simple platforms. For TA and PR, PEOU acts as a crucial buffer, significantly weakening their negative effects on usage (H11b, H11c), implying that user-friendly design can help overcome anxiety and risk perceptions.

This highlights the need to design differentiated support mechanisms for elderly DFS users. Firstly, for low PEOU users, prioritize foundational onboarding programs with step-by-step guidance, interactive tutorials, and demo versions to build initial comfort and familiarity. Secondly, for higher PEOU users: while support remains valuable, focus can shift towards advanced features, security education, and customization options. Managers and policymakers should advocate for universal design principles in financial technology development, ensuring accessibility and ease of use are foundational. This includes designing interfaces with clear visual cues, large fonts, simplified navigation, and intuitive error messages.

To operationalize these strategies, regulators could mandate PEOU audits (e.g., WCAG 2.1 standards adapted for Mandarin seniors), integrating cultural factors like family co-use in rural Henan (e.g., subsidized joint-training apps) to amplify FC's effect, directly addressing infrastructural divides (CNNIC, 2022; OECD, 2023). It implies that investments in facilitating conditions (e.g., nationwide digital literacy programs, community-based support centers) will yield disproportionately higher returns in encouraging DFS adoption among the elderly if the underlying platforms are also perceived as highly easy to use. For instance, rather than merely offering training, ensuring the training focuses on demonstrating and reinforcing the perceived simplicity of key DFS functions can dramatically boost its effectiveness. Managers should therefore prioritize developing highly intuitive interfaces and offering “dummy” or “sandbox” versions of DFS to enhance initial PEOU, thereby maximizing the

impact of broader facilitating conditions. This can translate directly into increased financial inclusion for a larger segment of the elderly population.

### **5.5.2 Theoretical Implications**

This study adapts the Unified Theory of Acceptance and Use of Technology (UTAUT) by adding constructs such as PT, TA, and PR. Since only selected variables (e.g., Facilitating Conditions) from the original UTAUT were retained while others were excluded, and new context-specific variables were integrated, this represents an adaptation rather than a full extension of the model. Saeed et al. (2024) and Klaver et al. (2021) found that TA and PR are relevant for elderly users. Integrating these constructs with UTAUT via PLS-SEM an enriched theoretical perspective on elderly DFS adoption, highlighting emotional-risk dynamics in vulnerable groups (Blut et al., 2022). Moreover, this study reinforces the theoretical importance of behavioural intention as an antecedent of usage behaviour, as posited by UTAUT.

The conceptual framework of this study was developed based on empirical evidence provided by previous research and gaps identified in the current literature. This study provides valuable insights into the factors that affect the overall adoption behaviour of the elderly population in Zhengzhou, China, regarding digital financial services. Moreover, the study explains how FC, TA, PR, PT, and PEOU shape BI and usage behaviour in the digital world. Most hypotheses in this model are supported by the existing literature, as discussed in the previous sections. This research provides a valuable contribution to the literature by providing insights into the adoption factors that critically shape adoption behaviour, especially in the Chinese context, as a limited number of studies have focused on the Chinese context, and the elderly population has not received attention from researchers.

Furthermore, the construct of TA has been covered in the literature in other contexts, while this study assessed the role of TA in the context of digital financial service adoption among the elderly population in China. In addition, this study contributes to the existing body of knowledge by extending the integrated model by assessing the moderating role of PEOU in the relationship between antecedents and usage behaviour. This study provides a more comprehensive understanding of the overall adoption behaviour of elderly people in the Chinese context.

It is acknowledged that while numerous studies regarding DFS adoption have been conducted in Eastern cultures, including China, the specific segment of the elderly population in regions like Henan has mostly remained understudied. This study also fills this gap by targeting the older population segment in Eastern cultures. Finally, this study fills the literature gap in many aspects, and the results can be generalised to other provincial contexts in China.

### **5.5.3 Methodological Implication**

Adopting new technology requires the availability of favourable factors (Thanigan et al., 2025). Digital financial service providers seek to integrate these favourable conditions to enhance the consumer experience. The adoption phenomenon has been widely studied, particularly in developed countries. However, few studies have focused on integrating pivotal factors to study adoption behaviours in developing countries, especially when it comes to the elderly population (Bertolazzi et al., 2024; Jang et al., 2024). Methodologically, this study validates the integration of pivotal elements that shape the adoption behaviours of elderly people in Zhengzhou, China. This study used PLS-SEM to validate the hypothesised paths between all independent and dependent variables in the presence of mediating and moderating variables.

This study provides an in-depth perspective on digital financial service adoption by including a PEOU construct. Moreover, this study highlights how prior experience of elderly people with platforms affects the strength of hypothesised relationships between the independent and dependent variables in this study. Methodologically, this provides a valuable contribution to the growing body of literature, especially dealing with the elderly segment of the population that remains understudied. Importantly, this study provides localised insights related to Zhengzhou which can be used by marketers, managers, and policymakers to tailor digital financial services in accordance with the needs of elderly people in other identical contexts. The inclusion of PR and TA is methodologically key, validating their relevance for elderly adoption amid security fears and complexity (Klaver et al., 2021). FC's assessment highlights training's role in skill-building (Alalwan et al., 2018).

In addition, this study assessed the reliability and validity of the scales operationalised from the perspective of digital financial services consumers. Moreover, this study provides actionable insights for managers, marketers, and policymakers to enhance and increase overall financial inclusion. The elderly population can be targeted, as it has mostly been an underbanked segment of the population.

## **5.6 Limitations and Recommendations for Future Research**

This study has some limitations that pave the way for future research. The first limitation of this study can be explained by the fact that it was conducted in the limited context of Zhengzhou, China. Future research could extend the studied model to other provinces in China to validate the results of this study. In addition, this model can also be used to assess the adoption behaviours of the younger and middle-aged populations in Zhengzhou, China. Second, the current model can be extended to include more

antecedents and consequences of behavioural intention and usage behaviour such as usage satisfaction. Moreover, the currently studied model can be further extended by considering other mediating and moderating variables such as user attitude and intrinsic motivation to use DFS to develop a more nuanced understanding of the phenomenon. Furthermore, this study paves the way for conducting qualitative research to understand the insignificant moderating effect of PEOU on the relationship between perceived trust and usage behaviour. Lastly, it can be said that this research was based on a cross-sectional survey, which has produced a limited understanding of the overall phenomenon. While PLS-SEM excels in predictive modeling, such cross-sectional limitations suggest the need for longitudinal extensions to better infer causality (Hair et al., 2021).

The selection of PLS-SEM over CB-SEM was justified by its variance-based prediction focus, which suits complex, non-normal elderly data for theory-building, unlike CB-SEM's emphasis on model fit for confirmatory analysis. Moreover, PLS-SEM is ideal for relatively small samples and formative constructs, enhancing methodological rigor in aging research contexts through bootstrapped mediation and moderation analyses with 5,000 resamples (Hair et al., 2017; Henseler et al., 2016).

Critically, institutional constraints (e.g., data privacy regs limiting cross-province samples) and cultural biases (e.g., urban-centric surveys overlooking rural dialects) warrant mixed-methods futures: qualitative interviews probing trust nuances in Henan's migrant families (Blut et al., 2022; CNNIC, 2022).

## **5.7 Conclusion**

This study investigated the combined impact of key factors influencing the adoption behaviour of digital financial services among the elderly population. The findings

indicate that facilitating conditions, technology anxiety, perceived risk, and perceived trust significantly shape the adoption behaviour of elderly individuals, particularly concerning digital financial services. Furthermore, the presence of Perceived Ease of Use (PEOU) influences the usage behaviour of this demographic. This research offers a comprehensive understanding of how financial inclusion can be enhanced, especially for individuals over 65 years of age. Consequently, this study is instrumental in advancing financial inclusion levels, particularly among the elderly population in China.



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## APPENDIX



Dear Participant,

I am a PhD student at Universiti Utara Malaysia. I am seeking your cooperation to respond to the attached survey on “FACTORS INFLUENCING ADOPTION OF DIGITAL FINANCIAL SERVICES AMONG THE ELDERLY IN ZHENGZHOU, CHINA: MODERATING EFFECT OF PERCEIVED EASE OF USE”.

This survey is part of the university requirement for the completion of my thesis. The questionnaire will take about 10 minutes to complete. Instructions for filling it can be found on the questionnaire. The questionnaire consists of eight sections. Respondents must choose one option from the given five-point Likert scale where 1 represents Strongly Disagree, 2 represents Disagree, 3 is Neutral, 4 represents Agree, and 5 represents Strongly Agree.

I would really appreciate it if you could complete and return the questionnaire. Please be assured that all information provided will be treated with utmost confidentiality and strictly used for academic purposes. Thank you for your time, cooperation, and participation.

For further enquiries, you may contact:

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## Survey Questionnaire

### Section A: Demographic Profile

#### 1. Age

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- ☐ Above 65
- ☐ Below 65

#### 2. Gender

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- ☐ Male ☐ Female

#### 3. Current Residential Area

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- ☐ Urban Area ☐ Semi Urban Area
- ☐ Rural Area

#### 4. Level of Education

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- ☐ No formal education
- ☐ Primary school
- ☐ Secondary school
- ☐ University degree
- ☐ Postgraduate degree

## 5. Current Occupation

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- ☐ Retired
- ☐ Employed full-time
- ☐ Employed part-time
- ☐ Homemaker
- ☐ Other

## 6. Technology and Digital Literacy

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a) I own a smartphone or other mobile device:

Yes

☐

No

☐

b) I use my mobile device for daily activities (e.g., communication, news, entertainment):

Yes

☐

No

☐

c) I am comfortable using the internet on my mobile device:

Yes

☐

No

☐

d) I am using digital financial services (e.g., mobile banking, online payments):

Yes

☐

No

☐

e) If yes, how did you learn to use it?

Difficult

☐

Easy

☐

## Section B: Usage Behaviour

Please indicate your level of agreement for each statement with (1) strongly disagree (2) disagree (3) neutral (4) agree and (5) strongly agree.

| <b>Usage Behaviour refers to the degree at which an individual intends to utilize the technology (Dwivedi et al., 2019)</b> |                                                                                          | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> |
|-----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|
| 1)                                                                                                                          | I use Alipay/WeChat Pay.                                                                 |          |          |          |          |          |
| 2)                                                                                                                          | I use Alipay/WeChat Pay to manage my e-wallet accounts.                                  |          |          |          |          |          |
| 3)                                                                                                                          | I use Alipay/WeChat Pay to do transactions.                                              |          |          |          |          |          |
| 4)                                                                                                                          | I sign up for Alipay/WeChat Pay that are specially designed for digital payment systems. |          |          |          |          |          |

## Section C: Perceived Trust

Please indicate your level of agreement with each statement with (1) strongly disagree (2) disagree (3) neutral (4) agree and (5) strongly agree.

| <b>Perceived trust refers to the belief held by users that the service provider will fulfil their obligations and their expectation of a specific technological outcome (Almarashdeh, 2018)</b> |                                                                        | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|----------|----------|----------|----------|----------|
| 1)                                                                                                                                                                                              | I think that Alipay/WeChat Pay will keep its promises and commitments. |          |          |          |          |          |
| 2)                                                                                                                                                                                              | Alipay/WeChat Pay is trustworthy.                                      |          |          |          |          |          |
| 3)                                                                                                                                                                                              | I would consider Alipay/WeChat Pay to be honest.                       |          |          |          |          |          |
| 4)                                                                                                                                                                                              | I think that Alipay/WeChat Pay is responsible.                         |          |          |          |          |          |

## Section D: Perceived Risk

Please indicate your level of agreement with each statement with (1) strongly disagree (2) disagree (3) neutral (4) agree and (5) strongly agree.

| <b>Perceived risk refers to the danger that consumers consciously recognise due to their lack of comprehension regarding product information. (Yu &amp; Zhang, 2020)</b> |                                                                                    | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|
| 1)                                                                                                                                                                       | I think using Alipay/WeChat Pay would put my privacy at risk.                      |          |          |          |          |          |
| 2)                                                                                                                                                                       | I think using Alipay/WeChat Pay in monetary transactions online has potential risk |          |          |          |          |          |
| 3)                                                                                                                                                                       | I think using Alipay/WeChat Pay has significant risks in making online purchase    |          |          |          |          |          |
| 4)                                                                                                                                                                       | I think using Alipay/WeChat Pay is a risky choice                                  |          |          |          |          |          |

## Section E: Technology Anxiety

Please indicate your level of agreement with each statement with (1) strongly disagree (2) disagree (3) neutral (4) agree and (5) strongly agree.

| <b>Technology Anxiety is a detrimental affective reaction that concerns individuals' apprehension or unease regarding the utilisation of technology (Kaushik &amp; Mishra, 2019)</b> |                                                                        | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|----------|----------|----------|----------|----------|
| 1)                                                                                                                                                                                   | Using Alipay/WeChat Pay services would make me very nervous.           |          |          |          |          |          |
| 2)                                                                                                                                                                                   | Using Alipay/WeChat Pay services make me worried.                      |          |          |          |          |          |
| 3)                                                                                                                                                                                   | Using Alipay/WeChat Pay services may make me feel uncomfortable.       |          |          |          |          |          |
| 4)                                                                                                                                                                                   | Using Alipay/WeChat Pay services may make me feel uneasy and confused. |          |          |          |          |          |

## Section F: Facilitating Conditions

Please indicate your level of agreement with each statement with (1) strongly disagree (2) disagree (3) neutral (4) agree and (5) strongly agree.

| <b>Facilitating Conditions refers to an individual's perception of the extent to which a technical and organisational infrastructure is operational to facilitate the system's use (Dwivedi et al., 2019)</b> |                                                                              | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------|----------|----------|----------|----------|
| 1)                                                                                                                                                                                                            | I have the resources necessary to use Alipay/WeChat Pay service.             |          |          |          |          |          |
| 2)                                                                                                                                                                                                            | I have the knowledge necessary to use Alipay/WeChat Pay service.             |          |          |          |          |          |
| 3)                                                                                                                                                                                                            | Alipay/WeChat Pay is compatible with other technologies I use.               |          |          |          |          |          |
| 4)                                                                                                                                                                                                            | I always have internet connection to use Alipay/WeChat Pay service.          |          |          |          |          |          |
| 5)                                                                                                                                                                                                            | I can get help from others when I have difficulties using Alipay/WeChat Pay. |          |          |          |          |          |

## Section G: Behavioural Intention

Please indicate your level of agreement with each statement with (1) strongly disagree (2) disagree (3) neutral (4) agree and (5) strongly agree.

| <b>Behavioural intention to utilize Alipay/WeChat Pay is a measure of the degree to which consumers' actual usage of the services can be predicted (Tian et al., 2023).</b> |                                                                          | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------|----------|----------|----------|----------|
| 1)                                                                                                                                                                          | I plan to use Alipay/WeChat Pay in the future.                           |          |          |          |          |          |
| 2)                                                                                                                                                                          | I intend to use Alipay/WeChat Pay when I purchase items.                 |          |          |          |          |          |
| 3)                                                                                                                                                                          | I plan to use Alipay/WeChat Pay frequently in my daily life.             |          |          |          |          |          |
| 4)                                                                                                                                                                          | I will use Alipay/WeChat Pay more frequently for paying bills in future. |          |          |          |          |          |

## Section H: Perceived Ease of Use (PEOU)

Please indicate your level of agreement with each statement with (1) strongly disagree (2) disagree (3) neutral (4) agree and (5) strongly agree.

| <b>Perceived ease of use is defined as the degree to which users perceive the operation of a particular system as requiring minimal effort (Liébana-Cabanillas, et al., 2020).</b> |                                                                  | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|----------|----------|----------|----------|----------|
| 1)                                                                                                                                                                                 | Alipay/WeChat Pay is easy to use.                                |          |          |          |          |          |
| 2)                                                                                                                                                                                 | Alipay/WeChat Pay's use is clear and understandable.             |          |          |          |          |          |
| 3)                                                                                                                                                                                 | Alipay/WeChat Pay transactions save me a lot of time and energy. |          |          |          |          |          |
| 4)                                                                                                                                                                                 | It is easy to interact with Alipay/WeChat Pay.                   |          |          |          |          |          |



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